Minerva Plug and Abandonment and Field Maintenance Environment Plan

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REVISION RECORD						
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Environment Plan Summary

This Environment Plan (EP) Summary has been prepared from material provided in this EP. This summarises the items as required by Regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

EP Summary Material Requirement	Relevant Section of EP
Details of the titleholder's nominated liaison person for the activity	Section 1.6
The location of the activity	Section 3.2
A description of the activity	Section 3
A description of the receiving environment	Section 4 Appendix C
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Details of the environmental impacts and risks	Section 7 Section 8 OPEP Appendix E
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Acronyms and Glossary

Term	Description
"	inch
µ	Micron
AMFA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AHS	Australian Hydrographic Service
AHTS	Anchor Handling Tug Supply (vessel)
AIS	Automatic identification system
ALARP	As low as reasonably practicable
AMOSC	Australian Maritime Oil Spill Centre
AMSA	Australian Maritime Safety Association
ANZECC	Australian & New Zealand Environment and Conservation Council
APPEA	Australian Petroleum Production and Exploration Association
APU	Australian Production Unit
AS	Australian Standard
ASBTIA	Australian Southern Bluefin Tuna Industry Association
AUV	Autonomous underwater vehicle
AWJ	Abrasive Water Jet
Bass Strait CZSF	Bass Strait Central Zone Scallop Fishery
bbl/d	Barrels per day
bpm	Barrel per minute
BACI	Before-After-Control-Impact
BHP	BHP Petroleum (Victoria) Pty Ltd
BIA	Biologically important area
BOP	Blowout preventer
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
BWM	ballast water management
BWMC	ballast water management certificate
BWMP	ballast water management plan
BWTS	ballast water treatment system
CAMBA	Agreement between the Government of Australia and the Government of the People's Republic of China for the protection of Migratory Birds and their Environment. (China Australia Migratory Birds Agreement)
CBTA	Competency-based training and assessment
CEM	Crisis and emergency management
CHARM	Chemical hazard and risk management
CRG	Community Reference Group
Cwlth	Commonwealth
CWTS	Controlled waste tracking system
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Attractions and Conservation
DELWP	Department of Environment, Land, Water and Planning (Victoria)
DPIPWE	Department of Primary Industries, Parks, Water and Environment (Tasmania)
DJPR	Department of Jobs, Precincts and Regions (Victoria)
DIIS	Department of Industry Innovation and Science
DNP	Director of National Parks
DoD	Department of Defence
DoEE	Department of Environment and Energy
DoT	Department of Transport (Victoria)
DP	Dynamic positioning
EAG	Executive Advisory Group
EES	Exclusive economic zone
EFL	Electrical flying lead
EMBA	Environment that may be affected
EMPCA	Environmental Management and Pollution Control Act 1994 (Tasmania)
EMT	Emergency Management Team
ENVID	Environment Impact (and risk) Identification
EP	Environment Plan, prepared in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
EPA	Environmental Protection Authority (Victoria)
EP Act	Environmental Protection Act 2017 (Victoria)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPG	Environment Protection Group
EPO	Environmental Performance Outcome
EP Regs	Environmental Protection Regulations 2021 (Victoria)
EPS	Environmental Performance Standard
ERP	Emergency Response Plan
ESD	Ecologically Sustainable Development
ETBF	Eastern Tuna and Billfish Fishery
FR	Flush return
FRT	Field Response Team
GHG	Greenhouse gas
GIH	Grease injection head
HBJ	Hydraulic bridging jumper
HFL	Hydraulic flying lead
Hg	Mercury
HMA	Hazard Management Agency
HSEC	health, safety, environment and community
HSE	health, safety and environment
IAP	Incident Action Plan
IAPP	International air pollution prevention
IBC	International bulk carriers
IBRA	Interim Biogeographic Regionalisation for Australia
ICS	Incident Command Structure
IEG	Industry Guidance Note
IMO	International Maritime Organisation
IMR	Inspection, maintenance and repair
IMS	Introduced marine species
IMT	Incident Management Team
IOPP	International oil pollution prevention
IPCC	Intergovernmental Panel On Climate Change
ISPP	International sewage prevention pollution
ITC	Internal tree cap
ITOPF	International Tank Owners Federation

IUCN	International Union for Conservation of Nature
JAMBA	Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment. (Japan Australia Migratory Birds Agreement)
JRCC	AMSA's Joint Rescue Coordination Centre
JSCC	Joint Strategic Coordination Committee
KEF	Key ecological feature
km	Kilometre
KP	kilometre point
L	Litre
LED	light emitting diode
LOWC	Loss of well control
LPG	Liquid petroleum gas
m	Metre
mm	Millimetre
m3	Cubic metre
m/s	Metres per second
MC	Measurement Criteria
MEE	Maritime environment emergency
MEE	Maritime environmental emergency response
MENSAR	INSERT
MARPOL	The Convention for the Prevention of Pollution from Ships (MARPOL Convention)
MDO	Marine diesel oil
MMbbl	Million barrels
MNES	Matters of National Environmental Significance, according to the EPBC Act
MODU	Mobile Offshore Drilling Unit
MOP	Marine oil pollution
MoU	Memorandum of Understanding
MP	Marine Park
NatPlan	National Plan for Maritime Environmental Emergencies
nm	Nautical mile
NAT-DET	National Plan dispersant effectiveness field test kit
SIMA	Net environmental benefit analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Petroleum Titles Administrator
NORMS	naturally occurring radioactive materials
NP	National Park
NRT	National Response Team
NSW	New South Wales
NT	Northern Territory
NTM	Notice to Mariners
NWS	North West Shelf
OCNS	Offshore Chemical Notification Scheme
ODS	Ozone-depleting substance
OIM	Offshore Installation Manager
OIW	Oil-in-water

OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPEP	Oil Pollution Emergency Plan
OSPAR	Oslo and Paris Convention (for the Protection of the Marine Environment of the North-East Atlantic)
OSM	Oil Spill Modelling
OSRO	Oil Spill Response Organisation
OSRC	Oil spill response coordination
OSRL	Oil Spill Response Limited
OSTB	Oil spill tracking buoys
OSTM	Oil spill trajectory modelling
OSV	Offshore support vessel
P&A	Plug and Abandonment
ppb	Parts per billion
ppm	Parts per million
ppt	Parts per thousand
PAH	Polycyclic aromatic hydrocarbons
PIC	Person in charge
PLONOR	OSPAR definition of a substance that Poses Little Or No Risk to the environment
PMS	Preventative maintenance system
POLREP	pollution report
POWBONS Act	Pollution of Waters by Oil and Noxious Substances Act 1986 (Victoria)
PPE	Personal protective equipment
PSZ	Petroleum Safety Zone
QET	Quick-effectiveness test
Rmax	Represents the total horizontal distance (km) to the marine mammal threshold of 120 dB re 1 µPa sound pressure level (SPL).
RO	Reverse Osmosis
ROV	remotely operated vehicle
ROV	Remotely operated vehicle
RSEZ	Rig Safety Exclusion Zone
SA	South Australia
SBTF	Southern Bluefin Tuna Fishery
SCAT	Shoreline clean-up assessment technique
SCERP	Source Control Emergency Response Plan
SCS	Source Control Section
SCCP	Source Control Contingency Plan
SDS	Safety Data Sheet
SEL	Sound exposure level
SEMR	South East Marine Region
SESSF	Southern and Eastern Scalefish And Shark Fishery
SETFIA	South East Trawl Fishing Industry Association
SFRT	Subsea First Response Toolkit
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SINTEF	The Foundation for Scientific Research at the Norwegian Institute of Technology
SITREP	Situation report
SIV	Seafood Industry Victoria
SLDMB	Self-locating datum marker buoys
SMEEC	State Maritime Environmental Coordinator
SMP	Scientific Monitoring Plan

SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plan
SPL	Sound pressure level
SSDI	Subsea dispersant injection
SSTT	Subsea Test Tree
STP	Standard Temperature & Pressure
SXT	Subsea Xmas Tree
TD	Total depth
TEC	Threatened Ecological Community
TH	Tubing hanger
TPH	Total petroleum hydrocarbons
TRP	Tactical Response Plan
TSSC	Threatened Species Scientific Committee
TTS	temporary threshold shift
Vic	Victoria
Woodside	Woodside Energy Group Ltd
WMP	Waste Management Plan
WOMP	Well Operations Management Plan
WWC	Wild Well Control
XT	Xmas tree
Zn	Zinc

1 Introduction

1.1 Overview of Proposed Activity

BHP Petroleum (Victoria) Pty Ltd (BHP) as Titleholder under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Commonwealth) (referred to as the Environment Regulations), proposes to undertake plug and abandonment (P&A) activities (drilling activities) within offshore petroleum production licence VIC/L22 and field maintenance activities (other activities) within VIC/L22 and adjacent pipeline licence VIC/PL33. These activities will hereafter be referred to as the petroleum activities that form the scope of this Environment Plan (EP). A detailed description of the petroleum activities are provided in Section 3.

BHP is acting as the Titleholder undertaking the activity on behalf of a joint venture comprising the titleholders:

- BHP; and
- Cooper Energy (MF) Pty Ltd.

Since the merger completion on 1 June 2022, BHP Petroleum (Victoria) Pty Ltd and its parent company BHP Petroleum Pty Ltd are owned 100% by Woodside Energy Group Ltd (Woodside).

1.2 Purpose of this Environment Plan

In accordance with the objectives of the Environment Regulations, the purpose of this EP is to demonstrate that:

- the potential environmental impacts and risks from planned (routine and non-routine) activities and unplanned events (including emergency situations) of the petroleum activity are identified and described;
- appropriate management controls are implemented to reduce impacts and risks to a level that is 'as low as reasonably practicable' (ALARP) and acceptable;
- the petroleum activity is carried out in a manner consistent with the principles of ecologically sustainable development (as defined in Section 3A of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act)).

The EP describes the process used by Woodside to identify and evaluate potential environmental impacts and risks arising from the petroleum activity, and defines environmental performance outcomes, performance standards and measurement criteria to be applied to manage the impacts and risks to ALARP and acceptable levels. This EP includes an implementation strategy for the monitoring, audit, and management of the petroleum activity to be performed by Woodside and its contractors. The EP documents and considers consultation with relevant authorities, persons and organisations.

This EP has been written to replace the in-force Minerva Cessation EP (MN/HSEC/04/020/A08), Rev 5, 2019.

This EP fulfills the Request for Revision to Environment Plans – Minerva Field as issued by NOPSEMA on the 15 November 2021 and demonstrates compliance with the General Direction 831 issued by NOPSEMA on the 30 August 2021, specifically: Direction 1 and Direction 3.

1.3 Scope of this Environment Plan

This EP addresses the management of planned activities and unplanned events identified from various environmental hazard assessments undertaken for the Minerva P&A and field maintenance activities.

This EP addresses General Direction 831 issued by NOPSEMA on the 30 August 2021, specifically:

Direction 1: Plug or close off, to the satisfaction of NOPSEMA, all wells made in the title areas by any person engaged or concerned in those operations authorised by each title as soon as practicable and no later than 30 June 2025; and

Direction 3: Until such time as direction 1 and 2 are satisfied, maintain all property on the titles to NOPSEMA's satisfaction, to ensure removal of the property is not precluded.

Petroleum activities within the scope of this EP are as follows:

- Preparatory operations including pre-lay moorings, cleaning of wellheads and status check of valves prior to P&A.
- The P&A of Minerva 3 and Minerva 4 (suspended) wells, and Minerva 1 and Minerva 2A (non-producing) wells within (VIC/L22);
- The disconnect of all Minerva wellheads and subsea Xmas trees (XT);
- The potential temporary wet storage of Minerva wellheads and XT's within the operational area prior to field removal during decommissioning operations; and
- The maintenance of all remaining subsea infrastructure including the Minerva subsea pipeline and umbilicals (VIC/PL33), which runs from the Minerva wells to the boundary of the Victorian State Waters (Figure 1 1);

For the avoidance of doubt, the sections of this EP submitted to NOPSEMA for acceptance under s11 of the OPGGS (E) Regulations are the activities that are contained within Commonwealth waters only and covered under the OPGGS Act.

A detailed description of the petroleum activity is provided in Section 3. The spatial boundary of the petroleum activity has been described and assessed using the operational area, which is described in Section 3.3.

This EP shall remain in-force until such time as the planned P&A activities have been completed and a separate approval has be obtained for field decommissioning and removal of development infrastructure remaining in VIC/PL33 and VIC/L22. Addressing:

Direction 2: Remove, or cause to be removed, to the satisfaction of NOPSEMA, from the title areas all property brought into those areas by any person engaged or concerned in the operations authorised by each title as soon as practicable and no later than 30 June 2025;

Direction 4: Provide, to the satisfaction of NOPSEMA, for the conservation and protection of the natural resources in the title areas within 12 months after property referred to in direction 2 is removed; and

Direction 5: Make good, to the satisfaction of NOPSEMA, any damage to the seabed or subsoil in the title areas caused by any person engaged or concerned in those operations authorised by the titles within 12 months after property referred to in direction 2 is removed.

The scope of this EP does not include the movement of project vessels, the MODU or aircraft outside of the operational area. These activities will be undertaken in accordance with other relevant maritime and aviation legislation, most notably, the *Navigation Act 2012* (Cwlth) and *Civil Aviation Act 1988* (Cwlth).

1.4 Woodside / BHP Petroleum Merger

BHP Petroleum and Woodside announced their intention to merge in 2021 which was effective on the 1 June 2022. Prior to the merger date BHP Petroleum and Woodside acted as independent companies and planning activities for this decommissioning Environment Plan were conducted independently. The merger consisted of a change of ownership and control of BHP Petroleum International Pty Ltd (the holding company for BHP Group Limited's global petroleum business) via a share sale to Woodside Petroleum Ltd. All BHP Petroleum entities holding Australian Petroleum titles transferred to Woodside control with this transaction.

All BHP Petroleum policies, standards, processes and procedures were included in the merger agreement and remain valid. Harmonisation of processes between BHP Petroleum and Woodside commenced planning upon the completion of the merger and will be conducted in a staged manner. The BHP Petroleum HSE Management system will continue to be used by 'heritage' BHP operations until potential changes have been assessed. References to APU, BHP, BHP Petroleum and Woodside are interchangeable throughout this document.

1.5 Overview of HSE Management System

All Woodside controlled activities associated with the petroleum activity will be conducted in a manner consistent with:

- Our Values and Woodside Health, Safety and Environment (HSE) Policy (Appendix A);
- Petroleum Health, Safety and Environment (HSE) Standard;
- Wells and Seismic Delivery (W&SD) Management System;
- Woodside Management System; and
- Any specific commitments laid out in this EP.

All Woodside sites must maintain up-to-date practices that adhere to the requirements contained in the HSE Management System and HSE Standard. Activity-specific environmental management measures specific to the activities are implemented through this EP.

Whilst HSE Management Systems apply to the manner in which Woodside execute their responsibilities under this EP, operational control of the MODU remains the responsibility of the MODU Contractor and shall be managed in accordance with Contractor Management Systems as detailed within the NOPSEMA accepted Safety Case for the facility.

1.6 Titleholder Details

The nominated Titleholder for this activity is BHP Petroleum (Victoria) Pty Ltd, on behalf of the Joint Venture Partners:

- BHP Petroleum (Victoria) Pty Ltd; and
- Cooper Energy (MF) Pty Ltd.

Since the merger completion on 1 June 2022, BHP Petroleum (Victoria) Pty Ltd and its parent company BHP Petroleum International Pty Ltd are owned 100% by Woodside Energy Group Ltd.

In accordance with Regulation 15(1) of the Environment Regulations, details of the titleholder are provided in Table 1-1.

Table 1-1: Titleholder details

Business name	BHP Petroleum (Victoria) Pty Ltd
Business address	11 Mount Street, Perth, Western Australia 6000
Telephone number	+61 8 9348 4000 or 9348 4200 (reception)
Email address	bhppetexternalaffairs@petroleumdeepwater.com
ACN	006 466 486

In accordance with Regulation 15(2) of the Environment Regulations, details of the titleholder's nominated liaison person are provided in Table 1-2.

Table 1-2: Titleholder nominated liaison person

Name	Clive Jones
Position	Director Projects Australia
Business address	11 Mount Street, Perth, Western Australia 6000
Telephone number	+61 8 9348 4000 or 9348 4200 (reception)
Email address	bhppetexternalaffairs@petroleumdeepwater.com

In the event of any change in the titleholder, titleholder parent company, a change in the titleholder's nominated liaison person or a change in the contact details for either the titleholder or the liaison person, Woodside will notify the regulator in writing in accordance with Regulation 15(3) of the Environment Regulations.

2 Legislative Framework

2.1 Commonwealth Legislation

Environmental aspects of petroleum activities in Australian Commonwealth waters are controlled by two main statutes, the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Each of these, as applicable to the proposed P&A program, is described in the following sections. There are also a number of applicable Commonwealth and Victorian statutes and regulations, International Agreements and Conventions and other applicable standards, guidelines, and codes under which the activities are implemented. These are listed in Appendix B of this EP.

2.1.1 Offshore Petroleum and Greenhouse Gas Storage Act (2006)

The OPGGS Act provides the regulatory framework for all offshore exploration and production activities in Commonwealth waters (those areas beyond three nautical miles from the Territorial sea baseline and with the Commonwealth Petroleum Jurisdiction Boundary). The Offshore Petroleum and greenhouse Gas Storage (Environment) Regulations (referred to as the Environment Regulations) have been made under the auspices of the OPGGS Act for the purposes of ensuring (as described in section 3) *"....that any petroleum activity or greenhouse gas activity carried out in an offshore area is:*

- *carried out in a manner consistent with the principles of ecologically sustainable development set out in section 3A of the EPBC Act; and*
- *carried out in a manner by which the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable; and*
- *carried out in a manner by which the environmental impacts and risks of the activity will be of an acceptable level".*

This EP meets the requirements of the Environment Regulations by providing a plan that:

- Is appropriate for the nature and scale of the activity;
- Demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable (ALARP);
- Demonstrates that the environmental impacts and risks of the activity will be of an acceptable level;
- Provides for appropriate environmental performance outcomes, environmental performance standards and measurement criteria;
- Includes an appropriate implementation strategy and monitoring, recording, and reporting arrangements;
- Does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being undertaken in any part of a declared World Heritage property with the meaning of the EPBC Act; and
- Demonstrates that:
  - an appropriate level of consultation, as required by Division 2.2A, has been carried out;
  - the measures (if any) adopted, or proposed to adopt, because of consultations are appropriate; and
  - complies with the OPGGS Act and the Environment Regulations.

Obligations in relation to the maintenance and removal of equipment and property brought onto title are provided in OPGGS Act section 572. Section 572 requires the removal of property when it is no longer used, unless NOPSEMA has accepted alternative arrangements where justification is appropriate and with regard to the Australian Government Offshore Petroleum Decommissioning Guideline. Field maintenance (Section 3.17) evaluates the infrastructure integrity and applies applicable measures, based on risk, to ensure subsea infrastructure may be removed in accordance with section 572(3) of the OPGGS Act. All Minerva subsea infrastructure will be removed before 30 June 2025, in accordance with section 572(3) of the OPGGS Act, unless NOPSEMA approves and is satisfied that an alternative decommissioning approach delivers equal or better environmental, safety and well integrity outcomes compared with complete removal.

2.1.2 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth government streamlining arrangements, the National Offshore Petroleum Safety and Environmental Management Authority's assessment of this EP provides an appropriate level of consideration of the impacts to matters of national environmental significance (MNES) protected under Part 3 of the EPBC Act.

2.2 State Legislation

The Minerva Gas Plant development was assessed as a joint Commonwealth / State EIS – Victorian EES under the Commonwealth Environmental Protection (Impact of Proposals) Act 1974 and the Victorian Environment Effects Act 1978. The Victorian Government approved the EIA in March 2000 and approval from the Federal Government was granted in March 2001.

In the event of a hydrocarbon release from a loss of well control (LOWC) event or a tank rupture from a vessel collision, there is the potential for the spill to impact on State waters and/ or shorelines. Relevant state legislation in listed in Appendix B.

2.3 Environmental Guidelines, Standards and Codes of Practice

A number of international codes of practice and guidelines are relevant to environmental management of the petroleum activity. Those considered most relevant are listed in Appendix B.

3 Description of Activity

3.1 Overview

This section has been prepared in accordance with Regulation 13(1) of the Environment Regulations, and describes the petroleum activity to be performed under this EP.

Woodside proposes to undertake plug and abandonment (P&A) activities (drilling activities) within offshore petroleum production licence VIC/L22 and field maintenance activities (other activities) within VIC/L22 and adjacent pipeline licence VIC/PL33. The activities are within Commonwealth waters, approximately 11 km south, south-west (SSW) of the township of Port Campbell, Victoria.

The offshore wells were drilled in late 2002, and the offshore and onshore pipeline was laid in 2003. The construction of the onshore gas plant was completed in December 2004, and the facilities were commissioned and commenced production in January 2005. Production of the field ceased in September 2019 and the Minerva-3 and Minerva-4 wells were suspended. A vessel-based campaign was conducted in Q1 2021 to disconnect flowlines from wells and install additional barrier plugs.

There are four wells required to be permanently plugged and abandoned using a moored semi-submersible mobile offshore drilling unit (MODU). There are two gas production wells, and two suspended exploration wells all currently in a state of preservation.

The program for this EP will include:

- Vessel based cleaning, inspection, and preparation of wells prior to MODU-based P&A scope;
- Permanent plug and abandonment of the four Minerva wells using a moored MODU;
- Disconnect of well infrastructure (Xmas trees and wellheads) above the mudline;
- The potential temporary wet storage of Minerva wellheads and XT’s within the operational area prior to field removal during decommissioning operations, if not removed via the MODU whilst on location; and
- The maintenance of all remaining subsea infrastructure including the Minerva subsea pipeline and umbilicals (VIC/PL33), which runs from the Minerva wells to the boundary of the Victorian State Waters.

Removal of any remaining infrastructure within the field is not described as part of this EP. The scope of a future Minerva decommissioning EP is address in Section 1.3. Future decommissioning planning and timing is discussed in Section 3.7.

3.2 Location

The Minerva Gas Field is located approximately 9 km SSW of the township of Port Campbell, Victoria, Australia. The Minerva field lies entirely offshore in the Production Licence VIC/L 22 in the Otway Basin, in approximately 60 m of water with the production pipeline in Commonwealth waters (VIC/PL33) (Figure 3-3).

The relative distances of key values and sensitivities from two wells within the operational area are provided in Table 3-1.

Table 3-1: Location of Activity

Value / Sensitivity	Approx. Distance from well centres (km)	
	Minerva-1 well	Minerva-4 well
Port Campbell	9.5	11.0
Peterborough	14.1	15.9
The Arches Marine Sanctuary	8.5	10.0

Twelve Apostles Marine National Park	6.2	6.2

3.3 Operational Area

The Operational Area defines the geographical boundary of the P&A and field maintenance activities. The Minerva wells are protected from third party vessels, shipping and fishing activities, by a petroleum safety zone (PSZ). The PSZ and pipeline are marked on nautical charts under the OPGGS (Part 6.6 "safety zones and the area to be avoided"). Nautical charts instruct fishing vessels to avoid navigating, anchoring or fishing within this area. During P&A activities, the MODU will be operating within the PSZ and a temporary 1km radius 'cautionary zone' will be established around each of the well centres to account for MODU mooring equipment.

The Operational Area includes the 500 m PSZ, the temporary cautionary zone which extends to a distance 1 km from each well centre in the field, and a 100 m wide corridor extending either side of the outermost asset along the pipeline route to the Commonwealth-State waters boundary, as shown in Figure 3-3.

3.4 Minerva Subsea Infrastructure Overview

The Minerva Gas Field was discovered in March 1993. The field lies entirely offshore in the Production Licence VIC/L 22 in the Otway Basin, in approximately 60 m of water (Figure 3 1). This SOW also covers the pipeline in Commonwealth waters (VIC/PL33) and State Waters (VIC/PL33(V)). The offshore wells were drilled in late 2002, and the offshore pipeline was laid in 2003. Production of the field ceased in September 2019 when the Minerva-3 and Minerva-4 wells were suspended.

The layout of the field infrastructure is presented in Figure 3-1

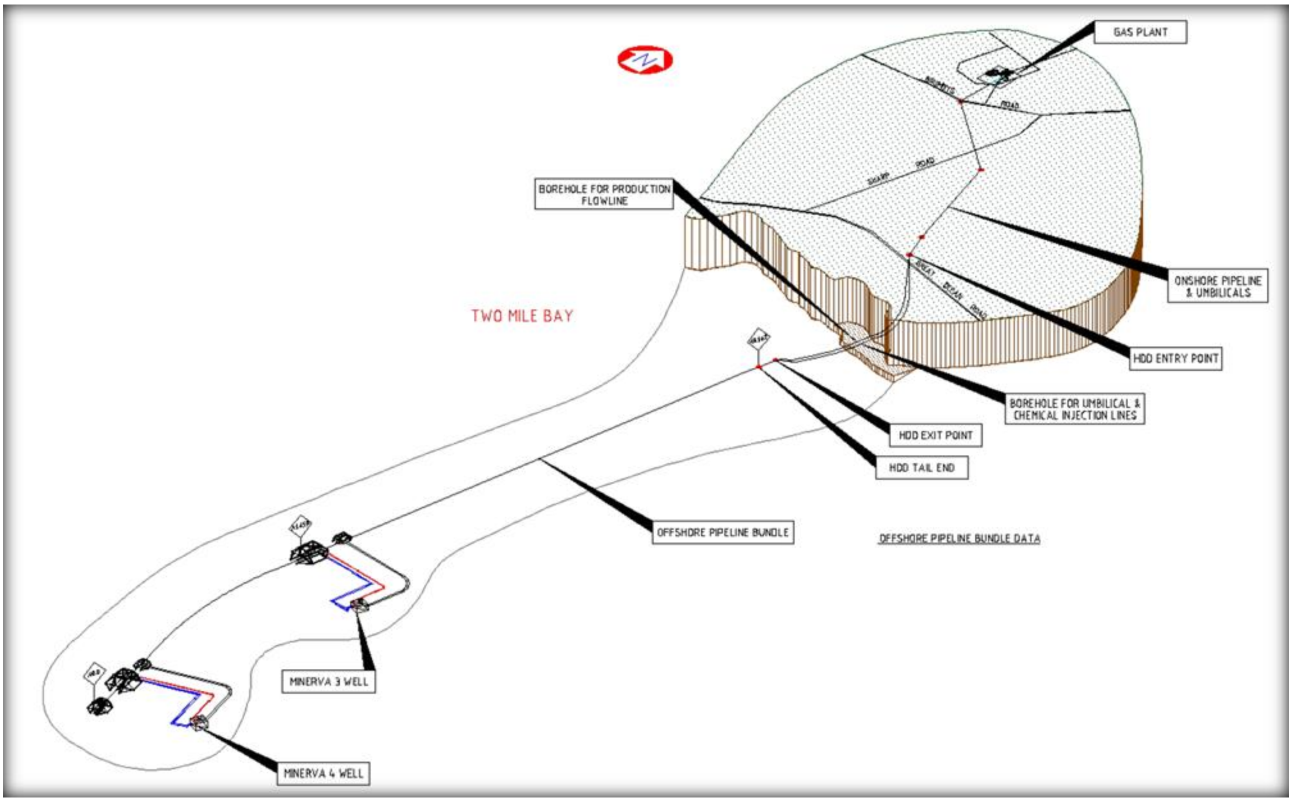


Figure 3-1: Minerva Infrastructure Schematic

3.4.1 Minerva-3 and Minerva- 4 Wells

The Minerva-3 and Minerva-4 subsea trees were tied into the export 10-inch flowline via a barred reducing tee with a double block and bleed valving arrangement and tie-in spool. Each subsea tree has a dedicated chemical injection line and a crossover chemical line connecting the chemical injection systems for each well.

Minerva -3 and Minerva -4 were suspended in October 2019 through Xmas tree valve closure.

3.4.2 Minerva-1, Minerva 2 and Minerva 2a wells

Minerva -1 and Minerva -2a were suspended with deep cement. A wellhead and corrosion cap are in place on both wells. Minerva 2 well is a dry hole it was never penetrated.

3.4.3 10-Inch Flowline

A 10-inch common flowline connects the wells to the land based gas plant near Port Campbell. The flowline is laid on the surface of the seabed from the subsea wells to the shoreline and has a total length of approximately 15 km, of which approximately 4 km is onshore. The flowline crosses underneath a rock platform at the shoreline through a 1,600 m horizontal directionally drilled crossing. The flowline was designed so that the 10-inch diameter and wall thickness selected were suitable for the flowrates, pressures and temperatures expected during operation.

The production flowline forms the basis for the pipeline bundle as the umbilical and both MEG lines were laid concurrently in a bundle (Figure 3-2)

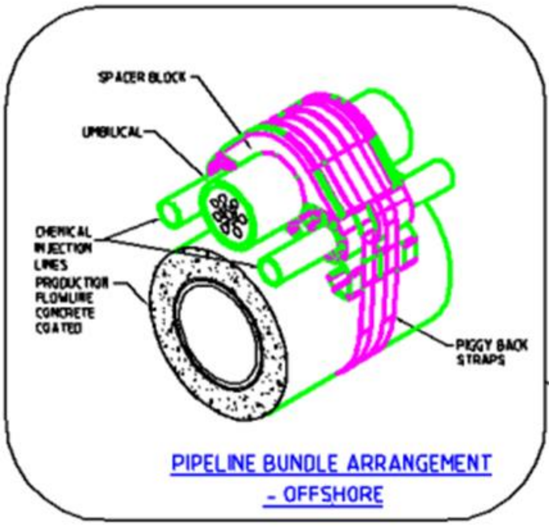


Figure 3-2: Minerva Pipeline Bundle Arrangement

3.5 Minerva Subsea Infrastructure Current Status

Suspension of the pipeline occurred at the end of operational field life in September 2019. The pipeline was depressurised, cleaned and flushed of hydrocarbons and the returns tested to confirm that the pipeline was hydrocarbon free. The final fill of the 10” pipeline and 2” Chemical injection lines was completed with potable, filtered water treated to 500ppm of “Hydrosure” which is a corrosion inhibitor/biocide/oxygen scavenger blend. The main production line also had a nitrogen purge and pack completed from the onshore facility side as a final step to provide a nitrogen gas blanket at the surface isolation blind for future intervention work.

The accumulation of pipeline integrity data over operational lifetime (approximately <15 years) provides sufficient level of information to satisfy Woodside with respect to internal pipe condition. Pipeline operating conditions and produced fluids were subject to frequent and consistent analysis over the operating life of field. All measured parameters fell within design parameters. In addition, the pipeline design corrosion allowances are 4mm for 12.7mm pipe and 6mm for 15.9mm pipe; for a design life of 15 years. Utilising a conservative corrosion rate based on measured data of 0.2mm/year, the pipeline remains within corrosion allowance through to planned final decommissioning in 2025.

Chemical injection lines were depressurised and flushed. Hydraulic lines were depressurised and disconnected at the onshore plant to prevent inadvertent operation of the subsea valves. Electrical controls were also switched off. The wells were bull-headed and well barriers closed and tested to isolate the pipeline from the wells. The pipeline was suspended with internal preservation fluid and existing passive external corrosion protection intact, maintaining pipeline integrity during this phase.

All work was completed from the onshore Gas Plant; no infield operations were required. The condition of the as left systems was recorded in a handover document. The work was completed in December 2019, prior to the plant and the onshore section of the pipeline being sold to Cooper Energy for reuse to process gas from other Otway basin gas fields.

Subsequent to initial cessation activities, a short offshore campaign was completed in March 2021, when the pipeline and flowlines were disconnected from the trees. The tree flowline connection and flowline were isolated through the introduction of a plug on each side.

The scope of work was:

- Cut both M3 and M4 8-inch production flowlines close to the subsea tree (total 2 lines), removing a section of the rigid flowlines to enable insertion of plugs. Pressure retaining plugs installed on both the tree side of the cuts. Environmental caps/plugs installed on the downstream side of the cut sections.
- Cut both M3 and M4 2-inch chemical injection lines close to the tree (total 4 lines), removing a section of the rigid lines to enable insertion of the plugs. Pressure retaining plugs installed on the tree side of the cuts. Environmental caps/plugs installed on the downstream side of the cut sections.
- Recover all cut section lengths of pipe to deck.

In addition to the cutting scope, the following activities were completed:

- Perform as left survey of tree’s SSIV Structures and Tie-in spools.
- GVI of M3 and M4 subsea trees, flowlines, CI flowlines and associated equipment.
- CP measurements.
- Environmental samples (soil, in fauna and water).
- NORM measurement at trees and seabed.

The scope was performed by ROV from a suitably equipped / specified vessel operating under its own safety case and operating under the controls described in Minerva Pipeline Cessation Safety Case.

The potential environmental impacts and risks associated with pipeline cessation were covered within the in-force Minerva Cessation EP (MN/HSEC/04/020/A08), Rev 5, 2019.

Drawing upon integrity management during operations, pipeline integrity was managed for the planned cessation period via internal preservation (treated water and nitrogen purge), and existing external pipeline coating and sacrificial anode cathodic protection. This was based on current condition of the pipeline which is confirmed as having no risk of corrosion outside the design allowance based on ongoing pipeline integrity monitoring in the operational phase.

As part of the scope of activity for cessation, the flowline system was positively isolated from the hydrocarbon source, by severing the flowline spools and installing pressure retaining plugs within the flowline at the XT flowbase. This eliminated the risk of future hydrocarbon contamination from the wells.

The following summarises the results of the work completed:

M3 & M4 Flowline Plugging

- 8” Production & 2” MEG lines were neatly cut with Diamond Wire Saws and plugged:
- Well side pressure retaining plugs installed & successfully pressure tested to 190bar.
- Downstream side environmental plugs (non-pressure retaining) installed.
- 2 off isolation valves on each 8” flow spool were closed.

Inspection

All structures and the pipeline were visually inspected; no significant anomalies were detected; all structures and the pipeline were in good condition. Pipeline: prior cathodic potential field gradient analysis has identified that the CP system will remain operational for >100years.

NORMs

All readings were at background level, with the exception of 3 subsea readings for the recovered spools and a reading at the M3 tree. All surface readings were at background levels.

Soil & Water Sampling

Laboratory testing indicated all test results within normal parameters.

Recovered Spools – Internal Scale Sampling

Analysis of scale from the inside of the recovered pipe spools indicated the presence of Mercury at 74mg/kg.

3.5.1 Minerva Well Suspension Status

The Minerva-3 and Minerva-4 subsea trees were tied into the export 10-inch flowline via a barred reducing tee with a double block and bleed valving arrangement and tie-in spool. Each subsea tree has a dedicated chemical injection line and a crossover chemical line connecting the chemical injection systems for each well.

Minerva -3 and Minerva -4 were suspended in October 2019 through Xmas tree valve closure.

Both Minerva-3 and Minerva-4 have the potential to naturally flow.

Minerva -3 and Minerva -4 were suspended with deep cement. A wellhead and corrosion cap are in place on both wells. Wells will be inspected in accordance with the WOMP and the Minerva Field Subsea Operations Offshore Pipeline ROV inspection frequency Plan (00MN-N28-6647).

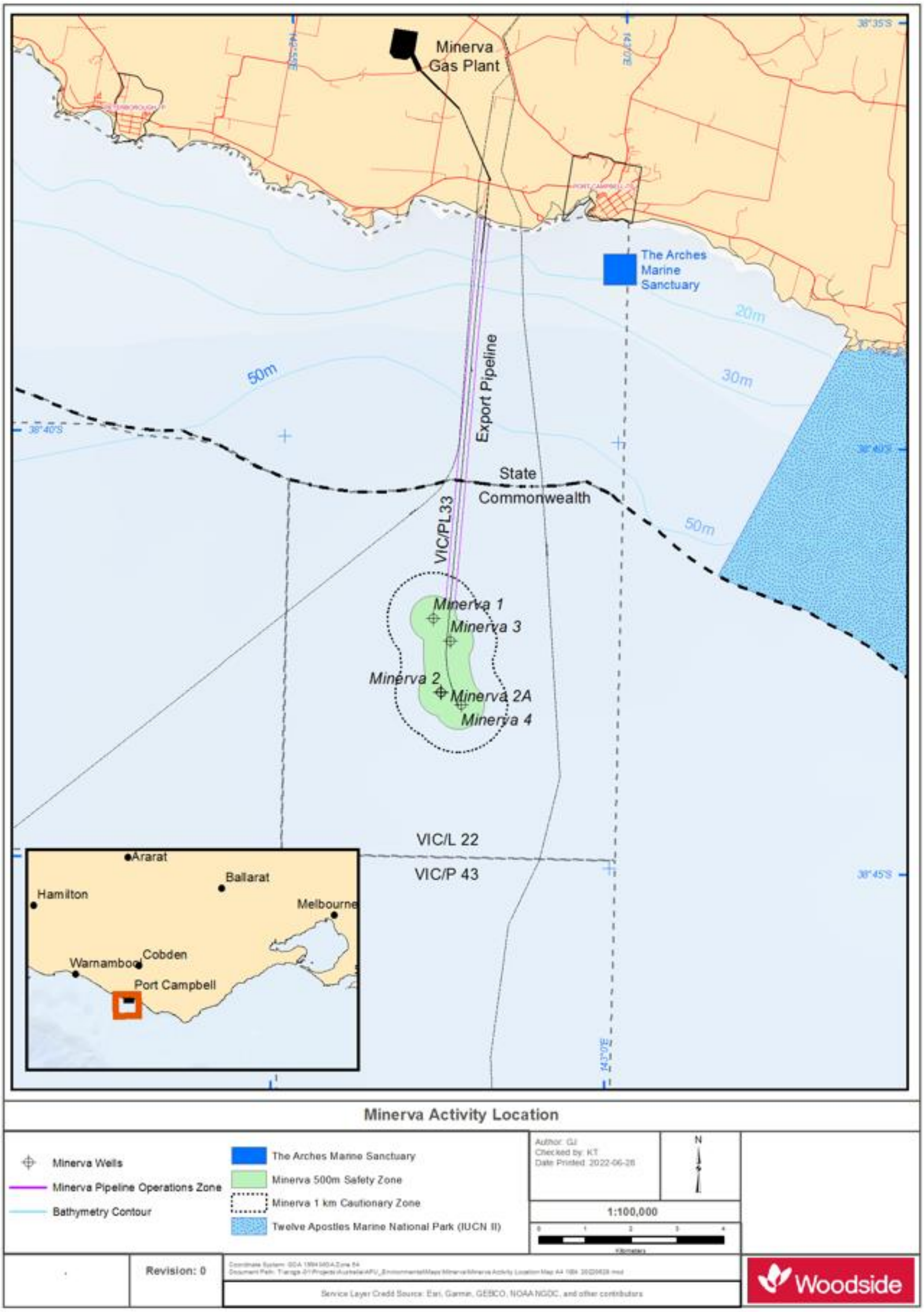


Figure 3-3: Location of the Activity

Table 3-2: Minerva Subsea Infrastructure

Infrastructure	Installation Date	Material / Status / Condition Description	Coordinates (GDA 94)		Decommissioning Schedule	
			Latitude (South)	Longitude (East)	Remove under this EP	Future Decomm Approval
Minerva-3 well & XT	25-Nov-02	Suspended Oct 2019 - barriers have been put in place which isolate the well	-38° 42 22.718”	142° 57 32.997”	Removal or temp wet-store	Removal if temp wet-stored
Minerva-4 well & XT	19-Dec-02	Suspended Oct 2019 - barriers have been put in place which isolate the well	-38° 43 07.368 “	142° 57 44.023”	Removal or temp wet-store	Removal if temp wet-stored
Minerva-1 well	8-Mar-93	Suspended on 17/04/93 - barriers have been put in place which isolate the well	-38° 42' 06.885"	142° 57' 17.278"	Removal or temp wet-store	Removal if temp wet-stored
Minerva 2 well	18-Sep-93	Abandoned 21/09/93 shallow hole (hydrocarbon zone never penetrated)	-38° 42' 58.821"	142° 57' 24.419"	N/A – no infrastructure in place	
Minerva-2A well	22-Sep-93	Suspended on 17/10/93- barriers have been put in place which isolate the well	-38° 42' 59.190"	142° 57' 25.742"	Removal or temp wet-store	Removal if temp wet-stored
Flowline crossing point from Commonwealth into State Waters	NA	Flushed flowline, current contents potable water (<30 ppm hydrocarbons) 750 m^3	-38° 40 29.10”	142° 57 39.4”	No	Yes
Chemical injection line (HFL – EFL)	N/A	Remains attached to Minerva- 3 and 4 so that the subsea trees can be monitored	-38° 40 29.10”	142° 57 39.4”	No	Yes

3.6 Activity Timing and Duration

Plug and abandonment activities are required to be completed no later than 30 June 2025. Given detailed project scheduling and MODU contracting is yet to be finalised, this EP provides for the P&A scope to be undertaken from Q3 2023 to end Q2 June 2025. Whilst this EP provides for the activity to be undertaken within this window of opportunity, the anticipated duration of MODU-based infield operations is less than 2 months.

Preparatory operations including pre-lay moorings, cleaning of wellheads and status check of valves are anticipated to be undertaken approximately one month prior to the commencement of P&A activities. Preparatory operations are anticipated to take less than a week to complete.

Following P&A activities, no further in-field maintenance activities are proposed. Further detail is presented within the Minerva Pipeline Decommissioning Safety Case (MNPM07020A04).

3.7 Future Decommissioning Planning and Timing

The decommissioning of remaining Minerva subsea infrastructure, not removed under this EP, will be covered under separate EPs at a later date. The scope of future decommissioning approval documents, including consideration of NOPSEMA Direction 831 (2), (4), and (5) is provided in Section 1.3. Further, Table 3-3 presents an indicative timetable of activities to support the decommissioning of all property on the title(s).

All Minerva subsea infrastructure will be removed no later than 30 June 2025, in accordance with Section 572(3) of the OPGGS Act, unless NOPSEMA approves and is satisfied that an alternative decommissioning approach delivers equal or better environmental, safety and integrity outcomes compared with complete removal. Until decommissioning, field maintenance (Section 3.17) will ensure remaining subsea infrastructure is maintained in good condition to allow a range of decommissioning options to be assessed and the optimal strategy to be selected. This will ensure Woodside complies with obligations under the OPGGS Act, including:

- section 572(2), to ‘maintain in good condition and repair all structures that are, and all equipment and other property that is, in the title area and used in connection with the operations’; and
- section 572(3), to ‘remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations in which the titleholder is or will be engaged; and that are authorised by the permit, lease, licence or authority’ (unless otherwise approved by NOPSEMA).

3.7.1 Field Survey Work to Inform Decommissioning

All required field survey work has been undertaken to enable the detailed planning of the decommissioning phase (see Section 3.5 above)

3.7.2 Engineering Critical Assessment

Engineering critical assessment is a specialised engineering study used to analyse existing flaws in pipeline welds and determine if such flaws are acceptable to withstanding the loading conditions the pipeline will be subjected to during recovery operations, in particular the reverse reel-lay.

3.7.3 Pipeline Burial

A desktop study will be performed on pipeline burial and how this will impact on recovery operations. The study will consider the soil suction loading on the pipeline whilst the pipeline is being recovered in a reverse reel-lay or S-lay recovery scenario. Outcomes of this study will ensure that loads are within the recovery vessels’ capabilities.

3.7.4 Pipe Coating Sampling

If determined to be necessary, a sample of the pipeline may be taken for testing prior to commencing removal activities to facilitate the selection of the optimal recovery method (or hybrid methods) for the Minerva pipeline. Up to 100m of the pipeline may be removed via subsea cut and recover method. The sample will be analysed to determine the suitability of the pipeline and field joint coating to support reverse reel and/or reverse S-lay removal.

3.7.5 Infrastructure Removal Method Selection Process

The selected removal method (or methods) for the Minerva pipeline will be determined by market engagement. Following completion of the assessments described above. Woodside will engage the market to select the tenderer to recover the pipeline and attached pipeline bundle (and Minerva wellheads and XTs if not removed from the field during the P&A campaign). Woodside's process to engage the market to identify a removal method(s) is as follows:

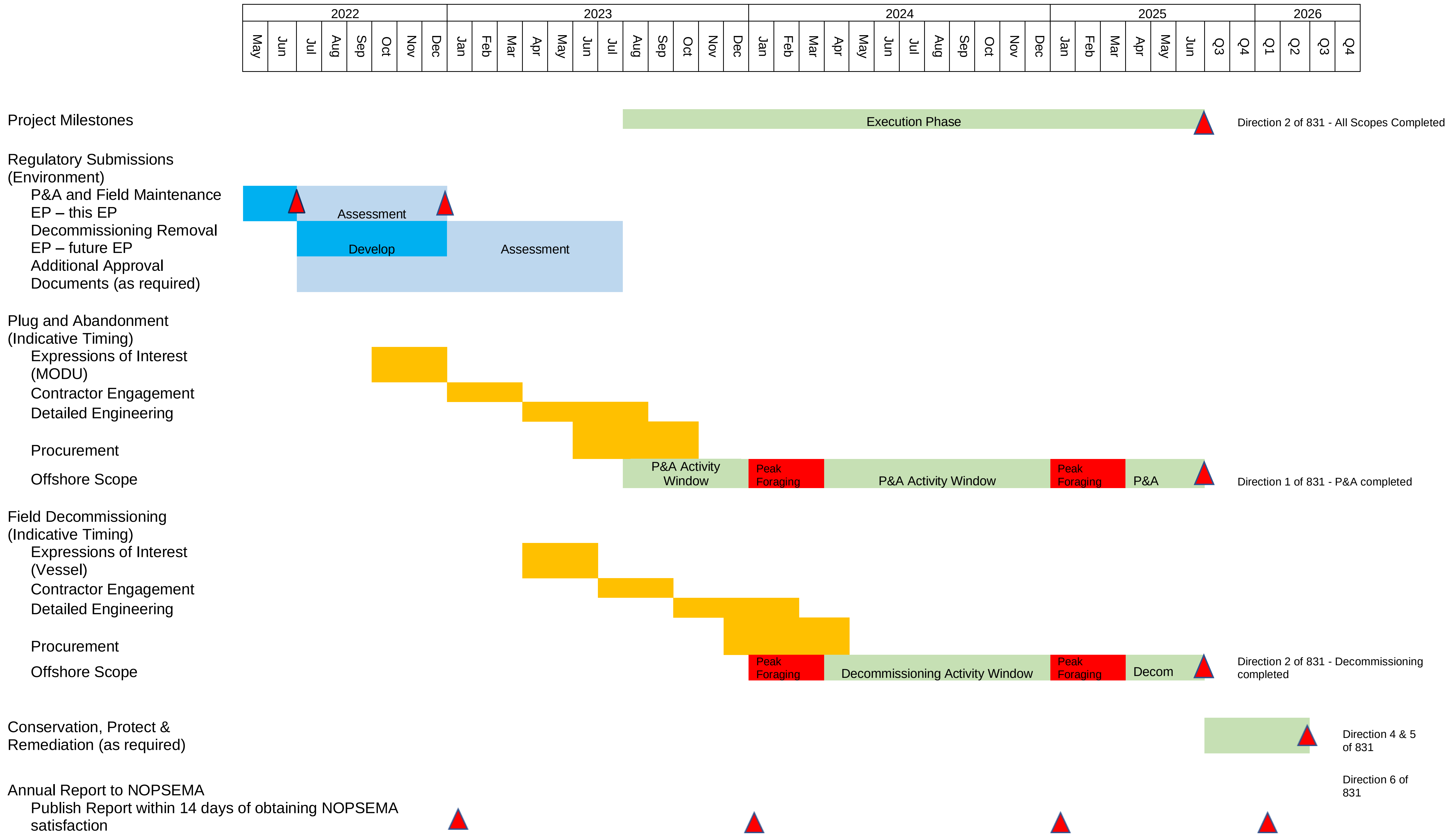
- **Expression of Interest (EOI)** – targets contractors known to industry who 'likely' have the capability to execute, based on experience and vessels. Through the EOI process, contractors are asked to submit details of relevant experience, basic methodology for removal, and vessel requirement and availability. EOI submissions will be assessed against the requested details to create a short-list of contractors who should be invited to respond to tender.
- **Invitation to Tender and Evaluation** – documents are released to the market and evaluated once the bid submissions have been received. Based on available information in the tender, the tenderer will propose their recommended removal method, proposed equipment and vessels to be used and schedule.
- **Contract Award** – contract awarded to the selected tenderer for the removal of the Minerva Pipeline, the attached bundle, and if required, the wet-stored Minerva wellheads and XTs.

3.7.6 Removal Method Selection Considerations

The process to confirm removal methods of the pipeline and attached bundle from those described above will be determined through market engagement based upon:

- **Technical Feasibility** – consideration of the technical complexity and probability of success to achieve recovery of the pipeline and attached bundle.
- **Health and Safety Risk** – consideration of potential health and safety risks of each method and if these potential risks can be managed to ALARP and acceptable levels.

Table 3-3: Indicative Decommissioning Schedule



3.8 Minerva Field Characteristics

The relevant characteristics of Minerva gas condensate oil are listed within Table 3-4.

Table 3-4: Characteristics of Minerva Gas Condensate

Minerva Reservoir Characteristics	
Parameter	**Minerva Condensate[1]**
Specific Gravity	0.7802 gm/cc
API Gravity	49.9º
Pour Point	-36
Viscosity at 20°C	1.204 cSt
Wax Content (%)	<0.1

Note 1: Data from ITS (2003)

3.9 General MODU Details and Operations

The proposed P&A activity would be undertaken by a moored semi-submersible mobile offshore drilling unit (MODU). Due to both the water depth and sea-state neither a jack-up or dynamically positioned (DP) drill rig would be suitable to undertake the P&A activity.

At the time of writing, there are a number of suitable MODUs operating in Australian State and Commonwealth waters that may be considered for this work scope, however, as no such MODU is currently under contract with Woodside to undertake this activity, this section presents general MODU details and arrangements.

3.9.1 MODU Dimensions and Capacities

To enable a suitably conservative environmental impact and risk assessment within this EP, the general MODU details and layout described in this section has been based upon the design specification of the Maersk Deliverer, representing the largest capacity semi-submersible MODU currently available in Australian Commonwealth waters. Further, indicative dimensions and capacities detailed below have been rounded up.

Indicative MODU dimensions are provided in Table 3-5.

Table 3-5: Indicative MODU dimensions

Indicative MODU Dimensions	
Length	117 m
Width	100 m
Height	100 m
Drilling Draft	21 m
Drilling Displacement	50,000 tn
Transit Draft	13 m
Transit Displacement	40,000 tn
Accommodation	Up to 180 POB

Indicative storage capacities are provided in Table 3-6.

Table 3-6: Indicative MODU capacities

Indicative MODU Capacities	
Ballast water	25,000 m^3
Diesel oil	4,000 m^3
Heli fuel	N/A – no offshore refuelling planned
Potable water	800 m^3
Drill water	N/A – no drill water required
Brine	750 m^3
Base oil	N/A – no base oil required
Liquid mud	N/A – no liquid mad required
Cement	680 m^3
Barite / bentonite	680 m^3
Sewage	30 m^3
Saltwater	30 m^3
Bilge, drain and skimmer tanks	50 m^3
Sack storage	200 m^3

3.9.2 Mooring and positioning equipment

Whilst the contracted MODU may have dynamic positioning (DP) / thruster capability to maintain station keeping as required, the MODU will be tethered via a mooring system anchored to the seafloor during drilling operations.

MODU mooring systems consist of between eight to twelve anchors ranging from 15 tn to 30 tn with an individual footprint of 30 m^2 to 60 m^2, although the final design of the mooring system will be dependent on the outcome of a detailed mooring analysis (Rig Move and Positioning Plan) undertaken prior to the commencement of the activity.

Each of the mooring lines will be tethered to drum winches aboard the MODU enabling the tensioning of individual moorings to compensate for MODU movement during the activity.

3.9.3 Blowout Preventer

The MODU will have a subsurface blowout preventer (BOP), enabling attachment to the wellhead and providing primary well control barrier during P&A activities. In accordance with Woodside standards, and consistent with APIS53, the BOP is required to contain at least one annular sealing element and one blind-shear ram capable of shearing and then sealing the wellbore; and contain at least four rams, one of which shall have shear capability.

3.9.4 Power Generation

Power generation aboard the MODU is generally facilitated by eight diesel engines, with a single or multiple backup generator providing alternate power as required. The average diesel fuel usage during operations for a typical semi-submersible MODU is in the order of 15,000 L per day.

3.9.5 Water Generation

The MODU will have capacity to generate potable water via reverse osmosis during operations.

3.9.6 Drainage Systems

Potentially contaminated bilge and chemical drainage will be directed through a closed-circuit drainage system routed through an oil water separator for treatment prior to discharge. Uncontaminated stormwater is directed through an open drainage system directly overboard.

3.9.7 Sewage Treatment

The MODU has a sewage treatment plant (STP) for the treatment of black and greywater during drilling operations.

3.9.8 Solids Control Equipment

The MODU will have industry-standard solids control equipment, however, the proposed P&A activity would not utilise this equipment.

3.9.9 Fluids Handling Package

The MODU will have a fluids handling package, enabling the recovery, treatment and storage of residual reservoir hydrocarbons aboard the MODU and, subject to pressures and volumes, the cold venting from a safe location overboard, or flaring via the burner boom, of residual reservoir gases.

3.9.10 Navigation Equipment

During both transit to site and drilling operations, the MODU will display navigational lighting and external lighting, as required for safe operations. Lighting levels will be determined primarily by operational safety and navigational requirements.

Navigation, bridge, and communication equipment will be compliant with appropriate marine navigation and vessel safety requirements. The MODU is also be fitted with an Automatic Identification System (AIS).

3.10 Vessel Operations

During the P&A activity, the MODU will be supported by up to three anchor handling tug supply (AHTS) vessels. The vessels will primarily be used to deploy anchors, for towing, transport equipment, materials, and fuel between the MODU and Port. If required, monitoring and maintenance of subsea infrastructure would likely be undertaken by an Offshore Support Vessel (OSV). Vessels will likely have ‘Work-Class’ ROV capability.

During the P&A activity, AHTS vessels will be transiting to and from the operational area multiple times per week for the duration of the activity, with at least one vessel stationed in close proximity to the MODU at all times to service the MODU as required and act as a guard vessel to prevent unauthorised interacts between the MODU and other marine users.

A temporary 500-m Rig Safety Exclusion Zone (RSEZ) around the MODU will be established for the duration of the P&A activity, and interactions between the support vessels and the MODU within this zone will be under the direction of the MODU.

Vessels use dynamic positioning (DP) to maintain position near the well centre. DP uses satellite navigation and radio transponders in conjunction with thrusters to maintain the position.

Each vessel will be subject to Woodside’s Marine Management Procedure. All required audits and inspections will assess compliance with the laws of the international shipping industry, which includes safety and environmental management requirements, and maritime legislation including *International Convention for the Prevention of Pollution from Ships 1973* as modified by the Protocol of 1987 (MARPOL) and other International Maritime Organisation (IMO) standards.

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

Operational discharge streams from project vessels include:

- deck drainage;
- putrescible waste and sewage/grey water;
- oily water;
- cooling water;
- desalination plant effluent (brine) and backwash water discharge; and
- ballast water.

Cetacean interaction procedures for project vessels are consistent with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 and are further detailed in Section 8.7.

3.11 MODU Mobilisation

It is likely the contracted MODU would be mobilised from Australian waters, either from the South East Marine Region (SEMR) or the N.W. Shelf. Depending on regional MODU availability, the MODU could be mobilised from international waters.

3.12 MODU Positioning and Mooring

Prior to the MODU arriving in the permit area a ‘Rig Move and Positioning Plan’ will be prepared. This plan details the configuration of the anchors necessary to keep the MODU securely on location. The final mooring configuration and design will be dependent on the outcome of this assessment.

Each anchor or pre-laid mooring would be attached to MODU by a chain / wire mooring line and extent out from the MODU by up to 1 km. The tension of each mooring would be continually monitored aboard the MODU and adjusted according to the parameters determined within the detailed mooring analysis, thereby reducing the potential for anchor drag along the seabed.

Anchors may be pre-laid on the sea floor with AHTS vessels prior to the mobilisation of the MODU to the operational area. Pre-lay operations may occur up to 1 month prior to the MODU being mobilised to the operational area.

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

Consistent with the requirements of section 572 of the OPGGS Act, all mooring equipment shall be removed from the seabed upon completion of the P&A activity.

3.13 MODU Refuelling and Bulk Transfer

The MODU will be refuelled via AHTS vessels.

MODU refuelling will likely occur 2-3 times per week for the duration of the proposed activity (less than 2 months, dependent on finalised work scope, weather conditions and unforeseen circumstances).

The transfer of fuel and bulk chemicals will be by hose and pumped from the AHTS vessels in accordance with conditions for preventing spills to the marine environment. These controls are discussed in Section 8.5.

3.14 Helicopter Crew Change

During the P&A activity, crew changes will be performed using helicopters with transit occurring approximately 3-5 times per week.

Helicopter operations within the operational area are limited to helicopter take-off and landing on the helideck.

Cetacean interaction procedures for aircraft are consistent with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 and are further detailed in Section 8.7.

3.15 Remotely Operated Vehicles

ROVs will be used throughout the petroleum activity, typically for:

- visual inspections and observations;
- seabed and hazard survey;
- placement of ROV tool baskets on the seabed;
- marine growth cleaning on infrastructure;
- tooling and infrastructure cutting;
- retrieval of dropped objects (as required);
- post-activity seabed survey.

The ROV is equipped with lights and can be fitted with various tools, pumps and camera systems to capture and record live (via video feed) and still (photographic) imagery of the subsea equipment and immediate surrounding environment.

3.16 Well Plug and Abandonment

The permanent plugging activities for the Minerva wells, including designing and installing permanent well barriers, will be completed in accordance with the NOPSEMA-accepted Well Operational Management Plan (WOMP) as required under the OPGGS (Resource Management and Administration) Regulations 2011.

The following description represents the base-case for the proposed well P&A methodology with final P&A design to be confirmed prior to undertaking the activity.

A summary of activities to be undertaken for Minerva Well P&A Program are detailed below, with further detail is provided within the activity-specific Well Operations Management Plan (WOMP)

3.16.1 Preparatory Operations

Approximately one month prior to mobilisation of the MODU a vessel based campaign is proposed prior to rig arrival in the field to conduct initial well cleaning operations and inspect and prepare the wells to facilitate an efficient and informed approach to rig based P&A activities.

Marine growth may be removed using a brush or high pressure water jet and acid (applied with high-pressure hose). The application of acid would be minimal, and cleaning mostly conducted by brush.

3.16.2 Production Well P&A

The nominal program for the Minerva production well P&A program comprises the following steps:

- Move MODU onto location and run anchors;
- Deploy ROV and perform calcium washes – this involves the discharge of calcium wash;
- Validate well barriers;
- Remove debris cap and confirm well condition;
- Install, latch and pressure and function test BOP to Subsea Xmas Tree – this involves the discharge of water-soluble biodegradable ROV / BOP control fluids;
- Establish control of well from MODU through IWOCS deployed from MODU;
- Recover Internal Tree cap (ITC) on drill pipe;
- Conduct flushing operations above tubing hanger (TH) barrier plug;
- Run and test landing string, subsea tree test and surface flow tree via ROV valve manipulation with associated control fluid discharges;
- Punch tube above production packer and flush tubing and annulus via the bullheading of brine / inhibited seawater / high viscosity gels. Flushing fluid is either pumped downhole (bullheaded) or circulated back to the MODU for treatment and filtration prior to discharge. At this stage there is potential for a small volume of residual gas in the tubing and annulus to be returned to MODU and vented to atmosphere;
- Install mechanical tubing plug in tailpipe of upper completion;
- Cut and recover tubing above production packer;
- Install combination (primary and secondary) permanent abandonment cement barrier above production packer;
- Recover BOP; and
- Pull anchors and move off.

3.16.3 Exploration Well P&A

The nominal program for the Minerva exploration well P&A program comprises the following steps:

- Move MODU onto location and run anchors;
- Deploy ROV and perform calcium washes – this involves the discharge of calcium wash;
- Remove debris cap and confirm well condition;
- Install, latch and pressure and function test BOP to Wellhead – this involves the discharge of water-soluble biodegradable ROV / BOP control fluids;
- Drill out upper cement suspension plug(s);
- Install secondary permanent abandonment cement plug above existing primary cement plug;
- Recover BOP; and
- Pull anchors and move off.

3.16.4 BOP Installation and Function Testing

A BOP is installed prior to re-entering the existing wells and is a primary well control device to prevent the uncontrolled flow of reservoir fluids to surface.

The following tests are performed after the subsea BOP stack is initially installed on each well:

- A BOP function-test (including ROV test for closure of rams), and wellhead connector pressure-test; and
- A full pressure-test no later than 21 days from previous BOP pressure test.

After the initial test, and for the duration of the activity, all BOP components (excluding hydraulic connectors and shear rams) shall be function tested every seven (7) days and pressure tested at intervals not exceeding 21 days.

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.

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

3.16.5 Cementing Operations

Cementing operations are undertaken to ensure permanent well integrity during well abandonment.

Cement is transported as dry bulk to the MODU by the AHTS vessels and is mixed with water and chemicals in the cementing unit onboard the MODU to form wet grout/concrete slurry immediately prior to use. The grout/concrete slurry is then injected down to the well using high pressure pumps.

Excess volumes of cement slurry may be discharged to sea under the following circumstances:

- When testing cementing unit aboard the MODU (approx. 1-2 m^3);
- When abandoning the motherbore of the well (approx. 10 m^3);
- Disposing of excess slurry due to a failed cement job (approx. 55 m^3 based upon 9-5/8” casing);
- Disposal of excess cement at the end of campaign that cannot be utilised by next operator.

3.16.6 Well Flaring / Venting

During the well P&A activity, residual reservoir gas purged from the well may be either cold vented or flared via the fluids handling package aboard the MODU.

3.17 Field Maintenance

There is no intention to carry out field maintenance or general visual inspection (GVI) activities prior to field abandonment. This is justified as follows:

1. The subsea infrastructure is no longer connected to hydrocarbon sources.
2. The final potable water fill of the 10” pipeline and 2” Chemical injection lines was completed with potable, filtered water treated to 500ppm of “Hydrosure” which is a corrosion inhibitor/biocide/oxygen scavenger blend – the fill process included a return path to enable fluid sampling, thereby ensuring the correct level of chemical inhibition was achieved.
3. The main production line also had a nitrogen purge and pack completed from the facility side as a final step to provide a nitrogen gas blanket at the surface isolation blind for future intervention work.
4. As the pipeline was filled with inhibited potable water in 2019, and blanketed with N2, no further internal corrosion is expected.
5. Historical inspection data has confirmed that the Minerva pipeline is almost 100% buried, rendering visual inspection by ROV unnecessary.
6. The accumulation of pipeline integrity data over operational lifetime (approximately <15 years) provides sufficient level of information to satisfy Woodside with respect to internal, & external, pipe condition.

7. Pipeline external corrosion is not considered an integrity concern as cathodic protection survey data shows the pipeline Cathodic Protection system is active and will remain active for over 100 years.
8. Given that the pipeline is almost 100% buried, and in a region where only light vessels are present, there is no credible threat of physical damage from an external source that would preclude recovery.
9. As any future intervention operations on the pipeline would be related to decommissioning. Based on the data assessed, pipeline integrity will be suitable for all decommissioning activities through to planned final decommissioning in 2025.

Given the above, periodic GVI is not considered necessary due to the limited risk profile and that the recent (2021) inspection campaign established that the pipeline protection from corrosion has been established with residual cathodic protection anode life-span at >100years. A GVI may occur only if deemed necessary to reconfirm infrastructure status prior to full removal of infrastructure.

3.18 Chemical Selection and Assessment

The chemicals required for the activity will be stored on-board the MODU within dedicated holding tanks for liquid chemicals / chemical mixtures and the sack room for dry chemicals. Hazardous chemicals are stored within bunds or in secure areas to prevent accidental overboard discharges. All chemicals that may be operational released or discharged to the marine environment from either planned activities or unplanned events are accompanied with relevant Safety Data Sheets (SDS).

The management, approval and control of SDSs must also comply with the requirements outlined in the Woodside Hazardous Materials Acquisition Environmental Supplement (AO-HSE-S-0002) and Environmental Supplement Form (AO-HSE-S-0002-0001), which provides guidance on environmental standards, assessment process and authorisation for material selection and use. Hazardous chemicals proposed for use intended to be directly or indirectly discharged to the marine environment must be assessed by this process to reduce the impacts to ALARP. Four steps are followed to determine the acceptability:

1. New material request;
2. Designated Low Ecotoxicity Materials - Offshore Chemical Notification Scheme (OCNS) Gold or Group E or D (lowest environmental hazard) with no substitution warning. If the chemical does not meet these criteria, a full risk assessment will be undertaken, as described below;
3. Material Specific Ecotoxicity Assessment:
   - Acute ecotoxicity;
   - Biodegradability; and/or
   - Bioaccumulation potential.
4. ALARP Assessment
   - Frequency of use, dose concentration and dilution factor of material potentially discharged to the environment;
   - Estimated fate of the material;
   - Environmental receptors;
   - Assessment of less harmful alternative materials demonstrates, alternatives unavailable;
   - Requirement for the material use can be technically justified (cannot be eliminated or redesigned);
   - Define risk mitigation measures to limit discharge to the environment (i.e., maximum dose rate or volume); and
   - Measures to ensure risk is monitored and controlled.

Caustic Soda

Under the OCNS scheme, sodium hydroxide has the least hazardous Group E rating (CEFAS, 2021). It is considered to be a PLONOR substance.

Hydraulic Control Fluid

During BOP testing and subsea valve actuation, control fluid, which generally consists of water mixed with a glycol-based detergent or equivalent water based anti-corrosive additive suitable for open hydraulic systems, is released to ocean. An example of a common BOP control fluid concentrate is Stack Magic EcoF, which is diluted to 2 to 3% in water on the MODU to make up the BOP control fluid. Each function test of the BOP will result in up to approximately 1500 L of the fluid (base chemical diluted in water) being discharged to the ocean.

Table 3-7 details the indicative chemicals used during the activity, and potential discharge volume.

Table 3-7: Indicative chemical types, discharge volumes and discharge frequencies

Chemical	Purpose/ Uses	Anticipated volume per discharge	Indicative Discharge frequency
Calcium wash (scale dissolver)	Removal of marine growth and carbonate scale; wellhead / connector cleaning	100 L	Pre-BOP deployment on each well
Hydraulic control fluid	Subsea valve actuation including full BOP functioning	1500 L	BOP installation, then every 7 days thereafter whilst BOP is installed
Hydraulic fluid	ROV control fluid	10 L	ROV valve manipulation

4 Description of Environment

The purpose of this section is to address the requirements of Regulation 13(2) and 13(3) through describing the environment that may be affected (the EMBA), including relevant values and sensitivities, by both routine/planned activities and non-routine/unplanned events. The information contained in this section has been used to inform the evaluation and assessment of the environmental impacts and risks presented in Section 7 and Section 8. The level of detail is appropriate to the nature and scale of the impacts and risks to the particular values and sensitivities.

4.1 Determination of the Environment that May Be Affected

To describe the EMBA, it is necessary to consider the spatial extent of all planned activities (impacts) and unplanned events (risks). The description of the environment is based on two spatial areas:

- The operational area. The operational area for the petroleum activity is a 1 km radius around each of the existing well centres and a 100 m wide corridor extending either side of the outermost asset along the pipeline route to the Commonwealth-State waters boundary. The operational area sets the spatial boundary within which activities described in this EP will occur.
- The wider EMBA. This is the environment that may be affected by a worst-case hydrocarbon spill (Figure 4-1), noting the spatial area of this EMBA is an over-representation of a single potential worst-case spill scenario.

The spatial extent of the wider EMBA has been defined using stochastic hydrocarbon fate and transport modelling of the worst-case hydrocarbon spills, based on the hydrocarbon exposure values (concentrations) for a subsea release of condensate from a loss of well control (LOWC) from the Minerva-4 well (Section 8.3) and a marine diesel oil (MDO) surface spill at the Minerva-1 well arising from a vessel-to-vessel or vessel to MODU collision (Section 8.4).

Stochastic oil spill modelling was undertaken for each spill scenario. The LOWC scenario was modelled based on a release from the Minerva-4 well, given this well represents the highest potential total spill volume from an unplanned LOWC. The MDO scenario was modelled based on a surface release of MDO at the Minerva-1 well location, given it is the closest well location to shoreline receptors. Each scenario consisted of 200 individual oil spill simulations based upon five years of historical hydrodynamic and wind data and covering both summer and winter seasonal variations.

The oil spill modelling considered four key hydrocarbons phases that pose differing environmental and socio-economic risks: surface (floating) oil, total submerged hydrocarbons (entrained oil droplets in the water column), dissolved oil in the water column, and shoreline accumulated oil. The modelling used defined oil exposure values (concentrations) to aid interpretation of the modelling, to identify when and where areas might be contacted by oil and to inform the subsequent environmental risk evaluation and spill response planning. The oil exposure values used to define the EMBA were guided by NOPSEMA's *Environment Bulletin – Oil Spill Modelling Guideline* (NOPSEMA, 2019) and are provided in Table 4-1. Section 8.2.4 provides information on the selection of the oil spill modelling exposure values.

Table 4-1: Hydrocarbon exposure values

Hydrocarbon phase	Exposure Value		
	Low	Moderate	High
Surface (floating) oil	1 g/m^2	10 g/m^2	50 g/m^2
Shoreline (accumulated) oil	10 g/m^2	100 g/m^2	1,000 g/m^2
Total submerged oil in the water column (a combination of entrained and dissolved oil components)	10 ppb	100 ppb	-
Dissolved oil in the water column	10 ppb	50 ppb	400 ppb

The EMBA presented in Figure 4-1, shows the combined stochastic modelling outputs for the worst-case condensate spill and marine diesel oil (MDO) spills, based on 200 individual spills for each spill scenario. By overlaying all of the individual spills onto a single figure, the stochastic modelling shows all the potential areas that could be affected in the event of a spill. While the EMBAs represent the area that could be contacted in the event of a spill, a single spill event would have a much smaller spatial extent.

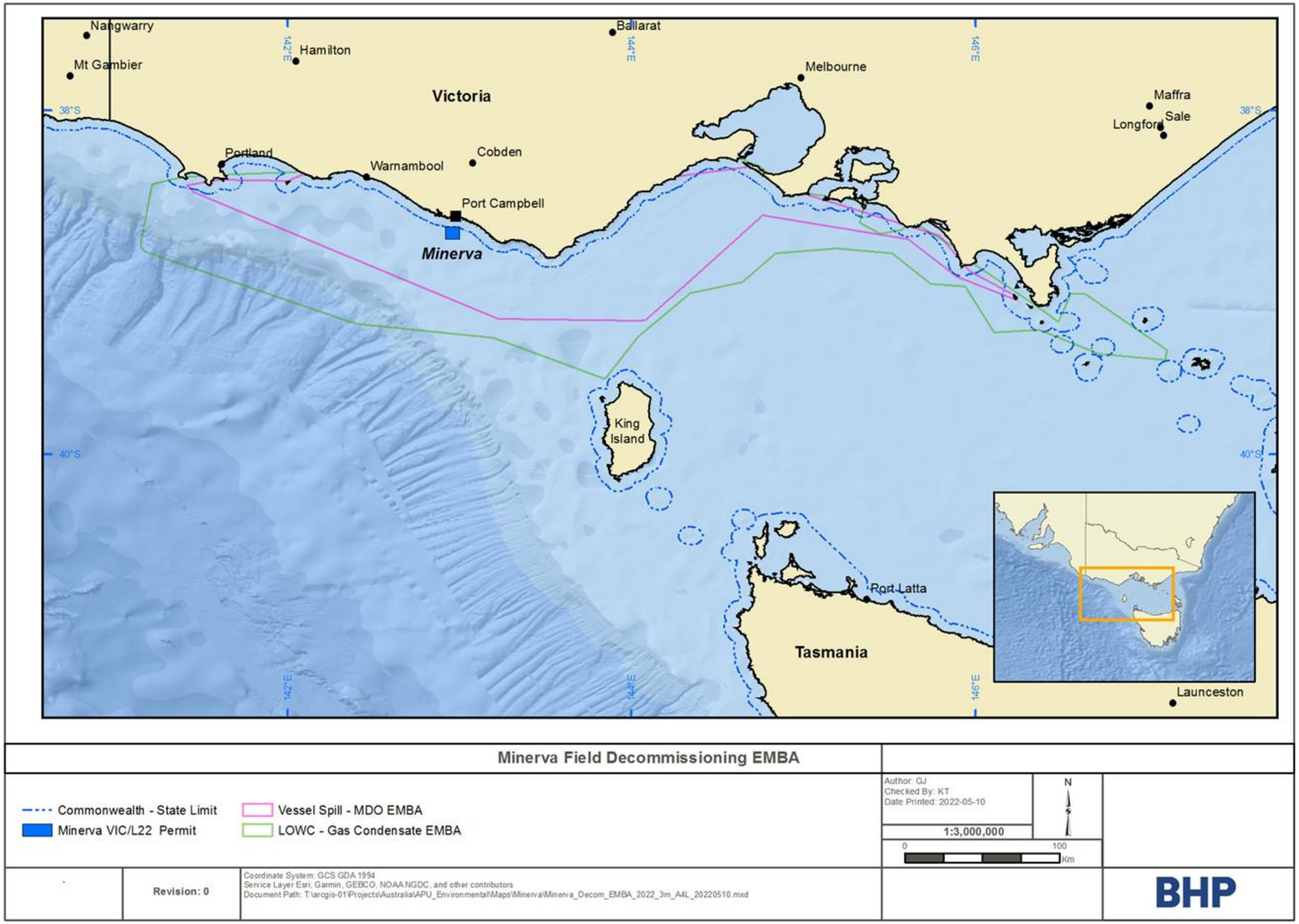


Figure 4-1: Environment that may be affected by the petroleum activity

4.2 Particular Values and Sensitivities

Regulation 13(2) of OPGGS ((E) Regulations states that "the environment plan must:

13(2)(a) Describe the existing environment that may be affected by the activity; and

13(2)(b) Include details of the particular relevant values and sensitivities (if any) of that environment".

Regulation 13(3) of the OPGGS (E) Regulations states that "Without limiting paragraph 13(2)(b), particular relevant values and sensitivities may include any of the following:

13(3)(f) Any values and sensitivities that exist in, or in relation to, part or all of:

(i) A Commonwealth marine area within the meaning of that Act; or

(ii) Commonwealth land within the meaning of that Act".

This section summarises environmental values and sensitivities, including physical, biological, socio-economic and cultural features in the marine and coastal environment that are relevant to the operational area and the EMBA. Searches for matters of national environmental significance (MNES) and other matters protected by the EPBC Act were undertaken for the operational area and the EMBA using the Protected Matters Search Tool (PMST).

A summary of the information derived from the Protected Matters Search, Bioregional Plans and the identified fauna Recovery Plans of relevance to the operational area and EMBA is provided in this section. A comprehensive description of the environmental values and sensitivities relevant to the Minerva Field and associated EMBAs is provided in the *Description of Environment for the Minerva Field* (Appendix C), inclusive of copies of the PMST Reports.

4.2.1 South-East Marine Region and Bioregions

Australia's offshore waters have been divided into six marine regions to facilitate their management by the Australian Government under the EPBC Act. The operational area and EMBA intersects the South-east Commonwealth Marine Region (SEMR), which extends from the south coast of New South Wales to Kangaroo Island in South Australia and around Tasmania (DNP, 2013).

The SEMR is further regionalised by the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) version 4.0, with the Minerva field located in the Otway mesoscale region. The Otway bioregion extends from Cape Otway (Victoria) to Cape Jaffa (South Australia) and includes the western islands of Bass Strait such as King Island (NOO, 2002).

4.2.2 Benthic and Shoreline Habitats

The presence of marine and coastal habitats within the operational area and EMBAs are summarised in Table 4-2 and a detailed description of these habitats with reference to the Otway IMCRA bioregion is provided in *Description of Environment for the Minerva Field* document (Appendix C).

The operational area does not contain does not contain any shoreline habitat with the Victorian coastline approximately 11km away.

The dominant benthic habitat throughout the continental shelf, as described by the South-east Marine Region profile (DoE, 2015) is rocky reef and soft sediment.

Habitats identified within the EMBA include benthic primary producers (seagrasses, algae, mangroves), soft sediment, rocky substrate, wetlands, saltmarshes, rocky shorelines and sandy beaches.

Habitat diversity promotes a range of benthic fauna and infauna in the region and supports the wider ecosystem. Benthic primary producers are important components of ecosystems as they provide the source of energy driving food webs and provide shelter for a diverse array of organisms. Further detail on these habitat types is provided in *Description of Environment for the Minerva Field* document (Appendix C).

Table 4-2: Benthic and Coastal Habitats Occurring within the Operational Area and EMBA

Habitat Type	Description	Operational Area	MDO EMBA	LOWC EMBA
Benthic Habitats				
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.	✓	✓	✓
Seagrass Beds	Seagrasses are marine flowering plants, with around 30 species found in Australian waters.	X	✓	✓
Macroalgal Beds	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.	X	✓	✓
Coral	Corals are generally divided into two broad groups: soft coral and hard coral. Hard corals are generally found in shallower (<50 m) waters while the soft corals are found at most depths.	X	X	X
Carbonate sands and exposed limestone	Carbonate sands and hard limestone substrates are reported to support benthic fauna and communities (Boreen et al. 1993).	✓	✓	✓

Basalt Rises	Rises can be classified as deep reefs, defined as rocky habitat at depths greater than 20 m (Hutchinson et al. 2010).	X	✓	✓
Coastal Habitats				
Rocky Shorelines	Hard and soft rocky shores, including bedrock outcrops, platforms, low cliffs (less than five metres), and scarps.	X	✓	✓
Sandy Beaches	Sandy beaches are dynamic environments, naturally fluctuating in response to external forcing factors (e.g. waves, currents etc).	X	✓	✓
Mangroves	Mangroves grow in intertidal mud and sand, with specially adapted aerial roots.	X	✓	✓
Wetlands	A wetland is a distinct ecosystem that is flooded by water, either permanently or seasonally.	X	✓	✓
Saltmarsh	Saltmarshes are terrestrial halophytic (salt-adapted) ecosystems that mostly occur in the upper-intertidal zone and are widespread along the coast.	X	✓	✓

4.2.3 Protected / Significant Areas

A number of EPBC Act protected areas can be found within the operational area and EMBA boundaries and are protected under state and federal legislation. Table 4-3 lists the MNES areas identified as potentially occurring within the operational area and EMBAs, as determined by the PMST results (Appendix C). Noting that terrestrial areas that are not linked to the shoreline have been excluded as they are not relevant to consideration of potential affects from marine hydrocarbon spills.

Summary information has been provided below with further descriptions available in the *Description of Environment for the Minerva Field* document (Appendix C).

There are no protected areas overlapping the operational area and no World Heritage Areas or Commonwealth Heritage Places overlapping the EMBAs.

Wetlands provide important habitat for native species and wetlands of international or national significance are awarded a higher level of protection. Two RAMSAR sites are located within the EMBAs and include Western Port and Port Phillip Bay. Nine Wetlands of National Importance also intercept the LOWC EMBA and six overlap the MDO EMBA. However, only two of these show connectivity with the marine environment and they include Western Port and Aire River.

The Point Napean Defence National Heritage Place is located along the Victorian coastline and intersects the EMBAs. It is recognised for its broad historic landscape, featuring a considerable array of historic values relating to national quarantine and defence (DAWE, 2006).

Both EMBAs overlap the Apollo Australian Marine Park (AMP), with the LOWC EMBA also overlapping the Beagle AMP to the east. The MDO EMBA overlaps ten Victorian State Marine Protected Areas and the LOWC EMBA overlaps 14. AMPs are recognised under the EPBC Act for protecting and maintaining biological diversity and contributing to a national representative network of marine protected areas. Management plans for AMPs have been developed with the Apollo AMP and Beagle AMP managed under the South-east Commonwealth Marine Reserves Network Management Plan 2013-23 (DNP, 2013). Under the various network management plans, AMPs are allocated conservation objectives (IUCN Protected Area Category) based on the Australian IUCN reserve management principles in Schedule 8 of the EPBC Regulations 2000. The relevant principles for each IUCN category identified within the EMBA is described in Table 4-4.

Three Threatened Ecological Communities (TECs) also have coastal connections and overlap the EMBAs; the Giant Kelp Marine Forests of South East Australia, the Subtropical and Temperate Coastal Saltmarsh, and the Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community. Threatened Ecological Communities (TECs) provide wildlife corridors and / or habitat refuges for many plant and animal species.

Key ecological features (KEFs) are components of the marine ecosystem that are considered to be important for biodiversity or ecosystem function and integrity of the Commonwealth Marine Area are also included in the EPBC Act Protected Matters Database results (Appendix C). The EMBAs overlap two KEFs; the West Tasmania Canyons and the Bonney Coast Upwelling.

Table 4-3: Summary of protected areas in waters within the Operational Area and EMBAs

Area Type	Title	IUCN Classification	Op Area	MDO EMBA	LOWC EMBA
World Heritage Areas	NA	-	-	-	-
Wetland of International Importance (RAMSAR)	Western Port	-	-	✓	✓
	Port Phillip Bay	-	-	✓	✓
Wetlands of National Importance	Western Port	-	-	✓	✓
	Swan Bay and Swan Island	-	-	-	✓
	Aire River	-	-	✓	✓
	Yambuk Wetlands	-	-	-	✓
	Tower Hill	-	-	✓	✓
	Princetown Wetlands	-	-	✓	✓
	Lake Connewarre State Wildlife Reserve	-	-	-	✓
	Lower Aire River Wetlands	-	-	✓	✓
	Lower Merri River Wetlands	-	-	✓	✓
National Heritage Places	Point Napean Defence	-	-	✓	✓
Commonwealth Heritage Places	NA	-	-	-	-
Threatened Ecological Communities (TEC)	Subtropical and Temperate Coastal Saltmarsh	-	-	✓	✓
	Karst springs and associated alkaline fens of the Naracoote Coastal Plain Bioregion	-	-	-	✓
	Assemblages of species associated with open-coast salt-wedge estuaries of	-	-	✓	✓

	western and central Victoria ecological community				
	Natural Damp Grassland of the Victorian Coastal Plains	-	-	✓	✓
	Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	-	-	✓	✓
	Giant Kelp Marine Forests of South East Australia	-	-	✓	✓
Key Ecological Features (KEF)	West Tasmania Canyons	-	-	✓	✓
	Bonney Coast Upwelling	-	-	✓	✓
Australian Marine Parks (AMP)	Apollo AMP	Multiple Use Zone (IUCN VI)	-	✓	✓
	Beagle AMP	Multiple Use Zone (IUCN VI)	-	-	✓
State Marine Parks	Bunurong Marine National Park	National Park (IUCN II)	-	✓	✓
	Churchill Island Marine National Park	National Park (IUCN II)	-	-	✓
	Discovery Bay Marine National Park	National Park (IUCN II)	-	-	✓
	Point Addis Marine National Park	National Park (IUCN II)	-	✓	✓
	Port Phillip Heads Marine National Park	National Park (IUCN II)	-	✓	✓
	Twelve Apostles Marine National Park	National Park (IUCN II)	-	✓	✓
	Wilsons Promontory Marine National Park	National Park (IUCN II)	-	✓	✓
	Marengo Reefs Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓
	The Arches Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓

	Barwon Bluff Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	-	✓
	Eagle Rock Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓
	Merri Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓
	Mushroom Reef Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓
	Point Danger Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	-	✓

Note: the PMST also identified several protected areas which were deemed to be irrelevant to Woodside's petroleum activities due to their terrestrial location and have been excluded.

Table 4-4: Australian IUCN Reserve Management Principles

IUCN Classification	Description	IUCN Principles	Applicable Marine Parks
National Park (IUCN II)	Natural area of land and/or sea, designated to: (a) protect the ecological integrity of one or more ecosystems for this and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.	The reserve or zone should be protected and managed to preserve its natural condition according to the following principles. Natural and scenic areas of national and international significance should be protected for spiritual, scientific, educational, recreational or tourist purposes. Representative examples of physiographic regions, biotic communities, genetic resources, and native species should be perpetuated in as natural a state as possible to provide ecological stability and diversity.	Bunurong Marine National Park Churchill Island Marine National Park Discovery Bay Marine National Park Point Addis Marine National Park Port Phillip Heads Marine National Park Twelve Apostles Marine National Park Wilsons Promontory Marine National Park

		Visitor use should be managed for inspirational, educational, cultural and recreational purposes at a level that will maintain the reserve or zone in a natural or near natural state.	
		Management should seek to ensure that exploitation or occupation inconsistent with these principles does not occur.	
		Respect should be maintained for the ecological, geomorphologic, sacred and aesthetic attributes for which the reserve or zone was assigned to this category.	
		The needs of indigenous people should be taken into account, including subsistence resource use, to the extent that they do not conflict with these principles.	
		The aspirations of traditional owners of land within the reserve or zone, their continuing land management practices, the protection and maintenance of cultural heritage and the benefit the traditional owners derive from enterprises, established in the reserve or zone, consistent with these principles should be recognised and taken into account.	
Natural Monument or Feature **(IUCN III)**	Area containing one or more specific natural or natural / cultural feature which is of outstanding value because of its inherent rarity, representative or aesthetic qualities or cultural significance.	The reserve or zone should be protected and managed to preserve its natural or cultural features based on the following principles.	Marengo Reefs Marine Sanctuary The Arches Marine Sanctuary Barwon Bluff Marine Sanctuary Eagle Rock Marine Sanctuary Merri Marine Sanctuary Mushroom Reef Marine Sanctuary Point Danger Marine Sanctuary
		Specific outstanding natural features should be protected or preserved in perpetuity because of their natural significance, unique or representational quality or spiritual connotations.	
		Opportunities for research, education, interpretation and public appreciation should be provided to an extent	

		consistent with these principles.	
		Management should seek to ensure that exploitation or occupation inconsistent with these principles does not occur.	
		People with rights or interests in the reserve or zone should be entitled to benefits derived from activities in the reserve or zone that are consistent with these principles.	
Multiple Use Zone **(IUCN VI)**	Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.	The reserve or zone should be managed mainly for the sustainable use of natural ecosystems based on the following principles.	Apollo AMP Beagle AMP
		The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term.	
		Management practices should be applied to ensure ecologically sustainable use of the reserve or zone.	
		Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles.	

Source: Environment Australia, 2002

4.3 Threatened and Migratory Species

A report was generated from the EPBC Act Protected Matters Search Tool (PMST) and was used to identify listed threatened and migratory species that may occur within the operational area and the EMBAs (Appendix C). The PMST report identified a total of 46 species listed with a threatened status (27 of which are also listed as migratory) and a further 15 migratory species may potentially occur, or have habitat, within the operational area.

A total of 55 threatened species (31 of which are also listed as migratory) potentially occur within the EMBAs.

The environmental values and sensitivities (threatened and migratory species) within the operational area and EMBAs as identified in the PMST searches (Appendix C). For each species identified, the extent of likely presence is provided.

Relevant conservation advices, recovery plans and management plans for marine fauna identified in the PMST for the operational area and EMBA are provided in Table 4-5.

The BIAs and habitats critical to the survival of a species are which overlap the operational area and EMBA are shown in Table 4-6.

Note that terrestrial species (such as terrestrial mammals, reptiles and bird species) that appear in the EPBC search of the EMBA and do not have habitats along shorelines are not relevant to the activity, as such these have been excluded.

The following species have been identified as having an elevated level of protection through recognised BIAs and are considered independently of other species with descriptions provided in the following subsections. Descriptions of the additional threatened and migratory species are available in the *Values and Sensitivities of the Description of Environment for the Minerva Field* document (Appendix C).

- Pygmy Blue Whale
- Southern Right Whale
- White Shark
- Albatross
- Petrels
- Shearwaters
- Other Seabirds

4.3.1 Listed Species Recovery Plans, Conservation Advice and Threat Abatement Plans

Woodside considered recent updates to Recovery Plans, Conservation Management Plans, Threat Abatement Plans or approved Conservation Advice in place for EPBC Act-listed threatened species that may potentially occur or utilise habitat within the operational area or EMBAs.

Recovery Plans set out the research and management actions necessary to stop the decline of, and support the recovery of listed threatened species. In addition, Threat Abatement Plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities.

Table 4-5 summarises the actions relevant to the activity with more information on the specific requirements of the relevant plans of management (including Conservation Advice and Conservation Management Plans) applicable to the Activity and demonstrates how current management requirements have been taken into account.

Table 4-5: Summary of relevant species recovery plans, approved conservation plans and threat abatement plans

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
All Vertebrate Fauna				
All vertebrate fauna	Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	There are four main objectives: • Contribute to the long-term prevention of the incidence of harmful marine debris • Remove existing harmful marine debris from the marine environment • Mitigate the impacts of harmful marine debris on marine species and ecological communities • Monitor the quantities, origins and impacts of marine debris and assess the effectiveness of management arrangements over time for the strategic reduction of debris.	Ship-sourced marine debris as a risk to vertebrate marine life through entanglement or ingestion	No explicit management actions for non-fisheries related industries (note that management actions in the plan relate largely to management of fishing waste (for example 'ghost' gear), and State and Commonwealth management through regulation.
Marine Mammals				
Sei Whale	Conservation Advice for the Sei Whale (TSSC, 2015a)	Determine population abundance, trends and population structure for sei whales, and establish a long-term monitoring program in Australian waters. Describe the spatial and temporal distribution of Sei Whales and further define biologically important areas (feeding and breeding), and migratory routes within Australian and Antarctic waters.	Noise interference	Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).
			Habitat degradation including pollution	No explicit relevant management actions; habitat degradation and pollution identified as threats.
			Vessel strike	Minimising vessel collisions: • Develop a national vessel strike strategy that investigates the risk of vessel strikes on Sei Whales and also identifies potential mitigation measures. • Ensure all vessel strike incidents are reported in the National Vessel Strike Database.
Blue Whale	Conservation Management Plan for the Blue Whale 2015-2025 (DoE, 2015a)	The long-term recovery objective is to minimise anthropogenic threats to allow the conservation status of the Blue Whale to improve so that it can be removed from the threatened species list under the EPBC Act.	Noise interference	Assess and address anthropogenic noise: shipping, industrial and seismic noise.
			Habitat modification	No explicit relevant management actions; habitat modification identified as a threat.
			Vessel disturbance	Minimise vessel collisions: • Develop a national vessel strike strategy that investigates the risk of vessel strike on blue whales and also identifies potential mitigation measures. • Ensure all vessel strike incidents are reported in the National Ship Strike Database. • Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented.
			Marine debris	No explicit relevant management actions; marine debris identified as a threat.
Fin Whale	Approved Conservation Advice for the Fin Whale (TSSC, 2015b)	Determine population abundance, trends and population structure for fin whales, and establish a long-term monitoring program in Australian waters. Describe the spatial and temporal distribution of Fin Whales and further define biologically important areas (feeding and breeding), and migratory routes within Australian and Antarctic waters.	Noise interference	Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).
			Habitat degradation including pollution	No explicit relevant management actions; habitat degradation and pollution identified as threats.

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
			Vessel strike	Develop a national vessel strike strategy that investigates the risk of vessel strikes on Fin Whales and identifies potential mitigation measures. Ensure all vessel strike incidents are reported in the National Vessel Strike Database.
Southern Right Whale	Conservation Management Plan for the Southern Right Whale 2011-2021 (DSEWPaC, 2012a)	Long term recovery objective: • To minimise anthropogenic threats to allow the conservation status of the southern right whale to improve so that it can be removed from the threatened species list under the EPBC Act Interim Recovery Objective 5: • Anthropogenic threats are demonstrably minimised	Noise interference	Assess and address anthropogenic noise: shipping, industrial and seismic noise.
			Habitat modification	No explicit relevant management actions; habitat modification identified as a threat.
			Marine debris	No explicit relevant management actions; entanglement in marine debris identified as a threat.
			Vessel disturbance / strike	Address vessel collisions: • Develop a national ship strike strategy that quantifies vessel movements within the distribution ranges of southern right whales and outlines appropriate mitigation measures that reduce impacts from vessel collisions.
Australian Sea Lion	Recovery Plan for the Australian Sea Lion (DSEWPaC, 2013a)	The overarching objective of this recovery plan is to halt the decline and assist the recovery of the Australian sea lion throughout its range in Australian waters by increasing the total population size while maintaining the number and distribution of breeding colonies with a view to: • Improving the population status leading to the future removal of the Australian sea lion from the threatened species list of the EPBC Act • Ensuring that anthropogenic activities do not hinder recovery in the near future or impact on the conservation status of the species in the future.	Habitat degradation	No explicit management actions; habitat degradation recognised as a threat.
			Pollution and oil spills	Implement jurisdictional oil spill response strategies as required.
			Disease	No explicit management actions; disease and pathogens recognised as a threat.
			Marine debris	Identify the sources of marine debris having an impact on Australian sea lion populations. Assess the impacts of marine debris on Australian sea lion populations. Develop and implement measures to mitigate the impacts of marine debris on Australian sea lion populations, noting the linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life.
			Vessel Strike	Collect data on direct killings and confirmed vessel strikes.
	Approved Conservation Advice on *Neophoca cinerea* Australian Sea Lion (TSSC, 2020a)	Primary conservation actions: • Mitigate the impacts of marine debris on Australian Sea Lions	Marine debris	Assess the impacts of marine debris on Australian Sea Lion populations and identify the sources of marine debris which have an impact. Develop and implement measures to mitigate the impacts of marine debris on the species (including reducing the amount of these marine debris entering the oceans), noting linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life.
			Disease and Parasites	Improve human wastewater management to minimise dispersal of bacteria, parasites and pollutants into the marine environment.
			Habitat degradation and pollution	Require all vessels to have oil spill mitigation measures in place, and implement jurisdictional oil spill response strategies as required.
			Noise interference	Monitor and mitigate impacts (including cumulative impacts) of human interactions on Australian Sea Lion colonies. Control access to breeding colonies to minimise the impacts of disturbance on Australian Sea Lions.
Marine Reptiles				

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
EPBC Act listed marine turtles in the EMBAs: • Loggerhead Turtle • Green Turtle • Leatherback Turtle	National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds (DoEE, 2020)	Lighting objectives will need to consider the regulatory requirements and Australian standards relevant to the activity, location and wildlife present. Objectives should be described in terms of specific locations and times for which artificial light is necessary. Consideration should be given to whether colour differentiation is required and if some areas should remain dark – either to contrast with lit areas or to avoid light spill. Where relevant, wildlife requirements should form part of the lighting objectives. A lighting installation will be deemed a success if it meets the lighting objectives (including wildlife needs) and areas of interest can be seen by humans clearly, easily, safely and without discomfort.	Light pollution	Best practice lighting design incorporates the following design principles: • Start with natural darkness and only add light for specific purposes. • Use adaptive light controls to manage light timing, intensity and colour. • Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill. • Use the lowest intensity lighting appropriate for the task. • Use non-reflective, dark-coloured surfaces. • Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.
	Recovery Plan for Marine Turtles (DoEE, 2017)	Long-term recovery objective: • 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. Interim objective 3: • Anthropogenic threats are demonstrably minimised.	Marine debris	Reduce the impacts from marine debris: • Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life.
			Chemical and Terrestrial Discharge	Minimise chemical and terrestrial discharge.
			Vessel disturbance	Vessel interactions identified as a threat; no specific management actions in relation to vessels prescribed in the plan.
			Light pollution	Minimise light pollution: • Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats. • Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches. • Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.
			Noise interference	Assess and address anthropogenic noise: • Understand the impacts of anthropogenic noise on marine turtle behaviour and biology.
			Habitat modification	Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival. Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue.
			Disease and pathogens	No explicit management actions; disease and pathogens recognised as a threat.
Leatherback Turtle	Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (DEWHA, 2008)	No explicit relevant objectives.	Boat strike	No explicit relevant management actions; vessel strikes identified as a threat.
			Habitat degradation (changes to breeding sites and degradation to foraging areas)	Identify and protect migratory corridors between nesting beaches and common foraging areas to facilitate colonization.
			Marine debris	No explicit relevant management actions; marine debris identified as a threat.
Fish, Sharks and Rays				

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
Whale Shark	Approved Conservation Advice for the Whale Shark (*Rhincodon typus)* (DoE, 2015b)	To maintain existing levels of protection for the whale shark in Australia while working to increase the level of protection afforded to the whale shark within the Indian Ocean and Southeast Asian region to enable population growth so that the species can be removed from the threatened species list of the EPBC Act.	Marine debris Habitat disruption Boat strike	Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with Whale Shark aggregations along the northward migration route that follows the northern Western Australian coastline along the 200 m isobath (as set out in the Conservation Values Atlas, DoE, 2014).
White Shark	National Recovery Plan for the White Shark (*Carcharodon carcharias* (DSEWPaC, 2013b)	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 with a view to: • Improving the population status leading to future removal of the white shark from the threatened species list of the EPBC Act • Ensuring that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future. The specific objectives of the recovery plan (relevant to industry) are: • Objective 7: Continue to identify and protect habitat critical to the survival of the white shark and minimise the impact of threatening processes within these areas.	Habitat modification	No explicit relevant management actions; habitat modification and climate change identified as threats.
				•
Shorebirds				
Seabirds and migratory shorebirds	National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds (DoEE, 2020)	Lighting objectives will need to consider the regulatory requirements and Australian standards relevant to the activity, location and wildlife present. Objectives should be described in terms of specific locations and times for which artificial light is necessary. Consideration should be given to whether colour differentiation is required and if some areas should remain dark – either to contrast with lit areas or to avoid light spill. Where relevant, wildlife requirements should form part of the lighting objectives. A lighting installation will be deemed a success if it meets the lighting objectives (including wildlife needs) and areas of interest can be seen by humans clearly, easily, safely and without discomfort.	Light pollution	Best practice lighting design incorporates the following design principles: • Start with natural darkness and only add light for specific purposes. • Use adaptive light controls to manage light timing, intensity and colour. • Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill. • Use the lowest intensity lighting appropriate for the task. • Use non-reflective, dark-coloured surfaces. Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.
All Migratory Shorebirds	Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015)	Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.	Habitat degradation and modification	No explicit relevant management actions; identified as a threat.
			Anthropogenic disturbance	Investigate the significance of cumulative impacts on migratory shorebird habitat and populations in Australia. Ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes (specifically for coastal developments).
Australasian Bittern	Approved Conservation Advice for *Botaurus poiciloptilus* (Australasian bittern) (TSSC, 2019)	The objective of this conservation advice is to provide guidance for actions that will expand the range and the number of Australasian Bitterns in Australia.	Habitat loss, disturbance and modifications	No explicit relevant management actions; habitat loss and degradation recognised as a threat.
Australian Painted Snipe	Approved Conservation Advice for Australian painted snipe (*Rostratula australis*) (DSEWPaC, 2013c)	No explicit relevant objectives	Habitat loss, disturbance and modification	Habitat recovery actions are a priority.

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
Bar-Tailed Godwit (baueri)	Approved Conservation Advice for the bar-tailed godwit (western Alaskan) (*Limosa lapponica baueri*) (TSSC, 2016)	No explicit relevant objectives	Habitat loss and degradation from pollution	Protect important habitat in Australia.
Curlew Sandpiper	Approved Conservation Advice for the curlew sandpiper (*Calidris ferruginea*) (DoE, 2015c)	Australian Objective: • Reduce disturbance at key roosting and feeding sites	Habitat loss and degradation from pollution	No explicit relevant management actions; oil pollution recognised as a threat.
Eastern Curlew	Approved Conservation Advice for eastern curlew (*Numenius madagascariensis*) (TSSC, 2015c)	Australian objectives: • Achieve a stable or increasing population. • Maintain and enhance important habitat. • Reduce disturbance at key roosting and feeding sites.	Habitat loss and degradation from pollution	No explicit relevant management actions; habitat loss and degradation recognised as a threat.
Eastern Hooded Plover	Conservation Advice *Thinornis rubricollis rubricollis* hooded plover (eastern) (DoE, 2014)	Relevant Primary Conservation Objectives: • Maintain, enhance and restore habitat, and integrate the subspecies needs into coastal planning	Oil spills	Prepare oil spill response plans to ensure effective rehabilitation of oiled birds.
Great Knot	Approved Conservation Advice for the great knot (*Calidris tenuirostris*) (TSSC, 2016a)	No explicit relevant objectives	Habitat loss and degradation from pollution	Identifies research priorities and the need for actions to prevent destruction of key breeding and migratory staging sites.
			Disease	No explicit relevant management actions; disease recognised as a threat.
Greater Sand Plover	Approved Conservation Advice for the greater sand plover (*Charadruis leschenaultii*) (TSSC, 2016b)	No explicit relevant objectives	Habitat loss and degradation from pollution	Identifies research priorities and the need for actions to prevent destruction of key breeding and migratory staging sites. Protect important habitat in Australia.
			Introduced species / disease	No explicit relevant management actions; introduced species and disease recognised as threats.
Lesser Sand Plover	Approved Conservation Advice *Charadrius mongolus* (Lesser sand plover) (TSSC, 2016c)	No explicit relevant objectives	Habitat loss and degradation from pollution	Outlines research and survey priorities and recommends habitat restoration / maintenance.
			Introduced species / disease	No explicit relevant management actions; introduced species and disease recognised as threats.
Red Knot	Approved Conservation Advice for the red knot (*Calidris canutus*) (TSSC, 2016d)	No explicit relevant objectives	Habitat loss and degradation Pollution/ contamination impacts	Protect important habitat in Australia. Maintain and improve protection of roosting and feeding sites in Australia
Birds – Seabirds				
All Seabirds	Draft Wildlife Conservation Plan for Seabirds (CoA, 2019)	Seabirds and their habitats are protected and managed in Australia.	Habitat degradation and modification	No explicit relevant management actions; identified as a threat.
			Anthropogenic disturbance	Ensure all areas of important habitat for seabirds are considered in the development assessment process. Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas.
			Pollution (marine debris, light, water)	Enhance contingency plans to prevent and/or respond to environmental emergencies that have an impact on seabirds and their habitats.
			Invasive species	Ensure seabirds are protected from the adverse effects of invasive species.

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
Relevant EPBC Act-listed seabirds: • Antipodean Albatross • Black-Browed Albatross • Buller's Albatross • Campbell Albatross • Gibson's Albatross • Indian Yellow-Nosed Albatross • Northern Buller's Albatross • Northern Giant Petrel • Northern Royal Albatross • Soft-Plumaged Petrel • Southern Giant Petrel • Shy Albatross • Sooty Albatross • Southern Royal Albatross • Wandering Albatross • White-Capped Albatross	Background Paper, Population Status and Threats to Albatrosses and Giant Petrels Listed as Threatened under the EPBC Act 1999 (DSEWPaC, 2011a) National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPaC, 2011)	Overall objective: • To ensure the long-term survival and recovery of albatross and giant petrel populations breeding and foraging in Australian jurisdiction by reducing or eliminating human related threats at sea and on land. Specific objectives: • Land-based threats to the survival and breeding success of albatrosses and giant petrels breeding within areas under Australian jurisdiction are quantified and reduced. • Marine-based threats to the survival and breeding success of albatrosses and giant petrels foraging in waters under Australian jurisdiction are quantified and reduced.	Marine pollution	Where feasible, population monitoring programs also monitor, in a standardised manner, the incidence of oiled birds at the nest.
			Parasites and disease	No explicit management actions; parasites and disease recognised as a threat.
Australian Fairy Tern	Approved Conservation Advice for Australian fairy tern (*Sternula nereis nereis*) (DSEWPaC, 2011b)	No explicit relevant objectives.	Oil spills	Ensure appropriate oil spill contingency plans are in place for the subspecies' breeding sites that are vulnerable to oil spills.
Blue Petrel	Approved Conservation Advice for the blue petrel (*Halobaena caerulea*) (TSSC, 2015d)	No explicit relevant objectives.	Habitat loss, disturbance and modification	No explicit relevant management actions; habitat loss, disturbance and modification recognised as a threat.
Fairy Prion (southern)	Approved Conservation Advice for fairy prion (southern) (*Pachyptila turtur subantarctica*) (TSSC, 2015e)	No explicit relevant objectives.	Habitat loss, disturbance and modification	No explicit management actions; habitat loss, disturbance and modification recognised as a threat.
Grey-Headed Albatross	Approved Conservation Advice for *Thalassarche chrysostoma* (Grey-headed Albatross) (DEWHA, 2009)	No explicit relevant objectives.	Habitat loss, disturbance and modification	No explicit management actions; habitat loss, disturbance and modification recognised as a threat.
Shy Albatross	Approved Conservation Advice for *Thalassarche cauta* (Shy Albatross) (TSSC, 2020c)	Conservation Advice refers to the objectives set out in the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC 2011).	Marine debris (plastics)	No explicit management actions; marine debris recognised as a threat.
			Disease	No explicit management actions; disease recognised as a threat.
Soft-Plumaged Petrel	Approved Conservation Advice for the soft-plumaged petrel (*Pterodroma mollis*) (TSSC, 2015f)	No explicit relevant objectives.	Habitat loss, disturbance and modification	No explicit management actions; habitat loss, disturbance and modification recognised as a threat.

4.3.2 Biologically Important Areas and Habitat Critical to the Survival of a Species

The Protected Matters Search Tool (PMST) identifies biologically important areas (BIAs) for some of the region's protected species. These are areas that are considered to be particularly important for the conservation of protected species and where aggregations of individuals display biologically important behaviour such as breeding, foraging, resting or migration. BIAs are not protected matters and should not be confused with 'critical habitat' as defined in the EPBC Act. There are no critical habitats identified within the operational area or EMBA.

A review of the PMSTs (Appendix C) identified BIAs for 17 protected species that intersect with the operational area and EMBA. The identified protected species and their BIAs are shown in Table 4-6.

Table 4-6: BIAs within the Operational Area and EMBA

Species	BIA Type	Operational Area	MDO EMBA	LOWC EMBA	Closest approx. distance to operational area (km) [1]
Whales					
Blue whale and pygmy blue whale	Distribution	✓	✓	✓	Within
	Foraging (annual high use area)	✓	✓	✓	Within
Southern right whale	Aggregation	-	✓	✓	25 km
	Known Core Range	✓	✓	✓	Within
	Migration and Resting on Migration	✓	✓	✓	Within
Sharks					
White shark	Breeding (nursing area)	-	-	✓	302 km
	Distribution	✓	✓	✓	Within
	Foraging	-	✓	✓	58 km
Seabirds					
Antipodean Albatross	Foraging	✓	✓	✓	Within
Australasian Gannet	Aggregation	-	✓	✓	117 km
	Foraging	-	✓	✓	83 km
Black-browed Albatross	Foraging	✓	✓	✓	Within
Black-faced Cormorant	Foraging	-	-	✓	116 km
Buller's Albatross	Foraging	✓	✓	✓	Within
Campbell Albatross	Foraging	✓	✓	✓	Within
Common Diving Petrel	Breeding	-	✓	✓	90 km
	Foraging	✓	✓	✓	Within
Indian Yellow-nosed Albatross	Foraging	✓	✓	✓	Within
Little Penguin	Breeding	-	✓	✓	190 km
	Foraging	-	✓	✓	120 km

Species	BIA Type	Operational Area	MDO EMBA	LOWC EMBA	Closest approx. distance to operational area (km) [1]
Short-tailed Shearwater	Breeding	-	✓	✓	192 km
	Foraging	-	✓	✓	20 km
Shy Albatross	Foraging	✓	✓	✓	Within
Wandering Albatross	Foraging	✓	✓	✓	Within
Wedge-tailed shearwater	Breeding	-	✓	✓	590 km
	Foraging	✓	✓	✓	Within
White-faced Storm Petrel	Foraging	-	✓	✓	56 km

[1] *Where multiple BIAs overlap with the wider EMBA, the distance shown is the distance of the closest BIA to the operational area.*

Summary of Windows of Ecological Sensitivity

Table 4-7 provides a summary of the windows of ecological sensitivity for values identified within and around the operational area and the wider EMBA. These receptors are considered throughout the EP in terms of the identified potential risk.

Table 4-7: Key environmental sensitivities and timing of biologically important activity

Category	Environmental Sensitivity	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Habitats / Communities	Phytoplankton abundance	Assumed peak occurrence associated with Bonney Upwelling				Present year-round							
	Zooplankton abundance	Assumed peak occurrence associated with Bonney Upwelling				Present year-round							
	Seagrass	Present year-round in coastal areas											
	Macroalgae	Present year-round											
TEC	Bonney Coast Upwelling	Upwelling event											
Marine Fauna (threatened/ migratory species)	**Marine Mammals**												
	Antarctic Minke Whale			Likely to occur in summer									
	Australian Sea Lion	Assumed present year-round – SEMR is a known range											
	Pygmy Blue Whale	Foraging occurs during Bonney Upwelling – BIA											
	Dusky Dolphin	Assumed present year-round – prefers inshore habitats but may also be pelagic at times											
	Fin Whale	Present during the Bonney Upwelling event											
	Humpback Whale				Nth Migration through SEMR						Sth Migration through SEMR		
	Killer Whale	Assumed present year-round – frequent sightings off Vic along the continental slope and shelf											
	Pygmy Right Whale	Uncommon / few or no records available for Vic.											
	Sei Whale	Sighted during the Bonney Upwelling event											
	Southern Right Whale					Aggregation and Migration and resting on migration BIAs							
	Sperm Whale	Prefer deep offshore environments >600 m											
	Marine Reptiles												
	Green turtle	Occurs in limited numbers in Vic and SA											

<table>
<tr><th rowspan="2">Category</th><th rowspan="2">Environmental Sensitivity</th><th colspan="12">Month</th></tr>
<tr><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td rowspan="21"></td><td>Leatherback Turtle</td><td colspan="12">Foraging in the SEMR is known to occur</td></tr>
<tr><td>Loggerhead Turtle</td><td colspan="12">Uncommon in southern Australia</td></tr>
<tr><td>Fish, Sharks and Rays</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Australian Grayling</td><td></td><td colspan="4">Spawning from late Summer to Winter (freshwater)</td><td colspan="7">Assumed present year-round – typically occurs in freshwater but can occur in coastal seas</td></tr>
<tr><td>Porbeagle</td><td colspan="12">Assumed present year-round</td></tr>
<tr><td>Shortfin Mako Shark</td><td colspan="12">Assumed present year-round</td></tr>
<tr><td>Whale Shark</td><td colspan="12">Uncommon in southern Australia – isolated records for Vic.</td></tr>
<tr><td>White Shark</td><td colspan="12">Assumed present year-round with breeding, distribution and foraging BIAs identified throughout the region</td></tr>
<tr><td>Blue Warehou</td><td colspan="12">Assumed present year-round</td></tr>
<tr><td>Eastern School Shark</td><td colspan="12">Assumed present year-round</td></tr>
<tr><td>Orange Roughy</td><td colspan="12">Assumed present year-round</td></tr>
<tr><td>Southern Bluefin Tuna</td><td colspan="12">Assumed present year-round</td></tr>
<tr><td>Southern Dogfish</td><td colspan="12">Assumed present year-round</td></tr>
<tr><td>Syngnathids</td><td colspan="12">Assumed present year-round in waters <50 m (sometimes recorded in deeper offshore waters)</td></tr>
<tr><td>Birds</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Antipodean Albatross</td><td colspan="12">Foraging known to occur all year</td></tr>
<tr><td>Australasian Gannet</td><td colspan="5"></td><td colspan="4">Present year-round – foraging and aggregation BIAs</td><td colspan="3">Breeding occurs Oct – May</td></tr>
<tr><td>Black-browed Albatross</td><td colspan="3"></td><td colspan="2">Fledglings (Apr – May)</td><td colspan="3">Present – foraging BIA</td><td colspan="4">Breeding within SEMR on Macquarie Is.</td></tr>
<tr><td>Black-faced Cormorant</td><td colspan="12">Assumed present year-round – foraging BIA (endemic to southern Australia)</td></tr>
<tr><td>Buller’s Albatross</td><td colspan="12">Foraging BIA – however, records indicate the species is mainly present around Tas when in the SEMR (species endemic to NZ)</td></tr>
</table>

<table>
<tr><th rowspan="2">Category</th><th rowspan="2">Environmental Sensitivity</th><th colspan="12">Month</th></tr>
<tr><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td></td><td>Campbell Albatross</td><td colspan="4"></td><td colspan="3">Present in the non-breeding season – foraging BIA</td><td colspan="5">Breeds on Campbell Island, south of NZ Aug - May</td></tr>
<tr><td></td><td>Common Diving Petrel</td><td></td><td colspan="5">Present year-round – foraging BIA</td><td colspan="6">Breeding occurs Jul-Jan – breeding BIA</td></tr>
<tr><td></td><td>Indian Yellow-nosed Albatross</td><td></td><td></td><td colspan="2">Fledgling Mar-Apr</td><td></td><td colspan="3">Non-breeding visitor – foraging BIA</td><td colspan="4">Breeding occurs in South Africa – eggs laid in Sep-Oct</td></tr>
<tr><td></td><td>Little Penguin</td><td colspan="2"></td><td colspan="6">Present year-round – foraging BIA</td><td colspan="4">Breeding Sept – Feb – breeding BIA</td></tr>
<tr><td></td><td>Short-tailed Shearwater</td><td colspan="5">Present Sep-May – foraging and breeding BIAs</td><td colspan="3">Migrates north for Winter</td><td></td><td colspan="3">Breeding Oct – May</td></tr>
<tr><td></td><td>Shy Albatross</td><td colspan="12">Assumed present year-round – foraging BIA. Breeding occurs in SEMR with eggs laid in Sept and fledglings in Apr</td></tr>
<tr><td></td><td>Wandering Albatross</td><td colspan="12">Assumed present year-round – foraging BIA. Breeding occurs biennially on Macquarie Island with eggs laid in Dec and fledglings between mid-Nov and late-Feb</td></tr>
<tr><td></td><td>Wedge-tailed Shearwater</td><td colspan="5">Present Aug-May – foraging and breeding BIA</td><td></td><td></td><td colspan="5"></td></tr>
<tr><td></td><td>White-faced Storm Petrel</td><td colspan="3">Fledglings mid-Feb – mid-Mar</td><td colspan="5">Migrates to tropical and subtropical locations in non-breeding season</td><td colspan="4">Species arrive at breeding colonies late-Sept – early-Oct with egg laying occurring in early Summer</td></tr>
<tr><td></td><td>Birds – other seabirds (with no BIAs identified)</td><td colspan="12">Various species – assumed present</td></tr>
<tr><td></td><td>Birds – shorebirds</td><td colspan="12">Various species – assumed present</td></tr>
<tr><td rowspan="4">Legend</td><td></td><td colspan="12">Peak occurrence / activity (reliable and predictable)</td></tr>
<tr><td></td><td colspan="12">Low level of occurrence/ activity (may vary from year to year)</td></tr>
<tr><td></td><td colspan="12">Activity can occur throughout the year</td></tr>
<tr><td></td><td colspan="12">No occurrence</td></tr>
</table>

4.3.3 Blue Whale

The operational area intersects the distribution and foraging BIA for the Pygmy Blue Whale.

Blue whales (*Balaenoptera musculus*) are listed as endangered and migratory under the EPBC Act. There four subspecies of Blue Whale, two of these occur within Australian waters, the southern or 'true' blue whale (*Balaenoptera musculus intermedia*) and the 'pygmy' blue whale (*Balaenoptera musculus brevicauda*) (DoE, 2015a). As with other baleen whales, they generally migrate between breeding grounds at lower latitudes where both mating and calving takes place during the winter, and feeding grounds at higher latitudes during the summer (DoE, 2015a).

The Bonney Upwelling is an important habitat and feeding ground for Pygmy Blue Whales and it is located within the EMBAs. The Pygmy Blue Whale aggregates between Cape Otway, Victoria, and Robe, South Australia, in relatively shallow shelf waters enriched by seasonal cold water upwelling driven by south-east winds. Aggregation in the Bonney Upwelling between the Great Australian Bight and Bass Strait occurs November–May (Gill et al. 2011). This upwelling event allows whales to feed on abundant krill surface swarms (DAWE, 2022).

4.3.4 Southern Right Whale

The operational area intersects the known core range and migration as well as migration BIAs for the Southern Right Whale, while the EMBAs also overlap an aggregation BIA.

The Southern right whale (*Eubalaena australis*) is listed as endangered and migratory under the EPBC Act. The species is a seasonal visitor to the Australian coast, arriving between May and November (occasionally as early as April and as late as November) and recorded in the coastal waters of all Australian states (Bannister *et al*., 1996). Southern Right Whales migrate from their summer feeding grounds in the Southern Ocean to calve and breed in warmer coastal waters (DoE, 2015). The species are known to regularly aggregate for breeding and calving off of Warrnambool, Victoria, with calving areas tending to be very close to the shore. The known calving and aggregation areas in the south-east region are Warrnambool, Port Fairy, Port Campbell and Portland (Victoria), and Encounter Bay (South Australia).

The species generally occupy shallow sheltered bays that offer protection from south westerly weather, within 2 km of the shore and in water depth of less than 10 m (Charlton, 2017).

4.3.5 White Shark

The operational area intersects the distribution BIA for the White Shark, while the EMBAs also overlap a foraging BIA.

The White Shark (*Carcharodon carcharias*) is listed as vulnerable and migratory under the EPBC Act and is widely distributed throughout temperate and subtropical regions (Bruce et al., 2006; Last & Stevens 2009). They are typically found from close inshore habitats (e.g. rocky reefs and shallow coastal bays) to the outer continental shelf and slope areas (Bruce 1992; Bruce et al. 2006; Bruce & Bradford 2008). The South-east Marine Region supports a white shark population that is thought to move seasonally along the southern and eastern Australian coasts, moving north along the east coast during autumn and winter, and returning to southern Australian waters by early summer (Bruce et al. 2006).

4.3.6 Seabirds

There are 14 seabird species with BIAs within the operational area and EMBAs. The seabird species are grouped as follows:

- Albatross
    - Antipodean Albatross
    - Black-browed Albatross
    - Buller's Albatross
    - Campbell Albatross
    - Indian Yellow-nosed Albatross
    - Shy Albatross
    - Wandering Albatross
- Petrel
    - Common Diving Petrel

    - White-faced Storm Petrel
- Shearwater
    - Short-tailed Shearwater
    - Wedge-tailed Shearwater
- Other Seabirds
    - Australasian Gannet
    - Black-faced Cormorant
    - Little Penguin

Based on seabird group, details on seabird BIAs overlapping the operational area and EMBAs are as follows with more detailed descriptions on individual species available in the *Minerva Field Description of Environment* (Appendix C).

Albatross

Albatross species are among the most oceanic of all seabirds, and seldom come to land unless breeding (DSEWPaC, 2011). Many species, such as Antipodean Albatross, are extremely dispersive, spending most of their time over the pelagic waters of the oceans. Albatross species exhibit a broad range of diets and foraging behaviours, and hence at-sea distributions are diverse. Given their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat.

Albatross species have a widespread distribution throughout the southern hemisphere. They feed mainly on cephalopods, fish and crustaceans, using surface feeding or plunge diving to seize their prey (ACAP, 2021). Albatross are likely to overfly and forage within the operational area and EMBAs with foraging BIAs recognised for Antipodean Albatross, Black-browed Albatross, Buller's Albatross, Campbell Albatross, Indian Yellow-nosed Albatross, Shy Albatross and Wandering Albatross.

No breeding colonies or nesting areas for listed albatross species are located within the operational area, however the South-east Marine Region Profile (DoE, 2015) recognises that fives species breed in or adjacent to the South-east Marine region with four sites listed: Macquarie Island, Albatross Island, Pedra Branca, and the Mewstone.

Petrel

Petrel species are oceanic and have a widespread distribution throughout the southern hemisphere. They are colonial and breed on sub-Antarctic and Antarctic islands in a circumpolar band generally between 40°S and 60°S. Petrel species feed on small fish, cephalopods (octopus, squid and cuttlefish) and crustaceans along the edge of the continental shelf and open waters (DSEWPaC, 2011).

Foraging BIAs have been identified within the operational area and EMBAs for the Common Diving Petrel and the EMBAs only for the White-faced Storm Petrel.

Breeding also occurs within the South-east Marine Region (DoE, 2015) with a breeding BIA identified within the EMBAs for the Common Diving Petrel.

Shearwater

Shearwaters have a wide distribution including Antarctica, Siberia, Japan, South America and New Zealand. All shearwaters fish for their food with various techniques including diving whilst in flight, diving while swimming on the water's surface or fly underwater with half-open wings (DPIE, 2022). Fish, squid, crustaceans, molluscs and plankton form the main part of their diet, but some species of shearwater are known to follow ships for scraps or scavenge for food at offshore waste-disposal points (DPIE 2022). Usually, shearwaters only visit land to breed. They establish colonies on remote islands, capes or coastal mountains in places where take-offs are helped by winds and there are few land predators.

Two species of Shearwater have identified BIAs within the operational area and EMBAs. The Short-tailed Shearwater has a breeding and foraging BIA within the EMBAs and the Wedge-tailed Shearwater has a foraging BIA within the operational area and an additional breeding BIA within the EMBAs.

Other Seabirds

Australasian Gannet

The Australasian Gannet has a foraging and aggregation BIA recognised within the EMBAs. The species generally feeds over continental shelves or inshore waters on pelagic fish, especially pilchard, anchovies and jack mackerel, but also squid and garfish (DoE, 2015). Prey is caught mainly by plunge-diving, but it is also seen regularly attending trawlers.

Black-faced Cormorant

The Black-faced Cormorant has a foraging BIA within the LOWC EMBA only. The species is endemic to southern Australia and feeds in coastal waters (DoE, 2015). Their diet consists of a variety of fish species which are caught mainly through pursuit-diving, sometimes in flocks of up to several thousand individuals (DoE, 2015).

Little Penguin

The Little Penguin breeding and foraging BIA recognised within the EMBAs. The Bass Strait is considered an important breeding site with the largest portion (60%) of the known breeding colonies in Australia (DoE, 2015). Breeding occurs in winter and spring with individuals displaying strong site fidelity, returning to the same breeding colony each year (Gillanders et al., 2013). Little Penguins feed on fish, squid and krill (DoE, 2015).

4.4 Socio-Economic Values and Sensitivities

Socio-economic activities that may occur within the operational area and EMBAs include commercial fishing, oil and gas exploration and production, and recreational fishing and tourism.

More detailed descriptions of socio-economic considerations are available in the *Description of Environment for the Minerva Field* document (Appendix C).

4.4.1 Australian Commercial Fisheries

A number of Commonwealth and State managed fisheries have boundaries that overlap with the operational area and EMBAs. **Table 4-8** provides a summary description of the commercial fisheries with management areas overlapping the operational area and / or EMBAs and therefore have the potential for their operations to be affected by the petroleum activity.

Table 4-8: Commonwealth and State managed fisheries within the EMBA

Fishery	Target Species	Description	Presence		
			OA	MDO EMBA	LOWC EMBA
Commonwealth Managed Fisheries[1]					
Bass Strait Central Zone Scallop	Scallops (*Pecten fumatus*)	Towed dredge fishing method. Fishery managed via seasonal/area closures and total allowable catch (TAC) controls together with quota statutory fishing rights (48 permits for 2019 season and 43 permits for the 2020 season) and individual transferrable quotas. 9 vessels were active in the fishery in the 2020 season. Fishing season: typically July to 31 December	No 2020 fishing intensity data shows activity north and east of King Island	Yes	Yes
Eastern Tuna and Billfish	Albacore tuna (*Thunnus alulunga*) Bigeye tuna (*Thunnus obesus*) Yellowfin tuna (*Thunnus albacares*) Broadbill swordfish (*Xiphias gladius*) Striped marlin (*Kaijikia audux*)	Pelagic longline, minor line (such as handline, troll, rod and reel). A total of 81 longline boat Statutory Fishing Rights, and 83 minor line Statutory Fishing Rights were issued in 2020. Vessels operating on 2019 and 2020 season –37 and 35 longline and 0 minor-line. Fishing season: 12 months beginning on 1 January	No Fishery effort is concentrated along the NSW coast and southern Queensland coast No Victorian ports are used to land catches.	No	No
Skipjack (eastern)	Skipjack tuna (*Katsuwonus pelamis*).	Historically, over 98% of the catch was taken using purse seine catch method. Pole and line method was used for the remaining 2% of the catch. There were 17 fishing permits for the 2019-20 fishing season, but no active Australian vessels. Fishing season: not currently active	No No fishing effort in the fishery since 2008-9 fishing season (stock highly variable and Australia is at the edge of the species range)	No	No
Small Pelagic (western sub-area)	Jack mackerel (*Trachurus declivis, T. symmetricus, T. murphyi*) Blue mackerel (*Scomber australasicus*), Redbait (*Emmelichthys nitidus*) and	Purse seine and mid-water trawl are the main fishing methods. There were 33 Statutory Fishing Rights in the 2020-21 fishing season, with 4 purse seine and 2 mid-water trawl vessels active. Fishing season: 12 months beginning 1 May	No Fishery effort concentrated in NSW and eastern Tasmania	No	No

Fishery	Target Species	Description	Presence		
			OA	MDO EMBA	LOWC EMBA
	Australian sardine (*Sardinops sagax*).				
Southern and Eastern Scalefish and Shark Fishey (SESSF) – CTS and Danish Seine	Blue grenadier (*Macruronus novaezelandiae*), Tiger flathead (*Platycephalus richardsoni*), Pink ling (*Genypterus blacodes*) Silver warehou (*Seriolella punctata*)	Fishing methods include otter trawl and Danish seine. There are 57 trawl licences with 30 trawl and 19 Danish seine vessels operational in the 2019/20 season. Fishing season: 12 months beginning 1 May	Unlikely (CTS) No (Danish Seine) Trawl sector is concentrated around shelf-break areas. Danish seine activity is located on the continental shelf and operate in sandy bottom environments	Unlikely (CTS) No (Danish Seine)	Unlikely (CTS) No (Danish Seine)
SESSF – Shark Gillnet and Shark Hook Sectors	Gummy shark (*Mustelus antarcticus*)	Within the Shark Gillnet and Hook sector there were 61 gillnet fishing permits and 13 hook fishing permits issued in 2019-20 season. Vessels actively fishing during the season included 35 gillnet vessels and 36 hook vessels. Fishing season: 12 months beginning 1 May	Possible (Gillnet) No (Hook) Gillnet sector heavily utilises the continental shelf. Hook sector does not fish in the Gippsland Basin	Possible (Gillnet) No (Hook)	Possible (Gillnet) No (Hook)
Southern Bluefin Tuna	Southern bluefin tuna (*Thunnus maccoyii*)	The primary fishing method is purse seine in waters off South Australia with a number of fishes captured by longline vessels off the East Coast. Tuna caught in SA are then transferred to aquaculture farming pens off Port Lincoln in South Australia. In the 2019-20 fishing season, there were 82 fishing permits with 7 active purse seine vessels and 23 longline vessels. Fishing season: 12 months beginning 1 December	No Fishery effort concentrated in the Great Australian Bight (GAB) off Kangaroo Island and in southern NSW coast off the continental shelf	No	No
Southern Squid Jig	Gould's squid (*Nototodarus gouldi*)	Squid jigging is the fishing method used, mainly in water depths of 60 to 120 m, at night. In 2020, there were 5 active jig vessels in the Commonwealth fishery. Portland is a primary landing port.	No Catches are concentrated in Commonwealth waters between Portland and Robe (SA). Low fishing intensity occurs in	Possible	Possible

Fishery	Target Species	Description	Presence		
			OA	MDO EMBA	LOWC EMBA
		Fishing season: 12 month season beginning 1 January	eastern Victoria and southern NSW		
State Managed Fisheries[2]					
Victorian Rock Lobster	Predominantly southern rock lobster (*Jasus edwardsii*), along with small quantities of eastern rock lobster (*Jasus verreauxi*).	71 licences in the Western zone, permitted to use baited rock lobster pots. In 2019/20, there were 43 vessels working in the western zone (VFA, 2021). In 2019/20, 225.6 tonnes were harvested in the western zone. Fished from rocky reefs in waters up to 150 m depth, with most of the catch coming from inshore waters less than 100 m deep. Pots are generally set and retrieved each day, marked with a surface buoy. Closed seasons: females 1 June to 15 November and males 15 September to 15 November.	Yes Fishing occurs throughout the area on rocky reefs.	Yes	Yes
Victorian Giant Crab	Giant crab (*Pseudocarcinus gigas*).	Giant crabs can only be taken using commercial rock lobster pots by Western Zone lobster fishers. Since the introduction of quota management in the Giant Crab Fishery in 2001, there have been <5 dedicated fishers active in the fishery and up to 20 fishers annually reporting Giant Crab catch as by-product from Rock Lobster fishing (VFA, 2021). In 2019/20 season 9.5t was landed (VFA 2021). Fished mostly on the shelf break (150-350 m water depth).	Unlikely Although concentrated on the continental shelf, given that licence holdings are linked to southern rock lobster licences, there may be some fishing.	Unlikely	Unlikely
Abalone	Blacklip abalone (*Haliotis rubra*) and greenlip abalone (*Haliotis laevigata*).	The fishery consists of 71 fishery access licences of which 14 operate in the Western Zone, 34 in the Victorian Central Zone, and 23 in the Eastern Zone. Commercial fishing methods use diving equipment such as a surface air supply to the diver (hookah system) from small high speed fishing boats. Diving is normally to depths less than 20 m. Fishing season: 12 months beginning 1 April	Likely Abalone diving activity occurs close to shoreline (generally to depths of 30 m on rocky reefs) and may operate around the assets.	Likely	Likely
Wrasse	Blue-throat wrasse (*Notolabrus tetricus*)	The fishery is divided into three commercial management zones; west, central and east, with licence holders able to fish in any of these zones.	Likely Wrasses are fished along the entire	Likely	Likely

Fishery	Target Species	Description	Presence		
			OA	MDO EMBA	LOWC EMBA
	Saddled (or purple) wrasse (*Notolabrus fucicola*) Rosy Wrasse (*Pseudolabrus psittaculus*) Senator Wrasse (*Pictilabrus laticlavius*) Southern Maori Wrasse (*Ophthalmolepis lineolatus*)	There are 22 licences (2021) issued for this fishery. Licences are transferrable. Fishing method is via hand line fishing (other than longline which are not permitted) and rock lobster pots if also in possession of a Rock Lobster Access Fishing Licence.	Victorian coast but in recent years, catches have been the highest off the central coast (Port Phillip Heads, Western Port, and Wilsons's Promontory) and west coast of Victoria (Portland). Catches of saddled wrasse are highest in the Western part of Victoria, which is thought to be related to a greater proportion of suitable reef habitat in this area. Wrasse can inhabit depths up to 160 m but their preferred depths are approximately 30 m.		
Scallop	Scallop (*Pecten fumatus*).	A total of 91 commercial licenses are issued each year and approximately 10-15 vessels operate within the fishery. Commercial vessels tow a single dredge that is dragged along the seabed. Dredges are deployed from the rear of the vessel and are up to 4.5 metres wide. Fishing season: 12 months beginning 1 April	No Fishery boundary extends the entire length of the Victorian coastline and out to the 20 nm point from the shoreline although mostly fished from Lakes Entrance and Welshpool.	No	No
Snapper	Snapper (*Pagrus auratus*).	A total of 246 ocean fishery access licences issued (SIV, 2016). A variety of commercial fishing equipment is used including long lines, haul seines, mesh nets, and hand lines.	Likely	Likely	Likely
Octopus	Pale Octopus (*Octopus pallidus*)	The fishery has established three zones; western, central and eastern octopus zones to manage commercial octopus fishing in Victoria. The western	No	No	No

Fishery	Target Species	Description	Presence		
			OA	MDO EMBA	LOWC EMBA
	Maori octopus (*Macroctopus maorum*) Gloomy Octopus (*Octopus tetricus*)	and central zones are less established and are being managed through exploratory, temporary permits. While the Eastern Zone (East Gippsland) is operational and extends from Seaspray to the Victorian / NSW border and out to 20 nm offshore, except for marine reserves. There are 11 transferable licences issued for the eastern octopus zone. The fishery uses purpose-built unbaited traps which aim to minimise bycatch.	The eastern octopus zone, from Seaspray to the Victorian / NSW border, is authorised for commercial take of octopus. Western and central octopus zones are less established.		

[1] Commonwealth fisheries information sourced from DAWE, 2021 and AFMA, ND.
[2] State-managed fisheries information sourced from VFA, 2021a

4.4.2 Tourism and Recreation

Recreational and tourism activities are extremely valuable foundations for the local and regional economy. Key activities include sight-seeing, surfing and fishing. However, these are generally land-based or near-shore activities and given the operational area is located approximately 11 km (SSW) of Port Campbell, Victoria, in approximate water depths of 60 m, these activities are not expected to overlap the operational area.

4.4.3 Commercial 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. The Australian Maritime Safety Authority (AMSA) indicates that there are no designated shipping lanes in the vicinity of the Minerva field, with the main shipping channel for vessels (e.g. cargo tankers) travelling between major Australian and foreign ports located south of the Minerva field, about 75 km (40 nm) south of Warrnambool.

Although a dedicated shipping lane is not present, commercial and local vessels utilize the area frequently. Ship tracking data from AMSA provides details of the shipping traffic in the area.

4.4.4 Oil and Gas Activities

Nearby production fields include the Otway Gas Field Development, operated by Beach Energy and the Casino, Henry, Netherby (CHN) gas field operated by Cooper Energy are within the EMBAs.

4.4.5 Defence Activities

The Defence Force uses offshore areas for training operations including live firing, bombing practice from aircraft, air-to-air and air-to-sea or ground firing, anti-aircraft firing, firing from shore batteries or ships, remote controlled craft firing, and rocket and guided weapons firing.

Five training and practice areas are located in and around Port Phillip Bay and Western Port Bay. This is to the east of the Minerva field and within the EMBAs.

Mine fields were laid in Australian waters during World War II. Post-war minefields were swept to remove mines and to make marine waters safe for maritime activities. There are three areas identified as dangerous due to unexploded ordnance (UXO), though these are located south and east of Wilson's Promontory (approximately 300 km east of the Minerva field).

5 Stakeholder Engagement

In accordance with requirements of Regulations 11A and 14(9) of the Environment Regulations, Woodside has consulted with relevant and interested stakeholders during the preparation of this EP.

Woodside's approach to stakeholder consultation aims to demonstrate to relevant persons that the environmental impacts and risks of an activity are being appropriately managed. Woodside is committed to ongoing engagement and consultation with stakeholders during all project stages.

Woodside has consulted with relevant stakeholders regarding this petroleum activity, including sharing information with stakeholders and responding directly to enquiries.

Stakeholders consulted specific to the activities covered in this EP commenced in April 2022, with consultation activities including:

- Phone calls and emails to establish relevant stakeholders, particularly those with an interest in commercial and recreational fishing.
- Minerva Plug and Abandonment and Field Maintenance Environment Plan Stakeholder Information Fact Sheet (Appendix D) distributed to relevant stakeholders in April 2022; and
- Reminder emails to stakeholders identified with an interest in commercial and recreational fishing in May 2022.

Woodside has considered all stakeholder feedback and assessed the merits of responses received. The process adopted to assess any objections and claims is outlined in Section 5.1. A summary of Woodside's responses is provided in Table 5-2.

Woodside considers that consultation with relevant stakeholders has been adequate to inform the development of this EP. Woodside has a process for ongoing stakeholder engagement and any concerns raised by stakeholders after the EP submission will be considered and addressed.

5.1 Stakeholder Engagement Process

5.1.1 Stakeholder Identification

Regulation 11A(1) of the Environment Regulations states that in the course of preparing an environment plan, or revision to an environment plan, the titleholder must consult with each of the following categories of relevant persons:

(a) each Department or agency of the Commonwealth to which the activities to be carried out under 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.

As part of Woodside's general stakeholder identification process, Woodside has drawn upon stakeholder consultation conducted for the Minerva Cessation Environment Plan accepted by NOPSEMA in December 2019, and reassessed for relevancy based on the location, nature and scale of activities, as well as sense-checking with representative organisations and departments for stakeholder currency.

Woodside also reviewed relevant regional Environment Plans and conducted desktop stakeholder identification and analysis.

Targeted consultation has been undertaken as outlined in Section 5.1.4. Identified stakeholders were provided information about the proposed activities and given adequate opportunity to evaluate and convey how it may impact on functions, interests and activities.

The consultation process also provided opportunity for additional stakeholders identified during the consultation process to be contacted, with a commitment to assess any new concerns or claims as part of ongoing consultation.

Woodside has engaged with key stakeholders through the EP preparation including:

- Commonwealth and State departments and agencies;
- Local Government;
- Commercial fishery licence holders and their representative associations within both Commonwealth and State managed fisheries that overlap the operational area;
- Non-governmental organisations.

5.1.2 Stakeholder Consultation History

BHP (Woodside) had a long history of community consultation to support its onshore and offshore operations in the Otway Basin prior to the cessation of operations in 2019. This included supporting the operation of a Minerva Community Reference Group (CRG) that was Chaired and run by the Corangamite Shire.

The CRG forum aimed for proactive and regular interaction to promote open and inclusive communication with relevant stakeholders, including business owners, landowners and community groups. Meetings were held regularly, and participants are invited to raise any concerns or issues about Woodside's onshore and offshore activities.

Following the end of gas production from the Minerva fields in 2019, BHP sold its interest in the onshore Minerva Gas Plant to Cooper Energy. The CRG is still in operation, but now with the support of Cooper Energy.

5.1.3 Stakeholder scope

Woodside has assessed stakeholders for this Environment Plan as those being relevant to Woodside's remaining Minerva interests, with consultation focused on those stakeholders with regulatory or business activity in State and Commonwealth Waters. This assessment is outlined in Table 5-1.

However, Woodside did engage and provide information to the Corangamite Shire for information purposes in the event it received public enquiries about Woodside's planned activities. Similar contact was made with Cooper Energy.

5.1.4 Identified stakeholders

Identified stakeholders and an assessment of their relevance under the Environment Regulations for the purposes of consultation for this petroleum activity are listed in Table 5-1.

Table 5-1: Stakeholders engaged with for the proposed activity

Stakeholder	Relevant to Activity	Rationale
Commonwealth Government Department or Agency		
Australian Border Force	Yes	Maintain the integrity of Australia's internal borders including customs and immigration
Australian Fisheries Management Authority (AFMA)	Yes	AFMA is the Commonwealth government agency responsible for the efficient management and sustainable use of Commonwealth fish resources from three nautical miles out to the extent of the Australian Fishing Zone.
Australian Hydrographic Office (AHO)	Yes	The AHO is Commonwealth government agency responsible for the publication and distribution of nautical charts and other

		information related for the safety of ships navigating in Australian waters including the distribution of Notice to Mariners.
Australian Maritime Safety Authority (AMSA)	Yes	AMSA is Australia's national agency responsible for maritime safety and navigation.
Australian Maritime Safety Authority (AMSA)	Yes	AMSA is Australia's national agency responsible for marine pollution response in Commonwealth waters.
Department of Agriculture, Water and the Environment (DAWE) – Fisheries	Yes	Department's Fisheries Branch has primary policy responsibility for promoting the biological, economic and social sustainability of Australian fisheries. The DAWE (Fisheries) is the relevant agency where the activity has the potential to negatively impact fishing operations and/or fishing habitats in Commonwealth waters.
Department of Agriculture, Water and the Environment (DAWE) – Biosecurity (marine pests)	Yes	Department's Biosecurity Branch has inspection and reporting requirements to ensure that all conveyances (vessels, installations and aircraft) arriving in Australian territory comply with international health regulations and that any biosecurity risk is managed.
Department of Agriculture, Water and the Environment (DAWE) – Biosecurity (vessels, aircraft and personnel)	Yes	Department's Biosecurity Branch has inspection and reporting requirements to ensure that all conveyances (vessels, installations and aircraft) arriving in Australian territory comply with international health regulations and that any biosecurity risk is managed.
Department of Defence (DoD)	No	The department is the responsible agency for the defence of Australia and its national interests. DoD is a relevant agency where the proposed activity may impact operational requirements; encroach on known training areas and/or restricted airspace, or when nautical products or other maritime safety information is required to be updated. The operational area does not overlap a Defence area of interest.
Department of Industry, Science, Energy and Resources	Yes	The Department is responsible for consolidating the Government's efforts to drive economic growth, productivity, and competitiveness by bringing together industry, energy, resources and science. The Department is required to be consulted under Regulation 11A(1) of the Environment Regulations.
Director of National Parks (DNP)	Yes	The DNP is the statutory authority responsible for the administration and management of the Australian Marine Parks under the EPBC Act.
Victorian Government Department or Agency		
Department of Environment, Land, Water and Planning (DELWP)	No	Protection and preservation of Victoria's native landscape, including management of potential impacts from an oil spill. Woodside has consulted on oil spill arrangements through DoT Victoria as the coordinating agency for marine pollution in Victorian state waters.
Department of Jobs, Precincts and Regions (DJPR): Earth Resources Regulation	Yes	The Department is the department of the relevant State Minister.
Department of Jobs, Precincts and Regions (DJPR): Marine Pollution	No	Ensuring Victoria is adequately prepared for and effectively responds to a marine

		pollution incident in State coastal waters up to three nautical miles offshore. Woodside has consulted on oil spill arrangements through DOT Victoria as the coordinating agency for marine pollution in Victorian state waters.
Department of Transport (DOT Victoria)	Yes	Oil spill control agency for level 2 and 3 spills in Victorian State waters.
Environment Protection Authority Victoria (EPA Victoria)	No	EPA Victoria is Victoria's environmental regulator. Woodside has consulted on oil spill arrangements through DOT Victoria as the coordinating agency for marine pollution in Victorian state waters.
Parks Victoria	No	Victorian agency responsible for managing parklands including boat ramps, public beach access. Potential impacts from an oil spill - DJPR will manage a whole of government review of the OPEP. Woodside has consulted on oil spill arrangements through DOT Victoria as the coordinating agency for marine pollution in Victorian state waters.
Victorian Fisheries Authority (VFA)	Yes	Independent statutory authority responsible for managing Victoria's fisheries resources. There are five Victorian state-managed fisheries that overlap the operational area.
Tasmanian Government Department or Agency		
Department of Natural Resources and Environment Tasmania - Sea Fishing & Aquaculture	Yes	The Department manages Tasmania's commercial fisheries.
Environment Protection Authority Tasmania (EPA)	No	Oil spill control agency for level 2 and 3 spills in Tasmanian State waters.
Local Government Department or Agency		
Corangamite Shire Council	No	The Corangamite Shire Council Chairs and runs the Minerva Community Reference Group. Woodside ceased to be a member of the Group following the sale of its onshore Minerva business interests to Cooper Energy in 2019. Woodside has chosen to engage and provide information to the Shire in the event it received public enquiries about Woodside's planned activities.
Industry Representative Organisations		
AMOSC	Yes	AMOSC is a petroleum industry-funded organisation to coordinate and support marine pollution response.
Apollo Bay Fishermen's co-op	Yes	The Co-op is retail and distribution outlet for local fishers in the Apollo Bay region.
Australian Petroleum Production & Exploration Association (APPEA)	Yes	APPEA is the peak body representing petroleum exploration and production companies.
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Yes	ASBTIA represents the interests of the commercial fishing industry in the Eastern Skipjack Tuna Fishery and the Southern Bluefin Tuna Fishery.
Bass Strait Scallop Industry Association (BSSIA)	Yes	Commonwealth Fisheries Association represents on behalf of the BSSIA the interests of the commercial fishing industry in the Bass Strait Central Zone Scallop Fishery.
Commonwealth Fisheries Association (CFA)	Yes	CFA represents the interests of the commercial fishing industry in the Bass Strait Central Zone Scallop Fishery, Eastern Skipjack Tuna Fishery, Eastern Tuna and Billfish Fishery, Small Pelagic Fishery

		(Western sub-area), Southern and Eastern Scalefish and Shark Fishery, Southern Bluefin Tuna Fishery, and Southern Squid Jig Fishery.
Seafood Industry Victoria (SIV)	Yes	SIV is the representative peak body for the Victorian seafood industry.
Small Pelagic Fishery Industry Association (SPFIA)	Yes	SPFIA represents the interests of the commercial fishing industry in the Small Pelagic Fishery (Western sub-area) Fishery.
South East Trawl Fishing Industry Association (SETFIA)	Yes	SETFIA represents the interests of the commercial fishing industry in the Small Pelagic Fishery (Western sub-area) Fishery and the Southern and Eastern Scalefish and Shark Fishery.
Southern Shark Industry Alliance (SSIA)	Yes	SSIA represents the interests of the commercial fishing industry in the Southern and Eastern Scalefish and Shark Fishery.
Tuna Australia	Yes	Tuna Australia represents the interests of the commercial fishing industry in the Eastern Tuna and Billfish Fishery.
VRFish	Yes	VRFish is the peak body for recreational fishers in Victoria.
Commonwealth Fisheries		
Bass Strait Central Zone Scallop Fishery	No	There are eight Commonwealth-managed fisheries that overlap the operational area. Woodside has consulted licence holders via their representative organisations based on contact details provided on the AFMA web site.
Eastern Skipjack Tuna	No	
Eastern Tuna and Billfish Fishery	No	
Small Pelagic Fishery (Western sub-area)	No	
Southern and Eastern Scalefish and Shark Fishery (SESSF) – Danish Seine and Trawl	Trawl – unlikely Daish Seine - No	
Southern and Eastern Scalefish and Shark Fishery (SESSF) - Shark Gillnet Hook and Trap	Gillnet – possible Hook - No	
Southern Bluefin Tuna Fishery	No	
Southern Squid Jig Fishery	No	
State Fisheries		
Abalone Fishery	Unlikely	There are seven State-managed fisheries that overlap the operational area. Woodside has undertaken consultation with these fisheries via contact details provided by the SIV.
Giant Crab Fishery	Unlikely	
Octopus Fishery	No	
Rock Lobster Fishery	Yes	
Scallop Fishery	No	
Snapper Fishery	Likely	
Wrasse Fishery	Likely	
Neighbouring Operators		
Beach Energy (Operations) Limited	Yes	Adjacent titleholder for VIC/P43
Cooper Energy	Yes	Adjacent titleholder for VIC/P76
Other Stakeholders		
Community Reference Groups • Corangamite Community Reference Group	No	Representatives including local business owners, landowners and community groups. Woodside no longer participates in the activities of the group following the sale of its onshore Minerva business interests to Cooper Energy in 2019.
Community • Adjoining land owners • Community partners • Community and land care groups • Indigenous groups • Local businesses	No	had a history of engaging community representatives during the construction and operations of the Minerva Gas Project. Minerva operations ceased in 2019, following which BHP (Woodside) sold its onshore Minerva business interests to Cooper Energy. Woodside has assessed that these stakeholders are no longer relevant to proposed activities outlined in this Environment Plan.

5.1.5 Stakeholder Consultation Activities

Woodside's consultation for this EP included the wide distribution of a general Fact Sheet (Appendix D) and follow up email correspondence. The information provided included the timing and duration of the activity, the mitigation measures for relevant impacts and risks, Woodside's policies and experience, and contact details to facilitate providing feedback to Woodside.

Stakeholder engagement and consultation activities informing this EP include:

- Phone calls and emails to establish relevant stakeholders, particularly those with an interest in commercial and recreational fishing.
- Minerva Plug and Abandonment and Field Maintenance Environment Plan Stakeholder Information Fact Sheet (Appendix D) distributed to relevant stakeholders in April 2022; and
- Reminder emails to stakeholders identified with an interest in commercial and recreational fishing in May 2022.

All stakeholder engagement records are maintained by Woodside Corporate Affairs.

5.1.6 Assessment of Stakeholder Objections and Claims

A summary of the stakeholder consultation undertaken for this EP, including responses received, Woodside's assessment of all comments received and how each of the responses has been addressed in the EP is provided in Table 5-2. Full transcripts between Woodside and stakeholders are provided in a confidential submission to NOPSEMA.

No objections or significant concerns were raised by stakeholders during consultation in the preparation of this EP.

Table 5-2: Stakeholder consultation summary

Organisation	Summary of Stakeholder and Titleholder Correspondence, and Any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
Commonwealth Departments / Agencies		
Australian Border Force (ABF)	ABF was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan (Appendix D) by email on 14 April 2022.	No response has been received from ABF at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
Australian Fisheries Management Authority(AFMA)	AFMA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. AFMA responded by email on 19 April 2022, advising that it did not have any specific comment on proposed activities. AFMA noted that Woodside was directly engaging with potentially impacted Commonwealth fishing stakeholders and supported this approach as it was important to consult with fishers who have entitlements to fish within the proposed area.	Woodside notes AFMA's response and considers it has addressed the stakeholder's feedback and no further consultation is required.
Australian Hydrographic Office (AHO)	AHO was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. AHO sent an automatically generated email on 14 April 20022, acknowledging that Woodside's email had been registered, assessed, prioritised and validated in preparation for updating our Navigational Charting products.	No response has been received from AHO at the time of submission of the EP. No action required, noting feedback provided by AMSA on 16 March 2022 requesting Woodside to notify the AHO no less than four weeks before operations, with details relevant to the operations in order for the AHO promulgate the appropriate Notice to Mariners. Section 7.3 relates to the physical presence of vessels and infrastructure. Table 10-3 includes reporting and notification requirements including those to AHO. Woodside considers it has addressed the stakeholder's feedback and no further consultation is required.
Australian Maritime Safety Authority (AMSA) – maritime safety	AMSA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. AMSA responded by email on 20 April 2022 providing the following requests: 1. The Australian Hydrographic Office must be contacted through datacentre@hydro.gov.au no less than four working weeks before operations commence for the promulgation of related notices to mariners. 2. Please have the main vessel/s notify AMSA's Joint Rescue Coordination Centre (JRCC) for promulgation of radio-navigation warnings 24-48 hours before operations commence. AMSA's JRCC will require the vessel details (including name, call sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end. 3. You should plan to provide updates to both the Australian Hydrographic Office and the JRCC on progress and, importantly, any changes to the intended operations. AMSA also reminded Woodside of its obligations to comply with the International Rules for Preventing Collisions at Sea (COLREGs), in particular, the use of appropriate lights and shapes to reflect the nature of operations (e.g. restricted in the ability to manoeuvre). Vessels should also ensure their navigation status is set correctly in the ship's AIS unit. AMSA provided contact details for Woodside obtain a vessel traffic plot showing Automatic Identification System (AIS) traffic data. Woodside responded on 23 May 2022, advising it would: 1. Notify the AHO no less than four weeks before operations, with details relevant to the operations in order for the AHO promulgate the appropriate Notice to Mariners. 2. Notify AMSA's Joint Rescue Coordination Centre (JRCC) at least 24-48 hours before operations commence, in order to promulgate radio-navigation warnings. 3. Notify AHO and the JRCC in the event of changes to intended operations. . Woodside notes AMSA's feedback the exhibition of appropriate lights and shapes and will: • Comply with the International Rules for Preventing Collisions at Sea • Ensure vessel navigation status is set correctly in the ship's AIS unit	Woodside notes AMSA's feedback on Maritime Safety Information and will: 1. Notify the AHO no less than four weeks before operations, with details relevant to the operations in order for the AHO promulgate the appropriate Notice to Mariners. 2. Notify AMSA's Joint Rescue Coordination Centre (JRCC) at least 24-48 hours before operations commence, in order to promulgate radio-navigation warnings. 3. Notify AHO and the JRCC in the event of changes to intended operations. Section 7.3 relates to the physical presence of vessels and infrastructure. Table 10-3 includes reporting and notification requirements including those to AHO and AMSA. Woodside considers it has addressed the stakeholder's feedback and no further consultation is required.
Australian Maritime Safety Authority (AMSA) – marine pollution	AMSA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received from AMSA at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.

Department of Agriculture, Water and the Environment (DAWE) – Fisheries	DAWE was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received by DAWE at the time of submission of the EP. Woodside has addressed matters relevant to DAWE's interests in the following section of the EP: Section 7.3 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries No further consultation is required.
Department of Agriculture, Water and the Environment (DAWE) – Biosecurity (marine pests)	DAWE was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet by email on 14 April 2022.	No response has been received by DAWE at the time of submission of the EP. Woodside has addressed matters relevant to DAWE's interests in the following section of the EP: Section 8.8 relates to risks and management of Introduction of Invasive Marine Species. No further consultation is required.
Department of Agriculture, Water and the Environment (DAWE) – Biosecurity (vessels, aircraft and personnel)	DAWE was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet by email on 14 April 2022.	No response has been received by DAWE at the time of submission of the EP. Woodside has addressed matters relevant to DAWE's interests in the following section of the EP: Section 8.8 relates to risks and management of biosecurity. No further consultation is required.
Director of National Parks (DNP)	DNP was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. A follow-up email was sent to DNP on the 17 June 2022	No response has been received by DNP at the time of submission of the EP. Woodside will address any comments from DNP should they arise in the future.
Department of Industry, Science, Energy and Resources (DISER)	DISER was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
State Government Departments - Victoria		
Department of Jobs, Precincts and Regions (DJPR): Earth Resources Regulation	DJPR was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. DJPR responded on 20 April 2022 and requested to be engaged about decommissioning of the Minerva pipeline that within its Sate waters jurisdiction. While outside the scope of this Environment Plan, Woodside has since consulted relevant stakeholders on activities to support the planning of the decommissioning of Minerva assets in State waters. DJPR was also in attendance at the meeting DOT Victoria on 23 May 2022 to discuss marine pollution response engagements for this Environment Plan. Woodside sent a copy of the following documents to DJPR (and Dot Victoria) for review on the 30 June 2022: • Minerva Field Decommissioning Oil Pollution Emergency Plan (Rev 0) (00MC-BHP-N00-0002); • Minerva Field Emergency Response: Basis of Design and Field Capability Assessment (Rev 0) (00MC-BHP-N00-0003); • Corporate Incident Coordination Centre (CICC) Capability Assessment Report (Rev 4) (AOHSE-ER-0071); and • Minerva Field: Operational and Scientific Monitoring Bridging Implementation Plan (Rev 0) (00MC-BHP-N00-0004)	DJPR has made no claims or objections about activities in Commonwealth waters. Woodside considers it has addressed the stakeholder's feedback and no further consultation is required.
Department of DOT Victoria (DOT Victoria)	DOT Victoria was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. Woodside met with DOT Victoria 23 May 2022 as the principal response agency for marine pollution in Victorian State waters. DoT Victoria facilitated the attendance at the meeting of the following support agencies: • DEWLP • DJPR, marine pollution • EPA Victoria • Parks Victoria • VFA Discussion points at the meeting included: • Present the results of oil spill modelling undertaken for the two spill scenarios – the environment that may be affected (EMBA) being determined by low instantaneous contact thresholds and oil spill preparedness measures being based upon actionable exposure thresholds (surface and shoreline).	The petroleum activities OPEP (Appendix E) outlines arrangements for the engagement of relevant Victorian Government agencies should a spill impact Victorian State waters.

	• Describe Woodside response arrangements in relation incident command structure, spill response capability, OPEP/EERM structure and content, operational and scientific monitoring etc. • Ensure Victorian State protection priorities are suitably identified and addressed with respect to spill response and ongoing monitoring. • Ensure all relevant Victorian Agencies have the information required to enable an informed assessment of potential environmental impacts and risks. • Ensure Woodside systems and procedures align with Victorian State expectations / requirements e.g., incident reporting, ongoing communications, emergency response support etc. A representative from DEWLP followed up by email on 14 June 2022 and provided advice on the coordination of oiled wildlife support for a marine pollution event. Woodside responding by email on 14 June 2022, thanking DEWLP for its advice on potential oiled wildlife response arrangements in Victorian State jurisdiction. Woodside sent a copy of the following documents to DoT Victoria (and DJPR) for review on the 30 June 2022: • Minerva Field Decommissioning Oil Pollution Emergency Plan (Rev 0) (00MC-BHP-N00-0002); • Minerva Field Emergency Response: Basis of Design and Field Capability Assessment (Rev 0) (00MC-BHP-N00-0003); • Corporate Incident Coordination Centre (CICC) Capability Assessment Report (Rev 4) (AOHSE-ER-0071); and • Minerva Field: Operational and Scientific Monitoring Bridging Implementation Plan (Rev 0) (00MC-BHP-N00-0004)	
Victorian Fisheries Authority (VFA)	VFA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. VFA responded by email on 5 May 2022 and provided the following feedback: 1. VFA acknowledged that Woodside was liaising with SIV, relevant access licence holders and the Apollo Bay Fishermans Cooperative. 2. VFA requested a description of subsea infrastructure that is likely to remain and provision of coordinates if structures a proposed to be left *in situ* to ensure that fishers are notified. 3. VFA asked if planned discharges to the marine environment (chemicals) will result in any loss of marine life/pose any risk to safety of consuming seafood harvested from the area. Woodside responded on 16 June 2022 and provided the following feedback: 2. Woodside confirmed its decommissioning approach was for full removal of subsea infrastructure, to be undertaken in stages and under separate Environment Plans. 3. Woodside confirmed that all proposed activities were to be managed to MARPOL and international standards, with no expected impacts to commercial fisheries in the region.	Woodside notes VFA's response and considers it has addressed the stakeholder's feedback and no further consultation is required.
State Government Departments - Tasmania		
Department of Natural Resources and Environment Tasmania - Sea Fishing & Aquaculture (NRE)	NRE was phoned on 22 April 2022 to assess whether Tasmanian State-managed fisheries may be impacted by planned activities. NRE was subsequently sent follow up email and fact sheet on 22 April 2022. NRE responded initially on 22 April 2022 and again on 26 April 2022 confirming that planned activities occurred to the north of the Tasmanian jurisdictional boundary with respect to State managed fisheries. NRE advised there was no need to engage Tasmanian based stakeholders.	Woodside notes NRE's response and considers that no further consultation is required.
Environment Protection Authority Tasmania (EPA)	EPA was phoned on 20 April 2022 to identify relevant contacts within the Authority with respect to oil spill arrangements in Tasmanian State waters. EPA responded by email on 20 April 2022 and provided contact details. Woodside responded by email on 20 April 2022 and provided a location map of proposed activities, committing to engaging EPA should there be implications for Tasmanian State Waters from marine pollution based on oil spill modelling. EPA responded by email on 20 April 2022 acknowledging Woodside's correspondence. Woodside responded by email on 16 June 2022 confirming that no response was required by the EPA based on oil spill modelling for a worst-case marine pollution event. Woodside also confirmed that it had engaged relevant Victorian Government agencies in preparation of the Oil Pollution Emergency Plan (OPEP) for proposed activities. EPA responded by email on 16 June and advised that it had no further questions about proposed activities.	The petroleum activities OPEP (Appendix E) outlines arrangements for the engagement of relevant Victorian Government agencies should a spill impact Tasmanian State waters.

Local Government Department or Agency		
Corangamite Shire Council (CSC)	CSC was emailed on 7 April 2022 seeking advice on how best to manage community interest on proposed activities, given that Woodside no longer had access to the Minerva Community Reference Group following the sale of its onshore interests to Cooper Energy in 2019. CSC responded by email on 7 April 2022 offering to meet. Woodside met by phone with CSC and agreed to provide stakeholder consultation material for on forwarding to Councillors and relevant Shire staff. This information was provided to CSC by email on 14 April 2022.	Woodside acknowledges CSC's support to raise awareness with Councillors and relevant staff in the event community members enquired about proposed activities. Woodside will address any comments from this stakeholder or community members should they arise in the future.
Industry Representative Organisations		
AMOSC	AMOSC was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. Woodside sent a copy of the following documents to AMOSC on the 30 June 2022: • Minerva Field Decommissioning Oil Pollution Emergency Plan (Rev 0) (00MC-BHP-N00-0002); • Minerva Field Emergency Response: Basis of Design and Field Capability Assessment (Rev 0) (00MC-BHP-N00-0003); • Corporate Incident Coordination Centre (CICC) Capability Assessment Report (Rev 4) (AOHSE-ER-0071); and • Minerva Field: Operational and Scientific Monitoring Bridging Implementation Plan (Rev 0) (00MC-BHP-N00-0004)	No response has been received from AMOSC at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
Australian Petroleum Production & Exploration Association (APPEA)	APPEA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received from AMOSC at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	ASBTIA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received from ASBTIA at the time of submission of the EP. Section 7.3 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.
Bass Strait Scallop Industry Association (BSSIA)	The CFA (on behalf of the BSSIA) was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received from BSSIA or CFA at the time of submission of the EP. Section 7.3 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.
Commonwealth Fisheries Association (CFA)	The CFA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received from CFA at the time of submission of the EP. Section 7.3 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.
Seafood Industry Victoria (SIV)	SIV was sent an email and location map on 1 April 2022, seeking support for engaging relevant commercial fishing interests. SIV was engaged by phone and sent a follow up email on 6 April 2022. SIV responded by email on 7 April 2022, advising it could provide Woodside with contact details of relevant operators to enable direct engagement. Woodside responded by email on 13 April 2022 and advised it had had identified five State-managed fisheries of relevance for proposed activities. Woodside noted that these had been drawn from its previous Minerva EP and sought confirmation from SIV on relevancy of these fisheries, these being: • Abalone Fishery • Giant Crab Fishery • Rock Lobster • Fishery Scallop Fishery • Wrasse Fishery SIV responded on 14 May 2022 and confirmed that the previous assessment remained accurate. SIV again offered to provide contact details for these fisheries. Woodside responded by email on 14 April 2022 and requested contact details for the fisheries. Woodside also requested confirmation if there were other representative organisations or fishermen's co-ops that should be engaged.	No response has been received SIV specific to proposed activities at the time of submission of the EP. Section 7.3 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.

	SIV responded by email on 19 April 2022 contact details for four State-managed fisheries and the Apollo Bay Fishermen's Co-Op. Woodside responded by email on 19 April 2022 and sought to clarify contact details for the five fisheries as requested. SIV responded by email on 19 April 2022 providing clarity on contact details for all relevant fisheries. Woodside responded by email on 20 April 2022 and advised that consultation materials had been sent to all fishery contacts as provided by SIV. SIV responded on 20 April 2022 acknowledging Woodside's thanks. Woodside sent a follow up email to SIV on 23 May 2022 confirming its consultation activities and seeking advice whether SIV wished to provide feedback about proposed activities in its own right.	
Small Pelagic Fishery Industry Association (SPFIA)	SPFIA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. A stakeholder representing the SPFIA responded by email on 19 April 2022 and provided the following response: 1. Comment on respective rights of fishers and petroleum companies 2. Comment on the base case for decommissioning being full removal 3. Request that the expectation of SPFIA is for no permanent exclusion zone and the area be over fishable or compensate paid to fishers for long term loss of fishing grounds 4. Comment that Petroleum Safety Zones are not an instrument to close fishing grounds and that fishers faced imprisonment if fishing within a PSZ. The stakeholder sent by email on 30 May 2022 a follow up request for feedback on comments and requests. Woodside responded by email on 31 May 2022 and provided the following response: 1. Woodside confirmed that that planned activities for this EP comprised the plugging and permanent abandoning of four wells, with final decommissioning activities planned to be completed in 2025. Woodside advised that decommissioning activities, including the removal of subsea infrastructure no longer required, would be covered by a separate EP and Woodside would continue to consult the SPFIA on planned activities for Woodside's interests in the Otway Basin. 2. Woodside confirmed that the base case for decommissioning under the OPGGS Act was for complete removal. 3. and 4. Woodside confirmed that PSZs were a requirement under the OPGGS Act and Woodside complied with this requirement. The stakeholder responded by email on 2 June 2022 requesting a meeting and advised that the SE fishing industry's expectations are that: 1. Compensation is made for lost grounds (which impact cost to catch and the value of rights) and risk 2. Fishers do not go to jail for steaming past a disused wellhead Woodside responded by email on 3 June 2022 acknowledging the meeting request and provided suggested meeting dates. The stakeholder responded by email on 3 June 2022 and sent a meeting invitation. The stakeholder also provided contextual information on: • The nature and value of property rights in the fishing industry • Cumulative loss of fishing grounds in the South East Marine Region Woodside met with the stakeholder on 9 June 2022 and sent a follow up email acknowledging challenges facing the fishing industry in the South East Marine Region and meeting summary covering the following discussion points on proposed decommissioning activities to managed under this and future Environment Plans: • Woodside's planned approach for future decommissioning of the Minerva field is for full removal of subsea infrastructure, with the first stage of decommissioning being the plugging and permanent abandonment of the Minerva wells. • The P&A activity will include the planned removal of the wellheads from the field via the mobile offshore drilling unit or temporary storage of the wellheads on the seafloor within the existing petroleum safety zone for removal during the next stage of decommissioning via a vessel.	Woodside notes SPFIA's response and considers it has addressed the stakeholder's feedback and no further consultation is required.

	• The second stage of decommissioning will comprise the removal of all remaining subsea infrastructure, including the subsea trees, wellheads (if still in field), and the flowline running from the gas field to the horizontal directional drill (HDD) exit point approximately 800m from shore just south of Port Campbell. The removal of this infrastructure would be supported by a field survey confirming all potential obstructions on the sea floor had been removed. Prior to the commencement of this activity, an additional EP shall be submitted to NOPSEMA covering this scope. • Upon completion of the decommissioning work, and consistent with the requirements of the OPGGS Act, Woodside Petroleum (Victoria) Pty Ltd (as titleholder) would apply to have the PSZ lifted and progress with relinquishing the petroleum title via NOPTA. The stakeholder responded on 16 June 2022 affirming support for full removal and thanking Woodside for the meeting of 9 June 2022. The stakeholder also provided details on a commercial SMS system operated by SETFIA to support pre-start and activity completion notifications.	
South East Trawl Fishing Industry Association (SETFIA)	SETFIA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. A stakeholder representing the SETFIA responded by email on 19 April 2022 and provided the following response: 1. Comment on respective rights of fishers and petroleum companies 2. Comment on the base case for decommissioning being full removal 3. Request that the expectation of SETFIA is for no permanent exclusion zone and the area be over fishable or compensate paid to fishers for long term loss of fishing grounds 4. Comment that Petroleum Safety Zones are not an instrument to close fishing grounds and that fishers faced imprisonment if fishing within a PSZ. The stakeholder sent by email on 30 May 2022 a follow up request for feedback on comments and requests. Woodside responded by email on 31 May 2022 and provided the following response: 1. Woodside confirmed that that planned activities for this EP comprised the plugging and permanent abandoning of four wells, with final decommissioning activities planned to be completed in 2025. Woodside advised that decommissioning activities, including the removal of subsea infrastructure no longer required, would be covered by a separate EP and Woodside would continue to consult the SETFIA on planned activities for Woodside's interests in the Otway Basin. 2. Woodside confirmed that the base case for decommissioning under the OPGGS Act was for complete removal. 3. and 4. Woodside confirmed that PSZs were a requirement under the OPGGS Act and Woodside complied with this requirement. The stakeholder responded by email on 2 June 2022 requesting a meeting and advised that the SE fishing industry's expectations are that: 1. Compensation is made for lost grounds (which impact cost to catch and the value of rights) and risk 2. Fishers do not go to jail for steaming past a disused wellhead Woodside responded by email on 3 June 2022 acknowledging the meeting request and provided suggested meeting dates. The stakeholder responded by email on 3 June 2022 and sent a meeting invitation. The stakeholder also provided contextual information on: • The nature and value of property rights in the fishing industry • Cumulative loss of fishing grounds in the South East Marine Region Woodside met with the stakeholder on 9 June 2022 and sent a follow up email acknowledging challenges facing the fishing industry in the South East Marine Region and meeting summary covering the following discussion points on proposed decommissioning activities to managed under this and future Environment Plans: • Woodside's planned approach for future decommissioning of the Minerva field is for full removal of subsea infrastructure, with the first stage of decommissioning being the plugging and permanent abandonment of the Minerva wells. • The P&A activity will include the planned removal of the wellheads from the field via the mobile offshore drilling unit or temporary storage of the wellheads on the seafloor within the existing petroleum safety zone for removal during the next stage of decommissioning via a vessel.	Woodside notes SETFIA's response and considers it has addressed the stakeholder's feedback and no further consultation is required.

	• The second stage of decommissioning will comprise the removal of all remaining subsea infrastructure, including the subsea trees, wellheads (if still in field), and the flowline running from the gas field to the horizontal directional drill (HDD) exit point approximately 800m from shore just south of Port Campbell. The removal of this infrastructure would be supported by a field survey confirming all potential obstructions on the sea floor had been removed. Prior to the commencement of this activity, an additional EP shall be submitted to NOPSEMA covering this scope. • Upon completion of the decommissioning work, and consistent with the requirements of the OPGGS Act, Woodside Petroleum (Victoria) Pty Ltd (as titleholder) would apply to have the PSZ lifted and progress with relinquishing the petroleum title via NOPTA. The stakeholder responded on 16 June 2022 affirming support for full removal and thanking Woodside for the meeting of 9 June 2022. The stakeholder also provided details on a commercial SMS system operated by SETFIA to support pre-start and activity completion notifications.	
Southern Shark Industry Alliance (SSIA)	SSIA was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. A stakeholder representing the SSIA responded by email on 19 April 2022 and provided the following response: 1. Comment on respective rights of fishers and petroleum companies 2. Comment on the base case for decommissioning being full removal 3. Request that the expectation of SPFIA is for no permanent exclusion zone and the area be over fishable or compensate paid to fishers for long term loss of fishing grounds 4. Comment that Petroleum Safety Zones are not an instrument to close fishing grounds and that fishers faced imprisonment if fishing within a PSZ. The stakeholder sent by email on 30 May 2022 a follow up request for feedback on comments and requests. Woodside responded by email on 31 May 2022 and provided the following response: 1. Woodside confirmed that that planned activities for this EP comprised the plugging and permanent abandoning of four wells, with final decommissioning activities planned to be completed in 2025. Woodside advised that decommissioning activities, including the removal of subsea infrastructure no longer required, would be covered by a separate EP and Woodside would continue to consult the SSIA on planned activities for Woodside's interests in the Otway Basin. 2. Woodside confirmed that the base case for decommissioning under the OPGGS Act was for complete removal. 3. and 4. Woodside confirmed that PSZs were a requirement under the OPGGS Act and Woodside complied with this requirement. The stakeholder responded by email on 2 June 2022 requesting a meeting and advised that the SE fishing industry's expectations are that: 1. Compensation is made for lost grounds (which impact cost to catch and the value of rights) and risk 2. Fishers do not go to jail for steaming past a disused wellhead Woodside responded by email on 3 June 2022 acknowledging the meeting request and provided suggested meeting dates. The stakeholder responded by email on 3 June 2022 and sent a meeting invitation. The stakeholder also provided contextual information on: • The nature and value of property rights in the fishing industry • Cumulative loss of fishing grounds in the South East Marine Region Woodside met with the stakeholder on 9 June 2022 and sent a follow up email acknowledging challenges facing the fishing industry in the South East Marine Region and meeting summary covering the following discussion points on proposed decommissioning activities to managed under this and future Environment Plans: • Woodside's planned approach for future decommissioning of the Minerva field is for full removal of subsea infrastructure, with the first stage of decommissioning being the plugging and permanent abandonment of the Minerva wells. • The P&A activity will include the planned removal of the wellheads from the field via the mobile offshore drilling unit or temporary storage of the wellheads on the seafloor within the existing petroleum safety zone for removal during the next stage of decommissioning via a vessel.	Woodside notes SSIA's response and considers it has addressed the stakeholder's feedback and no further consultation is required.

	• The second stage of decommissioning will comprise the removal of all remaining subsea infrastructure, including the subsea trees, wellheads (if still in field), and the flowline running from the gas field to the horizontal directional drill (HDD) exit point approximately 800m from shore just south of Port Campbell. The removal of this infrastructure would be supported by a field survey confirming all potential obstructions on the sea floor had been removed. Prior to the commencement of this activity, an additional EP shall be submitted to NOPSEMA covering this scope. • Upon completion of the decommissioning work, and consistent with the requirements of the OPGGS Act, Woodside Petroleum (Victoria) Pty Ltd (as titleholder) would apply to have the PSZ lifted and progress with relinquishing the petroleum title via NOPTA. The stakeholder responded on 16 June 2022 affirming support for full removal and thanking Woodside for the meeting of 9 June 2022. The stakeholder also provided details on a commercial SMS system operated by SETFIA to support pre-start and activity completion notifications.	
Tuna Australia	Tuna Australia was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received from Tuna Australia at the time of submission of the EP. Section 7.3 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.
VRFish	VRFish was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. A follow-up email was sent on 23 May 2022.	No response has been received from VRFish at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
Commercial Fisheries – Commonwealth Managed		
• Bass Strait Central Zone Scallop Fishery • Eastern Skipjack Tuna • Eastern Tuna and Billfish Fishery • Small Pelagic Fishery (Western sub-area) • Southern and Eastern Scalefish and Shark Fishery (SESSF) - Trawl • Southern and Eastern Scalefish and Shark Fishery (SESSF) - Shark Gillnet Hook and Trap • Southern Bluefin Tuna Fishery • Southern Squid Jig Fishery	Representative organisations for Commonwealth-managed fisheries were provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. Feedback from these organisations is included in the Industry Representative Organisations section of this table.	Woodside considers it has addressed the stakeholder feedback from SETFIA, SPFIA and SSIA and no further consultation is required with these organisations. Woodside will address any comments from other representative organisations should they arise in the future.
Commercial Fisheries – State Managed		
• Abalone Fishery • Giant Crab Fishery • Rock Lobster Fishery • Scallop Fishery • Wrasse Fishery	Representative organisations for Commonwealth-managed fisheries were provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. Woodside sent a follow up email on 20 April 2022 to the SIV nominated representative for the Rock Lobster Fishery to confirm whether regional representative organisations should be engaged. The stakeholder advised by email on 20 April 2022 to contact the Chair at SIV and provided contact details. Woodside responded by email on 20 April 2022 advising it had been engaging SIV on planned activities and sought advice if other stakeholders may be affected. The stakeholder advised by email on 21 April 2022 to contact the Apollo Bay Fishermen's Co-Op and provided contact details. Woodside responded to the stakeholder by email on 22 April 2022 thanking them for their assistance and in the same email sought feedback from the Apollo Bay Fishermen's Co-Op on potential impacts from planned activities. Woodside sent a follow up email on 23 May 2022 to the Apollo Bay Fishermen's Co-Op.	No claims or objections have been received from representative organisations or fishers relevant to State managed fisheries at the time of submission of the EP. Section 7.3 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.

	The Apollo Bay Fishermen's Co-Op responded by email on 26 May 2022 and provided contact details for local fishers. Woodside sent a follow up email on 31 May 2022 to the local fishers. Woodside sent on 17 June 2022 activity advice to other licence holders in the fishery to ensure all potential fishers had been consulted. <u>Abalone Fishery</u> Woodside sent on 17 June 2022 an email to the SIV nominated representative for the Abalone Fishery to assess potential impact to activities. The representative responded by email on 19 June 2022 confirming that abalone fishery activities would not be impacted given water depth and distance from shore.	
Neighbouring Operators		
• Beach Energy (Operations) Limited	Beach was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022.	No response has been received at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
• Cooper Energy	Cooper Energy was provided the Minerva Plug and Abandonment and Field Maintenance Environment Plan Fact Sheet (Appendix D) by email on 14 April 2022. Cooper Energy responded by email on 3 May 2022 and advised the JV partner it had been kept well informed and did not have any issues. Woodside responded by email on 23 May acknowledging Cooper Energy's feedback.	Woodside notes Cooper Energy's response and considers that no further consultation is required.

5.2 Ongoing Consultation

Stakeholder consultation will be ongoing, and Woodside will work with stakeholders to address any future concerns if they arise throughout the validity of this EP. Should any new stakeholders be identified, they will be added to the stakeholder database and included in all future correspondence as required.

Woodside's commitments to ongoing consultation include:

- Responding in a timely manner to all stakeholder and community contacts regarding the proposed Minerva decommissioning activities;
- Stakeholders who raise objections and claims following EP submission will be responded to directly, and should any concerns raised have not already been addressed in the EP, these will be assessed in the same manner as all risks identified by Woodside;
- As Controlling Agency withing Victorian State jurisdiction, Woodside will consider comments made by Victorian Department of Transport (Vic DoT) in relation to Vic DoT's review of the Minerva Field Oil Pollution Emergency Plan (OPEP) and associated documents, and where appropriate, respond to such comments;
- Woodside will establish and maintain a publicly available interactive map which provides stakeholders with updated information on the offshore petroleum activities being conducted as part of the Minerva Field decommissioning program; and
- In the event of a marine pollution incident, and where post spill scientific monitoring indicates a potential for oil tainting of commercial fish species, Woodside shall engage with potentially affected commercial fishing licence holders and their representative organisations.

6 Environmental Risk Management Framework

Woodside has established a risk management governance framework with supporting processes and performance requirements that provide an overarching and consistent approach for the identification, assessment, and management of risks. Woodside policies have been formulated to comply with the intent of the Risk Management Policy and be consistent with the AS/ISO 31000-2018 Risk Management Principles and Guidance.

An integrated impact and risk assessment process was utilised to identify the most appropriate control measures to ensure each impact and risk is reduced to ALARP and an acceptable level (Figure 6-1). This process includes the incorporation of stakeholder consultation, regulatory requirements, industry good practice and environmental monitoring data on the relevant environmental impacts and risks.

6.1 Evaluation of Impacts and Risks

A formal impact and risk assessment was completed for each environmental aspect and source of risk for the petroleum activity described in Section 3 using the Environmental Impact Identification (ENVID) workshop process. The primary objective of the impact and risk assessment was to develop an understanding of the impact and risk, demonstrate its reduction to ALARP and demonstrate its acceptability to Woodside. It provided definition on the decisions made during the ENVID process, considering the detailed impact assessment for the sources of hazard, the controls chosen to reduce or prevent the impact or risk and why some controls were not chosen. This also involved consideration of the sources of risk, their positive and negative consequences, and the likelihood that those consequences may occur.

The ENVID assessment was conducted as a workshop with a range of personnel from different disciplines including Subsea and Production Engineering, Drilling and Well Services, Risk and HSE. Decisions made within the ENVID included:

- Confirmation of the sources of hazard identified;
- Allocation of likelihood rating for an unplanned source of hazard;
- Severity rating for all sources of hazard;
- The decision context (Type A, B or C) and a determination as to whether they are higher-order or lower-order impacts and risks;
- Identification of management controls and their acceptance through an ALARP process based upon the decision context; and
- Final acceptability of the impact or risk to Woodside using the acceptability criteria.

The outcome of the assessment process illustrated in Figure 6-1 is displayed in Sections 7 and 7.3 using a series of summary tables, detailed impact and risk descriptions, and impact and risk conclusions. All environmental aspects and their respective sources of hazard are as follows:

- Overview of the source of risk;
- Environmental impact assessment;
- Demonstration of ALARP; and
- Demonstration of acceptability.

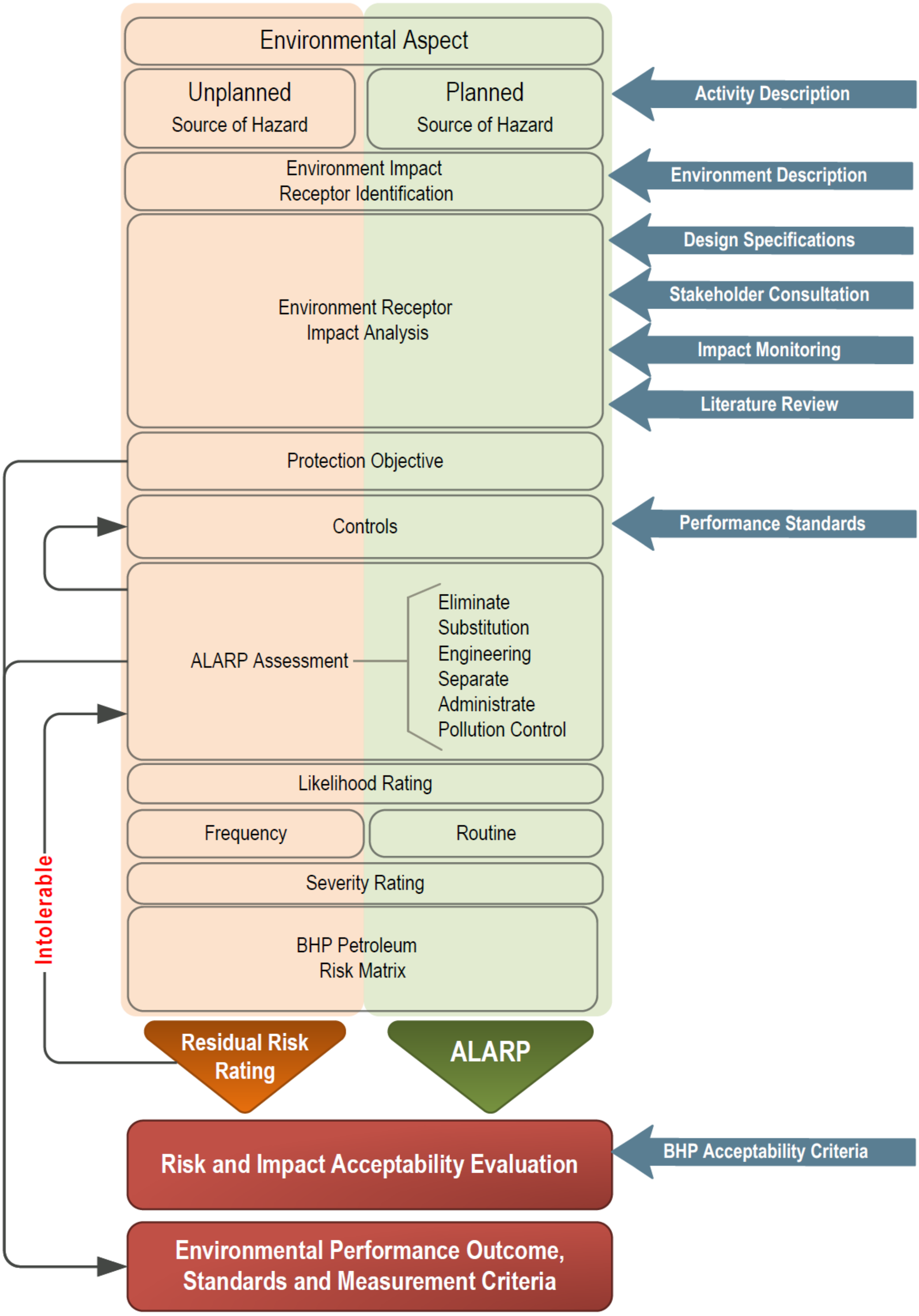


Figure 6-1: Environment Plan integrated impact and risk assessment

6.1.1 Decision Context

Consistent with the UKOOA Framework for Risk Related Decision Support (Oil & Gas UK, 2014), Woodside has applied a series of decision criteria to determine whether impacts and risks created during the *Minerva P&A and Field Maintenance activity* constitute 'lower-order' or 'higher-order' impacts and risks and subsequently how each are managed to ALARP and acceptable levels. This approach implies a level of proportionality wherein the principles of decision-making applied to each particular hazard are proportionate to acceptability of environmental risk of that hazard.

Woodside considers lower-order (or 'Type A') impacts or risks as those that:

- are well understood;
- are derived from standard, non-complex, or routine operations familiar to Woodside;
- there are clearly defined regulatory, corporate or industry (good practice) controls to manage the impact or risk;
- there are no concerns or objects from relevant Stakeholders;
- the 'severity level' for planned operations (impacts) and unplanned events (risks) does not exceed '2' based upon the Woodside severity level definition (Table 6-2); and
- the 'likelihood' for unplanned events is either 'unlikely' or 'highly unlikely' based upon the Woodside likelihood definitions (Table 6-3).

Woodside considers higher-order (or 'Type B') impacts or risks as those that:

- are not well understood or there is some uncertainty;
- are derived from complex operations not routinely undertaken by Woodside;
- regulatory, corporate or industry (good practice) controls require additional definition or validation;
- there have been some concerns or objections raised by relevant Stakeholders;
- the 'severity level' for planned operations (impacts) and unplanned events (risks) is '3' based upon the Woodside severity level definition (Table 6-2); and/or
- the 'likelihood' for unplanned events is considered 'probable' to 'highly likely' based upon the Woodside likelihood definitions (Table 6-3).

Woodside considers highest-order (or 'Type C') impacts or risks as those that:

- are not understood or there is a high degree of uncertainty;
- are derived from operations not previously undertaken by Woodside;
- corporate or industry (good practice) controls either do not exist or are insufficient to manage impacts or risks;
- there have been multiple concerns or objections raised by relevant Stakeholders and/or lobby groups;
- the 'severity level' for planned operations (impacts) and unplanned events (risks) is equal to or exceeds '4' based upon Woodside severity level definition (Table 6-2); and
- the 'likelihood' for unplanned events is considered 'probable' to 'highly likely' based upon the Woodside likelihood definitions (Table 6-3).

The decision-making principles described above are consistent with the precautionary principle (as defined in the EPBC Act) and provide assurance that the environmental impacts and risks are reduced to ALARP and of an acceptable level.

6.1.2 Environmental Impact and Risk Assessment

The environmental impacts were based on the environmental receptors identified in Section 4 with the impact descriptions developed in an initial screening process that identified the specific receptor that may be impacted. Further quantitative or qualitative definition of the impact was then completed to ensure an understanding of the impact (planned or unplanned) to confirm that the severity of the risk and impact was correctly assigned during the evaluation process.

6.1.3 Planned Activity Impact Assessment

All planned activities were assessed as being a routine impact and defined as such in the ENVID. The description and degree of impact formed the basis for the severity rating applied with a quantitative assessment of impact conducted where possible to ensure the impact was well understood and clearly categorised on the severity table. Where this was not possible, a robust qualitative assessment was completed and the severity rating assigned during the ENVID process in accordance with the HSE Risk Matrix, which is consistent with the Risk Management Severity Table (Table 6-2) taking into account any of the mitigative controls assigned. Where relevant, the potential for cumulative impacts or potential impacts to the values of World Heritage Properties from planned activities has also been evaluated. Given routine operations are planned, and impacts are mitigated via the application of control measures, likelihood or residual risk ratings were not applied.

6.1.4 Unplanned Event Risk Assessment

Risk ranking of unplanned events is the product of the consequence of an event (severity) and the likelihood of that event occurring.

Likelihood and potential severity ratings were assigned in accordance with the HSE Risk Matrix (Table 6-1), which allowed the risk of individual events to be categorised in a methodical and structured process. This was completed based upon judgement by the ENVID assessment team with detailed potential impact descriptions used to ensure a robust and comprehensive decision.

The likelihood rating is based on the frequency of the source of hazard actually occurring with all preventative controls taken into consideration (Table 6-3).

The potential severity rating was determined based on the potential impact that may occur once the source of hazard had occurred considering the application of mitigative controls in place to reduce the impact.

6.1.5 Spill Response Strategy Implementation Impact and Risk Assessment

A description of potential impacts and risks associated with the implementation of spill response strategies is detailed within the *Minerva Field Emergency Response Basis of Design and Field Capability Assessment* (00MC-BHP-N00-0003). This qualitative assessment informs the operational Spill Impact Mitigation Assessment (SIMA) processes and IAP development during and emergency oil spill response.

Table 6-1: Woodside risk matrix used for rating planned activities and unplanned events

Likelihood	Severity Level				
	1	2	3	4	5
Highly Likely	30	90	300	900	3000
Likely	10	30	100	300	1000
Probable	3	9	30	90	300
Unlikely	1	3	10	30	100
Highly Unlikely	0.3	0.9	3	9	30

Table 6-2: Woodside severity level definitions for environmental and community

Severity Level	Descriptor	Severity Factor
5	Severe impact to the environment and where recovery of ecosystem function takes 10 years or more; or Severe impact on community lasting more than 12 months or a substantiated human rights violation impacting 6 or more people	1000
4	Serious impact to the environment, where recovery of ecosystem function takes between 3 and up to 10 years; or Serious impact on community lasting 6-12 months or a substantiated human rights violation impacting 1-5 persons	300
3	Substantial impact to the environment, where recovery of ecosystem function takes between 1 and up to 3 years; or Substantial impact on community lasting 2-6 months	100
2	Measurable but limited impact to the environment, where recovery of ecosystem function takes less than 1 year; or Measurable but limited community impact lasting less than one month	30
1	Minor, temporary impact to the environment, where the ecosystem recovers with little intervention; or Minor, temporary community impact that recovers with little intervention	10

Table 6-3: Woodside likelihood definitions

Uncertainty	Frequency	Likelihood factor
Highly Likely	Likely to occur within a 1 year period.	3
Likely	Likely to occur within a 1 - 5 year period.	1
Probable	Likely to occur within a 5 - 20 year period.	0.3
Unlikely	Likely to occur within a 20 - 50 year period.	0.1
Highly Unlikely	Not likely to occur within a 50 year period.	0.03

6.2 Demonstration of ALARP

Regulation 10A(b) of the Environment Regulations requires demonstration that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable (ALARP).

6.2.1 Planned Activity and Unplanned Event ALARP Evaluation

This section details the process for demonstrating ALARP for both planned routine operations and unplanned events.

Demonstrating ALARP for lower-order (‘Type A’) impacts or risks

When an impact or risk has been evaluated as ‘lower-order’ based upon the Decision Context detailed in Section 6.1.1, and identified regulatory, corporate and/or industry good practice controls are implemented, Woodside considers the impact or risk to be managed to ALARP and no further detailed engineering evaluation of controls is required. The application of feasible and readily implementable alternate, additional, or improved controls may be adopted opportunistically when demonstrated to further reduce potential environmental impacts or risks.

Demonstrating ALARP for higher-order (‘Type B’) impacts or risks

When an impact or risk has been evaluated as higher-order based upon the Decision Context detailed in Section 6.1.1, in addition to relevant regulatory, corporate and/or industry good practice controls being implemented, alternate, additional or improved controls should be proposed and evaluated according to their feasibility, reasonableness, and practicability to implement to further reduce the potential for impacts and risks associated with the activity. Woodside apply a cost benefit analysis when evaluating additional controls and apply those that are both feasible and where the cost (safety / time / effort / financial) are not grossly disproportionate to the potential reduction in environmental impact or risk afforded by the control.

Demonstrating ALARP for highest-order (‘Type C’) impacts or risks

When an impact or risk has been evaluated as highest-order based upon the Decision Context detailed in Section 6.1.1, alternate, additional or improved controls over and above relevant regulatory, corporate and/or industry good practice must be proposed and evaluated based upon a precautionary approach, ensuring any and all feasible controls that have the potential to reduce environmental impacts and risks are implemented, when safe to do so and irrespective of the additional effort, time or financial cost associated with the implementation of the control.

Hierarchy of Controls and Emissions Reduction Hierarchy

When evaluating additional controls for ‘Type B’ and ‘Type C’ impacts and risks associated with each aspect of the activity with the exception of atmospheric emissions, Woodside applied the hierarchy of controls as defined below and illustrated in Figure 6-2:

- Eliminate – Remove the source preventing the impact, i.e. eliminate the hazard;
- Substitution – Replace the source preventing the impact;
- Engineering – Introduce engineering controls to prevent or control the source having an impact;
- Separate – Separate the source from the receptor preventing impact;
- Administrate – Procedures, competency and training implemented to minimise the source causing an impact;
- Pollution Control – Implement a pollution control system to reduce the impact;
- Contingency Planning – Mitigate control reducing the impact; and
- Monitoring – Program or system used to monitor the impact over time.

The general preference is to accept controls that are ranked in the Tier 1 categories of Eliminate, Substitute, Engineering and Separate as these controls provide a preventive means of reducing the likelihood of the hazard occurring over and above Tier 2 controls.

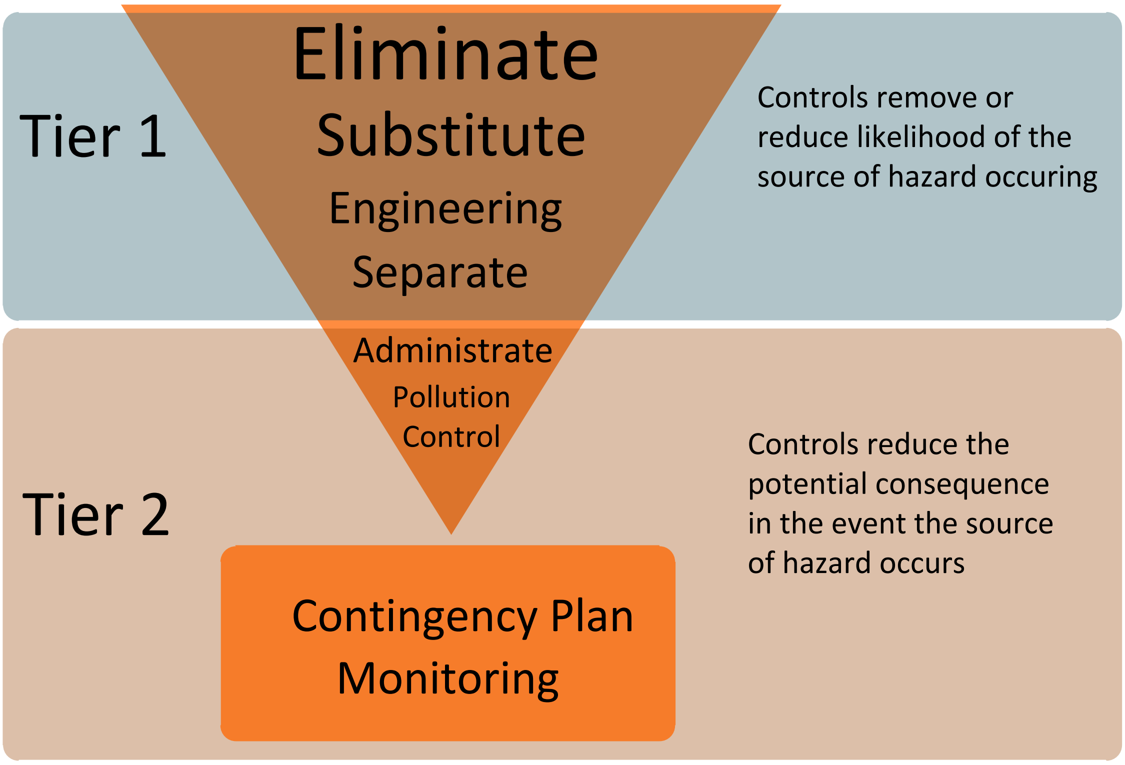


Figure 6-2: Hierarchy of control framework

For the evaluation of control measures to reduce atmospheric emissions associated with the activity to ALARP, Woodside applied the emissions reduction hierarchy as detailed below:

- Avoid – Remove the use of emissions sources, i.e. eliminate the hazard;
- Reduce – Limit the amount of emissions generated during the activity, i.e., reduce overall emissions;
- Offset – Purchase carbon credits via accredited scheme proportional to the emissions produced;
- Substitute – Replace sources of emissions for lower emissions technology and/or renewable energy;
- Monitor – Program or system used to monitor emission types / volumes to inform reporting and/or feedback to reduction targets; and
- Advocacy – Actively promote controls that avoid or reduce emissions to both internal and external stakeholders with the aim of influencing the adoption of new or improved technologies and the adoption of reduction targets.

6.2.2 Spill Response Strategy Effectiveness and ALARP evaluation

This section provides detailed ALARP assessment of the adequacy of resourcing available to support the identified suitable response spill strategies detailed within the *Minerva Field Emergency Response: Basis of Design and Field Capability Assessment* (00MC-BHP-N00-0003). In developing the environmental performance standards that apply to each response strategy, Woodside has considered the level of performance that is reasonable to achieve for each control measures and the 'effectiveness' of the control measures.

The effectiveness of the control measures is assessed considering the following criteria and follows the definitions in NOPSEMA's Control Measures and Performance Standards Guidance Note (NOPSEMA, 2012), with ranking provided in Table 6-4:

- Availability: the status of availability to Woodside;
- Functionality: a measure of functional performance;
- Reliability: the probability that the control will function correctly;
- Survivability: the potential of the control measure to survive an incident;
- Independence / Compatibility: the degree of reliance on other systems and/ or controls, in order to perform its function.

Table 6-4: Criteria for ranking spill response effectiveness

Evaluation Criteria	Spill Response Effectiveness Ranking	
	Low	High
Availability	Woodside does not have equipment/ resources on standby, or contracts, arrangements, and/ or MoU's in place for the provision of equipment/ resources. Woodside has internal processes and procedures in place to expedite timely provision of equipment/ resources.	Woodside has equipment/ resources on standby, and/ or contracts, arrangements, or MoU's in place for the provision of equipment/ resources.
Functionality	Implementation of the control measure does not greatly reduce the risk/ impact.	Implementation of the control measure has material difference in reducing the risk/ impact.
Reliability	The control measure is not reliable (e.g. has not been tried and tested in Australian waters) and/ or low assurance can be given to its success rate / effectiveness.	The control measure is reliable (e.g. has been tried and tested in Australian waters) and / or high assurance can be given to its success rate / effectiveness.
Survivability	Control measure has a low operating timeframe and will need to be replaced regularly throughout its operation period in order to maintain its effectiveness.	Control measure has a high operating timeframe and will not need to be replaced regularly throughout its operation period in order to maintain its effectiveness.
Independence/ Compatibility	Control measure is reliant on other control measures being in place and / or the control measure is not compatible with other control measures in place.	Control measure is not dependent on other control measures being in place and / or control measure can be implemented in unison with other control measures.

Each control was then evaluated taking into consideration the environmental benefit gained from implementation compared with its practicability (i.e., control effectiveness, cost, response capacity and implementation time) to determine if the control was either:

- Accept and implement; or
- Reject.

This traffic light system is used in the ALARP demonstration tables where the 'do nothing' option is rejected, along with a scalable option that generally involves mobilising spill response resources and equipment to site and on standby within the Minerva Field. Accepted controls in all the ALARP demonstration tables indicate those that would be implemented as part of the response.

Applying principles similar to those presented within the UKOOA Framework for Risk Related Decision Support (Oil & Gas UK, 2014), as described in Section 6.1.1 of this EP, Woodside has adopted the follow criteria for the determination of spill response strategy preparedness that present a lower-order risk compared to those that present a higher-order risk.

- A spill response strategy is determined to present a lower-order risk where all controls have been ranked as 'high' according to the criteria for ranking spill response effectiveness (Table 6-4) and additional controls would unlikely reduce potential environmental impacts and risks further. As such, Woodside considered 'Type A' spill response strategies to be managed to ALARP;

- A spill response strategy is determined to present a higher-order risk where one or more controls have been ranked as 'low' according to the criteria for ranking spill response effectiveness (Table 6-4) and additional controls would likely reduce potential environmental impacts and risks further. As such, alternate, additional or improved controls should be proposed in an attempt to increase their effectiveness ranking to 'high'. Where improved controls have been identified but are not readily available, and improvement plan has been developed to meet the oil spill response need prior to undertaking the activity.

Woodside's ALARP assessment for resourcing for each spill response strategy is presented within *Minerva Field Emergency Response: Basis of Design & Field Capability Assessment* (00MC-BHP-N00-0003).

6.3 Demonstration of Acceptability

Regulation 10A(c) of the OPGGS (Environment) Regulations 2009 requires demonstration that the environmental impacts and risks of the activity will be of an acceptable (tolerable) level.

The demonstration of acceptability is completed independently of the ALARP evaluation as described above. However, as with the demonstration of ALARP, the demonstration of acceptability detailed below applies the decision-making principles described in Section 6.1.1 ensuring consistency with the precautionary principle when considering the acceptable levels of impact and risk caused by the activity.

<u>Demonstrating acceptability for lower-order ('Type A') impacts or risks</u>

When an impact or risk has been evaluated as 'lower-order' based upon the Decision Context detailed in Section 6.1.1, and identified regulatory, corporate and/or industry good practice controls consistent with relevant actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) are implemented, and the application of these controls clearly indicate the aspect-specific Environmental Performance Outcomes (EPOs) can be achieved, Woodside considers the impact or risk to be managed to an acceptable level.

<u>Demonstrating acceptability for higher-order ('Type B') impacts or risks</u>

When an impact or risk has been evaluated as 'higher-order' based upon the Decision Context detailed in Section 6.1.1, acceptability of the impact or risk is evaluated based upon the following criteria:

- relevant regulatory, corporate and/or industry good practice controls have been identified and implemented (including consideration of relevant actions prescribed in recovery plans and approved conservation advice);
- the activity does not contravene any relevant Plan of Management for a World Heritage place, National Heritage place or Ramsar wetland identified within the EMBA;
- any alternate, additional, or improved controls adopted via the detailed engineering risk assessment have been/will be implemented to manage potential impacts and risks to ALARP;
- there are either no objections or claims made by relevant stakeholders for the aspect of the activity being assessed, or any objections or claims received from relevant Stakeholders are assessed for merit and controls adopted to address the objections or claims where merited;
- where industry good practice cannot be adopted, professional judgement made by subject matter experts used to evaluate acceptability of potential environmental impact or risk based upon adoption of alternate, additional, or improved controls identified during detailed engineering risk assessment;
- Consideration of relevant actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) have informed the development of control measures;
- Relevant principles of Ecologically Sustainable Development (ESD) (as defined within Section 3A of the EPBC Act) are considered with respect to:

  - The 'Integration Principle' in the context of stakeholder engagement and the adoption of suitable controls where reasonably practicable;
  - The 'Intergenerational Principle' in the context of considering how the activity may affect the health, diversity and productivity of the environment for future generations;
  - The 'Biodiversity Principle' in the context of mitigating potential impacts and risks to matters of National Environmental Significance (MNES);
  - For relevant aspects, such as oil pollution emergency response and remediation, the 'Valuation Principle' in the context of bearing the costs associated with the activity; and
- the application of adopted controls clearly indicate the aspect-specific Environmental Performance Outcomes (EPOs) can be achieved.

<u>Demonstrating acceptability for highest-order ('Type C') impacts or risks</u>

When an impact or risk has been evaluated as 'highest-order' based upon the Decision Context detailed in Section 6.1.1, the potential environmental impact or risk can only be deemed acceptable once the criteria for 'Type B' demonstration of acceptability detailed above has been met and:

- any alternate, additional, or improved controls adopted via the implementation of a precautionary approach (consistent with the 'Precautionary Principle' as defined within Section 3A of the EPBC Act) can demonstrate residual impacts have been lowered such that a severity level of '4' becomes 'unlikely' and / or the severity level of '5' becomes 'highly unlikely' based upon the Woodside Risk Matrix (Table 6-1).

6.4 Environmental Performance Outcomes, Environmental Performance Standards and Measurement Criteria

Regulation 10A(d) of the Environment Regulations requires the EP provides appropriate environmental performance outcomes (EPOs), environmental performance standards (EPSs) and measurement criteria.

An objective of the EP is to ensure that all activities are carried out in accordance with appropriate EPSs thus ensuring EPOs are achieved. This requires (among other things) that appropriate measurement criteria for demonstrating that the EPSs have been met as defined within the EP.

Establishing outcomes and standards is a process that considers legal requirements, environmental risks (described in risk assessment presented Section 7 and Section 8) control measures (Section 7 and Section 8), and the views of interested parties (Section 5). The resulting outcomes and standards must be measurable where practicable and consistent with Woodside's Our Values.

6.4.1 Environmental Performance Outcomes

EPOs were developed during the ENVID process to ensure protection of the environment from the impact or risk and to ensure ongoing performance and measurability of the controls. All environmental impacts and risks are required to have at least one associated environmental performance outcome. These were developed using the below criteria:

- Specific to the source of hazard;
- Indicate what level of performance is required (e.g. 'No' impact, 'limited to…', or 'reduced to…);
- Contain a statement of measurable performance (where applicable);
- Consistent with legislative and HSE requirements; and
- Are achievable provided the proposed control measures and associated Environmental Performance Standards (EPSs) are implemented and effective.

Table 6-5 details the EPOs developed for the *Minerva Decommissioning Program*, both in relation to planned activities and unplanned events.

Table 6-5: Minerva decommissioning environmental performance outcomes

EPO #	EPO Description	Relevant Aspect
EPO 01	No unplanned vessel interactions (including collision)	Physical Presence Hydrocarbon Release – Vessel Collision
EPO 02	Benthic habitat and biota disturbance limited to operational area	Benthic Habitat Disturbance
EPO 03	No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)	Light Emissions Noise Emissions Marine Fauna Interactions
EPO 04	Planned atmospheric emissions limited to those necessary to undertake the activity and maintain well integrity.	Atmospheric Emissions
EPO 05	Impacts to water quality from planned discharges reduced to ALARP	Routine & Non-Routine Discharges
EPO 06	No unplanned release of solid waste or objects to the marine environment	Waste Management Unplanned Discharge - Solids
EPO 07	No introduction of invasive marine species	Introduction of Invasive Marine Species
EPO 08	No accidental release of chemicals or hydrocarbons to the marine environment	Unplanned Discharges – Chemicals & Minor Hydrocarbon Spills Hydrocarbon Release – Vessel Collision Hydrocarbon Release – Loss of Well Control

6.4.2 Environmental Performance Standards

An EPS is a statement of performance required of a control measure (a system, an item of equipment, a procedure or functional responsibility (person)), which is used as a basis for managing environmental impact and risk, for the duration of the activity.

There is a specific link between the EPOs, the EPSs and control measures; each EPO has one or more standards defining the performance requirement that needs to be met by a control measure to meet the EPO.

EPSs detailed within this EP are specific, measurable, and achievable.

6.4.3 Environmental Measurement Criteria

Measurement criteria have been assigned for each EPS as a means of validating that each EPO and EPS will be / has been met throughout the duration of the activity, thus continually reducing environmental impacts and risks to ALARP and acceptable levels.

All measurement criteria are designed to be inspected or audited via compliance assurance activities and enable a traceable record of performance to be maintained.

EPOs, EPSs and Measurement Criteria both in relation to planned activities and unplanned events (and prevention of unplanned events) have been consolidated in the Environmental Performance Section 9 of this EP.

EPOs, EPSs and Measurement Criteria relating to oil spill response preparedness are detailed within the *Minerva Field Emergency Response: Basis of Design and Field Capability Assessment* (00MC-BHP-N00-0003).

EPOs, EPSs and Measurement Criteria relating to CICC capability and competency are detailed within the *Corporate Incident Coordination Centre (CICC) Capability Assessment* (AOHSE-ER-0071).

EPOs, EPSs and Measurements Criteria for the effectiveness of the of response strategy implementation are detailed within the *Minerva Field Decommissioning Oil Pollution Emergency Plan* (OPEP) (00MC-BHP-N00-0002).

7 Environmental Impact Assessment: Planned Activities

This Section of the EP presents the environmental impact and risk assessment for the planned petroleum activity described in Section 3 based on the Environmental Risk Management Framework described in Section 6.

7.1 Impact Assessment and Evaluation

The purpose of this Section is to address the requirements of Regulations 13(5) and 13(6) by providing an assessment and evaluation of all the identified impacts associated with the petroleum activity and associated control measures that will be applied to reduce the impacts to ALARP and an acceptable level.

The environmental aspects and sources of impacts identified during the ENVID process were divided into planned activities (i.e. routine operations) and unplanned (i.e. incidents) events. This Section presents the impact assessed for the planned activities identified for the petroleum activity. Section 8 presents the risk assessment for the unplanned events. Table 7-1 provides a summary of the impact analysis for the aspects associated with the planned activities. The following sub-sections provide a comprehensive impact assessment for each of the planned activities, and subsequent control measures to be implemented to reduce the impacts to ALARP and acceptable levels.

Table 7-1: Summary of the environmental impact analysis for planned activities

EP Section	Aspect	Value Potentially at Risk / Impact										Risk Assessment & Evaluation			
		Environmental							Socio-Economic						
Planned Activities		Marine Sediment	Water Quality	Air Quality	Ecosystems / Habitat	Marine Species	Marine Protected Areas	Key Ecological Features	Commercial Fisheries	Shipping Activities	Tourism and Recreation	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
7.3	**Physical presence**														
	Timing of the activity and location of the MODU and vessels within the operational area					x			x	x		10	N/A	-	Tolerable
	Presence of subsea infrastructure and mooring equipment								x	x		10	N/A	-	Tolerable
7.4	**Benthic disturbance**														
	Running and retrieving of mooring equipment for MODU				x			x				10	N/A	-	Tolerable
	Anchoring of vessels (contingent)				x			x				10	N/A	-	Tolerable
	Cement displacement to seabed	x			x							10	N/A	-	Tolerable
	ROV operations				x							10	N/A	-	Tolerable
	Well head cutting & removal				x							10	N/A	-	Tolerable
	Temporary wet storage of equipment adjacent to well locations – (see Griffin)				x							10	N/A	-	Tolerable
7.5	**Light emissions**														
	MODU & vessel operations within operational area				x	x	x					10	N/A	-	Tolerable
7.6	**Noise emissions**														
	MODU operations within operational area					x						10	N/A	-	Tolerable
	Vessel operations within operational area					x						10	N/A	-	Tolerable
7.7	**Routine and non-routine atmospheric emissions**														

EP Section	Aspect	Value Potentially at Risk / Impact										Risk Assessment & Evaluation			
		Environmental							Socio-Economic						
Planned Activities		Marine Sediment	Water Quality	Air Quality	Ecosystems / Habitat	Marine Species	Marine Protected Areas	Key Ecological Features	Commercial Fisheries	Shipping Activities	Tourism and Recreation	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
	MODU & vessel operation			x								10	N/A	-	Tolerable
	Surface venting / flaring of hydrocarbon gas			x								10	N/A	-	Tolerable
7.8	**Routine and non-routine discharges**														
	Routine discharges from MODU and vessels: • Sewage • Grey water • Desalination brine • Cooling water • Deck drainage • Bilge water • Putrescible (food) waste • BOP control fluid		x									10	N/A	-	Tolerable
	Cement discharge – surface		x									10	N/A	-	Tolerable
	Marine growth removal		x									10	N/A	-	Tolerable
7.9	**Waste management**														
	Waste generated by miscellaneous MODU & vessel operations: • General (non-hazardous) waste • Hazardous waste											10	N/A	-	Tolerable

7.2 Environmental Impacts and Risks Excluded from the Scope of the Environment Plan

This EP covers impacts and risks associated with vessels whilst within the operational area. During transit to and from the operational area, vessels will be governed by the relevant marine legislation.

Helicopter operations within the operational area are limited to helicopter take-off and landing on the helideck with no unnecessary or prolonged flight patterns that would impact marine mammals within the vicinity of the operational area. Helicopters transiting to and from the operational area will be governed by relevant aviation legislation.

7.3 Physical Presence

7.3.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Physical presence	Presence of the MODU and vessels and timing of the activity.	Interference with or displacement of other marine users (e.g. commercial shipping, commercial fishing and/ or other third party vessels).	10	N/A	-	Type A Low Order Impact	Tolerable

7.3.2 Source of Risk

In order to undertake the proposed activities, the MODU will be moored above each well location within the operational area. The activities will be short in duration, with the MODU expected to be on location for approximately 2 months, contingent on weather conditions or unforeseen circumstances. The MODU will be continually operating 24-hours a day, seven days a week for the duration of the activity. AHTS vessels will be transiting to and from the operational area multiple times per week for the duration of the activity, generally one vessel is stationed within the Field to service the MODU as required and to prevent unauthorised interacts between the MODU and other marine users.

The physical presence of the MODU and AHTS vessels in the operational area has the potential to cause interference with or displacement of other marine users, including commercial shipping and commercial fishing. The operational area lies within a cautionary area associated with the Minerva Field (refer to Figure 3-3). In addition, a temporary 500 m Rig Safety Exclusion Zone (RSEZ) and 1 km cautionary zone around the MODU will be established for the duration of the activity.

7.3.3 Environmental Impact Assessment

Interference with Commercial Shipping

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.

Ports Australia (2019) provide statistics for port operations throughout Australia's main commercial ports. Based on the latest information (2018 – 2019 financial year) the majority of commercial shipping traffic transiting to and from Victorian ports were bulk liquid carriers (696,261), bulk gas (445,230),other cargo (3,800), container (1,057), general cargo (716), car carrier (384) and livestock (36).

The use of the shipping fairways is strongly recommended by AMSA, but is not mandatory and the International Regulations for Preventing Collisions at Sea 1972 applies to all vessels navigating within or outside the shipping fairways.

The proposed activities are short in duration and the potential for disruption to other marine users is expected to be limited to temporary displacement of vessels should there be a requirement to make any slight modification to their course. The potential impact associated with interference with commercial shipping is considered to be low.

Displacement of Commercial Fishing

There are a number of Commonwealth and State managed fisheries with boundaries that overlap the operational area, however, only a few expend any effort in the waters directly adjacent to the operational area (Section 4.5.1). Commercial fishers are already excluded from the Petroleum Safety Zone (PSZ) surrounding Minerva subsea well infrastructure, therefore potential impacts to commercial fisheries are no different when the MODU is moored in the operational area. This exclusion may result in result in slightly reduced catch potential in a very small area. There may also be temporary disruption, with support vessels operating in waters adjacent to the operational area, but these would be temporary in nature.

An analysis of the current fishery closures, depth range of activity, historical fishing effort data, fishing methods (**Table** 4-8) and consultation feedback (Section 4) revealed that there is a low potential for active commercial fisheries in waters directly adjacent to the operational area. The area affected represents only a very small area available to commercial fishing activities. The potential impact is predicted to be low as a result of the exclusion of commercial fishing activity from a relatively small area.

There are no identified impacts to any values of any World Heritage Properties associated with physical presence within the operational area.

There are no identified cumulative impacts associated with physical presence within the operational area.

7.3.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) controls accepted by Woodside to manage the impacts associated with the physical presence of the MODU and vessels are detailed below:

Table 7-2: Physical presence – control measures

Control Measure	Source of Requirement / Good Practice
Navigation Equipment	Navigation Act 2012; International Convention of the Safety of Life at Sea (SOLAS) Marine Order Part 30: Prevention of Collisions, Issue 8 Marine Order 21, Issue 8 (Safety of Navigation and Emergency Procedures)
Automatic Identification System (AIS)	Navigation Act 2012; International Convention of the Safety of Life at Sea (SOLAS): Regulation 19-1 of Chapter V of SOLAS.
Notice to Mariners and AUSCOAST warning	Navigation Act 2012; International Convention of the Safety of Life at Sea (SOLAS)
Stakeholder Communication	OPGGS(E) Regs (11A) Woodside Community Stakeholder Management Plan Woodside Community Concerns, Inquiries and Complaints Procedure
Rig Safety Exclusion Zone	MODU Safety Case
Training & Competency	AMSA Marine Order Part 3: Seagoing Qualifications
Additional Opportunistic Controls	

Control Measure	Source of Requirement / Good Practice
Public Information	Establish and maintain a publicly available interactive map which provides stakeholders with updated information on the offshore petroleum activities being conducted as part of the Minerva Field decommissioning program

7.3.5 Demonstration of ALARP

The physical presence of the MODU and AHTS vessels for the duration of the *Minerva P&A and Field Maintenance* activity is considered a 'Type A' (lower order) impact based upon the Decision Context described in Section 6.1.1 of this EP. Given the limited nature and scale of potential disturbance from physical presence, and given the controls detailed above are consistent with both regulatory requirements and industry good practice, Woodside considers the impact has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls is required.

7.3.6 Demonstration of Acceptability

Woodside is satisfied that when the accepted controls detailed above are implemented the environmental performance outcome (EPO) of "No unplanned vessel interactions (including collision)" will be met, therefore Woodside considers the impact to be managed to an acceptable level. Additionally, consideration of actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) have been assessed, with none specifically relevant to the physical presence of the MODU and vessels within the operational area. Other aspects of the activity relevant to these plans and advices are detailed within subsequent sections of this EP.

Some concerns were raised regarding the application of PSZ more broadly, and the overall pressures on commercial fishers due to reduced fishing grounds within the SEMR, however, further consultation determined that these concerns were not relevant to the proposed decommissioning activities within the Minerva Field. There were no concerns or objections regarding the physical presence of the MODU or vessels within the operational area.

7.4 Benthic Habitat Disturbance

7.4.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Benthic habitat disturbance	Transponder & anchor placement within 1 km of well centre	Benthic habitat and biota disturbance	10	N/A	-	Type A Low Order Impact	Tolerable
	Cutting and recovery of well heads & ROV operations		10	N/A	-	Type A Low Order Impact	Tolerable
	Potential 'wet storage' of well heads and XTs adjacent to well locations (contingent & temporary)		10	N/A	-	Type A Low Order Impact	Tolerable

7.4.2 Source of Risk

Benthic habitat disturbance will occurring during the P&A program as a result of the temporary anchoring the MODU, setting transponders with clump weights on the seabed, the potential temporary wet storage of well heads and XT's on the seabed adjacent to the well locations and ROV operations.

Transponder clump weights may be placed on the seabed to inform anchor positioning (if required). Between 8 and 12 clump weights with an approximate footprint of 1 m^2 may be deployed on the seabed within 1 km of each well centre.

Anchors and chains from semi-submersible MODUs come into contact with the seabed during the deployment and removal of the MODU. The contracted MODU may be moored with up to 12 anchors, which can be laid at a distance of up to approximately 1 km from the MODU. The anchors and catenary of the chain are expected to occupy a total area of approximately 210 m^2 each (conservatively allowing for large anchors of 60 m^2 for anchor contact plus 300 m x 0.5 m for catenary contact).

The anchors are laid and retrieved by a support vessel, which carries the anchors to position and deploys them directly on the seabed. If the anchors are dragged accidentally during laying or retrieval, a larger localised area may be temporarily disturbed around the anchor locations. Anchor mooring analyses and procedures are in place prior to, and during anchor mobilisation and retrieval activities to ensure that it is undertaken in a safe manner. Also, anchors are tension tested after installation and prior to the commencement of well operations to minimise the potential for the MODU to drag off location (for example, during inclement weather).

When not undertaking support activities, supply vessels generally maintain station keeping via dynamic positioning (DP) when in Field.

Sediment surrounding each of the four wellheads will need to be moved (via water jetting by an ROV) in order to cut the well heads below the mudline. Jetting would likely displace sediment

7.4.3 Environmental Impact Assessment

Area of potential benthic disturbance

Based upon the setting of up to 12 transponders and corresponding large anchors, the total area of benthic disturbance around each well centre associated with mooring operations equates to 0.002532 km^2.

Jetting operations and the temporary storage of equipment would likely disturb around 10 m^2 of sediment surrounding each of the 4 wells.

The cumulative area that will be affected by activities over four well centres is estimated to be less than 0.01 km^2. The severity of potential impact to benthic communities is affected by density of biota, sensitivity of biota to disturbance and recovery potential of benthic communities. The seabed fauna throughout the operational area is considered to be sparse and comprised predominantly of crustaceans and polychaetes. These species are considered to have low sensitivity to physical disturbance compared to, for example, sponges or octocorals, and generally display high recovery following physical disturbance. The area of disturbance represents an extremely small portion of similar habitat and the environmental impact is considered to be insignificant.

There are no identified impacts to any values of any World Heritage Properties identified within the operational area.

There are no identified cumulative impacts associated with benthic habitat disturbance on previously disturbed benthos surrounding existing well centres.

7.4.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) controls accepted by Woodside to manage the impacts associated with benthic habitat disturbance are detailed below:

Table 7-3: Benthic habitat disturbance – control measures

Control Measure	Source of Requirement / Good Practice
Rig Mooring & Positioning Plan	API RP 2SK – mooring analysis; ISO 19901-7:2013 – mooring tensioning; and OPGGS Act (Section 572).
Additional Opportunistic Controls	
Dynamic positioning of MODU	Not Applicable – The Minerva Field is too shallow (~60 m) for the use of a DP MODU.

7.4.5 Demonstration of ALARP

The benthic habitat disturbance created by the placement of mooring equipment within the operational area during the *Minerva P&A and Field Maintenance* activity is considered a 'Type A' (lower order) impact based upon the Decision Context described in Section 6.1.1 of this EP. Given the limited (temporary) nature and scale (i.e., a very small percentage of similar regional habitat) of potential benthic habitat disturbance caused by the proposed activity, and given the controls detailed above are consistent with both regulatory requirements and industry good practice, Woodside considers the impact has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls is required.

Demonstration of Acceptability

Woodside is satisfied that when the accepted controls are implemented the environmental performance outcome (EPO) of "Benthic habitat and biota disturbance limited to operational area" will be met, therefore Woodside considers the impact to be managed to an acceptable level. Additionally, consideration of actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) have been assessed, with none specifically relevant to benthic disturbance within the operational area. Other aspects of the activity relevant to these plans and advices are detailed within subsequent sections of this EP.

No concerns or objections regarding benthic habitat disturbance have been raised by relevant stakeholders.

7.5 Light Emissions

7.5.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Light emissions	Artificial light onboard MODU and vessels	Light emissions (light spill/ glow) from external lighting causing behavioural alterations in protected species including displacement from foraging areas.	10	N/A	-	Type A Low Order Impact	Tolerable
	Light generated from contingent flaring via MODU flare boom	Short-duration (<1hr) light spill / glow causing behavioural alterations in protected species including displacement from foraging areas.					

7.5.2 Source of Risk

During the activity, artificial lighting on the MODU and AHTS vessels will be required on a 24-hour basis. This safety and navigational lighting on the MODU and AHTS vessels will generate light glow and direct illumination of surrounding surface waters. Most external lighting aboard both the MODU and AHTS vessels is directed towards working areas such as the main decks, although spot lighting may also be used on an as-needed basis. Lighting is required for safety and navigational purposes, and cannot be eliminated.

External lighting for deck operations typically consist of bright white (metal halide, halogen, fluorescent) lights. Lighting is designed to ensure adequate illumination for safe working conditions. Typical light intensity values are 5 to 10 lux for walkways, 50 lux for working areas and approximately 100 lux for high intensity light areas. Light intensity diminishes with inverse of distance squared (I received = I/r^2). Figure 7-1 presents a simple calculation of diminishment of received light with distance assuming 100 lamps on the MODU and/or AHTS vessel of low, medium and high intensity each acting additively. It can be seen that light received is diminished to about the equivalent of light that would be received from a full moon within about 200 m from the light source and to that of a moonless clear night within about 1,500 m for low intensity lights and 3,000 m for high intensity lights.

In the event that small volumes (approx. 30 m^3 per well) of reservoir gas are flared during well re-entry, light emissions may be produced from the flare-boom aboard the MODU. Flaring of these volumes would short-duration (likely taking several minutes to complete the operation) and contingent if reservoir gas cannot be bull-headed back to formation. Light emissions would be more pronounced if flaring is undertaken at night.

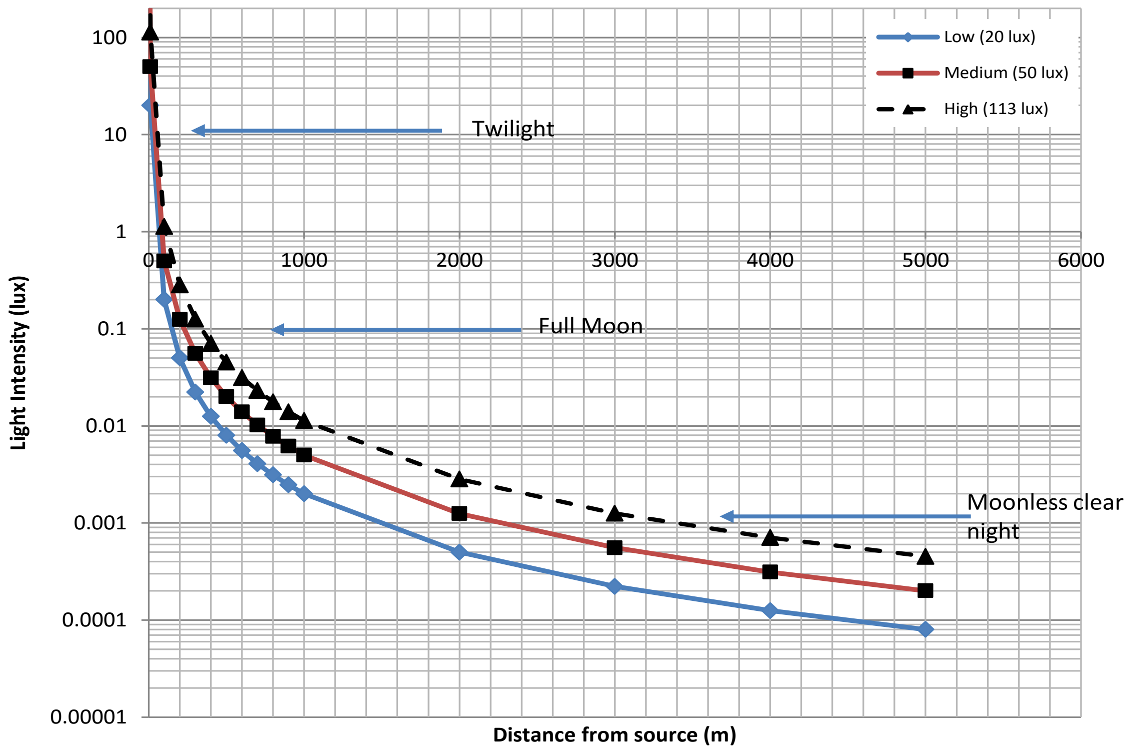


Figure 7-1: Diminishment of light with distance from source assuming 100 lamps of low, medium and high intensity

7.5.3 Environmental Impact Assessment

Artificial lighting has the potential to affect marine fauna that use visual cues for orientation, navigation, or other purposes, resulting in behavioural responses that can alter foraging and breeding activity. The species with greatest sensitivity to light are marine turtles, seabirds and fish.

Potential impacts to marine fauna from artificial lighting may include:

- Disorientation, or attraction or repulsion to the light;
- Disruption to natural behaviour patterns and cycles; and
- Indirect impacts such as increased predation risks through attraction of predators.

These potential impacts are dependent on:

- Wavelength and intensity of the lighting, and the extent to which the light spills into important wildlife habitat (e.g. foraging, breeding and nesting);
- The timing of light spill relative to the timing of habitat use by marine fauna sensitive to lighting effects; and
- The physiological sensitivity and resilience of the fauna populations that are at risk of potential effects.

Fish and Zooplankton

Fish and zooplankton may be directly or indirectly attracted to light. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan *et al*., 2001), with traps drawing catches from up to 90 m (Milicich *et al.*, 1992). Lindquist *et al*. (2005) concluded from a study that light fields around oil and gas activities resulted in an enhanced abundance of clupeids (herring and sardines) and engraulids (anchovies), both of which are known to be highly photopositive.

The concentration of organisms attracted to light results in an increase in food source for predatory species and marine predators are known to aggregate at the edges of artificial light halos. Shaw *et al.* (2002), in a similar light study, noted that juvenile tunas (Scombridae) and jacks (Carangidae), which are highly predatory, may have been preying upon concentrations of zooplankton attracted to the light fields around oil and gas activities. This could potentially lead to increase predation rates compared to unlit areas.

Light spill from MODU and AHTS vessels onto the surrounding surface waters, particularly during night-time activities, is likely to result in aggregations of zooplankton and fish around the light source as they are attracted to the light and increased food availability. However, the operational area does not contain any significant feeding, breeding or aggregation areas for important fish species. The potential for increased predation activity is unlikely to result in a significant impact on the plankton or fish communities. As such, effects are expected to be highly localised with no discernible consequences at the population level.

Seabirds and Migratory Shorebirds

Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that seabirds were attracted to and accumulated around illuminated offshore infrastructure (Marquenie *et al*., 2008) and that lighting can attract seabirds from large catchment areas (Wiese *et al*., 2001). Availability of roosting refuge at sea and increased food availability may be the most important reasons why seabirds are attracted to offshore oil and gas infrastructure (Wiese *et al*., 2001). Either seabirds may either be attracted by the light source itself or indirectly as structures in deep water environments tend to attract marine life at all trophic levels, creating food sources and shelter for seabirds (Surman, 2002; Wiese *et al*., 2001). The light from vessels may also provide enhanced capability for seabirds to forage at night (Burke *et al*., 2005). Studies in the North Sea indicate that migratory birds are attracted to lights on offshore platforms when travelling within a radius of 3–5 km from the light source (Marquenie *et al*., 2008). Beyond this distance, it is assumed that light source strength were not sufficient to attract birds away from their preferred migration route.

Negative potential impacts to seabirds and migratory shorebirds attracted by artificial lighting can include disorientation causing collision, entrapment, stranding, grounding and interference with navigation (being drawn off course from usual migration routes). Further, Birds may starve when artificial lighting disrupts foraging, and fledgling seabirds may not be able to take their first flight if their nesting habitat never becomes dark. Migratory shorebirds may use less preferable roosting sites to avoid lights and may be exposed to increased predation where lighting makes them visible at night (DoEE, 2020). These behavioural responses may cause injury and/ or death. Seabird mortalities from collisions have been found to be correlated to conditions of poor visibility (cloud, fog or rain) and proximity to nearby seabird colonies (Black, 2005).

During the proposed activities, it is possible a small number of seabirds and migratory shorebirds may be attracted to the MODU and / or AHTS vessels, including those for which a foraging BIA overlaps the operational area (refer **Table** 4-6). However, this is not expected to result in impacts to birds beyond a temporary change in behaviour, and with no discernible consequences at the population level.

Whilst there a number of seabird species with foraging BIA's that overlap the operational area, including a number of albatross species, the Common Diving Petrel and the Wedge-tailed Shearwater, there are no identified breeding BIAs within the nominal 20km buffer detailed within *the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds* (DoEE, 2020). As such, no impacts to breeding populations of listed migratory shorebirds are anticipated.

Marine Turtles

The attraction of marine turtles to light has been well documented. Adult marine turtles may avoid nesting on beaches that are brightly light (Witherington, 1992; Price *et al*., 2018) and adult and hatchling turtles can be disorientated and unable to find the ocean in the presence of direct light or sky glow (Witherington, 1992; Lorne & Salmon, 2007; Thums *et al*., 2016; Price *et al*., 2018).

Whilst a search of the EPBC Act Protected Matters database identified three EPBC Act listed marine reptile species with potential to occur or have habitat within the operational area and EMBA (the Loggerhead, Leatherback and Green Turtle), neither the Green nor Loggerhead turtle are expected to occur within the

EMBA. Whilst foraging behaviour for the Leatherback Turtle was identified as known to occur within the EMBA, these waters do not represent critical habitat for the species.

It is possible that individual turtles may be encountered traversing the operational area during the proposed activity, however considering the area does not constitute critical habitat for any potential turtle species, large numbers of inter-nesting adults are not expected. Localised behavioural impacts to individual foraging marine turtles from light emissions generated during the activity are considered negligible, with no impact predicted at a community or population level.

Species Recovery Plans, Conservation Management Plans and Approved Conservation Advice

Woodside has considered information contained in recovery plans, approved conservation advice and threat abatement plans (refer to previous **Table** 4-5). This includes the Recovery Plan for Marine Turtles in Australia (DoEE, 2017) as well as the more recently published National Light Pollution Guidelines (DoEE, 2020).

The overarching objective of the Recovery Plan for Marine Turtles in Australia is to reduce detrimental impacts on Australian populations of marine turtles and hence promote their recovery in the wild. All species of marine turtle that occur in Australian waters are listed as threatened under the EPBC Act. Marine turtles are long-lived, slow to mature and are subject to a number of threats. Light pollution is identified as a high-risk threat in the Recovery Plan for Marine Turtles because artificial light can disrupt critical behaviours such as adult nesting and hatchling orientation following their emergence from nests, sea-finding and dispersal and can reduce the reproductive viability of turtle stocks. Minimising light pollution such that artificial light within or adjacent to habitat critical to the survival of marine turtles is managed such that marine turtles are not displaced from these habitats (DoEE, 2017).

The operational area does not intersect any habitat critical to the survival of marine turtles, including Green, Loggerhead and Flatback turtles, as such, impacts to adults are not predicted.

Potential Cumulative Light Impacts

<u>Commercial Shipping</u>

As described in Section 4.4.3 The main shipping channel for vessels (e.g. cargo tankers) travelling between major Australian and foreign ports located south of the Minerva field, about 75 km (40 nm) south of Warrnambool. These shipping lanes lie in deeper offshore waters than the operational area. The overall (and slight) contribution of light emission from the MODU and/or support vessels is considered insignificant when compared to those produces by regional commercial shipping activities. The overall cumulative effect is considered negligible.

<u>Oil and Gas</u>

As described in Section 4.4.4, there are other oil and gas facilities within Commonwealth waters in the Otway Basin, namely Cooper Energy’s Casino, Netherby, Henry (CHN) Field.

In the instance when field activities are undertaken simultaneously, which is highly unlikely given the intermittent nature of these activities, there is a potential for light generated from one activity to be evident within the field of a separate activity. However, given the distance apart from these facilities, the diminishment of light intensity with distance (as presented within Figure 7-1), and the lack of marine turtle beaches (habitat critical to the survival of the species), no cumulative impacts on shorelines from light emissions are anticipated.

7.5.4 Control Measures

Woodside maintains controls to comply with *Navigation Act 2012*; International Convention of the Safety of Life at Sea (SOLAS), and Marine Order Part 30: Prevention of Collisions, Issue 8, both requiring minimum lighting to maintain safe operations.

7.5.5 Demonstration of ALARP

Light emissions generated during the *Minerva P&A and Field Maintenance* activity are considered a 'Type A' (lower order) impact based upon the Decision Context described in Section 6.1.1 of this EP and are not considered to present a cumulative impact when considered in the context of other offshore activities. However, given the operational area intersects a number of seabird foraging BIAs and proximity of the operational area to the mainland, a detailed engineering assessment has been undertaken to consider alternative, additional and/or improved control measures to minimise light impacts to marine fauna (Table 7-4). The analysis has considered measures detailed within the National Light Pollution Guidelines for Wildlife (DoEE, 2020) and is based upon both feasibility and cost (safety / time / effort / financial), with those controls considered feasible and reasonably practicable to implement being adopted, and those considered not feasible or not reasonably practicable to implement rejected. The assessment applies the hierarchy of controls as illustrated in Figure 6-2.

Table 7-4: Detailed engineering assessment – light emissions

Hierarchy of Control	Control Measure	Accept/ Reject	Reason
Eliminate	Do not undertake the night-time operations.	Reject	Limiting the activity to day-time hours would potentially reduce overall light spill / glow from offshore facilities and subsequently reduce the potential for adverse impacts to seabirds, however minimum lighting would still be required for safe operations and navigation to mitigate the potential for vessel collision. Additionally, by limiting night-time operations, the overall duration of the activity would double, with a corresponding increase in the potential impacts from other aspects of the activity such as atmospheric and noise emissions, waste generation, vessel collision risk, etc. The financial cost associated with doubling the duration of the activity would be significant, given the hire rates of both the MODU and AHTS vessels. Woodside considers the potential benefit to be grossly disproportionate to the cost of implementation.
Substitute	Alternate lighting types aboard the MODU and vessels	Reject	By reducing the colour, intensity and frequency of lighting would potentially reduce the potential for adverse impacts to seabirds. The adoption of this control would incur a significant cost. Also, navigation lighting colour and intensity must comply with relevant navigation requirements. Given minimum lighting requirements for crew safety and colour-specific navigational lighting requirements, the high financial cost to introduce this control, the short duration of the activity Woodside considers the potential benefit to be grossly disproportionate to the cost of implementation.
Engineer	Automatic off switches on outdoor lighting	Reject	There is a potential to reduce overall light spill / glow from deck areas and subsequently reduce the potential for adverse impacts to seabirds by implementing these controls. By virtue of the MODU design, crew rest areas are internal to reduce potential light ingress for night-shift workers, thereby also having the effect of limiting light spill from the MODU. The re-engineering of lighting systems aboard both the MODU and vessels would be limited to light sources not critical to safe operations. This would have limited effect given the need for navigation and safety lighting. Painting reflective surfaces would incur significant cost, especially given the MODU would be mobilised from an existing offshore location. Likewise, block-out blinds would be expensive to retrofit, and impair visual line-of-sight for Supervisors monitoring safety-critical operations. Given minimum lighting requirements for crew safety and navigational lighting, the high financial cost to introduce these controls, the short duration of the activity Woodside considers the potential
	Repaint reflective surfaces aboard the MODU and vessels	Reject	
	Block-out blinds on all windows / portholes aboard the MODU and vessels	Reject	

Hierarchy of Control	Control Measure	Accept/ Reject	Reason
			benefit to be grossly disproportionate to the cost of implementation.
Separate	Avoid periods of fauna sensitivity (e.g. Shorebird nesting seasons)	Reject	Given there are no identified areas critical to the survival of species (i.e., nesting BIAs) within 20km of the operational area, and the cost associated with maintaining a MODU and vessels on standby for a potentially extended period would incur a significant project cost for no environmental benefit, Woodside considers this control to be grossly disproportionate to any (potential) minor benefit gained and is not considered reasonable.
Administrative	Lighting Management Plan e.g.	Reject	Given there are no reasonable or practical controls identified to further limit the light spill / glow from the operational area, potential impacts from lighting emissions would be limited in nature and scale in relation to seabirds it is not considered reasonable to develop a project-specific Lighting Management Plan.

7.5.6 Demonstration of Acceptability

Whilst light emissions generated during the Minerva P&A and Field Maintenance activity are considered a 'Type A' (lower order) impact based upon the Decision Context described in Section 6.1.1 of this EP, a more detailed demonstration of acceptability has been provided consistent with that of a 'Type B' potential impact.

Lighting of the MODU and AHTS vessels complies with the *Navigation Act 2012*; International Convention of the Safety of Life at Sea (SOLAS), and Marine Order Part 30: Prevention of Collisions, Issue 8, all requiring minimum lighting to maintain safe operations. Whilst there are no specific regulatory requirements for reducing light emissions from offshore facilities, the light reduction controls as detailed within the National Light Pollution Guidelines for Wildlife (DoEE, 2020) have been considered during the detailed ALARP evaluation presented above. Consideration of actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) have been assessed and potential impacts and risks are not inconsistent with:

- Recovery Plan for Marine Turtles in Australia 2017-2027;
- National Light Pollution Guidelines for Wildlife 2020; or

There are no approved conservation advice, listing advice or recovery plans for the wedge-tailed shearwater.

The detailed ALARP evaluation for light emissions has been conducted with no reasonable and practicable alternate, additional, or improved controls identified.

There have been no objections or claims raised by relevant stakeholders in relation to offshore light emissions generated whilst undertaking the activity.

Relevant principles of Ecologically Sustainable Development (ESD) (as defined within Section 3A of the EPBC Act) have been considered with respect to potential impacts from light emissions generated whilst undertaking the proposed activity with the following determination:

- The 'Integration Principle' has not been compromised given there have been no objections or claims raised by relevant stakeholders regarding offshore lighting emissions;
- The 'Intergenerational Principle' has not been compromised given there are no identified health, diversity and productivity impacts that may affect the environment for future generations associated with the short-duration, localised and limited intensity of lighting emissions outside of the operational area;
- The 'Biodiversity Principle' has not been compromised given matters of National Environmental Significance (MNES) have been considered as part of the environmental impact evaluation and any potential impact is limited to the potential nuisance disturbance of individuals with no significant impacts identified at a population or species level;
- The 'Valuation Principle' is not considered relevant given there are no identified costs associated with offshore lighting emissions generated whilst undertaking the activity; and

- The ‘Precautionary Principle’ is not considered relevant to the potential impacts and risks associated with offshore lighting emissions given there are no ‘threats of serious or irreversible harm’ as detailed within EPBC Act (Section 391).

Woodside is satisfied that routine light emissions from the MODU and/or AHTS vessels and the short duration of the activity (approximately 2 months) represent a low residual risk that is broadly acceptable. Therefore, with the proposed level of lighting generated during the activity, Woodside is satisfied that the environmental performance outcome (EPO) of “No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)” will be met, therefore Woodside considers the impact to be managed to an acceptable level.

7.6 Noise Emissions

7.6.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Noise emissions	Generation of underwater noise from the MODU, vessels, ROVs, positioning equipment (transponders) and flaring/venting during the activity.	Sound emitted to the marine environment causing physical harm (auditory impairment – permanent threshold shift (PTS) or temporary threshold shift TTS)), masking of vocalisations, and / or behavioural changes to marine fauna.	10	N/A	-	Type B Higher Order Impact	Tolerable
	Generation of noise from helicopter operations during take-off and landing aboard the MODU.						

7.6.2 Source of Risk

During the P&A campaign, low intensity underwater noise of a continuous and intermittent nature will be generated, namely from: the cavitation of thrusters and power generation from the AHTS vessels within the operational area; power generation aboard the MODU; noise generated by positioning equipment (transponders), underwater ROV operations (including the cutting of casing to remove wellheads), short-term flaring/venting operations, and from helicopter operations within the operational area.

Noise Generate by the AHTS Vessels including dynamic positioning (DP)

The operation of the vessel engines, propeller cavitation, and thrusters contributes to underwater noise emissions within the operational area. Sound generated from these activities will contribute to and exceed ambient underwater noise levels which range from 80 dB re 1 µPa in calm conditions and low wind to 120 dB re 1 µPa under high wind and rain (Richardson *et al.*, 1995).

Koessler *et al*. (2020), estimated acoustic source levels from an AHTS vessel similar to that proposed for use during this activity, based upon all thrusters being included in the source level calculation for scenarios where the AHTS was under DP. Only the main propulsion system was considered for scenarios where the vessel was transiting. An overall source level of 183.0 dB re 1 µPa m was used for transit in the standby area and 186.6 dB re 1 µPa m was used for re-supply operations when the OSV was under DP. Likewise, McCauley (1998) measured underwater broadband noise equivalent to approximately 182 dB re µPa at 1 m from a vessel holding station in the Timor Sea. Under normal operating conditions when the vessel is idling, vessel noise would be detectable only over a short distance. The noise from a vessel holding its position using bow thrusters and strong thrust from its main engines was measured at 120 dB re 1 µPa at approximately 1 km from the source then dropped below 120 dB re 1 µPa within 3 to 4 km and may be detectable above background noise levels during calm weather conditions, for 20 km (McCauley, 1998) or more from the vessel although this range of audibility will be reduced under noisier (windier) background conditions.

Vessel noise varies the size, speed and engine type and the activity being undertaken. The AHTS vessels will use a DP thruster system to maneuver into the RSEZ at low speeds and to hold position whilst adjacent to the MODU. A vessel using DP thrusters can produce sound at levels between 108 and 182 dB re 1µPa at 1m at dominant frequencies between 50 Hz and 7 kHz (McCauley, 1998; Simmonds *et al.*, 2004).

Given the above, it is anticipated that whilst transiting or maintaining position within the operational area, noise generated by AHTS vessels would likely be audible at levels of 120 dB within 1 km of the vessel location, but attenuate rapidly to below 120 dB within 3-4 km from the vessel location. Given a single vessel would likely be stationed within the operational area for the duration of the P&A program, this noise emission would be temporary in nature i.e., would continue for a 2 months.

Noise Generated by the MODU

The noise emitted from MODUs consists of a combination of drill pipe operation and onboard machinery, and typically produces low intensity but continuous sound. Semi-submersible vessels are generally less noisy than drill ships (Richardson *et al*., 1995), as they lack large hull areas, and the machinery is mounted on decks raised above the sea on risers supported by pontoons.

Noise modelling undertaken in 2021 by Jasco Applied Sciences (McPherson, *et al.* 2021) on behalf of Beach Energy Limited, for a drilling operation undertaken by the Diamond Ocean Onyx at water depths of 70-100 m applied source level spectrum, based on those measured for the Transocean Polar Pioneer, whilst anchored and drilling, at a broadband (10 Hz to 35 kHz) source level of 178.7 dB re 1 µPa m. However, this source level spectrum is considered conservative given McCauley (1998) reported noise levels generated by a semi-submersible rig, during non-drilling periods the typical broadband level encountered was approximately 113 dB (rms) re 1 µPa@125 m and studies undertaken by Austin *et al*. (2018) on various MODU types indicate that noise levels dropped to 117 dB re 1 µPa within 1 km of the MODU.

McPherson, *et al.* (2021) determined that the appropriate representation of the seafloor was to consider it to consist of well-cemented carbonate caprock, overlying semi-cemented carbonate rock. This is despite the variably of the distribution of seafloor sediments within the wider region, where patches of sand are known to exist. Site survey results from the Minerva Field, completed by Racal Survey Australia for BHP Petroleum Ltd, indicates that the Minerva location also consists of well-cemented carbonate caprock, overlying semi-cemented carbonate rock, with patches of unconsolidated mobile carbonate sands.

The relevant results from McPherson *et al.* (2021) for the MODU and attendant AHTS vessel are presented below (Table 7-5). *Rmax* representing the total horizontal distance (km) to the marine mammal threshold of 120 dB re 1 µPa sound pressure level (SPL).

Table 7-5: Maximum (*Rmax*) and 95% (R95%) horizontal distances (in km) to the marine mammal behavioural response threshold of 120 dB re 1 µPa (SPL) (McPherson, et al, 2021)

SPL (L_p; dB re 1 µPa)	MODU (Scenario 5)		OSV standby (Scenario 6)		MODU and OSV resupply (Scenario 7)[A]		MODU and OSV standby (Scenario 8)[B]	
	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)
120[C]	1.17	1.09	0.37	0.35	7.02	6.41	2.09	1.9

A Radial distance reported from the mid-point between the Mobile Offshore Drilling Unit (MODU) and the Offshore Support Vessel (OSV) on dynamic positioning (DP) in resupply operations

B Radial distances for isopleths/thresholds that envelope the MODU and OSV were reported from the mid-point between the MODU and the centre of the OSV standby area. Otherwise radial distances reported from the OSV in the standby area.

The bathymetry is similar between the Beach Energy and Minera Field locations (Whiteway 2009), with a gradual increase in depth as distance from the coast increases, with Minerva being in 60 m of water and the Beach Energy location in 70 m of water. This difference in water depth is not expected to result in significant differences in sound field extents. This conclusion, combined with the similarity of the geology, supports the representation of the activities of a MODU and associated vessels at Minerva with the measured and modelled activities for Beach Energy from similar platforms.

An acoustic monitoring program commissioned by Santos Ltd was undertaken during exploratory drilling of the Casino-3 well in the Otway Basin (located in Commonwealth waters approximately 30 km from mainland). 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).

The MODU will not be using DP to maintain station keeping above the well centres, therefore DP will not contribute to noise emissions from the MODU.

Given the above, it is anticipated that whilst undertaking P&A operations within the operational area, noise generated by the MODU would potentially be audible at levels above 120 dB directly adjacent (approx. 1km) to the MODU, or whilst being attended by an OSV under DP to approx. 7km, but attenuate to levels below 120 dB outside this area and be inaudible beyond 28 km from the well centres. This noise emission would be temporary in nature i.e., would continue for approximately 2 months (for MODU) and intermittently during MODU resupply.

Noise Generated by Positioning Equipment (Transponders)

Transponders may be required to inform anchor positioning. The expected frequency (Hz) and source level (dB re 1 µPa @ 1 m) of the signal from transponders is 18 – 36 kHz, 196 dB (ref. 1 µPa @ 1 m). The transponders are passive, and only transmit when the vessel is locating the mooring. Likewise, miniature acoustic monitoring beacons aboard the ROV may transmit intermittently to enable the ROV position to be monitored whilst in operation.

Noise Generated by ROV Operations

ROVs are used intermittently during the activity to undertake seabed and subsea equipment inspection. The ROVs are deployed from either a support vessel or from the MODU. Noise levels from the ROVs (including abrasive or mechanical cutting of casing) are of a lower intensity than either the MODU or support vessels, so would not be considered the primary source of noise emissions during their deployment. Therefore, the overall contribution of ROV noise associated with the activity are considered negligible and not assessed further.

Noise Generated by Helicopters

Sonification of the water column surrounding the MODU may occur during take-off and landing of helicopters servicing the MODU during crew-change operations. Helicopter engine noise is emitted at various frequencies however, the dominant tones are generally of a low frequency below 500 Hz (Richardson *et al.*, 1995) Richardson *et al*. (1995), reported helicopter noise being audible in air for four minutes before it passed over receivers, but only detectable underwater for 38 seconds at 3 m depth and for 11 seconds at 18 m depth for the same flight path. The sound source was 162 dB re 1 µPa @ 1 m at its peak and had frequency of 155 Hz Given helicopter transfers to the MODU may occur on a daily basis, the predicted level of potential exposure to marine mammals (if in the vicinity of the MODU at the time of take-off and landing and within surface waters of approximately 20 m depth) is approximately 1 minute per helicopter landing and / or take-off within a 24-hour period.

Noise Generated by Venting / Flaring Operations

A single flaring / venting operation for each well may be undertaken during this proposed P&A program. Given flaring is a contingent operation, potential flare noise is limited in both duration and intensity and would be expected to attenuate rapidly from source. Flare noise levels for the proposed activity have been predicted based upon the following methodology for calculating flare noise within the Association of German Engineers (VDI) Standard 3272 Standard Noise Levels for Flares:

Lwac = 112 (±6) +17logQ

Where:

Lwac = A-weighted sound power level of the flare (dBA)

Q = flare gas mass flow (t/h)

At a flare gas flow rate of 0.9627 tn / hr (120 m^3 / hr) and a flare stack height of 30 m from the receptor, a flare sound power level (Lw) of 111.7 dBA ± 6 dB is predicted. The gas flow rate applied has been based upon the overall volume of gas anticipated for a flaring / venting operation from a Minerva well over a 15 min duration is approximately 30 m^3. Based upon previously undertaken airborne propagation modelling, results indicate the underwater received sound pressure level during flaring of 136 dB re 1 µPa at 1 m below the sea surface is estimated to attenuate below the marine mammal behavioural response threshold of 120 dB re 1µPa within only 7 m from the sea surface (Woodside, 2021).

Potential noise from flaring operations would be considered a secondary additive source of noise emissions given the primary (noisiest) source would be generated by the operation of the MODU, therefore flaring would make a limited contribution to overall noise emissions from the proposed activity and as such is not evaluated further.

7.6.3 Environmental Impact Assessment

Receptor Sensitivity and Noise Exposure Criteria

Noise has the potential to adversely affect marine fauna and in extreme cases cause physiological harm. Underwater noise generated by anthropogenic activities may impact on marine fauna by the following, presented in decreasing order of effect:

- Mortality or potential mortal injury – physical injury that may result in death of an animal through damage to internal organs:
- Physical impairment / injury to hearing organs:
    - Permanent threshold shift (PTS) – a permanent loss of hearing sensitivity. Recovery is not expected to occur.
    - Temporary threshold shift (TTS) – a temporary reduction in the ability of an animal to perceive sound. Recovery to pre-exposure levels is expected to occur.
    - Masking/ interference of biologically important sounds e.g. for communication, for navigation, and predator/ prey detection.
- Behavioural disturbance – typically short-term behavioural changes such displacement from biologically important habitat areas (such as feeding, resting, breeding, calving and nursery sites), avoidance, surfacing, etc. Behaviour expected to return to normal following cessation of noise.
- Indirect impacts, for example:
    - Impacts on other trophic levels (e.g. predator/ prey species displacement or depletion).
    - Reduced reproductive success.

Initial studies of underwater noise pollution focussed on megafauna and particularly marine mammals (Richardson *et al*., 1995; Southall *et al*., 2007; Theobald *et al*., 2009), but in recent years effects have been discovered in other taxa at lower trophic levels, including various fish species (Hastings & Popper, 2005; Popper *et al*., 2014), crustaceans (Tidau & Briffa, 2016) and zooplankton (McCauley *et al*., 2017).

There are no currently recognised thresholds/methods for reliably assigning a generic distance for masking effect. The potential for acoustic masking by vessel noise is influenced by numerous confounding factors, including the juxtaposition of the vessel to the animals that are communicating, changes in ambient noise levels, the strength, duration and wavelengths (frequency) of the species' calls, the ability of the species to directionalise sounds, the ability of the species to discriminate frequencies/intensities of sounds, the distance between calling animals, the overlap in vessel and call frequencies, etc.

The nature of underwater noise levels expected to be generated by AHTS vessels involving transient and relatively low intensity broadband noise, suggests that the potential for masking effects is likely to be limited to relatively close proximity to the noise source. Given that whales in the area that might be communicating would mostly be actively moving (migrating and/or foraging) through the area and hence unlikely to remain within any potential zone of masking for an extended period, it is unlikely that significant disruptions to communications that might result in adverse impacts to any species would occur.

Marine Mammals (Cetaceans)

Both the southern right whale and pygmy blue whale are likely to occur within the operational area. The operational area is also within the distribution and foraging (annual high use area) for the Pygmy Blue Whale.

The Blue Whale (Balaenoptera musculus) comprise two recognised subspecies in the Southern Hemisphere: the Antarctic blue whale (B. m. intermedia) and the pygmy blue whale (B. m. brevicauda).The Antarctic blue whale may exceed 33 m and 180 tonnes in weight (Yochem & Leatherwood 1985). Pygmy blue whales are shorter and grow to 25 m in length (Bannister 2008).

Blue whales have a cosmopolitan distribution. As with other baleen whales, they generally migrate between breeding grounds at lower latitudes where both mating and calving take place during the winter, and feeding grounds at higher latitudes during the summer. This means the distribution and habitat occupancy of populations and subspecies shifts in an annual cycle.

During the better-defined feeding season, pygmy blue whales and Antarctic blue whales are found predominately north and south respectively of 52º S, possibly bounded by the Antarctic Polar Front (DSEWPAC 2011b).

The South-east Marine Region is an important migratory area for the pygmy blue whale and also provides one of the most significant feeding aggregation areas for blue whales in Australian waters.

The Bonney Upwelling and adjacent waters off South Australia and Victoria (Gill 2002; Gill et al. 2011) are the most important feeding areas. This area is inhabited from November to May each year. Pygmy blue whales predominately occupy the western area of the Bonney Upwelling from November to December, and then expand south-east during January to April, though the within-season distribution trends in Bass Strait are unknown (Gill 2002; Gill et al. 2011). For the Otway, peak blue whale foraging is considered to be January to March (inclusive) with shoulder periods either side from November to May (inclusive).

Antarctic blue whales have been recorded off Tasmania predominately from May to December.

Blue whales are listed vulnerable, migratory and cetacean under the EPBC Act

The operational area is within the known core range of the southern right whale, and within the migration and resting on migration BIA for the species.

Other cetacean species identified as potentially occurring in the operational area are expected to be limited to individuals infrequently traversing the operational area.

Anthropogenic noise has been identified as a potential threat to cetaceans, including Southern Right Whales and blue whales.

Sound is very important to marine mammals and extensive research has been undertaken to understand the potential impacts of anthropogenic noise, with reviews by Richardson *et al*. (1995); Nowacek *et al*. (2007); Southall *et al*. (2007 and 2019); and Erbe *et al*. (2018). Underwater noise can interfere with key life functions of marine mammals (e.g. foraging, mating, nursing, resting and migration) by impairing hearing sensitivity, masking acoustic signals, eliciting behaviour responses, or causing physiological stress. Severity of the impacts typically decreases with the increase in distance from the sound source. Closer to the noise source, injuries such as tissue or organ damage (e.g. a permanent loss of hearing called permanent threshold shift (PTS); refer to Southall *et al*., 2007) may be found. If hearing loss recovers with time, it is termed a temporary threshold shift (TTS).

Marine mammals can be grouped based on how different species group use and hear sound differently. Underwater noise exposure criteria (also termed impact criteria or noise thresholds) can then be weighted for each broad species group to emphasise noise frequencies that a group may be particularly vulnerable to. This approach is described by Southall *et al.* (2007). The noise exposure criteria for continuous (non-impulsive) underwater noise (e.g. MODU and marine vessel operations) and impulsive noise sources (e.g. noise from transponders) applied to evaluate physical impairment / injury (PTS & TTS) and behavioural disturbance are presented in Table 7-6 and Table 7-7 respectively.

Table 7-6: Continuous noise sources: marine mammal injury and disturbance thresholds for various functional hearing groups

Functional Hearing Group	Generalised Hearing Range	TTS Threshold (received level)	PTS Threshold (received level)	Behavioural Disturbance Threshold
Low-frequency cetaceans (baleen whales e.g. blue, fin, sei, right, humpback, minke, Bryde's)	7 – 35,000 Hz	179 dB re 1 µPa^{2}s	199 dB re 1 µPa^{2}s	120 dB re 1 µPa
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 – 160,000 Hz	178 dB re 1 µPa^{2}s	198 dB re 1 µPa^{2}s	120 dB re 1 µPa
High-frequency cetaceans (true porpoises, river dolphins)	275 – 160,000 Hz	153 dB re 1 µPa^{2}s	173 dB re 1 µPa^{2}s	120 dB re 1 µPa

Table 7-7: Impulsive noise sources: marine mammal injury and disturbance thresholds for various functional hearing groups

Functional Hearing Group	Generalised Hearing Range	TTS Threshold (received level)	PTS Threshold (received level)	Behavioural Disturbance Threshold
Low-frequency cetaceans (baleen whales e.g. blue, fin, sei, right, humpback, minke, Bryde's)	7 – 35,000 Hz	168 dB re 1 µPa^{2}s	183 dB re 1 µPa^{2}s	160 dB re 1 µPa
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 – 160,000 Hz	170 dB re 1 µPa^{2}s	185 dB re 1 µPa^{2}s	160 dB re 1 µPa
High-frequency cetaceans (true porpoises, river dolphins)	275 – 160,000 Hz	140 dB re 1 µPa^{2}s	155 dB re 1 µPa^{2}s	160 dB re 1 µPa

The approach of Southall *et al*. (2007) recognises that even if the initial received levels are not great enough to cause injury, harmful effects can result from lower-level sounds which last for a longer duration.

Southall *et al*. (2007) conducted a comprehensive review of data published describing behaviour of marine mammals in response to sound, with the onset of behavioural disturbance to cetacean species reported at sound levels as low as 120 dB re 1 µPa. This may result in subtle responses such as changing in diving and breathing patterns, but that avoidance was generally not observed until sound levels reached more than 160 dB re 1 µPa (Southall *et al*., 2007). The zone of responsiveness to sound is expected to be smaller than the zone of audibility because an animal will not likely respond to a sound that is barely detectable. Measured indicators of disturbance include changes in swim direction and speed, dive duration, surfacing duration and interval, and respiration and changes in vocalisation. The US National Marine Fisheries Service (NMFS) propose a behavioural response threshold of 120 dB re 1 µPa for continuous noise sources and 160 dB re 1 µPa for impulsive noise sources (NMFS, 2018). Todd *et al.* predict that animals (marine mammals) experience different noise regimes while traversing the water column and can potentially detect the higher-frequency components of drilling noise to a distance of 70 m from the source; however, while levels were unlikely to cause auditory injury, effects on echolocation behaviour are still unknown (JASA, 2020).

NMFS (2018) concluded that after noise exposure ceases or between successive exposures, there is potential for recovery from hearing loss i.e., exposure to PTS thresholds results in incomplete recovery and exposure to TTS thresholds results in complete recovery. The likelihood of a cetacean experiencing a TTS or PTS from continuous noise sources, is directly related to the duration of exposure to the threshold levels.

Extended exposure may occur if the cetacean remains within the exposure area whilst undertaking biologically important behaviours (calving, foraging, resting or migration). However, cetaceans are likely to display avoidance at lower exposure thresholds.

Noise generated by primary emissions sources (i.e., the MODU and AHTS vessels operations), short-term helicopter operations or secondary additive sources (i.e., flaring and ROV operations) are not predicted to exceed the permanent injury threshold levels for continuous (non-impulsive) noise sources (shown in Table 7-6), and therefore permanent injury to protected cetacean species is not anticipated. However, noise generated within the operational area may exceed thresholds that could result in short-term behavioural responses in cetaceans.

Noise generated by positioning equipment (transponders) is highly intermittent but may temporarily exceed impulsive noise thresholds for both physical and behavioural disturbance. However, given transponders emit short-duration 'pings' (i.e., they are not repetitive impulse noises), these pings are limited to positioning operations, individuals would be expected to quickly recover and exhibit avoidance behaviour. Therefore, potential impacts on individual marine mammals are considered minor and highly localised, with no impact identified at a community or species level.

The Conservation Management Plan (CMP) for the Blue Whale (DoE, 2015a) assesses the impacts of shipping and industrial noise (on blue whales) as 'Minor' i.e., 'individuals are affected but no affect at population level' Consistent with the CMP, Woodside has assessed the temporary behavioural disturbance of a blue whale to be a potential, but minor impact limited to individuals and no potential impact at a community or species level. Likewise, potential impacts to other marine mammals within the vicinity of the operational area, including southern right whales, humpback whales, is considered minor, with no potential impacts at a community or species level.

Marine Turtles

Whilst a search of the EPBC Act Protected Matters database identified three EPBC Act listed marine reptile species with potential to occur or have habitat within the operational area and EMBA (the Loggerhead, Leatherback and Green Turtle), neither the Green nor Loggerhead turtle are expected to occur within the EMBA. Whilst foraging behaviour for the Leatherback Turtle was identified as known to occur within the EMBA, these waters do not represent critical habitat for the species.

Data on hearing by marine turtles is very limited. Turtles have been shown to respond to sounds in the low frequency range, with indications that they have the greatest hearing sensitivity in the frequency range of 100-900 Hz (Ketten & Bartol, 2005). There is no direct evidence of mortality or potential permanent injury to marine turtles from continuous noise sources such as vessels (Popper *et al*., 2014). However, few studies have investigated the threshold level necessary for behavioural effects. Early work by Lenhardt (1994) observed caged marine turtles show avoid responses to low frequency tones. O'Hara and Wilcox (1990) reviewed the use of noise as acoustic deterrents. They found that airguns with a source level of approximately 220 dB re 1µPa at 1m (measured in the 25 to 1,000 Hz range) were effective as a deterrent for a distance of about 30 m. Moein *et al*. (1994) also used airguns to investigate means to repel loggerhead turtles. Avoidance was observed at 175 dB re 1µPa at 1m exposure. McCauley *et al*. (2000) found behavioural avoidance at 155 to 164 dB re 1 $\mu Pa^2 s$ with observed behavioural responses of caged marine turtles including rising to the surface and altered swimming patterns.

During the proposed activity, noise generated by both primary and secondary emissions sources may result in temporary disturbance to marine turtles in the vicinity of activity. At most, this will be a behavioural response such as a change in diving behaviour and avoidance of the area. Impacts to marine turtles are not considered significant as there is no habitat critical to the survival of any marine turtle species surrounding the operational area and as marine turtles are at low risk of potential mortality or permanent injury from continuous noise sources such as vessels (Popper *et al*., 2014). Localised behavioural impacts to individual foraging marine turtles from noise emissions generated during the activity are considered negligible, with no impact predicted at a community or population level.

Fish, Sharks and Rays

There is a wide range of susceptibility to noise among fish. The primary factor likely to influence susceptibility is the presence or absence of a swim bladder. Generally, fishes with a swim bladder will be more susceptible than those without this organ. Many adult fishes, including the elasmobranchs (sharks, rays and sawfish) do not possess a swim bladder and so are not susceptible to swim bladder-induced trauma. The threshold criteria for PTS and recoverable injury has been calculated by Popper *et al*. (2014) to be between 207 and 213 dB re 1 µPa (peak sound pressure levels) depending on the presence or absence of swim bladders, and the threshold criteria for TTS is 186 dB re 1 μPa^2s (cumulative sound exposure level). Given there is no exposure criteria for sharks and rays, the same criteria can be adopted, although sharks and rays do not possess a swim bladder, instead having oil-filled livers.

Most pelagic fish are expected to exhibit avoidance behaviour and swim away when noise reaches levels which may cause physiological effects. Available evidence suggests that behavioural change for some fish species may be no more than a nuisance factor. These behavioural changes are localised and temporary, with displacement of pelagic or migratory fish populations having insignificant repercussions at a population level (McCauley, 1994).

Seabirds and Migratory Shorebirds

Whilst there a number of seabird species with foraging BIA's that overlap the operational area, including a number of albatross species, the Common Diving Petrel and the Wedge-tailed Shearwater, there are no identified breeding BIAs within the close proximity to the operational area. Given flaring operations are contingent, and if undertaken are limited in both duration and volume, any potential noise generated is predicted to have a negligible behavioural impact on individual avifauna that may happen to be in the direct vicinity of the flare boom during the operation. Short duration flaring is not anticipated to effect biologically important behaviours at either a community or population level.

Species Recovery Plans, Conservation Management Plans and Approved Conservation Advice

Woodside has considered information contained in recovery plans, conservation management plans and approved conservation advice (refer to previous **Table** 4-5).

The Recovery Plan for Marine Turtles in Australia (DoEE, 2017) highlights noise interference from anthropogenic activities as a threat to turtles. The Recovery Plan refers to vessel noise and the operation of some oil and gas infrastructure as sources of chronic (continuous) noise in the marine environment, exposure of which may lead to avoidance of important turtle habitat. The Recovery Plan specifies the following priority action: 'Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival'.

The National Recovery Plan for the White Shark (Carcharodon carcharias (DSEWPaC, 2013b) does not list anthropogenic noise as a threat to the species.

The Conservation Management Plan for the Blue Whale (DoE, 2015a) and Southern Right Whale 2011-2021 (DSEWPaC, 2012a) highlight anthropogenic noise as a threat, with both having the recovery objective of: anthropogenic threats are demonstrably minimised.

Based on the noise levels likely from the proposed activity, turtles, white sharks and whales transiting or in the vicinity of the operational area, may avoid the immediate area around the MODU and AHTS vessels. However underwater noise levels are expected to be localised, with possible effects to turtles and whales limited to, at worst, short-term avoidance behaviour. Infrequent, localised and temporary avoidance of a small area within the operational area will not affect the conservation status of turtles or whales that transit the operational area, is not anticipated to prevent any blue whale from a foraging within the area, or compromise the objectives or recovery actions that form the basis of the Management Plans and Conservation Advice.

Potential Cumulative Noise Impacts

<u>Commercial Shipping</u>

As described in Section 4.4.3, the operational area lies outside of declared and charted shipping fairways. The main shipping channel for vessels (e.g., cargo tankers) travelling between major Australian and foreign ports located south of the Minerva field, about 75 km (40 nm) south of Warrnambool. These shipping lanes lie in deeper offshore waters than the operational area, where noise generated by the activity is expected to attenuate below injury and disturbance thresholds in close proximity to the operational area, with no intersect above these thresholds within the distance to shipping fairways. Therefore, no cumulative noise emission impacts are predicted for the activity in relation to commercial shipping.

Oil and Gas

As described in Section 4.4.4, there are other oil and gas facilities within Commonwealth waters in the Otway Basin, namely Cooper Energy's Casino, Netherby, Henry (CHN) Field.

In the instance when field activities are undertaken simultaneously, which is highly unlikely given the intermittent nature of these activities, there is a potential for noise generated from one activity to be audible within the field of a separate activity. However, given the distance apart from these facilities, the diminishment of noise with distance to below injury or disturbance thresholds, potential cumulative impacts are considered minor and short-term, with no impact at a community or species level.

7.6.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) controls accepted by Woodside to manage the impacts associated with noise emissions from the MODU and AHTS vessels are detailed below:

Table 7-8: Noise emissions – control measures

Control Measure	Source of Requirement / Good Practice
Project Induction	EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.
Woodside Whale, Dolphin and Whale Shark Sightings Cards	EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans; NOPSEMA Bulletin – 'Recording and Reporting MMO Data': and Conservation Management Plan (CMP) for the Blue Whale
Preventative Maintenance System (PMS)	MODU Safety Case & Management System Vessel Preventative Maintenance System

7.6.5 Demonstration of ALARP

Noise emissions generated during the Minerva P&A and Field Maintenance activity are considered a 'Type B' (higher order) impact based upon the Decision Context described in Section 6.1.1 of this EP given the Operational Area overlaps with a known blue whale foraging BIA. As such a conservative (precautionary) approach to assessment of control measures has been adopted. The precautionary approach aligns with the blue whale Conservation Management Plan but differs from the 'precautionary principle' detailed within the EPBC Act (Section 391) given there are no 'threats of serious or irreversible harm' identified. Potential impacts are considered minor and short-term.

As such the following demonstration of ALARP (Table 7-9) is consistent with those for 'Type B' Decision Criteria as described in Section 6.1.1 and the Conservation Management Plan (CMP) for the Blue Whale.

Table 7-9: Detailed engineering assessment – noise emissions

Hierarchy of Control	Control Measure	Accept/ Reject	Reason
Eliminate	Do not undertake the activity	Reject	By not undertaking either P&A or field maintenance activities, the overall potential for fauna disturbance and or injury would be eliminated. Given DAWE assesses the potential impacts of shipping and industrial noise as 'minor' i.e., 'individuals are affected but no affect at population level' the potential environmental benefits of not undertaking the activity in relation to noise generation are also considered minor.

Hierarchy of Control	Control Measure	Accept/ Reject	Reason
			Additionally, Woodside must undertake the activity in accordance with NOPSEMA Direction Notice 831. Woodside does not consider this control as feasible, as the premise for field decommissioning requires these activities to occur.
Substitute	None identified	N/A	N/A
Engineer	None identified	N/A	N/A
Separate	Avoid periods of peak blue whale aggregation / feeding (January - March)	Accept	The Conservation Management Plan (CMP) for the Blue Whale requires that anthropogenic noise in biologically important areas be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area. DAWE Guidance states ‘Mitigation measures must be implemented to reduce the risk of displacement occurring during operations where modelling indicates that behavioural disturbance within a Foraging Area may occur. Given the CMP assesses the impacts of shipping and industrial noise as ‘Minor’, i.e., has little importance, influence, or effect, then the potential benefit gained by avoiding peak periods of marine fauna sensitivity is at most minor at a population level, and therefore assumed to be negligible at an individual level. Additionally, whilst avoiding peak periods of marine fauna sensitivity for some species may reduce the risk to that species, the risk is not eliminated, and could unintentionally present risks to alternate species utilising the area at other times. Other proposed adaptive management controls (described below) are targeted towards monitoring and avoidance of disturbance to individuals, these are considered more effective at reducing the risk of displacement to any cetacean, including blue whales. The timing of the activity is dependent on MODU availability and contracting arrangements. The financial cost associated with contracting a MODU that is sequenced for a window of opportunity is considerable. Although there is negligible potential impact to blue whale populations by undertaking the activity, and the overall contribution of underwater noise from commercial shipping activities within the region would pose a considerably higher risk to the recovery of the blue whale, Woodside consider a highly conservative approach to reducing the overall underwater noise over periods of peak blue whale aggregation to align with the approach outlined within the CMP. As such, this control has been adopted.
	Avoid periods of potential blue whale aggregation / feeding (November - May)	Reject	Woodside considers that an appropriately conservative approach has been adopted consistent with the DAWE Guidance stating ‘Mitigation measures must be implemented to reduce the risk of displacement occurring during operations where modelling indicates that behavioural disturbance within a Foraging Area may occur. The overly conservative approach adopted to avoiding periods of peak blue whale aggregation limits the potential window of opportunity to undertake the activities and the corresponding access to contracted services within that window. Woodside considers it to be grossly disproportionate in both time, cost and effort to further reduce the window of activity to less than 9 months of the year. A further reduction could hinder the ability for the project to be undertaken in accordance with NOPSEMA Direction Notice 831. Further, that Adaptive Management Plan proposed below provides details on reasonably practicable controls to monitor potential

Hierarchy of Control	Control Measure	Accept/ Reject	Reason
			interactions with blue whales and further reduce the risk of displacement occurring. This approach is also consistent with DAWE Guidance given DAWE do not require the elimination of risk, but rather the reduction of risk. Therefore, this control is rejected.
Administrative	Adaptive Management Plan	Accept	The adoption of adaptive management strategies upon the detection of cetaceans entering the operational area (based upon Table 7-5, Scenario 5 - Rmax 1km) and whilst MODU being serviced by OSV under DP (based upon Table 7-5, Scenario 7 – Rmax 7km), may reduce the likelihood of potential disturbance to individuals or aggregations of whales from the activity. Adaptive management measures such as: limiting activities to minimum MODU power generation requirements and standing off OSV from the MODU interactions upon the detection of whales within the operational area (1km) or 7km radius respectively is considered both reasonable and practicable. As such, this control is accepted.
Monitoring	Dedicated Marine Mammal Observers (MMOs) during periods of known blue whale aggregation / feeding (November - May)	Accept	Dedicated Marine Mammal Observers (MMOs) stationed aboard the MODU and/or vessels during periods of known blue whale aggregation / feeding (November - May) may reduce potential impacts over and above observations undertaken by vessel and MODU crews. Dedicated MMO would assist to inform the adaptive Management Plan (detailed above). There is financial cost associated with engaging dedicated MMOs as well as increasing overall POB aboard vessels / MODU, but this cost is considered reasonable over periods of known blue whale aggregation / feeding (November - May). As such, this control is accepted.
	In field marine mammal observations (non-dedicated) June – October.	Accept	Opportunistic marine mammal observations undertaken by the MODU and vessel crews when blue whales are unlikely to be present in the area may assist in detecting cetaceans in the unlikely event of unseasonal presence. The cost and effort associated with allocating existing crew members to undertake and record marine mammal observations whilst in field for these periods is considered both reasonable and practicable, as such, this control is accepted.
	Passive acoustic monitoring (PAM) to detect cetaceans in the operational area	Reject	The cost of a PAM system has been estimated to be unacceptably high for a short-duration activity and would require several permanent mooring locations in the operational area with real-time monitoring and analysis. Additionally, there is little benefit gained in implementing this control given the monitoring and adaptive management control already accepted. Woodside considers the cost grossly disproportionate when there is little to no benefit gained by implementing this control, therefore the control is rejected.

7.6.6 Demonstration of Acceptability

A detailed demonstration of acceptability has been provided consistent with that of a ‘Type B’ potential impact.

Controls considered and applied to reduce the potential impact of noise emissions align with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans; and NOPSEMA Bulletin – ‘Recording and Reporting MMO Data’. Additional, consideration has been given to adopting a precautionary approach to reducing the potential impact of anthropogenic noise consistent with the Conservation Management Plan (CMP) for the Blue Whale (DoE, 2015a).

The detailed ALARP evaluation for noise emissions has been conducted and any reasonable and practicable alternate, additional, or improved controls have been adopted, including adaptive management controls consistent with the Conservation Management Plan (CMP) for the Blue Whale (DoE, 2015a).

There have been no objections or claims raised by relevant stakeholders in relation to noise emissions generated whilst undertaking the activity.

Consideration of actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) have been assessed and potential impacts and risks are not inconsistent with:

- EPBC Act Significance Guidelines;
- Recovery Plan for Marine Turtles in Australia 2017-2027; and
- Conservation Advice Southern Right Whale 2011-2021 (DSEWPaC, 2012a)

Additionally, the proposed activity is not inconsistent with the Conservation Management Plan (CMP) for the Blue Whale (DoE, 2015a) given the following:

The CMP stated objective is ‘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.’ Therefore, for conservation status to improve, recovery must be at a population level. The CMP assesses the impacts of shipping and industrial noise as ‘Minor’: ‘individuals are affected but no affect at population level’ Given Woodside assess the potential of injury to, or disturbance of, a blue whale to be limited to individuals and minor in nature, this evaluation is consistent with the Commonwealth evaluation under the CMP. Therefore, the long-term recovery objectives for blue whales would not be compromised due to potential impacts from this proposed activity.

Further, the CMP assigns shipping and industry noise a ‘Moderate’ risk, because whilst impacts are Minor, the likelihood of their occurrence is assessed as ‘Almost certain’. The likelihood classification recognises that impacts from noise will occur. So, the potential minor impact from this proposed activity is accounted for in the risk ranking and criteria for addressing that moderate risk. The CMP also states that ‘for the conservation status of both subspecies to improve so that they no longer meet the criteria for threatened species listing under the EPBC Act, the cumulative impacts of the above listed threats should also be considered’. Section 7.6.3 of this EP is consistent with this statement by considering potential cumulative impacts from noise generation during the activity.

In addition to the long-term objectives of the CMP, the ‘Interim objective 4’ of the CMP states: ‘Anthropogenic threats are demonstratable minimised’. Further, the CMP states ‘mitigation measures must be implemented to reduce the risk displacement occurring during operations where modelling indicates that behavioural disturbance within a Foraging Area may occur.’ In the context of risk reduction (as required under the CMP), this EP demonstrates consistency by continually reducing potential environmental impacts and risks to ALARP and acceptable levels as is also required under the OPGGS(E) Regulations.

Action A.2.3 of the CMP states ‘Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area’. The EPO 03 ‘No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)’ aligns with objectives of Action A.2.3 of the CMP.

The Guidance on key terms within the Blue Whale CMP states: ‘Activities proposed to occur outside designated Foraging Areas must adopt best practice adaptive management approaches in the event that indicators of whale foraging (such as aggregating in a particular area) are evident to ensure that impacts to whales are not unacceptable e.g. injury or displacement.’ The guidance further states: ‘Noting the potential for whale foraging and feeding to occur in areas of high primary productivity outside of designated Foraging Areas, consideration also needs to be given to management of industry activities and underwater anthropogenic noise where opportunistic foraging potential exists.’ Given foraging and distribution BIAs for the Pygmy Blue Whale intercept the operational area, Woodside has adopted an adaptive management approach consistent with DAWE guidance and in addition to established controls under EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans. Given the proposed approach, including limiting activities to outside periods of known peak blue whale aggregation, and the temporary nature of noise generated by the proposed activity, Woodside considers it highly unlikely for noise generation to injure any whale, stop or prevent any blue whale from foraging, cause any blue whale to move on when foraging, or stop or prevent any blue whale from entering a foraging area.

Relevant principles of Ecologically Sustainable Development (ESD) (as defined within Section 3A of the EPBC Act) have been considered with respect to potential impacts from noise emissions generated whilst undertaking the proposed activity with the following determination:

- The ‘Integration Principle’ has not been compromised given there have been no objections or claims raised by relevant stakeholders regarding noise emissions;
- The ‘Intergenerational Principle’ has not been compromised given there are no identified health, diversity and productivity impacts that may affect the environment for future generations;
- The ‘Biodiversity Principle’ has not been compromised given the mitigation of potential impacts and risks to matters of National Environmental Significance (MNES) has been considered and controls adopted to continually manage potential impacts and risks to ALARP and acceptable levels for the duration of the proposed activity;
- The ‘Valuation Principle’ is not considered relevant given there are no identified costs associated with noise generation from the proposed activity; and
- The ‘Precautionary Principle’ is not considered relevant to the potential impacts and risks associated with noise emissions given there are no ‘threats of serious or irreversible harm’ as detailed within EPBC Act (Section 391). However, a ‘precautionary approach’ consistent with the Conservation Management Plan (CMP) for the Blue Whale (DoE, 2015a) has been adopted to evaluate alternate, additional, or improved controls including the adoption of an adaptive management strategy.

Woodside is satisfied that when the accepted controls are implemented the environmental performance outcome (EPO) of “No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)” will be met, therefore Woodside considers the impact to be managed to an acceptable level.

7.7 Routine and Non-Routine Atmospheric Emissions

7.7.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Atmospheric emissions	Exhaust emissions of particulates and volatile organic compounds (VOCs) from MODU & AHTS vessel engines and generators & vessel incinerators; and Emissions from MODU venting off / flaring reservoir hydrocarbon gas	Localised and temporary reduction in ambient air quality from non-GHG emissions and contribution to global GHG emissions.	10	N/A	-	Type A Low Order Impact	Tolerable

7.7.2 Source of Risk

The Australian Commonwealth Clean Energy Regulator defines 'Scope 1' greenhouse gas emissions as: *"emissions released to the atmosphere as a direct result of an activity, or series of activities at a facility level. Scope 1 emissions are sometimes referred to as direct emissions."*

The following sources of atmospheric emissions generated during the proposed activity constitute 'Scope 1' or 'direct' emission sources.

Exhaust Emissions and Incineration

The MODU and AHTS vessels use marine diesel oil (MDO) to power engines, generators, mobile and fixed plant and equipment and the incinerator. The combustion of fuel onboard the MODU and AHTS vessels, and the incineration of waste onboard the AHTS vessels will generate emissions of greenhouse gas (GHG), such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and non-GHG such sulphur oxides (SO_x) and nitrogen oxides (NO_x), particulate material and volatile organic compounds (VOCs).

The average diesel fuel usage during drilling and completions for a typical MODU is in the order of 15,000 L per day and 10,000 L per day per AHTS vessel. The atmospheric emissions have been calculated using E&P Forum (1994) methods (assuming three AHTS vessels in continuous use) and are presented in Table 7-10.

Table 7-10: Calculated atmospheric emissions from MODU and AHTS vessels

Parameter	MODU (tonnes / day)	Vessel (tonnes / day)
CO_2 eq	41	27
SO_x	0.01	0.007
NO_x	1.05	0.7

Venting of Hydrocarbon Gas

During the activity, hydrocarbon gas may be cold vented or flared from the MODU to the atmosphere if it is not possible to flush into the wellbore. The volume estimates provided in Table 7-11 are based on existing or planned pressure measurements and well design. During well intervention and re-entry / re-completion of the wells, the total volume of residual gas that may require venting is estimated to be <30 m^3 per well assuming the entire annulus and tubing from the TH to the gas lift valve is full of gas and the gas is unable to be flushed into the well. Gas purged from the production annulus will be vented or flared to the atmosphere via the fluids handling package aboard the MODU.

Table 7-11: Estimated gas volumes vented

Source of gas	Venting location	Gas Volume
Minerva-3 production annulus	MODU	<30 m^3
Minerva-4 production annulus	MODU	<30 m^3
	Total volume	<60 m^3

The Australian Commonwealth Clean Energy Regulator defines ‘Scope 2’ and ‘Scope 3’ greenhouse gas emissions as:

Scope 2: *“greenhouse gas emissions are the emissions released to the atmosphere from the indirect consumption of an energy commodity”.* Scope 2 emissions may be referred to as indirect emissions.

Scope 3: *“indirect greenhouse gas emissions other than scope 2 emissions that are generated in the wider economy. They occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business”*

Given the Minerva Field has been suspended and this activity represents a component of field decommissioning, there are no identified Scope 2 or Scope 3 (indirect) emissions associated with the activity. Therefore, the EPBC Policy Statement ‘Indirect consequences’ of an action: Section 527E of the EPBC Act are not considered relevant to this environmental impact assessment.

7.7.3 Environmental Impact Assessment

Atmospheric emissions associated with power generation, waste incineration, flaring and venting operations release GHG and non-GHG pollutants resulting in a localised reduction of ambient air quality and a contribution to global greenhouse gas emissions. GHG emissions are a cause of human-induced climate change.

According to the United Nations Intergovernmental Panel on Climate Change (IPCC) Working Group II Sixth Assessment Report (IPCC, 2022) observed impacts of human-induced climate change include more frequent and intense extreme events, widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability. Additionally, the report details near-term (2021-2040) risks associated with human-induced climate change, including global warming reaching 1.5°C in the near-term, causing unavoidable increases in multiple climate hazards and presents multiple risks to ecosystems and humans. The following potential risks have been identified within a medium to high level of confidence of occurring:

- an increased frequency, severity and duration of extreme events placing many terrestrial, freshwater, coastal and marine ecosystems at high or very high risks of biodiversity loss;
- Continued and accelerating sea level rise will encroach on coastal settlements and infrastructure and commit low-lying coastal ecosystems to submergence and loss; and
- The number of people at risk from climate change and associated loss of biodiversity will progressively increase.

Whilst the burning of fuel oil for power generation and transport associated with this activity does not have the potential to cause these identified impacts and risks in isolation, the activity does contribute to overall global GHG emissions. Given the short-duration of the activity and the consumption of fuel oil is limited to that required for power generation and transport requirements during the activity, the overall contribution to global GHG levels is considered negligible.

The reduction in ambient air quality associated with the release of non-GHG pollutants such as sulphur oxides (SO_X) and nitrogen oxides (NO_X) has the potential to cause adverse health effects, however a reduction in air quality is highly localised to the source of emissions, such as directly adjacent to exhaust systems and flare booms. Given these pollutants will rapidly disperse within the unimpeded offshore location, the temporary and localised reduction in ambient air quality is not expected to adversely personnel or avifauna should they be transiting the operational area.

Given the closest residential area is Port Campbell located approximately 11 km north of the operational area and emissions are expected to rapidly dissipate into the surrounding atmosphere, no impacts are predicted for regional communities.

Ozone-depleting substances are used in closed refrigeration systems on board vessels. There is no planned release of ozone-depleting substances during the activity, therefore impacts are not predicted.

There are no identified impacts from a minor reduction to local air quality to any values of any World Heritage Properties associated with Scope 1 (direct) atmospheric emissions generated during the activity.

There are no identified cumulative impacts on local air quality associated with Scope 1 (direct) atmospheric emissions generated during the activity in relation to other regional offshore activities.

7.7.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) controls accepted by Woodside to manage the impacts associated with direct (Scope 1) atmospheric emission generated via the operation of the MODU and AHTS vessels are detailed below:

Table 7-12: Atmospheric emissions – control measures

Control Measure	Source of Requirement / Good Practice
Well Operations Management Plan (WOMP) (NOPSEMA accepted)	Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations, 2011
MODU Safety Case (NOPSEMA accepted)	Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations, 2009
Marine Order 97 (Marine Pollution Prevention – Air Pollution (as applicable to vessel class: • Very low sulphur fuel oil (VLSFO); • International Air Pollution Prevention (IAPP) Certificate; • Ship Energy Efficiency Management Plan (SEEMP); • Ozone-depleting substances (ODS) Record Book; and • No discharge of ODS.	Annex VI of MARPOL 73/78 and Marine Order 97 (Marine Pollution Prevention – Air Pollution (as applicable to vessel class).
Preventative Maintenance System (PMS)	MODU Safety Case & Management System Vessel Preventative Maintenance System
Emissions Recording and Reporting	*National Greenhouse and Energy Reporting Act 2007* (NGER Act)

7.7.5 Demonstration of ALARP

Scope 1 atmospheric emissions generated by the MODU and AHTS vessels for the duration of the *Minerva P&A and Field Maintenance activity* with the potential to generate localised and temporary reduction in ambient air quality and a negligible contribution to overall GHG emissions is considered a 'Type A' (lower order) potential impact based upon the Decision Context described in Section 6.1.1 of this EP. Given the limited (temporary) nature and scale of atmospheric emissions generated during the proposed activity, and given the controls detailed above are consistent with both regulatory requirements (including international maritime regulations) and industry good practice, Woodside considers the potential impact from Scope 1 emissions has been managed to ALARP.

However, giving consideration to the external context of the IPCC Working Group II Sixth Assessment Report (IPCC, 2022) additional opportunistic controls for Scope 1 emissions have been considered applying the ALARP methodology for a 'Type B' (higher order) impact based upon the Decision Context described in Section 6.1.1 of this EP. This assessment is presented in Table 7-13.

Table 7-13: Detailed engineering assessment – atmospheric emissions

Emissions Reduction Hierarchy of Control	Control Measure	Accept/ Reject	Reason
Avoid	Do not undertake the activity	Reject	By not undertaking either P&A or field maintenance activities, the overall potential for direct atmospheric would be eliminated. Additionally, Woodside must undertake the activity in accordance with NOPSEMA Direction Notice 831. Woodside does not consider this control as feasible, as the premise for field decommissioning requires these activities to occur.
	No use of MDO for either transport or power generation aboard the MODU or AHTS vessels	Reject	The use of MDO for both power generation and transport aboard the MODU and AHTS vessels is the only feasible option given both constitute the use of internal combustion engines. Eliminating the use of MDO within the timeframes of this activity is not feasible.
	No cold venting of hydrocarbon gas	Reject	The venting of gas is necessary for technical and HSE reasons for release of pressure and therefore cannot be eliminated.
	No flaring of gas during drilling activity	Reject	No flaring is planned during the activity; however flaring may be required for safety reasons if gas volumes cannot be flushed downhole and exceed what can be safely cold vented. Flaring is the preferred contingent option when compared with cold venting.
Reduce	Vessel Emission Reduction Plan	Accept	A vessel emissions reduction plan including the monitoring of vessel activities and fuel consumption when in field has the potential to reduce overall atmospheric emissions for the duration of the decommissioning program. The cost and effort associated with developing and monitoring the plan during the activity is considered reasonable and practicable.
	Automated MODU Power Management System	Reject	An automated power management system aboard the MODU has the potential to reduce emissions by automatically adjusting the number of generators used to maintain minimum power requirements for the MODU to facilitate the operations whilst still maintaining essential services. The technology would have greater effect on a DP rig given greater fuel consumption demands to mobilise and maintain station keeping. As the MODU for this activity is moored on location, fuel consumption is limited to that required to maintain winch tension. During offshore operations, the MODU uninterrupted power supply to maintain functionality, including all safety features. Also, running engines at idle for prolonged periods increases the risk of carbonising the engines causing reduced reliability and increasing maintenance costs.

Emissions Reduction Hierarchy of Control	Control Measure	Accept/ Reject	Reason
			Some MODUs designed and constructed more recently have the ability to regulate power usage to a greater degree than the MODU currently under contract to undertake this activity. Retrofitting an automated power management system is not considered feasible, and as such is not a reasonable or practicable measure to reduce emissions during this activity.
	Establish activity-specific scope 1 emissions reduction targets	Reject	Given corporate emissions reduction targets are a whole-of-company approach, and the targets exceed the timeframes of this short-duration activity, they are not practical to implement for this program. However, the emissions generated by this program shall be monitored with the information used to evaluate the success of the broader long-term company targets.
Offset	Voluntarily offset all GHG emissions from the activity through carbon offsets eligible under the Climate Active Carbon Neutral Standard	Reject	Whilst carbon offsetting may contribute to Woodside’s broader emissions reduction strategy, it is not considered reasonable to offset on an activity-by-activity basis, given activity specific emissions data already informs the overarching offsetting strategy.
Substitute	Replace very low sulphur fuel oil (VLSFO) use with marine-grade biodiesel	Reject	The substitution of very low sulphur fuel oil (VLSFO) (marine diesel oil) with an alternate marine-grade biodiesel has been tested within the maritime industry, but as yet, the large-scale adoption of biodiesel for shipping has not occurred. Therefore, biodiesel is not readily available for use in the SEMR.
	Replace very low sulphur fuel oil (VLSFO) use with ultra-low sulphur fuel oil (ULSFO) of lower-calorific value	Reject	The substitution of very low sulphur fuel oil (VLSFO) (marine diesel oil) with an alternate ultra-low sulphur fuel oil (ULSFO) diesel fuel with a lower calorific value is not feasible given the fuel specification requirements of the AHTS vessels’ and MODU generators.
	Vessel Tender Process considering vessel fuel efficiency	Accept	By incorporating vessel fuel efficiency considerations within the Vessel Tender Process, there is opportunity to evaluate and engage vessels with higher fuel efficiency when available to market. This includes prioritisation of battery-supported vessels where minimum performance capacity can be demonstrated. The cost and effort associated with developing and implementing this process during procurement is considered reasonable and practicable.
	LNG-powered / dual fuel AHTS vessels	Reject	LNG / dual-fuel powered vessels have the potential to reduce atmospheric pollutants, but the lower calorific value of LNG compared with MDO means the vessels consume a larger quantity of LNG fuel than MDO for an equivalent voyage. Whilst a limited number of LNG-powered support vessels have been tested for in-field applications, these vessels are not readily accessible to the region. The conversion costs associated with re-engineering a AHTS vessel from MDO to LNG are significant. LNG supply chains for refuelling are not as accessible when compared with conventional MDO supply within the region.

Emissions Reduction Hierarchy of Control	Control Measure	Accept/ Reject	Reason
	AHTS vessels for lesser capacity OSV during the activity	Reject	Replacing large AHTS vessels with smaller (and more fuel efficient) OSV for routine supply operations may reduce the overall fuel consumption for the project. However, given the short duration of the activity, and the need for AHTS to mobilise the MODU to and from well locations, the mobilisation costs to change out vessel types would be prohibitive. Additionally, even if OSV were mobilised to field for a short duration, the AHTS vessels would remain on standby thereby incurring additional costs and consuming fuel in standby mode.
Monitor	Monitoring of fuel usage (Scope 1) and reporting to the Australian Clean Energy Regulator via NGER	Accept	Woodside will monitor atmospheric emission from the activity consistent with the National Greenhouse and Energy Reporting Act and report these emissions to the Clean Energy Regulator on an annual basis.
Advocate	Actively advocate for GHG emissions reductions related to Scope 1 from this activity	Reject	Woodside reports and sets company-wide targets to reduce Scope 1 and 2 greenhouse gas emissions on a net equity basis, including both operated and non-operated assets. Woodside regularly engages with governments of countries where we are active in support of our business strategy, to exchange information, and to inform policy development and decision making. Any advocacy undertaken by Woodside would focus on a whole-of-business approach rather than project-specific advocacy for Scope 1 emissions.

7.7.6 Demonstration of Acceptability

Whilst atmospheric emissions generated during the Minerva P&A and Field Maintenance activity are considered a ‘Type A’ (lower order) impact based upon the Decision Context described in Section 6.1.1 of this EP, a more detailed demonstration of acceptability has been provided consistent with that of a ‘Type B’ potential impact.

Scope 1 atmospheric emissions from hydrocarbon combustion for vessel and MODU use in Australian waters are permissible under Marine Order 97 (Marine Pollution Prevention – Air Pollution). Controls are in place that are consistent with National Greenhouse and Energy Reporting Act 2007 (NGER Act) requirements. There are no relevant actions prescribed in recovery plans or conservation advice in relation to atmospheric emissions released whilst undertaking the activity. There are no relevant actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) relating to direct atmospheric emissions from offshore activities. Whilst habitat loss and degradation has been identified as a potential threat to a number of listed species, the minor and temporary reduction in ambient air quality associated with direct emissions from the activity does not threaten regional habitat.

Atmospheric emissions generated whilst undertaking the activity do not contravene any Plan of Management for a World Heritage place, National Heritage place or Ramsar wetland identified within the EMBA.

The detailed ALARP evaluation for atmospheric emissions has been conducted and any reasonable and practicable alternate, additional, or improved controls have been adopted.

There have been no objections or claims raised by relevant stakeholders in relation to atmospheric emissions generated whilst undertaking the activity.

Relevant principles of Ecologically Sustainable Development (ESD) (as defined within Section 3A of the EPBC Act) have been considered with respect to potential impacts from atmospheric emissions generated whilst undertaking the proposed activity with the following determination:

- The ‘Integration Principle’ has not been compromised given there have been no objections or claims raised by relevant stakeholders regarding atmospheric emissions;
- The ‘Intergenerational Principle’ has not been compromised given there are no identified health, diversity and productivity impacts that may affect the environment for future generations associated with the short-duration, localised and limited release of direct (Scope 1) atmospheric emissions;
- The ‘Biodiversity Principle’ has not been compromised given there are no significant impacts and risks associated with direct (Scope 1) atmospheric emissions to matters of National Environmental Significance (MNES);
- The ‘Valuation Principle’ is not considered relevant given there are no identified costs associated with direct (Scope 1) emissions generated whilst undertaking the activity; and
- The ‘Precautionary Principle’ is not considered relevant to the potential impacts and risks associated with direct (Scope 1) atmospheric emissions given there are no ‘threats of serious or irreversible harm’ as detailed within EPBC Act (Section 391). However, a detailed ALARP evaluation has been undertaken to identify reasonable and practicable alternate, additional, or improved controls to reduce direct emissions associated with the activity.

Woodside is satisfied that when the accepted controls are implemented the environmental performance outcome (EPO) of “Planned atmospheric emissions limited to those necessary to undertake the activity and maintain well integrity” will be met, therefore Woodside considers the potential impacts and risks to be managed to an acceptable level.

7.8 Routine and Non-Routine Marine Discharges

7.8.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Routine MODU & AHTS vessel discharges within operational area	Routine planned discharge of sewage, grey water, putrescible (food), desalination brine, cooling water, and deck and bilge water to the marine environment from the MODU & AHTS vessels.	Localised and temporary reduction in water quality adjacent to the discharge point associated with minor increases in nutrients, salinity, temperature and oily water/ chemical residues.	10	N/A	-	Type A Low Order Impact	Tolerable
	Discharge of BOP control fluids or other chemicals such as hydraulic fluids and greases (and well kill brine as contingency).	Localised and temporary reduction in water quality adjacent to the discharge point associated with hydrocarbon and chemical contaminants causing adverse toxicity effects.	10	N/A	-		Tolerable
	Discharge of cleaning chemicals and growth removal						
Discharge of cement during drilling activities	Cement residue from flushing of pipework and cement unit/ tank after each cement job.	Localised, short-term changes in water quality and toxicity at the surface due to cement discharge.	10	N/A	-	Type A Low Order Impact	Tolerable
	Mixed cement and/ or cement additives mixed for use but not subsequently used discharged overboard.	Localised loss of biota from smothering.	10	NA	-		Tolerable

7.8.2 Source of Risk

Routine MODU and AHTS Vessel Discharges

During the activity, both the MODU and AHTS vessels will generate and routinely discharge to the marine environment treated sewage, grey water, putrescible (food) wastes and desalination brine, cooling water, bilge water and deck drainage.

Sewage, Grey Water and Food Waste

The volume of sewage, grey water and food wastes generated is directly proportional to the number of persons onboard (POB) the MODU / vessel. The total volume of sewage and grey water generated by the MODU and AHTS vessels (if fully manned) is estimated to be in the order of 5 m^3 to 15 m^3 per day depending on POB. Food waste generated is typically 1 L per person per day. This scale of discharge falls within the scope of the

Environment Plan Reference Case – Planned Discharge of Sewage, Putrescible Waste and Grey Water (National Energy Resources Australia, 2017).

Desalination Brine Reject from Reverse Osmosis

Potable water is produced onboard the MODU / vessel using reverse osmosis (RO) machinery. RO is a membrane-technology filtration method that removes salt molecules and ions from seawater by applying pressure to the solution when it is on one side of a selective membrane. The result is that a brine solution with salinity elevated by approximately 10% is retained on the pressurised side of the membrane and the potable water is allowed to pass to the other side.

Cooling Water

Seawater is used as a heat exchange medium for the cooling of machinery engines on some vessels; others use air cooling. Seawater is pumped onboard the vessel, passes through heat exchangers and is subsequently discharged from the vessel with temperature elevation in the order of 2 to 5°C. Seawater used for cooling is dosed with chlorine following intake and discharged with low residual chlorine concentrations that are rapidly diluted by prevailing water currents.

Deck Drainage

No wastes contaminated with hydrocarbons or chemicals will be routinely discharged from the MODU or AHTS vessels' deck drains. Drainage from areas with potential for hydrocarbon or chemical contamination will be directed to a MARPOL compliance oily water separator for treatment.

Rainfall and wash down of the decks may result in minor quantities of chemical residues, such as detergent, oil and grease entering the deck drainage system and being possibly discharged overboard.

Routine and Non-Routine Discharges During Activities

Cement

Cement is utilised to permanently plug within and between the casing and the formation to form a permanent barrier. The majority of the cement remains downhole but minor volumes may be discharged to the environment, including:

- When testing cementing unit aboard the MODU (approx. 1-2 m^3);
- When abandoning the motherbore of the well (approx. 10 m^3); or
- Disposal of excess cement at the end of campaign that cannot be utilised by next operator.

Cementing fluids generally consist of Portland cement and additives such as inorganic salts, lignins, bentonite, barite, defoamers, silica and surfactants.

Bulk cement may also be discharged directly overboard if critical problems occur during a cement job that could lead to a compromise in well integrity (in the order of 55 m^3 based upon 9-5/8" casing).

BOP Control (Actuator) / Subsea Control Fluids

As part of the activity, the BOP is required to be regularly function and pressure tested when subsea, as defined by company policy and legislative requirements. During this testing, BOP control (actuator) fluid, which generally consists of water mixed with a glycol-based detergent or equivalent water-based anti-corrosive additive suitable for open hydraulic systems, is released to the ocean. The operation of valves on the SXT will result in the release of small volumes water-based hydraulic control fluids.

7.8.3 Environmental Impact Assessment

Routine MODU and Vessel Discharges

Sewage, Grey Water and Food Waste

The operational area is located less than 12 Nm from land, which is less than the distance required by Marine Order 96 (Marine Pollution Prevention – Sewage) 2009 and Marine Order 95 (Marine Pollution Prevention –

Garbage) 2013 at which untreated sewage may be discharged. Therefore sewage, greywater and food waste will be treated aboard the MODU and support vessels prior to overboard.

Brine Reject from Reverse Osmosis

The brine solution will be quickly dispersed and diluted to undetectable levels within a few metres of the discharge point. Given the relatively low volume of discharge, the relatively low increase in salinity and the open ocean environment, the discharge of desalination brine stream is considered to have an insignificant environmental effect.

Cooling Water

When discharged to sea the cooling water will be subject to turbulent mixing and loss of heat to the surrounding waters. The area of detectable increase in seawater temperature is likely to be less than 10 m radius. The impact of cooling water discharge is considered to be insignificant.

Deck Drainage

Open deck drainage aboard the MODU may contain very low levels of residual contaminants such as residual from foot traffic or from small deck-spills of chemicals. Any residual in the discharge would rapidly dilute and disperse in the open ocean, the environmental effects will be temporary and localised. The discharge of deck drainage is considered to have a negligible environmental effect.

Oil / Water Discharge

All drains from chemical storage areas aboard the MODU, such as drill floor, mud pit rooms, mud pump room, shaker house, engine room are routed to the MARPOL-compliant oily water separator prior to overboard discharge. Under Marine Order 91 (Marine Pollution Prevention – Oil) 2014 treated oil water mix may be discharged if <15ppm.

Routine and Non-Routine Discharges During Activities

Cement

At completion of cementing operations, small amounts of residual cement slurry remaining in the mixing area will be discharged to sea before it sets to concrete. The cement slurry discharged to sea has low dispersibility, although some will disperse in the water column. As such, there will be some localised, short-term decrease in water quality until the cement slurry settles to the seabed as a very thin layer. Pelagic water column fauna such as fish, turtles and whales are unlikely to be affected as the decrease in water quality will be localised and short-term (hours) and these mobile species would avoid the area. The environmental consequence of this disturbance is insignificant because of the minor quantities involved and the essentially inert nature of the material (CIN, 2004). The benthic habitats affected by this localised disturbance will be unconsolidated sediments that are colonised by a sparse, low abundance epibiotic and infaunal community. As this habitat type and benthic community are ubiquitous throughout the Bioregion, potential deterioration in habitat quality in this small area is not considered to be significant.

BOP Control (Actuator) / Subsea Control Fluids

Concentrated BOP control fluids (such as Stack Magic EcoF) are diluted to 2 to 3% in water on the MODU to make up the BOP control fluid subsequently released to the marine environment. When used at this concentration, Stack Magic EcoF it is classed as a Group E product by the OCNS and therefore considered to be PLONOR. If an alternative BOP control fluid is used aboard the MODU, only BOP control fluids ranked D or better on OCNS ranked list will be utilised.

During a well-related activities, the BOP is function tested during assembly and maintenance and during operation on the seabed. Approximately 1500 litres of diluted control fluid is discharged to the ocean during each function test. Acute toxicity is not likely to occur due to the low inherent toxicity of the control fluid composition. Chronic toxicity will not occur because a) the already dilute fluid is further diluted upon release and dispersed away from the BOP, and b) even if there was no dispersion the interval between releases exceeds the biodegradation period of the fluid.

The release of small volumes of water-based low-toxicity subsea control fluids will result in a temporary and localised alteration in water quality in the vicinity of the release source point, resulting in potential adverse effects to marine biota. Given the low volumes discharged and the limited number of release events, the potential impacts are expected to be very localised with only a slight impact on the marine environment due to rapid dilution.

Summary

Threatened or Migratory Fauna and Local Fauna

As discussed in the sections above, all planned discharges will have a limited discharge extent localised to the area around the source point, with rapid dilution occurring due to the offshore ocean environment and the volumes and nature of discharges involved. Reduction in water quality will be limited to the proximity of the operational area with limited adverse effects to marine biota as a result of short-term reduction in water quality.

The operational area overlaps with BIAs for southern right whales, pygmy blue whales, and white sharks and as such these species may be encountered within the operational area. Marine fauna within the operational area are likely to be transient, however they may be affected if they come in direct contact with a release (i.e. by passing through the immediate discharge area). If contact does occur with any marine fauna, it will be for a short duration due to rapid dispersion, such that exposure time may not be of sufficient duration to cause a toxic effect. Given the small volumes of discharges, the water depth of release and the rapid dilution, the likelihood of ecological impacts to these marine fauna is considered to be highly unlikely.

There are no identified impacts to any values of any World Heritage Properties associated with routine and non-routine marine discharges within the operational area.

There are no identified cumulative impacts associated with routine and non-routine marine discharges within the operational area.

7.8.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) controls accepted by Woodside to manage the impacts associated with marine discharges generated via the operation of the MODU and AHTS vessels and the drilling activity are detailed below:

Table 7-14: Marine discharges – control measures

Control Measure	Source of Requirement / Good Practice
Macerator for putrescible waste	Marine Order 95 (Pollution Prevention – Garbage)
IOPP Certificate	Marine Order 91 (Pollution Prevention – Oil)
MARPOL-compliant oily water filter system	
ISPP Certificate & Sewage Treatment Plant (STP)	Marine Order 96 (Pollution Prevention – Sewage)
Discharge Location	
Chemical Assessment Process	MARPOL Annex II; Hazardous Materials Acquisition Environmental Supplement (AO-HSE S-0002) consistent with Offshore Chemical Notification Scheme (OCNS); and
Cement Management	Cementing Standard (DR-PET-STD-DC-0142)
Additional Opportunistic Controls	
Routine wastes (i.e., greywater) stored onboard and transferred to shore for onshore treatment and disposal.	Health and safety risks associated with the storage of routine vessel wastes onboard. Owing to the short duration of the activity (approximately 2 months), transfers not practicable and increase the risk of spills/ leaks and risk to personnel during transfer operations. Additional costs involved in transfers disproportionate to the environmental benefit gained given the rapid dilution in offshore waters and low potential impact from routine vessel discharges. Additionally, the proposed controls are consistent with industry good practice and relevant Marine Orders for discharge to the marine environment.

7.8.5 Demonstration of ALARP

Routine discharges generated by the MODU and AHTS vessels for the duration of the *Minerva P&A and Field Maintenance activity* is considered a 'Type A' (lower order) impact based upon the Decision Context described in Section 6.1.1 of this EP. Given the limited (temporary) nature and scale (within proximity of the operational area) of routine discharges generated during the proposed activity, and given the controls detailed above are consistent with both regulatory requirements (including international maritime regulations) and industry good practice (including the EP Reference Case (National Energy Resources Australia, 2017), Woodside considers the impact has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls is required. However, opportunistic controls have also been evaluated but not adopted given the proposed controls have been deemed disproportionate in coast when compared with the negligible potential environmental benefit gained.

7.8.6 Demonstration of Acceptability

Routine marine discharges in Australian waters are permissible under MARPOL and relevant Marine Orders. Woodside is satisfied that when the accepted controls are implemented the environmental performance outcome (EPO) of "Impacts to water quality from planned discharges reduced to ALARP" will be met, therefore Woodside considers the impact to be managed to an acceptable level. Consideration of actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) have been assessed. The Recovery Plan for Marine Turtles in Australia (DoEE, 2017) identifies chemical discharge as a relevant threat to marine turtles. The proposed activity is not inconsistent with recovery plan for marine turtles, as a range of control measures were identified and adopted that align with the intent of the recovery plan.

Additionally, the operational area does not intersect any Commonwealth or State marine parks or KEFs and no impacts to commercial or recreational fisheries are expected.

No concerns or objections regarding routine and non-routine discharges have been raised by relevant stakeholders.

7.9 Waste Management

7.9.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Waste management	Waste (hazardous and non-hazardous) generated during activities	Increase waste to landfill. Additional usage of onshore waste reception facilities	10	N/A	-	Type A Low Order Impact	Tolerable

7.9.2 Source of Risk

Offshore vessels produce a variety of solid wastes, including domestic and industrial wastes. These include aluminium cans, bottles, paper and cardboard, scrap steel, chemical containers, batteries, and medical wastes. These materials could potentially impact the marine environment if discharged in significant quantities.

Waste is segregated onboard the MODU and AHTS vessels and stored in designated skips and waste containers. Wastes are segregated into the following categories:

- Non-hazardous waste (or general waste);
- Hazardous waste; and
- Recyclables (further segregation is conducted in line with practices at existing Woodside operations in the region).

Non-Hazardous Waste

General non-hazardous waste include general domestic and galley waste and recyclables such as scrap materials, packaging, wood and paper and empty containers. Volumes of non-hazardous waste generated on the vessels are generally low.

Hazardous Waste

Hazardous wastes are defined those wastes that are or contain ingredients harmful to health or the environment. Hazardous wastes likely to be generated onboard includes oil contaminated materials (e.g., sorbents, filters and rags), chemical containers and batteries. The volumes of hazardous wastes generated are relatively small.

7.9.3 Environmental Impact Assessment

Improper management of wastes may result in pollution and contamination of the environment. There is also the potential for secondary impacts (ingestion and/ or entanglement) on marine fauna that may interact with wastes such as packaging and binding materials, should these enter the ocean.

All waste (hazardous and non-hazardous) generated during the activity will be transported to and managed appropriately by third parties. Environmental impacts associated with onshore disposal relate to the small incremental increase in waste volumes received at the onshore licensed waste recycling and/or disposal sites. The environmental impacts associated with waste disposal onshore are anticipated to be low because of the minor quantities involved and recycling of some materials.

Accidental loss overboard of single items or units of waste may impact the environment through a reduction in water quality, or present a hazard to marine fauna, depending on the waste involved. Given the small volumes of waste generated and the management in place to prevent loss overboard (e.g. covers on skips/bins), the risk of impact is considered to be low. No significant environmental impacts are anticipated because of the minor quantities involved and the localised area of impact.

There are no identified impacts to any values of any World Heritage Properties associated with waste management for the activity.

There are no identified cumulative impacts associated with waste management for the activity.

7.9.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) controls accepted by Woodside to manage the impacts associated with waste management are detailed below:

Table 7-15: Waste management – control measures

Control Measure	Source of Requirement / Good Practice
Waste Management	MARPOL 73/78 Annex III and V, and the following Marine Orders, as appropriate to vessel class; Marine Order 94 (Pollution Prevention – Packaged Harmful Substances); and Marine Order 95 (Pollution Prevention – Garbage)
Project Induction	Woodside procedures and standards
Additional Opportunistic Controls	
None identified	-

7.9.5 Demonstration of ALARP

Waste management aboard the MODU and AHTS vessels for the duration of the *Minerva P&A and Field Maintenance activity* is considered a 'Type A' (lower order) impact based upon the Decision Context described in Section 6.1.1 of this EP. Given project waste streams are appropriately stored offshore and transported to a licenced mainland facility for treatment, recycling and/or disposal and the controls detailed above are consistent with both regulatory requirements and industry good practice, Woodside considers the impact has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls is required. No opportunistic controls have been identified that could further reduce potential environmental impacts and risks.

7.9.6 Demonstration of Acceptability

The proposed waste management controls are consistent with MARPOL and relevant Marine Orders. Woodside is satisfied that when the accepted controls are implemented the environmental performance outcome (EPO) of "No unplanned release of solid waste or objects to the marine environment" will be met, therefore Woodside considers the impact to be managed to an acceptable level. Consideration of actions prescribed in listed species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) have been assessed. The Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018) identifies ship-sourced marine debris as a risk to vertebrate marine life through entanglement or ingestion, as do other species-specific conservation advices for marine mammal, marine reptiles, and seabirds and migratory shorebirds. The proposed activity is not inconsistent with any of these plans given the proposed controls have been designed to prevent marine pollution.

Additionally, there is no anticipated impact to any Commonwealth or State marine parks, KEFs or to commercial or recreational fisheries.

No concerns or objections regarding waste management practices have been raised by relevant stakeholders.

8 Environmental Risk Assessment: Unplanned Events

This section of the EP presents the environmental risk assessment for unplanned events that may occur during the *Minerva P&A and Field Maintenance Program*.

8.1 Risk Assessment and Evaluation

The purpose of this section is to address the requirements of Regulations 13(5) and 13(6) by providing an assessment and evaluation of all the identified risks and impacts associated with the petroleum activity and associated control measures that will be applied to reduce the impacts and risks to ALARP and an acceptable level.

The environmental aspects and sources of risk identified during the ENVID process were divided into planned activities (i.e. routine operations) and unplanned events (i.e. incidents). This section presents the environmental impacts and risks associated with unplanned events. Table 8-1 summarises the impact and risk analysis for the aspects associated with the unplanned events. A comprehensive risk and impact assessment for each of the unplanned events, and subsequent control measures proposed by Woodside to reduce the risk and impacts to ALARP and acceptable levels, are detailed in the following subsections.

Table 8-1: Summary of the environmental impact and risk analysis for unplanned events

EP Section	Aspect	Value Potentially at Risk / Impact										Risk Assessment & Evaluation			
		Environmental							Socio-Economic						
Unplanned Events		Marine Sediment	Water Quality	Air Quality	Ecosystems / Habitat	Marine Species	Marine Protected Areas	Key Ecological Features	Commercial Fisheries	Shipping Activities	Tourism and Recreation	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
8.3	**Hydrocarbon release – Loss of well control**														
	Hydrocarbon release due to loss of well control		x		x	x	x	x	x	x	x	30	0.03	0.9	Tolerable
8.4	**Hydrocarbon release – Vessel collision**														
	Vessel collision resulting in surface release of MDO		x		x	x	x	x	x		x	30	0.03	0.9	Tolerable
8.5	**Unplanned discharges – Chemicals and Minor Hydrocarbon Spills**														
	Minor spills/ leaks of chemicals and hydrocarbons		x			x						10	0.1	1	Tolerable
8.6	**Unplanned discharges – Solids**														
	Dropped solid objects overboard from MODU or vessel	x	x			x						10	0.1	1	Tolerable
8.7	**Marine fauna interaction**														
	Vessel interactions / strike with marine fauna					x						10	0.03	0.3	Tolerable
8.8	**Introduction of invasive marine species**														
	Biofouling of vessel and submersible equipment, or through ballast water exchange				x	x						100	0.03	3	Tolerable

8.2 Worst-Case Spill Scenarios

8.2.1 Scenario Context

Several unplanned events may occur during the proposed activities, resulting in the potential for large-scale releases of hydrocarbons (i.e. incidents or emergencies). Worst-case credible spill scenarios were identified through the environmental impact and risk assessment process and a series of workshops. The following scenarios were identified:

- Subsea release of hydrocarbons from the Minerva-4 well from a loss of well control (LOWC) scenario
- Surface release of marine diesel oil (MDO) from a vessel collision at the Minerva-1 well location.

Table 8-2 presents the worst-case hydrocarbon spill scenarios identified.

Table 8-2: Summary of worst-case hydrocarbon spill scenarios

Scenario	Hydrocarbon Type	Worst-case Maximum Spill Volume	Comment	Oil Spill Modelling?	EP Section
Subsea release of condensate oil from a loss of containment from the Minerva-4 well.	Minerva condensate	52,634 bbl over 81 days	Maximum credible volume modelled with highest flow LOWC	Yes	8.3
Surface release of MDO from fuel tank rupture on AHTS vessel due to collision at the Minerva-1 well location.	Marine diesel oil	330 m^3 over 6 hours	Maximum credible volume based on largest fuel tank capacity on AHTS vessel.	Yes	8.4

An overview of the oil spill modelling undertaken for the worst-case maximum spill volumes presented in Table 8-2 is presented in Section 8.2.2.

Non-Credible Scenarios

Vessel grounding was discussed and considered but determined non-credible given the water depths and offshore location of the operational area, and therefore, not discussed further.

8.2.2 Oil Spill Modelling Overview

Spill modelling was carried out using SINTEF's Oil Spill Contingency and Response (OSCAR) System (Version 11.0.1). OSCAR is a system of integrated models that quantitatively assess the fate and transport of hydrocarbons in the marine environment, as well as evaluate the efficacy of response measures (Reed *et al*., 2001; Reed *et al*., 2004).

OSCAR provides an integrated hydrocarbon transport and weathering model that accounts for hydrocarbon advection, dispersion, surface spreading, entrainment, dissolution, biodegradation, emulsification, volatilisation and shoreline interaction.

Three-dimensional (3D) OSCAR modelling was undertaken in stochastic mode (total of 200 realisations per scenario) with start dates spaced approximately fortnightly over a five year period. Inputs into the model were sourced from HYCOM (regional ocean currents, temperature and salinity profiles), TPXO7.2 (tidal currents) and NCEP/NCAR (regional winds).

OSCAR enables simulation of a hydrocarbon release scenario in deterministic mode (i.e. a scenario is simulated with one start date with spatial results available at fixed time intervals over the duration of the simulation) or stochastic mode (i.e. a scenario is simulated a number of times with varying start dates, and the results are outputted spatially in a probabilistic manner).

Table 8-3 provides the details on the model input specifications for the modelled scenarios.

Table 8-3: Model input specifications

Parameter	MDO Release	Condensate Release
Scenario description	Vessel collision resulting in complete loss of MDO from single largest tank aboard project vessel	Minerva-4 Loss of well control with completed reservoir section open to flow via production casing
Oil type	MDO (see Table 8-5)	Condensate (see Table 8-4)
Release location	Surface release	Subsea release: An uncontrolled release from BOP, 11.28m above mudline
Water depth at location	Approx. 60 m	Mudline: 59.6m MSL Release depth: 48.32m MSL
Permit area	VIC/L 22	
Release coordinates	Minerva-1 well: -38° 42' 06.885" South 142° 57' 17.278" East	Minerva 4 well: -38° 43’ 07.37” South 142° 57’ 44.02” East
Release duration / rate	Instantaneous (6 hours)	Based on 81 day release
Total release volume	330 m^3	Based on 81 day release: Condensate: 52,634 bbl Water: 110,543 bbl Gas: 15,618 MMscf
Simulation length	Time to extend far enough past cessation of the spill such that oil concentrations drops below stated threshold concentrations	Time to kill well plus time to extend far enough past cessation of the spill such that oil concentrations drops below stated threshold concentrations
Release orifice	N/A	18.75"
Period analysed	Any time of year (summer & winter)	

Weathering Modelling

Modelling for both the MDO spill and the loss of well control scenarios, included a preliminary analysis of the hydrocarbon weathering using the SINTEF Oil Weathering Model. The model predicts the weathering (i.e. mass balance partitioning) of hydrocarbons under steady-state metocean conditions. Weathering simulations were run for constant wind speeds of 1 m/s (low winds), 5 m/s (moderate winds) and 10 m/s (high winds). The simulations were based on a test case of 100 m^3 of hydrocarbon release instantaneously onto the sea surface.

8.2.3 Hydrocarbon Properties

Table 8-4 and Table 8-5 provide a summary of characteristics of the hydrocarbons relevant to the worst-case spill scenarios identified. Selection of appropriate hydrocarbon analogues were selected from the SINTEF Oil Library that provides the best match to the specified hydrocarbons.

Properties of Minerva Condensate

Woodside provided GHD with the laboratory report for Minerva condensate, which was used for spill modelling purposes.

Table 8-4: Minerva Condensate Properties

Parameter	Minerva Condensate
API Gravity	49.9º
Wax Content (%)	<0.1
Pour Point (°C)	-36
Specific Gravity	0.7802 gm/cc
Viscosity @ 20ºC	1.204 cSt

Properties of Marine Diesel Oil

Marine diesel is a moderate weight, moderately persistent oil in the marine environment. The International Tanker Owners Pollution Federation (ITOPF) and the Australian Maritime Safety Authority (AMSA) (2015) categorise diesel as a moderate group III hydrocarbon. For the MDO spill modelling, *Marine Diesel (IKU)* was selected from the SINTEF oil library to represent MDO. A summary of the marine diesel oil properties is provided in Table 8-5.

Table 8-5: Marine diesel oil properties

Parameter	Marine Diesel Oil (data from SINTEF's *Marine Diesel IKU*)
API Gravity	0.843
Wax Content (%)	0.05
Pour Point (°C)	-36
Asphaltene (%)	0.05
Specific Gravity	36.4
Viscosity (cP)	3.9 @ 20°C

8.2.4 Hydrocarbon Exposure Values

As described in Section 4.1, the spatial extent of the EMBA has been derived using stochastic hydrocarbon fate and transport modelling of the worst-case hydrocarbons spills. To present this large amount of simulated data in a meaningful way and to inform the impact and risk assessment and environmental management actions, appropriate hydrocarbon exposure values were applied to each of the hydrocarbon components. NOPSEMA recommends the selection of hydrocarbon exposure values that broadly reflect the range of consequences that could occur at various concentrations (NOPSEMA, 2019).

The gas condensate spill EMBA shown in Figure 4-1 was defined using low exposure values (Table 8-6). These low exposure values may not be ecologically significant but they are adequate for identifying the full range of environmental receptors that might be contacted by hydrocarbons (NOPSEMA, 2019). In this EP, the EMBA defined by the low exposure values, was used to run the protected matters searches (Section 4.3).

To inform the impact and risk assessment, exposure values that may be representative of biological impact were identified. These are called 'moderate' and 'high' exposure values (Table 8-6). The moderate and high exposure values were modelled to identify receptors contacted and therefore potentially impacted in the event of the worst-case spill scenarios identified.

Table 8-6: Summary of exposure values applied in the hydrocarbon spill modelling

Exposure Type / Exposure Value		Description
Surface (floating) hydrocarbons	1 g/m^2	***Low:*** It is recognised that 1 g/m^2 represents the practical limit of observing hydrocarbon sheens in the marine environment. This exposure value is below the levels that would cause ecological impacts, but is considered relevant to approximate the area of effect to socio-economic receptors. This exposure value has been used to define the spatial extent of the environment that may be affected (EMBA) from surface hydrocarbons; and used to describe environmental sensitivities within the EMBA.
	10 g/m^2	***Moderate:*** This value is considered appropriate to assess ecological impact risk, as it is the estimate for the minimum thickness of oil that will result in harm to seabirds through ingestion from preening of contaminated feathers, or the loss of thermal protection of their feathers. This has been estimated by different researchers at 10-25 g/m^2 (Koops *et al*., 2004; French, 2009). Furthermore, based on literature reviews on aquatic birds and marine mammals (Engelhardt, 1983; Clark, 1984; Geraci and St. Aubin, 1988; and Jenssen, 1994), the exposure value for harmful impacts is 10 g/m^2. This exposure value is used to determine the risk of exposure that can cause adverse impact to turtles, sea snakes, marine mammals and seabirds (NRDAMCME, 1996). Therefore, the threshold of 10 g/m^2 was selected as a reasonable and conservative value to apply to the risk evaluation with respect to surface oil.
	50 g/m^2	***High:*** This high exposure value for surface oil is above the minimum threshold observed to cause ecological effect. At this concentration surface slicks would be clearly visible on the sea surface.
Shoreline (accumulated) hydrocarbons	10 g/m^2	***Low:*** This low exposure value defines the area for potential socio-economic impacts (e.g. reduction in aesthetic value of the area). This exposure value has been used to define the spatial extent of the environment that may be affected (EMBA) from shoreline hydrocarbons; and used to describe environmental sensitivities within the EMBA.
	100 g/m^2	***Moderate:*** The concentration for exposure to hydrocarbons stranded on shorelines is derived from levels likely to cause adverse impacts to intertidal habitats and associated fauna. Studies have reported oil thicknesses of 0.1 mm (100 g/m^2) as the lethal exposure values for benthic epifaunal invertebrates on intertidal habitats (rock, artificial, or man-made) and in intertidal sediments (mud, silt, sand and gravel) (French-McCay et al., 2003; French-McCay *et al*., 2004; French-McCay, 2009). It is also the impact threshold assumed for oiling of birds (French-McCay *et al*., 2004). This exposure value has been used to inform the risk evaluation with respect to accumulated hydrocarbons and the threshold for shoreline response, based on possible clean-up options.
	1,000 g/m^2	***High:*** This low exposure value predicts area likely to require intensive clean-up effort.
Total submerged hydrocarbons (entrained plus dissolved)	10 ppb	***Low:*** Total submerged hydrocarbons, also referred to as 'total water-accommodated fraction' or entrained hydrocarbons, encompass oil droplets in the water column. Much of the published scientific literature does not provide sufficient information to determine if toxicity is caused by the dissolved or the entrained hydrocarbon component, but rather the toxicity of total submerged hydrocarbons. Variation in the methodology of the water-accommodated fraction may account for much of the observed wide variation in reported threshold values, which also depend on the test organism, duration of exposure, oil type and the initial oil concentration. Total oil toxicity acute effects of total oil as LC50 for molluscs range from 500 to 2,000 ppb. A wider range of LC50 values have been reported for species of crustacea and fish from 100 to

Exposure Type / Exposure Value		Description
		258,000,000 ppb (Gulec *et al*., 1997; Gulec and Holdway, 2000; Clark *et al*., 2001) and 45 to 465,000,000 ppb (Gulec and Holdway, 2000; Barron *et al*., 2004) respectively. The 10 ppb exposure value represents the very lowest concentration and corresponds with the lowest trigger levels for total hydrocarbons in water recommended in the ANZECC water quality guidelines for Australia (ANZECC, 2000). This exposure value has been used to define the spatial extent of the environment that may be affected (EMBA) from total submerged hydrocarbons; and used to describe environmental sensitivities within the EMBA.
	100 ppb	***High:*** This exposure value is considered conservative in terms of potential sub-lethal impacts to most species and lethal impacts to sensitive species based on literature for toxicity testing as described above. This exposure value has been used to inform the risk evaluation with respect to total submerged hydrocarbons.
Dissolved hydrocarbons	10 ppb	***Low:*** A large number of studies have been published describing the toxicities of hydrocarbons. The common theme in findings it that the observed toxicity of condensate and refined hydrocarbons is primarily attributable to volatile and water-soluble aromatic hydrocarbons (monocyclic aromatic hydrocarbons (MAHs), naphthalenes and phenanthrenes) and polycyclic aromatic hydrocarbons (PAH) of higher molecular weight. Toxicity to aquatic organisms increases with time of exposure, such that organisms may be unaffected by brief exposures (acute) to the same concentration that is lethal at longer exposures (chronic). Data from French-McCay (2002 and 2003) showed that species sensitivity (fish and invertebrates) to dissolved aromatics exposure greater than 4 days (96-hour LC50) under different environmental conditions varied from 6 to 400 ppb with an average of 50 ppb. This exposure value has been used to define the spatial extent of the environment that may be affected (EMBA) from dissolved hydrocarbons; and used to describe environmental sensitivities within the EMBA.
	50 ppb	***Moderate:*** This exposure value approximates toxic effects, particularly sub-lethal effects to sensitive species (NOPSEMA, 2019). French-McCay (2002) indicates that an average 96-hour LC50 of around 50 ppb could serve as an acute lethal threshold. For most marine organisms, a concentration of between 50 and 400 ppb is considered to be more appropriate for risk evaluation.
	400 ppb	***High:*** This exposure value approximates toxic effects including lethal effects to sensitive species (NOPSEMA, 2019).

8.2.5 Potential Impacts of Hydrocarbons

To help inform the hydrocarbon spill impact and risk assessment, a summary of potential impacts to the environmental values, sensitivities and receptors within the EMBA from exposure to hydrocarbons is provided in Table 8-7; this information is drawn upon within the hydrocarbon risk assessment for each release scenario.

Table 8-7: A summary of potential impacts to environmental values, sensitivities and receptors within the EMBA from exposure to hydrocarbons

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
Marine fauna	
Plankton (including phyto/ zooplankton, larvae, fish eggs)	The effects of hydrocarbons on plankton have been well studied in controlled laboratory and field situations. The different life stages of a species often show widely different tolerances and reactions to oil pollution (Harrison, 1999). Usually the eggs, larval and juvenile stages will be more susceptible than the adults. Surface and entrained oil could impact fish eggs and larvae due to entrainment in surface slicks. However, fish eggs and larvae are highly dispersive and are carried significant distances by ocean currents. Any impacts to fish eggs and larvae are not anticipated to significantly impact on fish populations. Post-spill studies on plankton populations are few, but those that have been done have shown either no effects or temporary minor effects (Kunhold, 1978). The prime reason put forward to explain the lack of observed effects is that many marine species produce very large numbers of eggs and larval stages to overcome natural losses (such as through predation by other animals; adverse hydrographical and climatic conditions; or failure to find a suitable habitat and adequate food). Therefore, it is unlikely that any localised losses of eggs or larvae caused by a single oil spill event in the open ocean, would have no discernible effect on the size or health of future adult populations in the area. Recently spawned gametes and larvae may be especially vulnerable to oil spill effects since they are generally positively buoyant and would be exposed to surface slicks. The potential consequences of this vulnerability, in the unlikely event of a worst-possible release event occurring, would be mitigated by the very large numbers of eggs and larvae released (as discussed above).
Fish, sharks and rays (including commercial species)	Near the sea surface, fish are likely to able to detect and avoid contact with surface slicks and as a result, fish mortalities rarely occur in open waters from floating oils (Scholz *et al*., 1992; Kennish, 1997). Pelagic fish species are therefore generally not highly susceptible to impacts from hydrocarbon spills. Demersal fish species living and feeding on or near the seabed in deeper waters are not likely to be affected by surface and entrained oil in open waters. Likewise, most reef fish are expected to occur at water depths significant enough to be unaffected by surface oil; whereas reef fish in shallow waters (<10 m) and sheltered embayments are at greatest risk from surface oil (Law *et al*., 2011), particularly if they are territorial and unlikely to leave their habitat. Potential impacts to pelagic fish species include smothering and coating of gills and epidermal areas by suspended oil droplets that could potentially lead to reduction in oxygen exchange efficiency, irritation and infection. Fish may also ingest entrained oil or contaminated food leading to physiological impacts. The toxicity of dispersed hydrocarbons to fish species has been the subject of a large number of laboratory studies. In general, fish mortalities and/or ecosystem level impacts are rarely observed following oil spills, as for example, evidenced by the lack of any shifts in species composition or abundance of coastal fishes following the Deepwater Horizon spill in the Gulf of Mexico (Fodrie and Heck, 2011). There are various possible explanations for a buffering of effects of surface oil exposure including fish mobility, avoidance behaviour and/or foraging ecology (Peterson *et al*., 1996, Edgar *et al*., 2003). Exposure to dissolved hydrocarbons from oil may delay embryo development in some fish potentially prolonging their susceptibility to mechanical damage as well as increased levels of mortality (Carls and Thedinga, 2010). While fish, sharks and rays do not generally break the sea surface, individuals may feed near the surface for short periods. The probability of prolonged exposure to a surface slick by fish, shark and ray species is low.
Marine mammals	Marine mammals (whales, and dolphins) come to the sea surface to breathe air. They are therefore theoretically vulnerable to exposure to oil spill impacts caused by contact with hydrocarbons at the sea surface. Whales and dolphins are smooth-skinned, hairless mammals so oil tends not to stick to their skin and since they do not rely on fur for insulation, they will not be as sensitive to the physical effects of oiling. Small doses of oil have been shown to cause acute fatal pneumonia in mammals when aspirated. Studies on effects of petroleum vapours on terrestrial mammals and seals showed (in cases of prolonged exposures and high concentrations) absorption of hydrocarbons in organs and other tissues, and

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	damage to the brain and central nervous system. However, short-term inhalation of petroleum vapours at concentrations similar to those found in oceanic oil spills may not be necessarily detrimental either in terms of structural tissue damage or respiratory gas exchange. Ingested oil, particularly the lighter fractions, can be toxic to marine mammals. Ingested oil can remain within the gastro-intestinal tract and be absorbed into the bloodstream and thus irritate and/or destroy epithelial cells in the stomach and intestine. Dispersed oil is unlikely to cause any effect to marine mammals due to the low toxicity of dispersed oils, low period of exposure that could occur and the low dosage of oil that may be received. The way whales and dolphins consume their food may well affect the likelihood of their ingesting oil. Baleen whales (such as humpback whales), which skim the surface, are more likely to ingest oil than toothed whales, which are 'gulp feeders' (Etkin, 1997). Spilled oil may also foul the baleen fibres of baleen whales, thereby impairing food-gathering efficiency or resulting in the ingestion of oil or oil-contaminated prey. Baleen whales may therefore be vulnerable to oil if feeding. Weathered oil residues from an oil spill event may persist for long periods, causing a potential risk to baleen whales' feeding systems. It should be noted that adult humpback whales, which are seasonally present and relatively abundant in the region, are not thought to be feeding during their migration through the region. The most vulnerable whale species in the Otway region is the pygmy blue whale which is most abundant in months coinciding with the Bonney Coast Upwelling. Pygmy blue whales predominately occupy the western area of the Bonney Upwelling from November to December, and then expand south-east during January to April, though the within-season distribution trends in Bass Strait are unknown (Gill 2002; Gill et al. 2011). Blue whales are listed vulnerable, migratory and cetacean under the EPBC Act The moderate exposure value extends over known areas of blue whale and southern right whale aggregation areas, although predominantly within shallow coastal waters around Twelve Apostles Marine Park. Data capture during the Deepwater Horizon (DWH) response efforts showed that bottlenose dolphins, a species also common throughout the EMBA, were subject to adrenal gland disease and dysfunction as a result of the DWH spill (Deepwater Horizon Natural Resource Damage Assessment Trustee, 2016).
Marine reptiles	*Turtles:* Marine turtles are vulnerable to the effects of hydrocarbon spills at all life stages (eggs, post hatchlings, juveniles and adults) whilst in the water or onshore (NOAA, 2010); however, there is little documented evidence of the effect of hydrocarbons on turtles. Should turtles make contact with a spill, the impact is likely to include oiling of the body as well as irritations caused by contact with eyes, nasal and other body cavities and possibly ingestion or inhalation of toxic vapours (Jones, 1986). Post-mortem investigations on dead loggerhead turtles from the Mediterranean implicated oil as a cause of death in a number of cases (Gramentz, 1988). In these cases, tarballs were found in the mouth and gastro-intestinal tract of the turtles, suggesting ingestion of tarballs as a possible cause of death. Direct contact of marine turtles with hydrocarbons and exposure from hydrocarbons may lead to the following problems: • Digestion/absorption of hydrocarbons through food contamination or direct physical contact, leading to damage to the digestive tract and other organs • Irritation of mucous membranes (such as those in the nose, throat and eyes) leading to inflammation and infection • Contamination of eggs leading to inhibition of development or developmental defects in hatchlings, either due to oil on the nesting beach or through transference from the adult turtles whilst laying the eggs • Hatchlings becoming oiled after emerging from the nests and making their way across the beach to the water. The waters of the EMBA do not represent critical habitat for the species, however, the foraging behaviour for the Leatherback Turtle was identified as known to occur within the EMBAs. There are no turtle nesting beaches potentially impacted by moderate exposure values within the EMBA.

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
Seabirds and shorebirds	Birds exposed to hydrocarbons may suffer a range of internal and external health effects. Direct contact with hydrocarbons and exposure from hydrocarbons has the potential to cause the following: • Oiled feathers affecting the ability of the birds to fly and those birds on the sea surface may suffer from loss of buoyancy and drown or die from hypothermia; • Skin irritation or ulceration of eyes, mouth or nasal cavities; • Internal effects from poisoning or intoxication through ingestion, preening and ingestion of oil via their prey items; • Reduced reproduction ability; • Reduction in the number of eggs laid; • Decreased shell thickness; and • Disruption of the normal breeding and incubating behaviours. The surface oil component poses the greatest risk of impact to seabirds due to the amount of time they spend on or near the sea surface. Individuals are at risk of lethal or sub-lethal physical and toxic effects due to external exposure (oiling of feathers) and ingestion, especially those close to the source point where concentrations are at their highest. Even small quantities of feathers contaminated by oil can be lethal, causing hypothermia and reduced buoyancy (O'Hara and Morandin, 2010). Seabirds are less likely to be affected by entrained and dissolved hydrocarbons, except through the ingestion of contaminated prey. Surface oiling from a LOWC event in the Minerva Field is unlikely to pose a significant risk to seabirds and shorebirds given Minerva condensate is a non-persistent oil with a high tendency to evaporate. Under low wind speeds of 1 m/s, approximately 90% of the surface slick is predicted to have evaporated after 5 days (120 hours), with ~10% remaining on the sea surface and minimal dispersion into the water column. Under moderate wind speeds of 5 m/s, the entire surface slick is predicted to evaporate (89%) or disperse (21%) after 24 hours. High wind speeds of 10 m/s are predicted to disperse ~30% of the oil and evaporate the remaining ~70% after only 6 hours. Minerva condensate has a low tendency to form emulsions. Surface oiling from an MDO release is likely to pose a greater risk to seabirds and shorebirds than a condensate release, as MDO is moderately persistent oil in the marine environment. Under low winds (1 m/s), 60% of the surface slick is predicted to remain after 120 hours (5 days). Under moderate winds (5 m/s), 40% of the initial surface slick is predicted to remain after 24 hours, decreasing further to ~10% after 48 hours and ~1% after 72 hours. With high winds (10 m/s), the surface slick is predicted to be almost entirely evaporated (~25%) and dispersed (~75%) after 12 hours. Marine Diesel has a very low tendency for emulsion formation The waters of the SEMR of Victoria support large populations of seabirds. A search of the EPBC Act Protected Matters database identified a total of 70 EPBC Act listed bird species, with potential to occur or have habitat within the EMBA. Of these, a total of 34 were listed as threatened and 52 were listed as migratory bird species, some with breeding and foraging BIAs. The seabirds that most commonly occur within the moderate exposure value area in the EMBA include albatross, petrels, terns and shearwaters. Seabirds spend most of their time at sea, travelling over large distances to forage over the open ocean, returning to land during breeding only and therefore some seabirds may transit the offshore waters within the moderate exposure value area in the EMBA and come into contact with surface oil. While individual seabirds may be affected, it is not predicted that large numbers of seabirds will be impacted from surface oil as they are unlikely to be present in significant numbers due their vast distribution area. In contrast, shoreline accumulated oil poses the greatest risk of impact to shorebirds whereby they come into contact with hydrocarbons washed up onto shore where the shorebirds spend time feeding, roosting and breeding. Seabirds are also at risk when they return to land to breed. Both adults and chicks/fledglings may be impacted through contact, ingestion and/or oiling of feathers. Oiled adults may also transfer oil on to their eggs or chicks. There

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	is the potential of bioaccumulation of toxins ingested by adults affecting embryos and the development of chicks, although this is considered to be low due to the low toxicity of the weathered oil. Indirect impacts may effects shorebirds and wading birds through contamination of foraging areas that may result in a reduction in available prey items (Clarke, 2010). Shoreline accumulated oil at the moderate exposure value has the potential to impact Warrnambool Plain, the Otway Plain and the Otway Ranges regions. These coastal habitats (particularly intertidal mud flats and sandy beaches) that are important staging sites for migratory shorebirds and important breeding sites. Intertidal mud flats and sandy beaches are also important habitat for shorebirds and migratory wading birds that spend time roosting and feeding on invertebrate infauna such as polychaetes, crustaceans and gastropods.
Shoreline Habitats	
Intertidal sandy beaches/ mud flats	Sandy beaches are present along the Victorian coastline and intercept the EMBAs. The following areas have known stretches of sandy beach: • Portland to Port Fairy • Port Fairy to Lady Bay (Warrnambool) coastline • Small sections of sandy beach between Warrnambool and Cape Otway • Marengo east to Anglesea Shoreline loading has the potential to cause temporary declines in infauna and epifauna populations and may have an indirect effect on feeding shorebirds, seabirds and migratory wading birds.
Intertidal rocky shores/ reefs	Epibiota that colonise intertidal rocky shores/ reef are vulnerable to oil spills. Filter feeders such as molluscs are particularly vulnerable to lethal and various sub-lethal effects from hydrocarbons in the water column. The latter include alteration in respiration rates, decreases in filter feeding activity, reduced growth rates, biochemical effects, increased predation, reproductive failure and mechanical destruction by waves due to inability to maintain hold on substrate (Connell and Miller, 1981; Ballou *et al*., 1989). The risk of significant impact to rocky shore and limestone platform biota from condensate oil from the Minerva reservoir is low due to Minerva condensate being a non-persistent oil with a high tendency to evaporate and has a low tendency to form emulsions. In contrast, the recovery time from MDO may be longer.
Coral reefs	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. Experimental studies and field observations have found all species of corals to be sensitive to the effects of oil, although there are considerable differences in the degree of tolerance between species (Jackson *et al*., 1989). The effect of oil on corals range from short or long-term sub-lethal effects to irreversible tissue necrosis and death. The timing of an oil spill event in relation to other environmental stresses, such as ambient temperature, or reproductive stage could also have significance in that corals are likely to be more sensitive to oil spill events at times of physiological stress. The water-accommodated fractions of oil can produce lethal and sub-lethal effects in corals (Loya and Rinkevich, 1980); however documented effects such as increased mucous production, decreased growth rates, changes in feeding behaviours and expulsion of zooxanthellae (Peters *et al*., 1981; Knap *et al*., 1985) generally only occur at concentrations of water-accommodated hydrocarbons that are considerably higher than would occur in field situations.
Mangroves	Mangroves are considered to be an important component of tropical ecosystems as they provide protection for coastlines and a source of organic matter and nutrients for marine ecosystems. 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 within the spill EMBA.

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	The sensitivity of mangroves to oil spills has been well recorded, with extensive defoliation, and sometimes mortality, being noted following a number of oil spills. These spills have varied in size, oil type, degree of oiling and mangrove species. In general, studies have suggested that damage occurs through the smothering of lenticels (mangrove breathing pores vital for respiration) on pneumatophores or prop roots or by the loss of leaves due to chemical burning (Duke *et al*., 1999). Smothering and contamination can lead to mortality of plants, seedlings and propagules. A comprehensive review of the literature on the impacts of oil spills on mangroves was conducted by Thorhaug (1987), from which it was concluded that while defoliation of mangroves was a common occurrence, massive mortality was not always the ultimate outcome. Mangrove death is predicted whenever when more than 50% of the leaves are lost (Evans, 1985). There may also be some sub-lethal impact to mangroves due to toxicity and it is known that mangroves take up hydrocarbons from oil that contacts leaves, roots or sediments, and it is suspected that this uptake causes defoliation through leaf damage and tree death (Wardrop *et al*., 1987).
Seagrass beds	Laboratory tests have illustrated the sensitivity of seagrasses to both surface oil and dissolved or physically dispersed hydrocarbons (Hatcher & Larkum, 1982; Baca and Getter, 1984; Wilson & Ralph, 2017). Stress response has also been demonstrated for seagrass at low hydrocarbon concentrations similar to that expected to occur in oil spill situations (Thorhaug, 1987; Thorhaug *et al*., 1991). Potential direct impacts to seagrasses from hydrocarbons include mortality due to smothering and chemical toxicity. Indirect impacts may occur due to reduced light attenuation, which would restrict the seagrasses ability to photosynthesise, leading to reduced growth rates and reduced flowering capability. Entrained oil may also adhere to seagrass in shallower areas, inhibiting respiration. The susceptibility of seagrass to hydrocarbons will depend largely on their distribution, with communities in deeper water less likely to be affected, whereas seagrass beds in shallower waters are more likely to be affected by dispersed oil droplets or, in the case of emergent seagrasses, direct oiling. Intertidal seagrass communities would theoretically be the most susceptible because the leaves and rhizomes may both be affected. 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. Known seagrass meadows within the spill EMBA include Corner Inlet, Port Phillip Bay and Western Port Bay.
Socio-economic	
Fisheries	The EMBA overlaps a number of Commonwealth and State Managed Fisheries (refer to Section 4.4.1). The potential area of moderate exposure is not widespread and the level of fishing within the actual area of moderate exposure is anticipated to be low. Exclusions zones surrounding a spill can directly impact fisheries by restricting access to fishing vessels. Commonwealth and fisheries are unlikely to be affected from an oil spill due to the water depth at which many of them operate. State pelagic fisheries may be affected by a loss of fishing effort associated with avoidance of the oil spill, or gear clean-up and associated costs. The market value/demand for fish may also be impacted due to actual or perceived tainting of catches and closure of fishing grounds could also impact operations. The significance of any decrease in market value/demand for fish may be substantial to those few individual fishery operators working in the affected areas but it is unlikely to cause any significant long-term impact to the identified managed fisheries that operate in the region.
Tourism and recreation	There is a wide variety of nature-based tourism and recreational activities including recreational fishing that occurs in the EMBA for the worst-case spill scenarios. In the event of an oil spill, there is the potential for temporary closure of all recreational activities, including diving, due to the risk to public health and safety. Similar impacts arising from the shoreline stranding of hydrocarbons will add a visual impact and potentially restricted access to shorelines.
Defence	Five training and practice areas are located in and around Port Phillip Bay and Western Port Bay. This is to the east of the Minerva field and within the EMBA, however, they are unlikely to be impacted by a hydrocarbon spill.
Shipping	The impact on shipping in the event of a worst-case discharge is likely to be limited to the potential for minor modification of shipping routes through the implementation of exclusion zones to avoid the spill. Shipping operations may be affected by spill response efforts by way of a 'Notice to Mariners' being issued to avoid the area, leading to the potential diversion from normal shipping routes.

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
Oil and gas activities	In the event of a large scale spill, petroleum production operations in the region would likely remain unaffected.
Indigenous	Any oil that reaches the coastline from a large scale spill has potential to impact on registered sites and indigenous heritage places along the coastline. In the unlikely event of an oil spill, shoreline accumulated oil may effect sensitive artefacts or areas, which could damage their heritage value. Furthermore, personnel accessing the area to implement response strategies have potential to damage or destroy heritage values of the area. These sensitivities will be prioritised and taken into account as part of the daily Operational SIMA within the *Minerva Field Decommissioning Oil Pollution Emergency Plan (OPEP) (00MC-BHP-N00-0002)*.
Maritime heritage	There are a number of shipwrecks in the EMBA. Surface hydrocarbons will have no impact on shipwrecks. Hydrocarbons in the water column pose the greatest risk of impacts shipwrecks. Microbial communities (biofilms) on structures and in the surrounding seafloor play important roles in shipwreck preservation and degradation, and in recruitment of macro-organisms to artificial reefs (Hamdan *et al*., 2018). Hydrocarbons in the water column may potentially impact those microbial and encrusting communities that may in turn affect the structural integrity of the shipwreck. This is highly unlikely given the non-persistent nature of Minerva condensate.
Protected areas	
World Heritage and National Heritage	There are no World Heritage or National Heritage places likely to be impacted by either a Minerva condensate or MDO release from the Minerva Field.
Commonwealth and State Marine Parks	For a LOWC event in Autumn-Winter, the Twelve Apostles state marine park was predicted to be contacted by total submerged oil with 100% probability, a maximum time-averaged concentration of 282 ppb and a minimum arrival time of 0.5 days. The Apollo Australian Marine Park (AMP) was predicted to be contacted with 1% probability, a maximum time-averaged concentration of 140 ppb and minimum arrival time of 3.8 days. For a LOWC event in Spring-Summer, the Twelve Apostles state marine park was predicted to be contacted with 100% probability, a maximum time-averaged concentration of 348 ppb and a minimum arrival time of 0.6 days. For an MDO release in Autumn-Winter surface oiling at moderate thresholds low contact probabilities were predicted at The Arches state marine park (<1%) and the Twelve Apostles state marine park (5%), with maximum time-averaged concentrations of 13 and 26 g/m2, respectively, and minimum arrival times of 1.3 and 0.3 days, respectively For an MDO release in Autumn-Winter total submerged oil at high thresholds a moderate contact probability was predicted at the Twelve Apostles state marine park (49%), with a maximum time-averaged concentration of 1,584 ppb and a minimum arrival time of 0.2 days. A very low contact probability of 2% was also predicted at The Arches state marine park, with a maximum time averaged concentration of 283 ppb and a minimum arrival time of 0.4 days. The Apollo AMP was predicted to be contacted with low probability (3%), a maximum time-averaged concentration of 169 ppb and a minimum arrival time of 1.4 days. For an MDO release in Autumn-Winter dissolved hydrocarbons at a moderate thresholds , a moderate contact probability was predicted at the Twelve Apostles state marine park (39%), with a maximum time-averaged concentration of 648 ppb and a minimum arrival time of 0.3 days. A very low contact probability of <1% was also predicted at The Arches state marine park, with a maximum time averaged concentration of 52 ppb and a minimum arrival time of 1.3 days Similar contact exposures were predicted for Spring-Sumer months. The environmental values and sensitivities of these Marine Parks are described in Sections 4.2 and 4.3. The potential impacts to these are described in the relevant sections of this Table.

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
Key ecological features	The Bonney Coast Upwelling has the potential to be contacted by total submerged hydrocarbon at low threshold values, with no contact predicted at high threshold values for either an MDO or condensate release. Whilst this presents no risk to the KEF, the nutrient rich waters of Bonney Coast Upwelling promote primary productivity. The pelagic marine faunal assemblages that are attracted to the nutrient rich waters, such as whales, large pelagic fish and seabirds are at risk of impacts from entrained hydrocarbons.

8.3 Hydrocarbon Release – Loss of Well Control

8.3.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Loss of well control during P&A due to failure of well barrier integrity.	Loss of hydrocarbons (condensate) to the marine environment.	Reduction in water quality with potential for toxicity effects to marine fauna and flora (including potential mortality), oiling of offshore, nearshore and shoreline habitats (smothering). Disruption to biologically important behaviours (feeding / breeding / migration). Hypothermia due to hydrocarbon exposure. Impacts to socio-economic receptors.	30	Highly Unlikely (0.03)	0.9	Type B Higher Order Risk	Tolerable

8.3.2 Source of Risk

A loss of well control can lead to an uncontrolled release of reservoir hydrocarbons and other wellbore fluids to the environment. Woodside has identified a subsea release of condensate resulting from a loss of well control (failure of well barrier integrity) from the Minerva-4 well as the scenario with the worst-case credible environmental outcome.

Woodside have calculated the worst-case discharge (WCD) for a LOWC event consistent with the methodology applied within the *SPE Technical Report; Calculation of Worst-Case Discharge (WCD), Rev 1 2016* (Society of Petroleum Engineers, 2015).

During the abandonment workover operation, as a contingency to perforating the tubing and pumping cement with the tubing in place, it is planned to cut and remove the tubing string above the production packer and place cement barriers above. It is during this time – after removing the tubing and before placing the cement barriers - that the worst case scenario exists for loss of well control and is therefore the well description that is assessed for this work. Although the tailpipe and production packer will remain in place SPE-174705-TR and APPEA guidelines do not allow any credit for restrictions to flow in the wellbore during the modelled well release. Figure 1 below shows a simplified drawing of the well construction as applied in the spill modelling scenario.

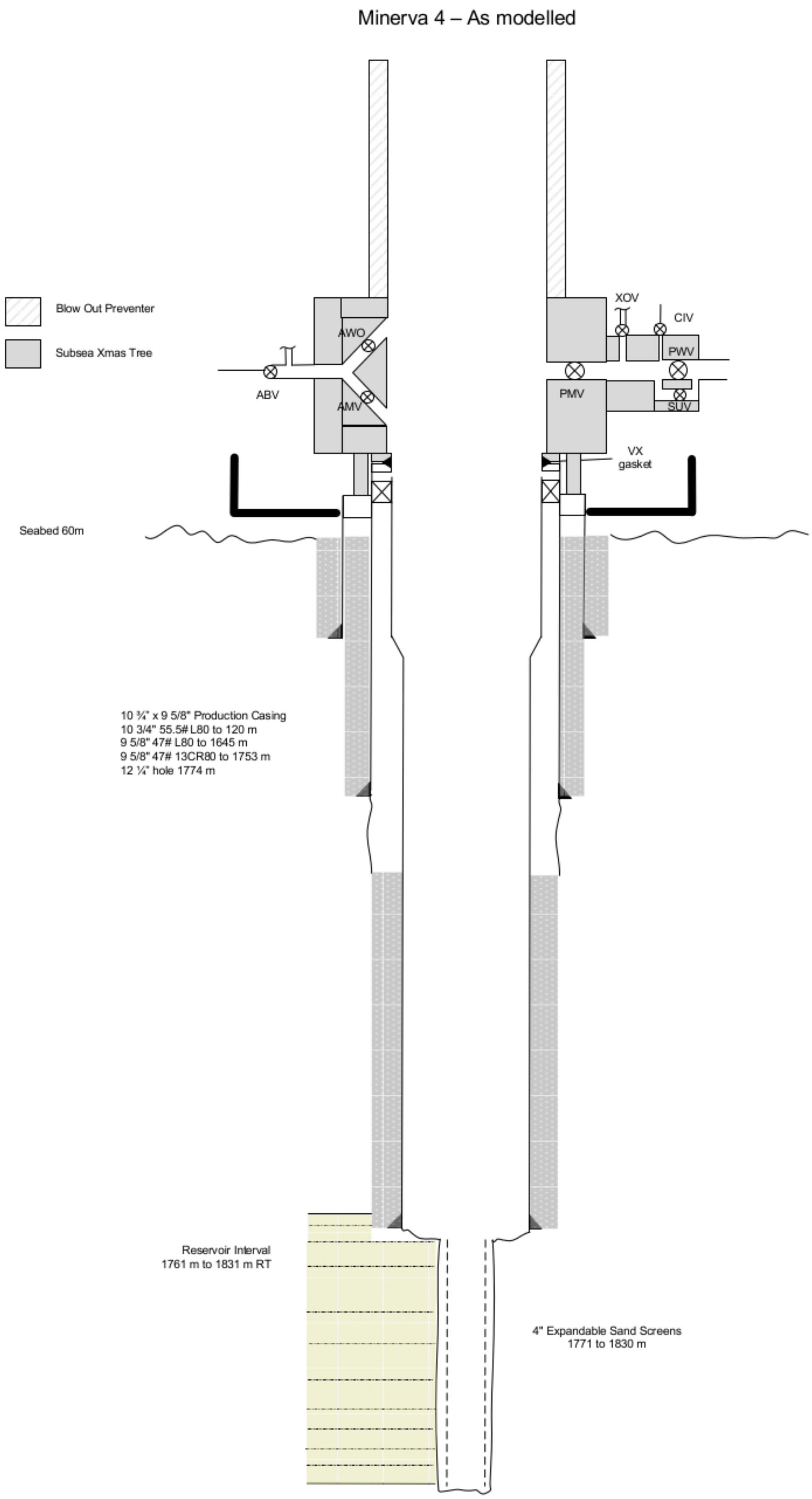


Figure 1: Minerva 4 - As modelled

Industry Statistics

A review of international data provided in the Bureau of Safety and Environmental Enforcement (BSEE) *Loss of Well Control Occurrence and Size Estimators Report* (BSEE, 2017) and the International Oil and Gas Producers *Blowout Frequencies – Risk Assessment Data Directory Report* (IOGP, 2019) was undertaken to provide an understanding of historical event frequency of well release incidents on production wells. The frequencies are mainly based on data from the areas of the US Gulf of Mexico (GoM) outer continental shelf and North Sea. The data is based on events reported in the SINTEF Offshore Blowout Database.

The data reported for releases from abandoned wells are the most analogous statistics to apply to P&A activities in the Minerva Field. The data demonstrates the very low likelihood of a release during abandonment activities for normal wells:

- Probability, reported as frequency per year, of a well blowout / well release from an abandoned well is 2.3 x 10^{-5}.

Oil Spill Modelling Results

Hydrocarbon Weathering Behaviour

Marulk was selected from SINTEF’s oil library to represent Minerva-4 Condensate for the subsea LOWC scenario. The results of the weathering analyses are presented in Figure 8-1.

Marulk is a light, non-persistent oil with a high tendency to evaporate. Under low wind speeds of 1 m/s, approximately 90% of the surface slick is predicted to have evaporated after 5 days (120 hours), with ~10% remaining on the sea surface and minimal dispersion into the water column. Under moderate wind speeds of 5 m/s, the entire surface slick is predicted to evaporate (89%) or disperse (21%) after 24 hours. High wind speeds of 10 m/s are predicted to disperse ~30% of the oil and evaporate the remaining ~70% after only 6 hours.

Marulk has a low tendency to form emulsions, attaining a maximum water content of 10% under all wind conditions simulated.

Viscosities increase with weathering, as the lighter oil components evaporate out of the oil and the proportion of heavier oil components increases. However, for this light condensate oil, viscosities are predicted to remain relatively low, reaching a maximum of <8 cP after 5 days of weathering.

Similarly, the pour point increases during weathering, with peak pour points of <12°C for the various wind scenarios assessed. This peak pour point is below typical sea surface temperatures in the region, meaning the weathered surface slick is likely to remain in liquid form (i.e. no gelling or solidification is predicted).

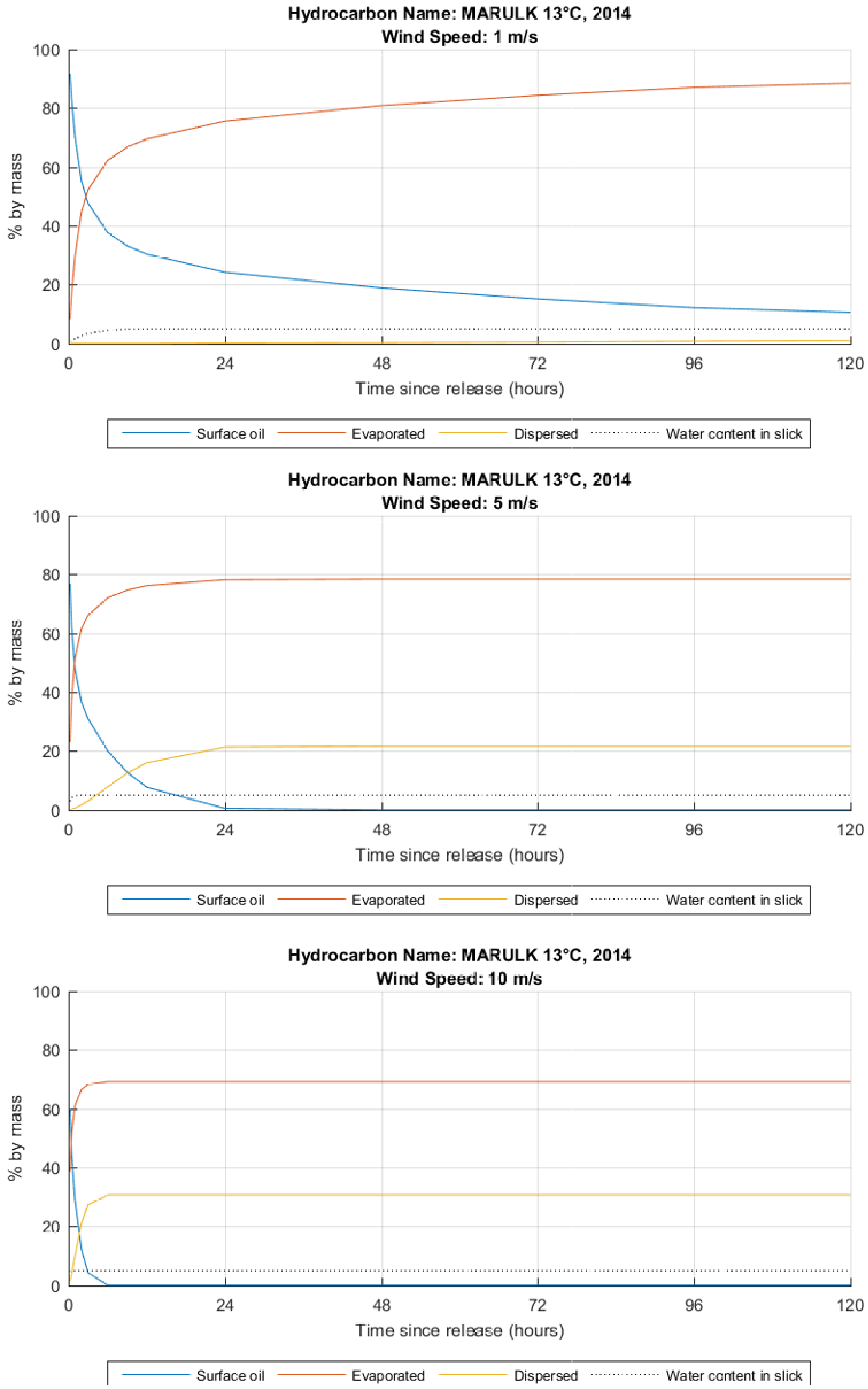


Figure 8-1: Simulated weathering of the SINTEF MARULK 13C 2014 hydrocarbon for constant wind speeds of 1 m/s (top), 5 m/s (middle) and 10 m/s (bottom) (GHD, 2022)

Stochastic Spill Modelling Results

The stochastic modelling outputs are presented below for the fate and transport of hydrocarbons (surface, total submerged, dissolved and shoreline accumulated) at the exposure values defined in previous Table 4-1. The spatial extents of each threshold are described, with more detailed analysis focussing on the moderate (for shoreline oiling, surface hydrocarbons and dissolved hydrocarbons) and high (for total submerged oil) thresholds, which represent the lower limits for biological impacts.

Low threshold values were used to inform the detailed Description of Environment in Appendix C of this EP.

Sea Surface Hydrocarbons

No surface oiling exceeding the low, moderate or high thresholds was predicted to occur in any model cells during any of the stochastic realisations for either Summer or Winter seasons.

Dissolved Hydrocarbons

Low exposure (>10 ppb)

For Autumn-Winter, dissolved hydrocarbons at the low threshold (10 ppb) were predicted to occur at distances of up to ~75 km west and ~150 km east of the spill site. The maximum spatial extents at the moderate (50 ppb) and high (400 ppb) thresholds were reduced to ~110 km and ~50 km, respectively.

For Spring-Summer, Dissolved hydrocarbons at the low threshold (10 ppb) were predicted to occur at distances of up to ~100 km west and ~125 km east of the spill site. The maximum spatial extents at the moderate (50 ppb) and high (400 ppb) thresholds were reduced to ~80 km and ~25 km, respectively.

Moderate exposure (50ppb)

For Autumn-Winter, A summary of contact predictions for dissolved hydrocarbons at the moderate threshold (50 ppb) include:

- For IBRA regions (including neighbouring state waters), high contact probabilities of ~80-100% were predicted at the Otway Plain, Warrnambool Plain and Otway Ranges, with maximum local time-averaged concentrations of 596 ppb and minimum arrival times of 0.3 days.
- For marine reserves, the Twelve Apostles state marine park was predicted to be contacted with 100% probability, a maximum time-averaged concentration of 185 ppb and a minimum arrival time of 0.3 days. The Apollo AMP was predicted to be contacted with 1% probability, a maximum time-averaged concentration of 86 ppb and a minimum arrival time of 3.8 days.
- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 596 ppb and minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model time step). The Central Victoria IMCRA region was predicted to be contacted with 1% probability, a maximum time-averaged concentration of 75 ppb and minimum arrival time of 4.0 days.

For Spring-Summer, Summarised contact predictions for dissolved hydrocarbons at the moderate threshold (50 ppb) include:

- For IBRA regions (including neighbouring state waters), high contact probabilities of ~62-100% were predicted at the Warrnambool Plain and Otway Ranges, with maximum local time-averaged concentrations of 242 ppb and minimum arrival times of 0.3 days. A lower contact probability of 18% was predicted at the Otway Plain, with a maximum time-averaged concentration of 112 ppb and minimum arrival time of 3.8 days.
- For marine reserves, the Twelve Apostles state marine park was predicted to be contacted with 100% probability, a maximum time-averaged concentration of 242 ppb and a minimum arrival time of 0.6 days.
- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 319 ppb and minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model time step).

There were no predicted exceedances of the high (400 ppb) threshold anywhere within the model domain.

Total Submerged Hydrocarbons (entrained plus dissolved)

Low exposure (>10 ppb)

For Autumn-Winter, total submerged oil at the low threshold (10 ppb) was predicted to occur up to ~125 km to the west and ~625 km east of the spill site. Exposure at the high threshold (100 ppb) was limited to within ~75 km west and ~110 km east of the spill site.

For Spring-Summer, Total submerged oil at the low threshold (10 ppb) was predicted to occur up to ~250 km to the west and ~375 km east of the spill site. Exposure at the high threshold (100 ppb) was limited to within ~75 km from the spill site.

High exposure (>100 ppb)

For Autumn-Winter, a summary of contact predictions for dissolved hydrocarbons at the moderate threshold (50 ppb) include:

- For IBRA regions (including neighbouring state waters), high contact probabilities of ~80-100% were predicted at the Otway Plain, Warrnambool Plain and Otway Ranges, with maximum local time-averaged concentrations of 596 ppb and minimum arrival times of 0.3 days.
- For marine reserves, the Twelve Apostles state marine park was predicted to be contacted with 100% probability, a maximum time-averaged concentration of 185 ppb and a minimum arrival time of 0.3 days. The Apollo AMP was predicted to be contacted with 1% probability, a maximum time-averaged concentration of 86 ppb and a minimum arrival time of 3.8 days.
- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 596 ppb and minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model time step). The Central Victoria IMCRA region was predicted to be contacted with 1% probability, a maximum time-averaged concentration of 75 ppb and minimum arrival time of 4.0 days.

For Spring-Summer, summarised contact predictions for dissolved hydrocarbons at the moderate threshold (50 ppb) include:

- For IBRA regions (including neighbouring state waters), a moderate-high contact probability of 66% was predicted at the Warrnambool Plain, with a maximum time-averaged concentration of 3,785 ppb and minimum arrival time of 0.1 days (2 hours). Lower contact probabilities were predicted at the Otway Plain (5%) and Otway Ranges (7%), with maximum local time-averaged concentrations of 151 ppb and minimum arrival times of 0.8 days.
- For marine reserves, a moderate contact probability was predicted at the Twelve Apostles state marine park (39%), with a maximum time-averaged concentration of 648 ppb and a minimum arrival time of 0.3 days. A very low contact probability of <1% was also predicted at The Arches state marine park, with a maximum time averaged concentration of 52 ppb and a minimum arrival time of 1.3 days.
- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 4,349 ppb and minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model timestep).

Shoreline Accumulated Hydrocarbons

Low exposure (>10 g/m^2)

For Autumn-Winter, Shoreline loading above the low threshold (>10 g/m2) was predicted to occur between the Victorian Volcanic Plain (~150 km west) and Flinders (575 km east). At the moderate threshold (100 g/m2), predicted shoreline accumulation was limited to within a 100 km distance from the well site, spanning the Warrnambool Plain, Otway Plain and Otway Ranges.

For Spring-Summer, shoreline loading above the low threshold (>10 g/m2) was predicted to occur between the Victorian Volcanic Plain (~200 km west) and Wilsons Promontory (475 km east). At the moderate threshold (100 g/m2), predicted shoreline accumulation was limited to within a ~75 km distance from the well site, spanning the Warrnambool Plain, Otway Plain and Otway Ranges.

Moderate exposure (>100 g/m^2)

For Autumn-Winter, at the moderate threshold (100 g/m^2), a very high contact probability of 95% was predicted across all shorelines, with individual contact probabilities of 88% at the Warrnambool Plain, 39% at the Otway Plain and 24% at the Otway Ranges. Across all shorelines, the predicted maximum accumulated shoreline load was 12.3 tonnes, with a minimum arrival time of 0.5 days and a maximum oiled shoreline length of 31 km. Maximum accumulated shoreline loads at individual receptors were 9.6 tonnes at the Warrnambool Plain, 3.0 tonnes at the Otway Plain and 1.4 tonnes at the Otway Ranges, with minimum arrival times of 0.5, 3.1 and 4.1 days, respectively, and maximum oiled shoreline lengths of 25, 8 and 5 km, respectively.

For Spring-Summer, at the moderate threshold (100 g/m^2), a contact probability of 100% was predicted across all shorelines, with individual contact probabilities of 100% at the Warrnambool Plain, 13% at the Otway Plain and 11% at the Otway Ranges. Across all shorelines, the predicted maximum accumulated shoreline load was 9.6 tonnes, with a minimum arrival time of 0.6 days and a maximum oiled shoreline length of 28 km. Maximum accumulated shoreline loads at individual receptors were 8.4 tonnes at the Warrnambool Plain, 2.2 tonnes at the Otway Plain and 1.2 tonnes at the Otway Ranges, with minimum arrival times of 0.6, 1.8 and 2.8 days, respectively, and maximum oiled shoreline lengths of 23, 5 and 3 km, respectively.

High exposure (>1,000 g/m^2)

No shoreline accumulation at the high threshold (1,000 g/m^2) was predicted for either Summer or Winter seasons.

Deterministic Modelling Results

Whilst the combined 200 stochastic LOWC realisations present the overall geographic area of potential hydrocarbon contact, realisation number 75 of the LOWC scenario resulted in the highest accumulated shoreline mass (above 100 g/m^2) of 12.3 tonnes, including 8.2 tonnes at the Warrnambool Plain, 3.0 tonnes at the Otway Plain and 1.1 tonnes at the Otway Ranges.

The deterministic simulation of this realisation did not generate a surface slick exceeding any of the assessed thresholds (i.e. the surface slick was <1 g/m^2 at all times). Total submerged oil exceeding 100 ppb and dissolved hydrocarbons exceeding 50 ppb extended up to ~75 km from the release location, travelling primarily eastward from the Minerva-4 well site

The predicted hydrocarbon weathering (i.e. mass balance partitioning) for the specific met-ocean conditions encountered during the deterministic simulation is presented in Figure 8-2, and summarised as follows:

- Evaporation is the primary weathering mechanism with evaporated oil accounting for ~60% of the total oil mass between day 40 and the end of the simulation (day 116).
- Oil decay (i.e. biodegradation) accounts for the remaining ~40% of the oil by the end of the simulation (day 116).
- Entrained and dissolved hydrocarbons account for the majority of the unweathered oil mass during the discharge period (81 days), with surface slicks appearing only intermittently in response to calm wind conditions that allow entrained droplets to surface.

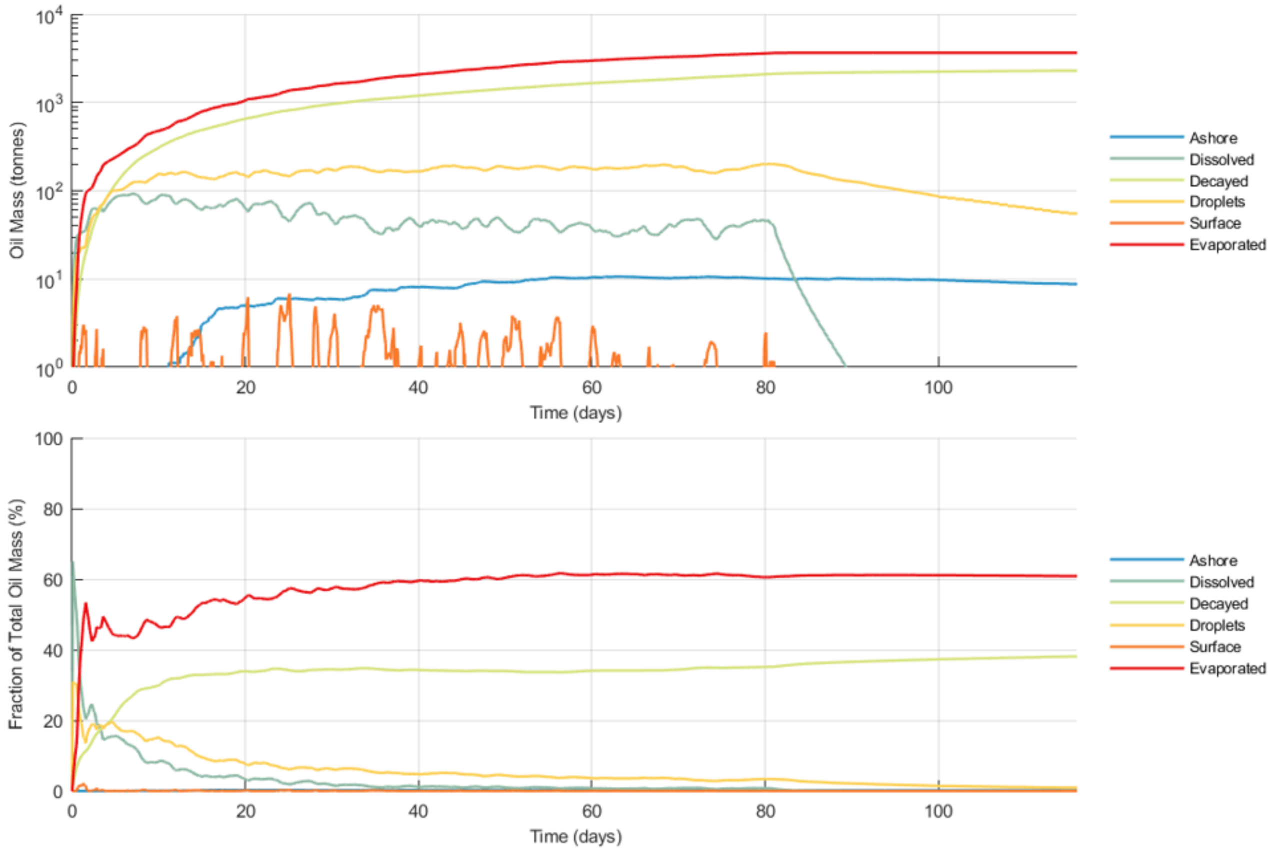


Figure 8-2: Hydrocarbon mass balance time series plots – LOWC: realization number 75 (GHD, 2022)

8.3.3 Environmental Impact Assessment

The following environmental impact assessment is based on potential impacts and risks to the physical environment and biological and socio-economic receptors within the area affected by hydrocarbons at the moderate exposure values. Potential impacts to environmental values, sensitivities and receptors within the spill EMBA from exposure to hydrocarbons are described in previous Table 8-7.

Local Fauna and Threatened and Migratory Fauna

Potential sensitive receptors in the vicinity of the spill area will include fish, marine mammals, marine reptiles and seabirds at the sea surface, which may come into contact with the condensate oil leading to potential impacts as described in previous Table 8-7. Each of these receptors is discussed below.

Marine Mammals

Whales and dolphins spend a significant time at the sea surface in search of food and to breathe, as such if they are in the vicinity of the spill location, however, given that rapid dispersion and modelling indicating surface oil is not expected to meet or exceed the moderate threshold for the LOWC scenario, and impact from surface contact is highly unlikely.

At the moderate in-water exposure level, a number of threatened and migratory mammals may be contacted with water column hydrocarbons including Antarctic Minke Whale, Australian Sea Lion, Pygmy Blue Whale, Southern Right Whale, Dusky Dolphin, Fin Whale, Humpback Whale, Killer Whale, Pygmy Right Whale, and Sei Whale. Of these, the Southern Right Whale (core range, migration and resting on migration, and aggregation), and Pygmy Blue Whale (Foraging and distribution) BIAs are within the EMBA. Given whales and dolphins are not predicted to be impacted by entrained/dissolved hydrocarbons in the water column since they are mobile species and not likely to be constantly exposed for extended durations that would be required to cause any major toxic effects. Given the size of the spill and expected rapid evaporation and dispersion rate, impacts to marine mammals are expected to be low.

An unplanned release of gas condensate is not expected to interfere with their migration activity. There is the potential for behaviour disruption to the local population and individuals that traverse the spill area. Owing to the rapid dispersion and evaporation of gas condensate, impacts are not predicted at the population level.

However thresholds of in-water (submerged) components of the condensate my contact the Bonney Coast Upwelling, resulting in a degradation of water quality that may impact foraging, especially of the pygmy blue whale for which and high annual use BIA overlaps the spill EMBA. Depending on seasonality and the distribution of species within these areas at the time of a release, there may be some impact to marine mammals at a population level.

Marine Reptiles

There are no identified marine turtle nesting beaches predicted to be contacted by moderate thresholds of condensate oil. Likewise, surface oil is not expected to meet or exceed the moderate threshold for the LOWC scenario.

Physical contact with hydrocarbons in the water column are likely to have biological consequences to individuals only, especially given there is no identified areas critical to the survival at any turtle species that may occur within the EMBA.

Fish (including Sharks and Rays and Commercial Species)

At the moderate exposure values for hydrocarbons, a number of threatened and migratory fish species are considered at risk of impact from contact with surface and water column hydrocarbons including the white shark (which has an overlapping foraging BIA within the EMBA). There is the potential for feeding behaviour disruption to the local population and individuals that traverse the spill area should the timing of the spill coincide with timing of foraging.

In the offshore environment, pelagic fish and sharks are expected to move away from areas affected by hydrocarbon spills, such that impacts are expected to be limited to behaviour responses/ displacement. Some mortality and sub-lethal effects may impact individuals located close to the release location; however, overall impacts are not predicted at the population level.

Marine Birds

Given surface oil is not expected to meet or exceed the moderate threshold for the LOWC scenario, it is unlikely that marine seabirds would come into contact with condensate oil at conservative impact levels.

There is a potential for shoreline accumulation with deterministic modelling indicating the highest accumulated shoreline mass (above 100 g/m^2) of 12.3 tonnes, including 8.2 tonnes at the Warrnambool Plain, 3.0 tonnes at the Otway Plain and 1.1 tonnes at the Otway Ranges.

Whilst much of the coastline of the Twelve Apostles is rocky, there are shoreline types along these stretches of potentially impacted coastline including sandy beaches and saltmarsh that would be suitable shorebird nesting and feeding habitat.

Of the 14 identified bird species with BIAs overlapping the wider EMBA, the most likely to be impacted as a result of moderate levels of shoreline loading would include: the Common Diving Petrel, White-faced Storm Petrel, Short-tailed Shearwater, Wedge-tailed Shearwater, Australasian Gannet, Black-faced Cormorant, and Little Penguin.

Impacts are expected to marine seabirds and shorebirds that come into contact with stranded condensate oil as well from as indirect effects from localised reduction of prey abundance. Given the limited extent of moderate shoreline exposure, and the non-persistent nature of condensate, impacts may occur at either an individual or population level, however they would not be considered widespread or persistent.

Benthic Habitats

Potential sensitive receptors in the vicinity of the spill area will include shallow water benthic habitats which come into contact with hydrocarbons in the water column, leading to potential impacts as described in previous Table 8-7. Further activity-specific information on the impacts and risks to these receptors is discussed below.

Shallow Water Benthic Habitats: Macroalgal Beds and Seagrass Beds

In the highly unlikely event of a subsea release from a loss of well control, the stochastic spill modelling predicted no exceedances of dissolved hydrocarbons at the moderate (50 ppb) or the high (400 ppb) exposure values.

For both Winter and Summer periods the Twelve Apostles Marine Park has the highest probability of being contacted with moderate thresholds of dissolved hydrocarbons: a maximum time-averaged concentration of 185 ppb and a minimum arrival time of 0.3 days (Autumn-Winter), and a maximum time-averaged concentration of 242 ppb and a minimum arrival time of 0.6 days (Spring-Summer). There was no predicted contact at high thresholds.

Likewise, for both Winter and Summer periods the Twelve Apostles Marine Park has the highest probability of being contacted by submerged (entrained) hydrocarbons at high thresholds: a maximum time-averaged concentration of 185 ppb and a minimum arrival time of 0.3 days (Autumn-Winter), and a maximum time-averaged concentration of 648 ppb and a minimum arrival time of 0.3 days (Spring-Summer).

In-water hydrocarbons that reach nearshore environments have the potential to impact shallow water benthic habitats, that host encrusting mollusc, sponge, bryozoan and red algae assemblages and other nearshore benthic habitats such as seagrass communities.

Macroalgae are important contributors to primary productivity and nutrient cycling. Subtidal macroalgae on reef fronts and reef edges would not be exposed to direct oiling, but may experience exposure to entrained oil or by stranded oil on shorelines that becomes remobilised and entrained in the water column due to periodical tidal and wave action exposure. The effect of hydrocarbons on macroalgae, particularly on intertidal shores, is largely dependent on the degree of direct exposure, the shoreline exposure (degree of wave and tidal action) and how much of the hydrocarbon adheres to the algae. Macroalgae on exposed shores is predicted to recover quicker than sheltered shores as a result of wind, wave and tidal driven coastal processes naturally ‘flushing’ hydrocarbons from the shoreline.

Potential direct impacts to seagrasses from hydrocarbons include mortality due to smothering and chemical toxicity. Indirect impacts may occur due to reduced light attenuation, which would restrict the seagrasses ability to photosynthesis, leading to reduced growth rates and reduced flowering capability. Entrained oil may also adhere to seagrass in shallower areas, inhibiting respiration. The susceptibility of seagrass to hydrocarbons will depend largely on their distribution, with communities in deeper water are less likely to be affected, whereas seagrass beds in shallower waters are more likely to be affected by entrained oil droplets. Impacts to seagrass beds may present secondary impacts to species reliant on the habitat.

Shoreline Habitats: Sandy Beaches, Saltmarshes and Rocky Shores

There is a potential for shoreline accumulation with deterministic modelling indicating the highest accumulated shoreline mass (above 100 g/m^2) of 12.3 tonnes, including 8.2 tonnes at the Warrnambool Plain, 3.0 tonnes at the Otway Plain and 1.1 tonnes at the Otway Ranges.

Whilst much of the coastline of the Twelve Apostles is rocky, there are shoreline types along these stretches of potentially impacted coastline including sandy beaches and saltmarsh.

Given the predictive modelling results, the following shoreline habitats are considered at risk:

- Saltmarshes to the north and south of Port Campbell.
- Sandy beaches of the Port Fairy to Lady Bay (Warrnambool) coastline, and small sections of sandy beach between Warrnambool and Cape Otway. Sandy beaches and intertidal sediments are important breeding/feeding/roosting areas for breeding seabirds and migratory shore birds.
- Rocky shore habitats are common along the Twelve Apostles Marine Park. These rocky shore habitats and limestone platforms provide a range of habitat niches and as such have a high biodiversity of associated fauna and flora.

Given the limited volumes, low wax content and non-persistent nature of potentially stranded condensate, potential impacts are considered moderate and are not expected to persist.

Protected Areas

There are a number of protected areas within the broader EMBA, with most of these only having the potential to be contacted by low instantaneous thresholds of hydrocarbons rather than being exposed to moderate to high levels of oiling. Of note is the Aire River being popular for recreational activities such as fishing, picnicking, camping and sight-seeing. There are also approximately 18 archaeological sites in the area, most of which are Aboriginal shell middens.

The Twelve Apostles Marine National Park located 7 km east of Port Campbell, the marine park covers 16 km of coastline from east of Broken Head to Pebble Point and extends offshore to 5.5 km. The area is representative of the Otway Bioregion and is characterised by a submarine network of canyons, caves, arches and walls housing a variety of seaweed and sponge gardens (Visit Victoria, NA). The underwater structures providing habitat for resident schools of reef fish as well as the greatest diversity of intertidal and sub-tidal invertebrates in Victoria.

The Arches Marine Sanctuary protects 45 ha of ocean directly south of Port Campbell. Approximately 5-25 m below the water surface is a labyrinth of limestone formations, rocky arches and canyons that have been formed over time by high-energy waves (Parks Victoria, 2016). The complex limestone structures provide a foundation for seaweeds and sponges to grow in turn providing additional habitat to support schools of reef fish, seals and a range of invertebrates such as lobster, abalone and sea urchins (Parks Victoria, 2016). 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.

Given the limited volumes, low wax content and non-persistent nature of potentially stranded condensate, potential impacts are considered moderate and are not expected to persist.

Socio-Economic Receptors

There is the potential for hydrocarbons to temporarily disrupt fishing activities if surface or water column hydrocarbons move through fishing areas. Fishing grounds may be temporarily closed, which would have an impact through loss of income. Market value/ demand for fish may also be impacted due to actual or perceived tainting of catches. Potential impacts to fish stock are unlikely to be extensive volatile and non-persistent nature of Minerva gas condensate. The dissolved component of the hydrocarbon is likely to be the most toxic to commercial species, but moderate to high levels are not anticipated over a broad area and would not persist in the environment. Some mortality and sub-lethal effects may impact individuals located close to the release location; however, overall impacts are not predicted at the population level. Potential direct impacts to fish and planktonic fish larvae are described in previous Table 8-7.

Offshore petroleum activities may be affected due to temporary exclusion zones that could be enforced as a safety or navigation control measure, thereby restricting vessels from operating in the area. However, impacts are predicted to be temporary.

Shipping operations are not predicted to be affected by a condensate spill. However, response activities may result in temporary diversions from normal shipping routes.

Tourism and recreation could be affected by a condensate spill, either from reductions in water quality and shoreline oiling resulting in temporary loss of access or reduction in aesthetic value of the area.

Defence activities are not predicted to be affected by a condensate spill.

Any condensate oil that reaches shorelines has potential to impact on registered sites and indigenous heritage places along the coastline. In the highly unlikely event of an oil spill, shoreline accumulated oil may effect sensitive artefacts or areas, which could damage their heritage value.

Based on the above assessment, a subsea release of gas condensate from a loss of well control has the potential to impact an array of receptors. The residual risk associated with a loss of well control scenario has been assessed to be Tolerable.

8.3.4 Control Measures

A potential LOWC scenario from the *Minerva P&A and Field Maintenance activity* is considered a ‘Type B’ (higher order) risk based upon the Decision Context described in Section 6.1.1 of this EP. The clearly defined regulatory, corporate and industry (good practice) preventative controls accepted by Woodside to manage the risks associated with a potential LOWC event are detailed in Table 8-8 below:

Table 8-8: Loss of well control – control measures

Control Measure	Source of Requirement / Good Practice
Preventative Controls	
Woodside WOMP (NOPSEMA accepted)	Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011 Woodside procedures and standards
MODU Safety Case (NOPSEMA accepted)	Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 MODU Operator system & procedures
Woodside MODU Safety Case Revision	Woodside procedures and standards
Well Control Training	Woodside procedures and standards Woodside Well & Seismic Delivery (WSD) Organisation, Development and Training Standard (DR-STD-PET-DC-0123) API Standard RP59
Blowout Preventer (BOP)	Woodside procedures and standards Woodside Petroleum Well Control Standard (DR-STD-PET-DC-0211)

Control Measure	Source of Requirement / Good Practice
	API Standard 16A
BOP Pressure and Function Testing	Woodside procedures and standards Woodside Petroleum Well Control Standard (DR-STD-PET-DC-0211); API Standard API 53

8.3.5 Demonstration of ALARP

Given a potential LOWC scenario represents a higher order risk, and consistent with the Demonstration of ALARP for higher order risks as described in Section 6.1.3, Woodside have undertaken a detailed engineering risk assessment to evaluate alternate, additional or improved controls according to their feasibility, reasonableness, and practicability to implement to further reduce the potential for risks associated with this event.

Table 8-9 below details the cost benefit analysis of proposed controls based upon both feasibility and cost (safety / time / effort / financial), with those preventative controls considered feasible and reasonably practicable to implement being adopted, and those considered not feasible or not reasonably practicable to implement rejected. The assessment applies the hierarchy of controls as illustrated in Figure 6-2.

A detailed environmental impact and risk assessment for spill response activities and detailed ALARP assessment including the evaluation of alternate, additional, or improved response controls for a LOWC scenario is presented in the *Minerva Field Emergency Response: Basis of Design & Field Capability Assessment* (00MC-BHP-N00-0003)

Table 8-9: Detailed engineering assessment – loss of well control

Hierarchy of Control	Control Measure	Accept/ Reject	Reason
Preventative Controls			
Eliminate	Do not undertake activity	Reject	Woodside does not consider this control as feasible, as the premise for field decommissioning requires these activities to occur. Decommissioning is a requirement of the OPGGS Act.
Substitute	None identified	N/A	N/A
Engineer	None identified	N/A	All detailed engineering is planned in accordance with relevant Woodside Critical Control and Well Planning Performance Standards. All standards align with industry good practice for well design and well barriers.
Separate	None identified	N/A	N/A
Administrative	None identified	N/A	All required and good practice administrative controls have been adopted by Woodside, both preventative and spill response.
Monitoring	None identified	N/A	All required controls to monitor for potential LOWC events whilst undertaking the activity have been adopted.
Response Controls			
Pollution Control & Contingency Planning	Minerva Field Emergency Response: Basis of Design & Field Capability Assessment (00MC-BHP-N00-0003)		
Monitoring	Post incident monitoring programs have been established as presented within the Woodside Minerva Field: Operational and Scientific Monitoring Bridging Implementation Plan (OSMBIP) (00MC-BHP-N00-0004)		

Based upon Woodside adopting all relevant regulatory, corporate and industry (good practice) controls in relation to prevention of, and response to, a potential LOWC scenario and the application of a detailed engineering assessment alternate, additional or improved controls, Woodside considers the potential risk associated with a LOWC have been managed to ALARP.

8.3.6 Demonstration of Acceptability

The potential for a LOWC event occurring during the *Minerva P&A and Field Maintenance activity* is considered a ‘Type B’ (higher order) risk, that has been considered acceptable by Woodside based upon:

- The risk has been deemed ALARP via a detailed engineering assessment (see Section 8.3.5 above);
- There have been no objections or claims made by relevant stakeholders for this aspect of the activity;
- There is sufficient regulatory control, Woodside corporate procedures and standards and industry good practice guidance to inform the development of robust preventative control measures and these measures have been evaluated by internal Woodside subject matter experts during the ENVID process and reflected within this EP;
- By undertaking the activity, there is no contravention of any relevant Plan of Management for a World Heritage place, National Heritage place or Ramsar wetland identified within the EMBA;
- Consideration of listed species recovery plans, conservation advice and threat abatement plans relevant to chemical discharge/oil spills, marine pollution, and habitat degradation/modification have informed the development of control measures.
- The valuation principle of Ecologically Sustainable Development (ESD) (as defined within Section 3A of the EPBC Act) has been considered with respect to potential costs incurred for a LOWC event. This principle has not been compromised given mitigative controls have been adopted to reduce potential impacts and risks in the event of an unplanned spill, and Woodside has committed to fully funding any and all remedial costs associated with an emergency oil pollution event; and
- Woodside is satisfied that when the accepted controls are implemented the environmental performance outcome (EPO) of “No accidental release of chemicals or hydrocarbons to the marine environment” will be met.

Given all of the above criteria for acceptability have been met, Woodside considers the risks associated with a LOWC event during *Minerva P&A and Field Maintenance activity* have been managed to an acceptable level.

8.4 Hydrocarbon Release – Vessel Collision

8.4.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Vessel collision resulting in fuel tank rupture	Loss of hydrocarbons (marine diesel oil) to the marine environment.	Reduction in water quality with potential for toxicity effects to marine fauna and flora (including potential mortality), oiling of offshore, nearshore and shoreline habitats (smothering). Disruption to biologically important behaviours (feeding / breeding / migration). Hypothermia due to hydrocarbon exposure. Impacts to socio-economic receptors.	30	Highly Unlikely (0.03)	0.9	Type A Lower Order Risk	Tolerable

8.4.2 Source of Risk

The presence of the MODU in the operational area for the duration of the activity (approx. 2 months) presents a navigational hazard to third-party vessels. A collision between AHTS vessels or with passing third-party vessels has also been identified as a credible risk. A vessel collision could occur due to poor weather, human error or vessel navigation/equipment failure.

A vessel collision has the potential to result in the rupture of a vessel fuel tank and the release of marine diesel oil. A review of the potentially active commercial fisheries (Section 8.4.3) along with consultation undertaken during the development of this EP (Section 4), determined a low likelihood of active commercial fishing in the area, as such, there is a very low risk of a vessel collision with a commercial fishing vessel.

The AMSA *Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities* (2015) has been applied to determine the credible WCD associated with an in-field vessel collision event.

For the type of AHTS vessels anticipated to support the MODU during the activity, the largest single fuel oil (FO) tank is likely 250-300 m^3. Generally, FO tanks are filled to 80% of total capacity (maintaining 20% ullage) whilst undertaking offshore operations. To allow for an appropriately conservative environmental impact and risk assessment, or for a vessel with larger-than-anticipated FO capacity to support the activity, a total potential marine diesel oil (MDO) release volume of 330 m^3 has been modelled as the WCD for a vessel collision scenario.

Industry Statistics

A review of the Annual Overview of Marine Incidents (AMSA, 2019) (covering the period from January 2016 to December 2019) indicates that 'very serious marine incidents', which may include loss of a vessel and serious pollution, accounted for a small portion (0.05%) of the overall reported marine incidents during the reporting period. Based upon this report, and reports from previous years, this would indicate a vessel collision resulting in a loss of 330 m^3 MDO would be considered a highly unlikely event.

Oil Spill Modelling Results

Hydrocarbon Weathering Behaviour

MDO is a moderate weight, moderately persistent oil in the marine environment.

Results of the weathering analysis are shown in Figure 8-3 and are summarised as follows. Under low winds (1 m/s), 60% of the surface slick is predicted to remain after 120 hours (5 days). Under moderate winds (5 m/s), 40% of the initial surface slick is predicted to remain after 24 hours, decreasing further to approximately 10% after 48 hours and ~1% after 72 hours. With high winds (10 m/s), the surface slick is predicted to be almost entirely evaporated and dispersed after 12 hours. The MDO has a very low tendency for emulsion formation, with only ~1% water contained entrained into the surface slick after 120 hours for all wind conditions assessed.

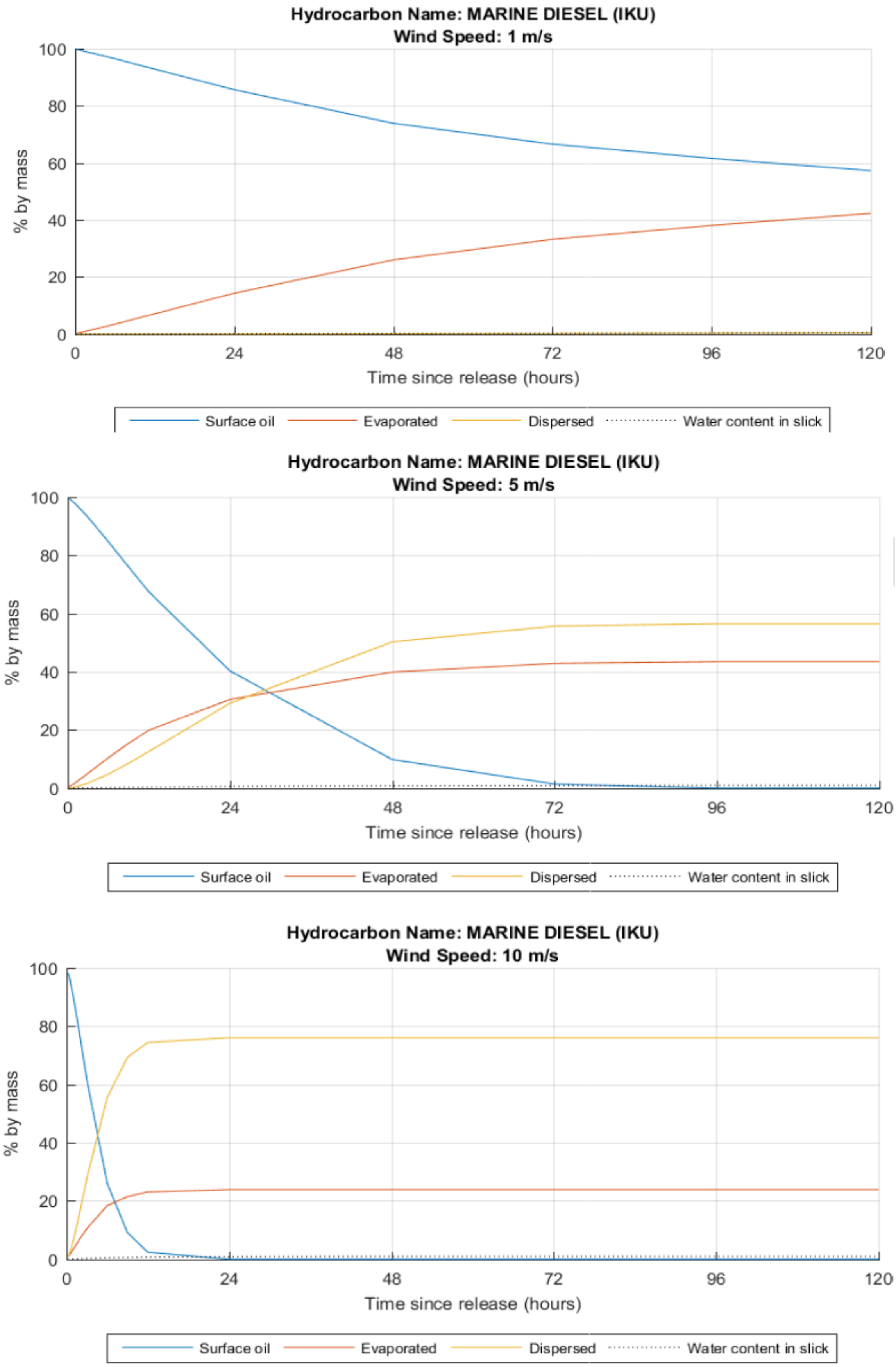


Figure 8-3: Simulated weathering of the SINTEF marine diesel (IKU) hydrocarbon for constant wind speeds of 1 m/s (top), 5 m/s (middle) and 10 m/s (bottom) (GHD, 2022)

The modelling results are presented for the fate hydrocarbons at the hydrocarbon exposure values defined in Table 4-1. The spatial extent of the MDO release is presented in Figure 4-1. The outer extent of the MDO EMBA shown is derived from the oil spill modelling defined using the low exposure values (Table 4-1) and is based on the combined area of contact for all hydrocarbon phases (surface oil, dissolved oil, total submerged oil and shoreline accumulated oil).

Sea Surface Hydrocarbons

Low exposure (>1 g/m^2)

For Autumn-Winter, surface oiling exceeding the low threshold (1 g/m^2) was predicted to occur up to ~25 km west and ~75 km east of the spill location.

For Spring-Summer, surface oiling exceeding the low threshold (1 g/m^2) was predicted to occur up to ~40 km west and ~30 km east of the spill location.

Moderate exposure (>10 g/m^2) to *High exposure (>50 g/m^2)*

For Autumn-Winter, the maximum spatial extent of surface oiling at the moderate (10 g/m^2) and high (50 g/m^2) thresholds was reduced to within ~25 km and ~10 km of the spill site, respectively. Summarised contact predictions for surface oil at the moderate threshold (10 g/m^2) include:

- For IBRA regions (including neighbouring state waters), a low-moderate contact probability of 24% was predicted at the Warrnambool Plain with a maximum local time-averaged concentration of 78 g/m2 and a minimum arrival time of 0.2 days (4 hours).
- For marine reserves, low contact probabilities were predicted at The Arches state marine park (<1%) and the Twelve Apostles state marine park (5%), with maximum time-averaged concentrations of 13 and 26 g/m^2, respectively, and minimum arrival times of 1.3 and 0.3 days, respectively.
- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 99% probability (meaning 1% of realisations did not generate a surface slick exceeding 10 g/m^2), a maximum time-averaged concentration of 276 g/m^2 and a minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model time step).

For Spring-Summer, The maximum spatial extent of surface oiling at the moderate (10 g/m^2) and high (50 g/m^2) thresholds was reduced to within ~25 km and ~10 km of the spill site, respectively. Summarised contact predictions for surface oil at the moderate threshold (10 g/m^2) include:

- For IBRA regions (including neighbouring state waters), a low-moderate contact probability of 31% was predicted at the Warrnambool Plain with a maximum local time-averaged concentration of 107 g/m^2 and a minimum arrival time of 0.2 days (4 hours).
- For marine reserves, a very low contact probability was predicted at the Twelve Apostles state marine park (1%), with a maximum time-averaged concentration of 15 g/m^2 and a minimum arrival time of 0.6 days.
- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 252 g/m^2 and a minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model time step).

Dissolved Hydrocarbons

Low exposure (>10 ppb)

For Autumn-Winter, dissolved hydrocarbons at the low threshold (10 ppb) were predicted to occur at distances of up to ~75 km west and ~150 km east of the spill site.

For Spring-Summer, dissolved hydrocarbons at the low threshold (10 ppb) were predicted to occur at distances of up to ~90 km west and ~80 km east of the spill site.

Moderate exposure (>50 ppb) to High exposure (>400 ppb)

For Autumn-Winter, the maximum spatial extents at the moderate (50 ppb) and high (400 ppb) thresholds were reduced to ~90 km and ~25 km, respectively. Summarised contact predictions for dissolved hydrocarbons at the moderate threshold (50 ppb) include:

- For IBRA regions (including neighbouring state waters), a moderate-high contact probability of 66% was predicted at the Warrnambool Plain, with a maximum time-averaged concentration of 3,785 ppb and minimum arrival time of 0.1 days (2 hours). Lower contact probabilities were predicted at the Otway Plain (5%) and Otway Ranges (7%), with maximum local time-averaged concentrations of 151 ppb and minimum arrival times of 0.8 days.
- For marine reserves, a moderate contact probability was predicted at the Twelve Apostles state marine park (39%), with a maximum time-averaged concentration of 648 ppb and a minimum arrival time of 0.3 days. A very low contact probability of <1% was also predicted at The Arches state marine park, with a maximum time averaged concentration of 52 ppb and a minimum arrival time of 1.3 days.
- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 4,349 ppb and minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model timestep).

For Spring-Summer, the maximum spatial extents at the moderate (50 ppb) and high (400 ppb) thresholds were reduced to ~75 km and ~50 km, respectively. Summarised contact predictions for dissolved hydrocarbons at the moderate threshold (50 ppb) include:

- For IBRA regions (including neighbouring state waters), a high contact probability of 74% was predicted at the Warrnambool Plain, with a maximum time-averaged concentration of 2,812 ppb and minimum arrival time of 0.2 days (4 hours). Lower contact probabilities were predicted at the Otway Plain (<1%) and Otway Ranges (1%), with maximum local time-averaged concentrations of 113 ppb and minimum arrival times of 0.9 days.
- For marine reserves, a moderate contact probability was predicted at the Twelve Apostles state marine park (33%), with a maximum time-averaged concentration of 1,698 ppb and a minimum arrival time of 0.3 days
- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 5,708 ppb and minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model time step).

Total Submerged Hydrocarbons (entrained plus dissolved)

Low exposure (>10 ppb)

For Autumn-Winter, total submerged oil at the low threshold (10 ppb) was predicted to occur up to ~150 km to the west and ~450 km east of the spill site.

For Spring-Summer, total submerged oil at the low threshold (10 ppb) was predicted to occur up to ~225 km to the west and ~150 km east of the spill site.

High exposure (>100 ppb)

For Autumn-Winter, exposure at the high threshold (100 ppb) was limited to within ~80 km west and ~150 km east of the spill site. Summarised contact predictions for total submerged oil at the high threshold (100 ppb) include:

- For IBRA regions (including neighbouring state waters), a high contact probability of 76% was predicted at the Warrnambool Plain, with a maximum time-averaged concentration of 7,711 ppb and minimum arrival time of 0.1 days (2 hours). Lower contact probabilities were predicted at the Otway Plain (23%) and Otway Ranges (21%), with maximum local time-averaged concentrations of 1,199 ppb and minimum arrival times of 0.7 days.
- For marine reserves, a moderate contact probability was predicted at the Twelve Apostles state marine park (49%), with a maximum time-averaged concentration of 1,584 ppb and a minimum arrival time of

0.2 days. A very low contact probability of 2% was also predicted at The Arches state marine park, with a maximum time averaged concentration of 283 ppb and a minimum arrival time of 0.4 days. The Apollo AMP was predicted to be contacted with low probability (3%), a maximum time-averaged concentration of 169 ppb and a minimum arrival time of 1.4 days.

- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 7,711 ppb and minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model timestep). The IMCRA regions of Central Victoria and Central Bass Strait had very low predicted contact probabilities of 3% and 1%, respectively, with maximum time-averaged concentrations of 179 and 126 ppb, respectively, and minimum arrival times of 1.6 and 2.1 days, respectively.

For Spring-Summer, Exposure at the high threshold (100 ppb) was limited to within ~90 km west and east of the spill site. Summarised contact predictions for total submerged oil at the high threshold (100 ppb) include:

- For IBRA regions (including neighbouring state waters), a high contact probability of 87% was predicted at the Warrnambool Plain, with a maximum time-averaged concentration of 7,073 ppb and minimum arrival time of 0.2 days (4 hours). Lower contact probabilities were predicted at the Otway Plain (11%) and Otway Ranges (9%), with maximum local time-averaged concentrations of 474 ppb and minimum arrival times of 0.9 days.

- For marine reserves, a moderate contact probability was predicted at the Twelve Apostles state marine park (45%), with a maximum time-averaged concentration of 2,566 ppb and a minimum arrival time of 0.2 days. A very low contact probability of 3% was also predicted at The Arches state marine park, with a maximum time averaged concentration of 348 ppb and a minimum arrival time of 0.3 days.

- The spill site is located within the Otway IMCRA region. Therefore, Otway was contacted with 100% probability, a maximum time-averaged concentration of 8,929 ppb and minimum arrival time of 0.1 days (i.e. 2 hours, or 1 model time step).

Shoreline Accumulated Hydrocarbons

Low exposure (>10 g/m^2)

For Autumn-Winter, shoreline loading above the low threshold (>10 g/m^2) was predicted to occur between the Warrnambool Plain (~150 km west) and Wilsons Promontory (~500 km east).

For Spring-Summer, shoreline loading above the low threshold (>10 g/m^2) was predicted to occur between the Victorian Volcanic Plain (~200 km west) and the Otway Ranges (~125 km east).

Moderate exposure (>100 g/m^2) to High exposure (>1,000 g/m^2)

For Autumn-Winter, At the moderate (100 g/m^2) and high (1,000 g/m^2) thresholds, predicted shoreline accumulation was limited to within a 100 km distance from the well site, spanning the Warrnambool Plain, Otway Plain and Otway Ranges. At the moderate threshold (100 g/m^2), a high contact probability of 74% was predicted across all shorelines, with individual contact probabilities of 63% at the Warrnambool Plain, 29% at the Otway Plain and 13% at the Otway Ranges. Across all shorelines, the predicted maximum accumulated shoreline load was 187 tonnes, with a minimum arrival time of 0.2 days (4 hours) and a maximum oiled shoreline length of 35 km. Maximum accumulated shoreline loads at individual receptors were 187 tonnes at the Warrnambool Plain, 27 tonnes at the Otway Plain and 7 tonnes at the Otway Ranges, with minimum arrival times of 0.2, 1.0 and 0.8 days, respectively, and maximum oiled shoreline lengths of 30, 21 and 9 km, respectively.

For Spring-Summer, at the moderate (100 g/m^2) and high (1,000 g/m^2) thresholds, predicted shoreline accumulation was limited to within a 100 km distance from the well site, spanning the Warrnambool Plain, Otway Plain and Otway Ranges. At the moderate threshold (100 g/m^2), a high contact probability of 76% was predicted across all shorelines, with individual contact probabilities of 74% at the Warrnambool Plain, 16% at the Otway Plain and 10% at the Otway Ranges. Across all shorelines, the predicted maximum accumulated shoreline load was 152 tonnes, with a minimum arrival time of 0.2 days (4 hours) and a maximum oiled shoreline length of 33 km. Maximum accumulated shoreline loads at individual receptors were 152 tonnes at the Warrnambool Plain, 24 tonnes at the Otway Plain and 5 tonnes at the Otway Ranges, with minimum arrival times of 0.2, 1.4 and 1.2 days, respectively, and maximum oiled shoreline lengths of 30, 17 and 10 km, respectively.

8.4.3 Environmental Impact Assessment

A loss of MDO to the marine environment would result in a localised and temporary reduction in water quality in the upper surface waters of the water column. While MDOs are generally considered to be non-persistent oils, many contain a small percentage by volume of hydrocarbons that are classified as persistent.

When spilt at sea, MDOs will spread and thin out quickly and more than half of the volume can be lost to evaporation. Due to their higher solubility and ease of entrainment, MDO spills can have a greater ecological impact in comparison to other floating oils slicks.

For both Winter and Summer periods, modelling predicts the maximum spatial extent of surface oiling at the moderate (10 g/m^2) and high (50 g/m^2) thresholds was reduced to within ~25 km and ~10 km of the spill site respectively. Modelling also indicate that at moderate thresholds (100g/m^2), shoreline accumulation may occur up to 100 km distance from the release site, with a maximum potential loading of 187 tonnes over a 30km length of shoreline (along the coastal region of the Warrnambool Plain).

The following environmental impact assessment is based on potential impacts and risks to the physical environment and biological and socio-economic receptors within the area affected by hydrocarbons at the moderate exposure value.

Local Fauna and Threatened and Migratory Fauna

Marine Mammals

Whales and dolphins spend a significant time at the sea surface in search of food and to breathe, as such if they are in the vicinity of the spill location, they are likely to come into contact with MDO.

At the moderate exposure level, a number of threatened and migratory mammals may be contacted with surface and water column hydrocarbons including Antarctic Minke Whale, Australian Sea Lion, Pygmy Blue Whale, Southern Right Whale, Dusky Dolphin, Fin Whale, Humpback Whale, Killer Whale, Pygmy Right Whale, and Sei Whale. Of these, the Southern Right Whale (core range, migration and resting on migration, and aggregation), and Pygmy Blue Whale (Foraging and distribution) BIAs are within the EMBA. However, given the moderate exposure area is considerably smaller, the likelihood of a whale traversing the area is greatly reduced. As they are smooth skinned, hairless mammals, MDO tends not to adhere to their skin, limiting the potential impacts of oiling.

Whales and dolphins are not predicted to be impacted by entrained/dissolved hydrocarbons in the water column since they are mobile species and not likely to be constantly exposed for extended durations that would be required to cause any major toxic effects. Given the size of the spill and expected rapid evaporation and dispersion rate, impacts to marine mammals are expected to be low.

An unplanned release of MDO is not expected to interfere with their migration activity. There is the potential for behaviour disruption to the local population and individuals that traverse the spill area. Owing to the rapid dispersion and evaporation of MDO, impacts are not predicted at the population level.

Marine Reptiles

Marine reptiles may be exposed to surface and water column hydrocarbons through direct contact resulting in eye and skin damage, ingestion, consumption of contaminated prey items and prolong inhalation of diesel vapour. Ingestion can subsequently lead to physiological effects including internal organ damage. Coasting of their body surface can cause irritation of mucous membranes in the nose through and eyes that can result in inflammation and infection.

Due to the weathering nature of MDO, a spill rapidly and thinly consequently marine reptiles are not expected to ingest significant volumes or result in persistent oiling. Most evaporation of MDO is within the first 48 hours, hence exposure timeframes to vapours is short.

There are no identified marine turtle nesting beaches predicted to be contacted by moderate thresholds of MDO. Physical contact with hydrocarbons in the water column are likely to have biological consequences to individuals only, especially given there is no identified areas critical to the survival at any turtle species that may occur within the EMBA. Owing to the rapid dispersion and evaporation of MDO, impacts are not predicted at the population level.

Fish (including Sharks and Rays and Commercial Species)

At the moderate exposure values for hydrocarbons, a number of threatened and migratory fish species are considered at risk of impact from contact with surface and water column hydrocarbons including the white shark (which has an overlapping foraging BIA within the EMBA). There is the potential for feeding behaviour disruption to the local population and individuals that traverse the spill area should the timing of the spill coincide with timing of foraging.

Pelagic fish that spend their time in the upper water column will be at greatest risk of impact from surface and water column hydrocarbons. Pelagic fish are highly mobile and species likely to be include predatory species such as tuna, mackerel and sharks.

Fish near the sea surface are thought to be able to detect and avoid contact with surface slicks and mortalities rarely occur in the event of a hydrocarbon spill in open waters. Those fish that do come into contact with surface and water column hydrocarbons will be affected by smothering through coating of gill structure leading to suffocation or through ingestion leading to potential infection and internal organ or tissue damage.

There is the potential for feeding behaviour disruption to the local population and individuals that traverse the spill area should the timing of the spill coincide with timing of whale shark aggregations. Owing to the rapid dispersion and evaporation of MDO, impacts are not predicted at the population level.

Marine Birds

Marine birds are at risk of exposure to MDO from diving to obtain food or resting on the sea surface. Impact pathways arise from direct oiling, exposure to oil vapours, and direct or indirect ingestion of oil and contaminated food prey. Ingestion can lead to intestinal damage and reproductive effects. Oiling of feathers can affect the bird’s ability to thermo-regulate (IPIECA-IOGP, 2017). Due to the weathering nature of MDO, surface oil spreads rapidly and thinly, and hence marine birds are not expected to ingest significant volumes or result in persistent heavy oiling.

While marine seabirds may be contacted by MDO in the offshore environment, migratory shorebirds are at risk of contact with moderate thresholds of MDO that accumulate on shorelines. Whilst much of the coastline of the Twelve Apostles is rocky, there are shoreline types along these stretches of potentially impacted coastline including sandy beaches and saltmarsh that would be suitable shorebird nesting and feeding habitat. Shorebirds are at risk of contact with accumulated hydrocarbons as they roost, feed and breed on shorelines, although they tend to roost and nest above the high water mark.

Of the 14 identified bird species with BIAs overlapping the wider EMBA, the most likely to be impacted as a result of moderate levels of shoreline loading would include: the Common Diving Petrel, White-faced Storm Petrel, Short-tailed Shearwater, Wedge-tailed Shearwater, Australasian Gannet, Black-faced Cormorant, and Little Penguin.

Given the limited extent of moderate shoreline exposure, and the non-persistent nature of MDO, impacts may occur at either an individual or population level, however they would not be considered widespread or persistent.

Benthic Habitats

Potential sensitive receptors in the vicinity of the spill area will include shallow water benthic habitats which come into contact with hydrocarbons in the water column, leading to potential impacts as described in previous Table 8-7. Further activity-specific information on the impacts and risks to these receptors is discussed below.

Shallow Water Benthic Habitats: Macroalgal Beds and Seagrass Beds

For Autumn-Winter, the maximum spatial extents dissolved hydrocarbons at the moderate (50 ppb) and high (400 ppb) thresholds were reduced to ~90 km and ~25 km, respectively and for Spring-Summer the maximum spatial extents at the moderate (50 ppb) and high (400 ppb) thresholds were reduced to ~75 km and ~50 km, respectively. However, there is a very low probability of contact at moderate threshold at either the Twelve Apostles Marine Par or the Arches State Marine Park.

In-water hydrocarbons that reach nearshore environments have the potential to impact shallow water benthic habitats, that host encrusting mollusc, sponge, bryozoan and red algae assemblages and other nearshore benthic habitats such as seagrass communities.

Macroalgae are important contributors to primary productivity and nutrient cycling. Subtidal macroalgae on reef fronts and reef edges would not be exposed to direct oiling, but may experience exposure to entrained oil or by stranded oil on shorelines that becomes remobilised and entrained in the water column due to periodical tidal and wave action exposure. The effect of hydrocarbons on macroalgae, particularly on intertidal shores, is largely dependent on the degree of direct exposure, the shoreline exposure (degree of wave and tidal action) and how much of the hydrocarbon adheres to the algae. Macroalgae on exposed shores is predicted to recover quicker than sheltered shores as a result of wind, wave and tidal driven coastal processes naturally ‘flushing’ hydrocarbons from the shoreline.

Potential direct impacts to seagrasses from hydrocarbons include mortality due to smothering and chemical toxicity. Indirect impacts may occur due to reduced light attenuation, which would restrict the seagrasses ability to photosynthesis, leading to reduced growth rates and reduced flowering capability. Entrained oil may also adhere to seagrass in shallower areas, inhibiting respiration. The susceptibility of seagrass to hydrocarbons will depend largely on their distribution, with communities in deeper water are less likely to be affected, whereas seagrass beds in shallower waters are more likely to be affected by entrained oil droplets. Impacts to seagrass beds may present secondary impacts to species reliant on the habitat.

Shoreline Habitats: Sandy Beaches, Saltmarshes and Rocky Shores

There is a potential for shoreline accumulation with deterministic modelling indicating the maximum accumulated shoreline mass (above 100 g/m^2) of 187 tonnes at the Warrnambool Plain over a 30km long stretch of coastline.

Whilst much of the coastline of the Twelve Apostles is rocky, there are shoreline types along these stretches of potentially impacted coastline including sandy beaches and saltmarsh.

Given the predictive modelling results, the following shoreline habitats are considered at risk:

- Saltmarshes to the north and south of Port Campbell.
- Sandy beaches of the Port Fairy to Lady Bay (Warrnambool) coastline, and small sections of sandy beach between Warrnambool and Cape Otway. Sandy beaches and intertidal sediments are important breeding/feeding/roosting areas for breeding seabirds and migratory shore birds.
- Rocky shore habitats are common along the Twelve Apostles Marine Park. These rocky shore habitats and limestone platforms provide a range of habitat niches and as such have a high biodiversity of associated fauna and flora.

Given the potential degree of shoreline loading, but the non-persistent nature of potentially stranded MDO, potential impacts are considered moderate to significant but are unlikely to persist.

Protected Areas

There are a number of protected areas within the broader EMBA, with most of these only having the potential to be contacted by low instantaneous thresholds of hydrocarbons rather than being exposed to moderate to high levels of oiling. Of note is the Aire River being popular for recreational activities such as fishing, picnicking, camping and sight-seeing. There are also approximately 18 archaeological sites in the area, most of which are Aboriginal shell middens.

The Twelve Apostles Marine National Park located 7 km east of Port Campbell, the marine park covers 16 km of coastline from east of Broken Head to Pebble Point and extends offshore to 5.5 km. The area is representative of the Otway Bioregion and is characterised by a submarine network of canyons, caves, arches and walls housing a variety of seaweed and sponge gardens (Visit Victoria, NA). The underwater structures providing habitat for resident schools of reef fish as well as the greatest diversity of intertidal and sub-tidal invertebrates in Victoria.

The Arches Marine Sanctuary protects 45 ha of ocean directly south of Port Campbell. Approximately 5-25 m below the water surface is a labyrinth of limestone formations, rocky arches and canyons that have been formed over time by high-energy waves (Parks Victoria, 2016). The complex limestone structures provide a foundation for seaweeds and sponges to grow in turn providing additional habitat to support schools of reef fish, seals and a range of invertebrates such as lobster, abalone and sea urchins (Parks Victoria, 2016). 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.

Given the potential degree of shoreline loading, but the non-persistent nature of potentially stranded MDO, potential impacts are considered moderate to significant but are unlikely to persist..

Socio-Economic Receptors

There is the potential for hydrocarbons to temporarily disrupt fishing activities if surface or water column hydrocarbons move through fishing areas. Fishing grounds may be temporarily closed, which would have an impact through loss of income. Market value/ demand for fish may also be impacted due to actual or perceived tainting of catches. Potential impacts to fish stock are unlikely to be extensive volatile and non-persistent nature of Minerva gas condensate. The dissolved component of the hydrocarbon is likely to be the most toxic to commercial species, but moderate to high levels are not anticipated over a broad area and would not persist in the environment. Some mortality and sub-lethal effects may impact individuals located close to the release location; however, overall impacts are not predicted at the population level. Potential direct impacts to fish and planktonic fish larvae are described in previous Table 8 7.

Offshore petroleum activities may be affected due to temporary exclusion zones that could be enforced as a safety or navigation control measure, thereby restricting vessels from operating in the area. However, impacts are predicted to be temporary.

Shipping operations are not predicted to be affected by an MDO spill. However, response activities may result in temporary diversions from normal shipping routes.

Tourism and recreation could be affected by an MDO spill, either from reductions in water quality and shoreline oiling resulting in temporary loss of access or reduction in aesthetic value of the area.

Defence activities are not predicted to be affected by an MDO spill.

Any MDO that reaches shorelines has potential to impact on registered sites and indigenous heritage places along the coastline. In the highly unlikely event of an oil spill, shoreline accumulated oil may effect sensitive artefacts or areas, which could damage their heritage value.

Based on the above assessment, an MDO release during vessel operation has the potential to impact an array of receptors. The residual risk associated with an MDO release has been assessed to be Tolerable.

8.4.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) preventative controls accepted by Woodside to manage the risks associated with vessel collision are detailed below:

Table 8-10: Vessel collision – control measures

Control Measure	Source of Requirement / Good Practice
Navigation Equipment	Navigation Act 2012; International Convention of the Safety of Life at Sea (SOLAS) Marine Order Part 30: Prevention of Collisions, Issue 8 Marine Order 21, Issue 8 (Safety of Navigation and Emergency Procedures)
Automatic Identification System (AIS)	Navigation Act 2012; International Convention of the Safety of Life at Sea (SOLAS): Regulation 19-1 of Chapter V of SOLAS.
Notice to Mariners and AUSCOAST warning	Navigation Act 2012; International Convention of the Safety of Life at Sea (SOLAS) Woodside procedures and standards
Stakeholder Communication	OPGGS(E) Regs (11A) Woodside Community Stakeholder Management Plan Woodside Community Concerns, Inquiries and Complaints Procedure
Rig Safety Exclusion Zone	MODU Safety Case
Training & Competency	AMSA Marine Order Part 3: Seagoing Qualifications
Additional Opportunistic Controls	
None identified	

8.4.5 Demonstration of ALARP

The potential for a vessel collision resulting in a release of MDO during the *Minerva P&A and Field Maintenance activity* is considered a 'Type A' (lower order) risk based upon the Decision Context described in Section 6.1.1 of this EP. Given the routine nature of vessel operations and the controls detailed above being consistent with both regulatory requirements and industry good practice, Woodside considers the impact has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls is required. Additional opportunistic controls have also been evaluated but deemed not reasonably practicable to implement.

8.4.6 Demonstration of Acceptability

Woodside is satisfied that when the accepted controls detailed above are implemented the environmental performance outcome (EPO) of "No accidental release of chemicals or hydrocarbons to the marine environment" or "No unplanned vessel interactions (including collision)" will be met, therefore Woodside considers the impact to be managed to an acceptable level. Additionally, consideration of listed species recovery plans, conservation advice and threat abatement plans relevant to chemical discharge/oil spills, marine pollution, and habitat degradation/modification (Table 8-7) have informed the development of control measures.

No concerns or objections regarding the potential for vessel collision during the activity have been raised by relevant stakeholders.

8.5 Unplanned Discharges – Chemicals and Minor Hydrocarbon Spills

8.5.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Accidental discharge of chemicals and hydrocarbons	Minor spills / leaks of chemicals or hydrocarbons to the marine environment.	Reduction in water quality adjacent to the discharge point associated with hydrocarbon or chemical contaminants with potential for toxicity effects to marine species.	10	Unlikely (0.1)	1	Type A Lower Order Risk	Tolerable

8.5.2 Source of Risk

During the activity, the transfer, handling, use and storage of chemicals and hydrocarbons will be required, which may include, but not limited to:

- MDO;
- Cement;
- Hydraulic fluids/ oils; and
- Subsea control fluids

Accidental loss of such chemicals from the MODU or vessels to the marine environment could occur as a result of spillage during handling, inadequate bunding and/ or storage, inadequate method of securing or tank/ pipework failure, leak from equipment or rupture or failure of ROV hydraulic hoses whilst underwater.

MDO is stored aboard the MODU in dedicated fuel oil tanks house within the pontoons of the MODU.

Inventories of bulk liquid chemicals are stored within mud pits aboard the MODU, with bulk dry chemicals stored within the sack room. Each of these location have sealed drainage systems for chemical containment.

Given the quantities of chemicals used aboard the deck of the MODU are limited in volume to single containers, the volume of chemical potentially released from a leak or spillage on deck into the marine environment, and based on a review of past incidents and possible causes, is less than 80 L.

Bulk supplies of liquid chemicals and hydrocarbons are bunkered from the project support vessels onto the MODU during the activity. Whilst unlikely, spills may occur during bunkering operations.

The AMSA Technical guidelines for preparing contingency plans for Marine and Coastal Facilities (2015) has been applied to determine the credible WCD associated with bunkering operations that are subject to continuous supervision. The potential causes and credible WCD have been identified as:

- Failure of the hoses during pumping: the maximum credible spill that would occur from total failure of a diesel transfer hose is approximately 450 L (volume of 100 m of 75 mm diameter hose) plus allowance for time to shut down the pump (accounting for 15 min of flow). The potential WCD (assuming an average pumping rate of 225 m^3 per hour) is 56.7 m^3 diesel.
- Failure of connections or valves at disconnection: valves are dry break but if a valve was to fail at disconnection worst-case would result in contents of the hose, approximately 450 L, being released to sea.

Leaks or rupture of ROV hydraulic hoses may occur through equipment malfunction or line pinches which would lead to the loss of small volumes of hydraulic fluids directly to the marine environment. ROVs on the MODU or AHTS vessels are fitted with leak alarms generally set at 5 L.

8.5.3 Environmental Impact Assessment

The accidental discharge of chemicals and hydrocarbons has the potential to cause localised toxic effects on marine fauna (pelagic fish, cetaceans and marine reptiles) and flora (phytoplankton) and a localised reduction in water quality. The potential impacts would most likely be highly localised and restricted to the immediate area in the footprint of the spill. Pelagic fish, cetaceans, marine reptiles will be able to move out of the spill area and any accidental spills is therefore not predicted to result in fatalities. Phytoplankton entrained in the spill will be impacted, however, the rapid dilution and dispersal that will result at the oceanic locations, the environmental effects will be temporary and localised, with significant impacts not expected owing to the short exposure timeframe.

Habitat degradation for marine pollution and chemical discharges are highlighted as threats to marine turtles, whales, and a number of migratory shorebirds in relevant recovery plans and approved conservation advice (refer to previous **Table** 4-5). The plans and conservation advice provide recovery objective and action to help combat these threats.

In particular, the Recovery Plan for Marine Turtles in Australia (DoEE, 2017) identifies chemical discharge as a relevant threat to marine turtles. Three species of turtle may occur within the operational area. The waters of the operational area or EMBA do not represent critical habitat for any species, however, the foraging behaviour for the Leatherback Turtle was identified as known to occur within the EMBA. Management measures listed in the Recovery Plan in relation to chemical discharges include implementation of best practices to minimise impacts to marine turtles and marine turtle habitat; and ensure spill risk strategies and response plans adequately include management for marine turtles and their habitats.

It is possible (although highly unlikely) that individual turtles may come into contact with accidental chemical and hydrocarbon spills, however, given the lack of regional habitat critical for the species, no predicted and significant impacts to populations will not occur. Impacts may occur to a small number of individuals should they be traversing the area when an accidental release occurs.

With the proposed controls in place, Woodside considers the potential impacts and risk to marine fauna including turtles from changes in water quality from unplanned discharges of chemicals and hydrocarbons are low. The proposed activity is not inconsistent with recovery plan for marine turtles, as impacts and risks associated with unplanned discharges of chemicals and hydrocarbons were considered in the Environmental Risk Assessment, and a range of control measures were identified and adopted during the ALARP assessments, as detailed below.

8.5.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) preventative controls accepted by Woodside to manage the risks associated with the unplanned discharge of chemicals and minor volumes of hydrocarbons are detailed below:

Table 8-11: Unplanned chemical and hydrocarbon discharge – control measures

Control Measure	Source of Requirement / Good Practice
Preventative Controls	
Bunding of equipment & chemicals	MODU Operator system & procedures Woodside procedures and standards
Spill clean-up equipment	MODU Operator system & procedures Woodside procedures and standards
Preventative Maintenance System (PMS)	MODU Safety Case & Management System Vessel Preventative Maintenance System

Control Measure	Source of Requirement / Good Practice
Diesel / liquid chemical bunkering checklist	Woodside procedures and standards – Drilling and Completions Marine Standard (DR-STD-PET-DC-0209)
Additional Opportunistic Controls	
None identified	-

8.5.5 Demonstration of ALARP

The potential for an unplanned discharge of chemicals or a minor spill during the *Minerva P&A and Field Maintenance activity* is considered a 'Type A' (lower order) risk based upon the Decision Context described in Section 6.1.1 of this EP. Given the routine nature of hydrocarbon and chemical handling aboard the MODU and vessels and the controls detailed above being consistent with both regulatory requirements and industry good practice, Woodside considers the impact has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls are required.

8.5.6 Demonstration of Acceptability

Woodside is satisfied that when the accepted controls detailed above are implemented the environmental performance outcome (EPO) of "No accidental release of chemicals or hydrocarbons to the marine environment" will be met, therefore Woodside considers the impact to be managed to an acceptable level. Additionally, consideration of listed species recovery plans, conservation advice and threat abatement plans relevant to chemical discharge/oil spills, marine pollution, and habitat degradation/modification (Table 8-7) have informed the development of control measures.

No concerns or objections regarding the potential for minor chemical or hydrocarbon spills during the activity have been raised by relevant stakeholders.

8.6 Unplanned Discharges – Solids

8.6.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Accidental release of solid objects overboard	Loss of solid waste or equipment overboard due to improper waste management or handling error.	Impacts to marine fauna (e.g. ingestion, entanglement) and seabed disturbance if object heavy enough to sink to the seabed. Dropped objects can occur (albeit highly unlikely) during cargo transfer operations.	10	Unlikely (0.1)	1	Type A Lower Order Risk	Tolerable

8.6.2 Source of Risk

The handling and storage of solid materials and waste on-board the MODU and vessels has the potential for accidental overboard release. In the normal course of operations, solid waste will be stored on the vessel until it is transported via port facilities for appropriate disposal at licensed on shore facilities. However, accidental releases to the marine environment are a possibility, especially in rough ocean conditions and high winds, when items have the potential to roll off or be blown off the deck, if not appropriately stored or secured.

General non-hazardous waste include general domestic and galley waste and recyclables such as scrap materials, cardboard packaging, wood, paper and empty containers. Volumes of non-hazardous waste generated on the vessels are generally low. Hazardous wastes are defined those wastes that are or contain ingredients harmful to health or the environment. Hazardous wastes likely to be generated on-board the vessel includes oil contaminated materials (e.g., sorbents, filters and rags), chemical containers and batteries, medical wastes, paints and aerosol cans. The volumes of hazardous wastes generated are relatively small.

Solid objects/ equipment has the potential to be accidentally released overboard from manual handling errors or unsecure/ unbalance loads during lifts. All non-buoyant solid waste material or dropped objects/ equipment are expected to remain within the operational area as they sink through the water column and settle on the seabed. Buoyant waste material lost overboard could potentially be carried by ocean currents beyond the operational area.

8.6.3 Environmental Impact Assessment

The known and potential impacts to the marine environment from the accidental release of hazardous solid waste/ materials and dropped objects include:

- Marine pollution and contamination (and a temporary and localised reduction in water quality);
- Ecotoxicological effects, injury or fatality of marine fauna through ingestion of, and entanglement in marine debris;
- Smothering of benthic habitats, if dropped object is heavy enough to sink to the seabed.

Heavier solid hazardous materials and objects/ equipment accidentally released overboard would sink to the seabed in the operational area. The area of impact would be limited to the footprint (size) of the object with physical disturbance to the benthic sediments and communities beneath the object. Unless retrieved, the disturbance would remain until the object eventually breaks down and disintegrates, which could potentially be many years, dependent on the waste material. There are no sensitive or unique marine habitats in the operational area and the consequence to benthic habitats and invertebrate communities is considered to be highly localised and negligible.

Marine debris is one of the world's five major marine pollutants (ANZECC, 1995) and is increasing worldwide. Harmful marine debris refers to all land-source garbage, plastics and floating non-biodegradable material that may cause harm to vertebrate marine species, including marine turtles, birds, marine mammals, fish, sharks and rays. During the P&A activities, there is the potential for impacts on marine fauna that come into contact with buoyant solid objects, such as packaging, plastic objects, etc. accidentally released overboard. Such objects could potentially be carried by ocean currents beyond the operational area.

Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in harmful debris was listed as a key threatening process under the EPBC Act in August 2003. Floating non-biodegradable marine debris has been highlighted as a threat to marine turtles, whales, whale sharks, albatrosses and giant petrels in the relevant recovery plans and approved conservation advice (refer to previous **Table** 4-5). The plans, conservation advice and the *Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans* (DoEE, 2018) have specified a number of recovery objectives and actions to help combat this threat.

The disposal of plastic materials at sea is totally prohibited by the International Convention for the Prevention of Pollution from Ships (MARPOL) to which Australia is a signatory. Given the typically small volumes of solid wastes that may be accidentally released during any given event, potential impacts to sensitive species are expected to be restricted to individual animals. Many of the vertebrate species considered vulnerable to marine debris occur seasonally or expected to occur in low densities (transiting the operational area).

8.6.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) preventative controls accepted by Woodside to manage the risks associated with the unplanned discharge of solids are detailed below:

Table 8-12: Unplanned solids discharge – control measures

Control Measure	Source of Requirement / Good Practice
Preventative Controls	
Preventative Maintenance System (PMS)	MODU Safety Case & Management System Vessel Preventative Management System
MODU Safety Case (NOPSEMA accepted)	Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009; MODU Operator system & procedures
Woodside Waste Management Plan	MARPOL 73/78 Annex III and V: Marine Order 94 (Packaged Harmful Substances) & Marine Order 95 (Garbage); and Woodside procedures and standards
Additional Opportunistic Controls	
None identified	-

8.6.5 Demonstration of ALARP

The potential for an unplanned release of solid waste or objects during the *Minerva P&A and Field Maintenance activity* is considered a 'Type A' (lower order) risk based upon the Decision Context described in Section 6.1.1 of this EP. Given the routine nature of lifting and transfer operations aboard the MODU and vessels and the controls detailed above being consistent with both regulatory requirements and industry good practice, Woodside considers the impact has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls are required.

8.6.6 Demonstration of Acceptability

Woodside is satisfied that when the accepted controls detailed above are implemented the environmental performance outcome (EPO) of “No unplanned release of solid waste or objects to the marine environment” will be met, therefore Woodside considers the impact to be managed to an acceptable level. Additionally, consideration of listed species recovery plans, conservation advice and threat abatement plans relevant to the impacts of marine debris (Table 8-7) have informed the development of control measures.

No concerns or objections regarding the potential for the unplanned release of solid waste or objects during the activity have been raised by relevant stakeholders.

8.7 Marine Fauna Interaction

8.7.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Interaction with marine fauna	Accidental collision between vessels and marine fauna	Potential lethal impact or injury to protected marine species.	10	Highly Unlikely (0.03)	0.3	Type A Lower Order Risk	Tolerable

8.7.2 Source of Risk

The physical presence and/ or movements of the vessels in and around the operational area may present a potential hazard to slow moving marine megafauna (cetaceans). Vessel movements can result in collisions between the vessel (hull, propellors) and marine fauna, with potential impacts ranging from minor behavioural interferences (e.g. avoidance) to severe impacts such as injury and mortality through vessel strikes. Potential behavioural responses to underwater noise emissions during the petroleum activity are discussed in Section 7.6.3.

The vessels will be either stationary or moving at low speeds when supporting the MODU. The risk period is restricted to the duration that a vessel is on location in the operational area (intermittently over 2 months).

8.7.3 Environmental Impact Assessment

Considering the limited vessel movements associated with supporting the P&A activity and the low vessel speeds in the operational area, it is unlikely that the activity will have a significant impact on migratory fauna species or other transiting marine fauna that may be present. In the highly unlikely event of a whale or turtle mortality, the effect is not likely to be significant (as defined by EPBC Act significance impact guidelines) at the population level.

Vessel collisions have been known to contribute to the mortality of marine fauna including resident and migrating turtles (Hazel and Gyuris, 2006; Hazel *et al*., 2007) and migratory whales (Laist *et al.*, 2001; Jensen and Silber, 2003). For both whales and turtles, the risk of lethal collision is a function of abundance of animals in the area of operations, probability of a collision and the probability of that collision being fatal.

Cetaceans

The Conservation Management Plan (CMP) for the Blue Whale (DoE, 2015a) identifies vessel disturbance as a potential threat to the blue whale. The CMP states, vessel disturbance can occur in the form of collisions or by disrupting the behaviour of animals. Vessel collision can lead to mortality or significant injury, and could impede recovery of blue whale populations. Vessel disturbance or collisions can result from industrial, recreational or commercial activities including whale watching.

The likelihood of vessel-whale collision being lethal is influenced by vessel speed. The risk of a collision causing mortality of the whale increases as the vessel speed increases (Laist *et al*., 2001; Jensen and Silber, 2003). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike declines from 80% at 15 knots to about 20 % at 8.6 knots.

The AHTS vessels are either stationary or moving slowly (~4 knots) in the operational area, hence the chance of a vessel-whale collision resulting in lethal outcome within these waters is much reduced. According to the data of Vanderlaan and Taggart (2007), it is estimated that the risk is less than 10% at a speed of 4 knots. Vessel-whale collisions at this speed are uncommon and, based on reported data contained in the US National Ocean and Atmospheric Administration database (Jensen and Silber, 2003) there only two known instances of collisions when the vessel was travelling at less than 6 knots, both of these were from whale watching vessels that were deliberately placed amongst whales.

The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when in the vicinity of a vessel while others are known to be curious and often approach vessels that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster moving vessels (Richardson *et al*., 1995).

The operational area intercepts a high annual use BIA for the pygmy blue whale. The worst-case consequence from a vessel strike would be the fatality of a single EPBC Act-listed individual species, however as they would represent an individual within the local population it is not expected that it would result in a decreased population size. However, considering the low vessel movements and low vessel speeds in the operational area, it is unlikely there would be a significant impact on cetaceans at the population level.

Turtles

There is no available data on factors affecting the likelihood of a vessel-turtle collision being lethal. It is reasonable to assume that the higher the speed of collision, the greater the risk of mortality, but contact with the propeller would be lethal at almost all speeds. Studies have shown that turtles are less likely to flee from a fast moving vessel, presumably because of poor hearing and visual senses than from a slow-moving vessel (Hazel *et al*., 2007).

Considering the limited vessel movements and the low speeds in the operational area, it is unlikely that presence of the vessel will have a significant impact on turtles at the population level.

Species Recovery Plans and Approved Conservation Advice

Woodside has considered information contained in relevant recovery plans and approved conservation advice for cetaceans and marine turtles that identify vessel strike as a threat (**Table** 4**-**5).

Woodside has evaluated the impacts and risks associated with vessel strike and vessel disturbance. Woodside considers the proposed activity is not inconsistent with recovery plans for cetaceans, the Conservation Management Plan (CMP) for the Blue Whale or recovery plans for marine turtles, as impacts and risks associated with marine fauna interaction were considered in the Environmental Risk Assessment, and a range of preventative controls were identified and adopted during the ALARP assessments, as detailed below.

8.7.4 Control Measures

The clearly defined regulatory, corporate and industry (good practice) preventative controls accepted by Woodside to manage the risks associated with unplanned marine fauna interactions are detailed below:

Table 8-13: Unplanned marine fauna interactions – control measures

Control Measure	Source of Requirement / Good Practice
Project Induction	EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans
Woodside Whale, Dolphin and Whale Shark Sightings Cards	EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans; NOPSEMA Bulletin – 'Recording and Reporting MMO Data'; and Conservation Management Plan (CMP) for the Blue Whale (Action Area A.4)
Additional Opportunistic Controls	

Control Measure	Source of Requirement / Good Practice
Additional opportunistic control relevant the further reduction in risk of unplanned marine fauna interactions are detailed within Table 7 9: Detailed engineering assessment – noise emissions. These controls are not replicated within this section.	

8.7.5 Demonstration of ALARP

The potential for an unplanned marine fauna interactions during the *Minerva P&A and Field Maintenance activity* is considered a 'Type A' (lower order) risk based upon the Decision Context described in Section 6.1.1 of this EP. Given the routine nature of AHTS vessel operations and the controls detailed above being consistent with both regulatory requirements (and industry good practice, Woodside considers the impact has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls are required. Additional opportunistic controls have been considered but not adopted.

8.7.6 Demonstration of Acceptability

Woodside is satisfied that when the accepted controls detailed above are implemented the environmental performance outcome (EPO) of "No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)" will be met, therefore Woodside considers the impact to be managed to an acceptable level. Additionally, consideration of listed species recovery plans, conservation advice and threat abatement plans relevant to the impacts of Vessel disturbance/ strike (**Table** 4-5) have informed the development of control measures.

No concerns or objections regarding the potential for marine fauna interaction during the activity have been raised by relevant stakeholders.

8.8 Introduction of Invasive Marine Species

8.8.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Introduced marine species	Movement of MODU, AHTS vessels and immersible equipment from known high invasive marine species risk areas	Introduction of invasive marine species to area leading to major impact to native species.	100	Highly Unlikely (0.03)	3	Type A Low Order Risk	Tolerable

8.8.2 Source of Risk

Biofouling on immersed surfaces (e.g. ship hulls), floating/ immersible equipment and within internal seawater circulation systems, as well as ballast water, are potential pathways for invasive marine species (IMS) to translocate on offshore vessels.

There is the potential for the transfer of IMS from international waters into the operational area, and given the water depths it is possible that IMS could establish in the local environment. There is a smaller risk of transfer of IMS from Australian waters.

The MODU is yet to be contracted, but would likely be mobilised to site from within the region. Likewise, it is likely that the AHTS vessels would also be mobilised to site from within the region.

Ballast Water

The Commonwealth Department of Agriculture, Water and the Environment (DAWE) is the lead agency for management of ballast water, with responsibility (formerly the Department of Agriculture). Vessels manage ballast water in accordance with International Maritime Organisation (IMO) Ballast Water Management (BWM) Convention, IMO Guidelines, the mandatory Australian Ballast Water Management Requirements (Rev 8) are enforced under the *Biosecurity Act 2015* and associated local measures intended to minimise the risk of transplanting harmful aquatic organisms and pathogens from ships' ballast water and associated sediments, while maintaining ships safety. Contracted vessels have individual Ballast Water Management Plans.

Vessels arriving from overseas, intending to discharge trim or ballast water in coastal Australian waters are required to have undertaken a ballast water exchange in accordance with Department of Agriculture, Water Resources requirements. The Australian Ballast Water Management Requirements (Rev 8) are now aligned with the (BWM) Convention:

- All vessels must carry a valid Ballast Water Management Plan;
- Vessels with a ballast water management system (BWMS) should also carry a Type Approval Certificate specific to the type of BWMS;
- All vessels must submit a Ballast Water Report. Vessels intending to discharge ballast are obligated to report;
- International vessels can submit a Ballast Water Report through the Maritime Arrivals Reporting;
- System (MARS) at least 12 hours prior to arrival;
- All vessels must maintain a complete and accurate record of all ballast water movements; and

- Domestic trading vessels can request a low risk exemption through a Domestic Risk Assessment. All applications must be submitted through MARS.

From September 2019, all vessels that use ballast water are required to meet the Regulation D2 discharge standard of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (the Convention) at their next renewal survey. Vessels using ballast water exchange as their primary ballast water management method are required to phase out this management method and meet the Regulation D2 discharge standard. Vessels may meet this standard by installing an International Maritime Organisation (IMO) Type Approved ballast water management system, or as specified within the Convention.

The AHTS vessels will exchange ballast water outside ports where possible.

The proposed control measures for IMS introduced by ballast water are consistent with the Australian Ballast Water Management Requirements (Rev 8). They are also consistent with good oilfield practice.

Biofouling

Biofouling on vessel hulls, external niche areas and immersible equipment pose a potential risk of IMS in Australian waters. Under the National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry and IMO Guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (resolution MEPC.207(62), DAWR and DoEE guidelines and Woodside IMS Management Procedure a risk assessment approach is applied to manage biofouling.

The Woodside IMS Management Procedure outlines:

- Regulatory Framework for management of IMS;
- Identify Woodside's marine activities at risk of facilitating introduction/translocation of IMS into Victorian and Commonwealth waters;
- Woodside and Contractors roles and responsibilities;
- The Woodside IMS Risk Assessment & Approval Procedure (AOHSE-E-0018-001) for assessing vessel and immersible equipment for IMS risk that is in alignment with NOPSEMA's Information Paper (IP1899) on '*Reducing Marine Pest Biosecurity Risks through Good Practice Biofouling Management*' (NOPSEMA, 2020). The Woodside IMS Risk Assessment & Approval Procedure (AOHSE-E-0018-001) considers the following variables:
    - History of the vessel, including destination and time spent in last port of call;
    - Equipment deployment and cleaning history;
    - Status of anti-fouling coating and marine growth protection system;
    - Independent biofouling inspection results and timing; and
    - Ballast water management including water exchange and origin.
- Management and mitigation measures to prevent IMS incursions and manage identified bio-fouling pre hire and post-mobilisation.
    - All contracted vessels are required to complete the Woodside IMS risk assessment process described in this procedure. The IMS risk assessment assigns a final risk category of low, moderate, uncertain or high) to vessels based on a range of information listed above. If a risk category of moderate, uncertain or high is scored, a range of management options are available including inspections, cleaning or treatment of internal seawater systems.
    - Provide all documentation to Woodside during the Marine Management Process prior to hire; and
    - Any vessel contracted for greater than 12 months will be audited annually.

8.8.3 Environmental Impact Assessment

The present knowledge base is inadequate to produce a detailed character profile of all marine organisms that may be translocated by shipping beyond their natural range. Ruiz *et al*. (2000) have analysed the common factors influencing success of translocated marine pests. The majority of marine pest species appear to have planktotrophic larvae, however oviparous species are included. Many of them are epibenthic fouling species but some are soft substratum burrowers or planktonic. It seems likely that many of them are transported as ship bottom fouling organisms rather than as propagules in ballast water.

IMS may be economically damaging, including direct damage to assets (fouling of vessel hulls and infrastructure), depletion of commercial marine species, and damage to recreational vales of the area (tourism and recreational fishing). Furthermore, once introduced to an area, eradication or control of introduced species may be difficult, expensive and disruptive or damaging to other marine life.

8.8.4 Control Measures

Given the offshore location in water depths of approximately 50-60m, the potential introduction of invasive marine species during the *Minerva P&A and Field Maintenance activity* is considered a 'Type A' (lower order) risk based upon the Decision Context described in Section 6.1.1 of this EP. The clearly defined regulatory, corporate and industry (good practice) controls accepted by Woodside to manage the risks associated with the introduction of invasive marine species are detailed below:

Table 8-14: Introduction of invasive marine species – control measures

Control Measure	Source of Requirement / Good Practice
International Anti-Fouling System Certificate for each AHTS vessel	Marine Orders 8 - Part 98: Marine Pollution - Anti-fouling Systems: International Convention on the Control of Harmful Anti-fouling Systems on Ships (IMO, 2001).
MODU and AHTS vessels have: **Ballast Water Management Plan:** Exchange ballast water outside 12 nmi from the nearest land in water depths greater than 50 m or treat ballast water using approved ballast water treatment system	*Biosecurity Act 2015*, Biosecurity (Ballast Water and Sediment) Determination 2017 Australian Ballast Water Management Requirements (Rev 8)
MODU and AHTS vessels have: **Ballast Water Management Certificate**	
Ballast Water Record System with a minimum of 2 years records retained on board	
AHTS vessels have: **Biofouling Management Plan** and record book consistent with IMO Biofouling Guidelines.	Australian Biofouling Management Requirements (Proposed) consistent with International Maritime Organization (IMO) 2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species
Cleaning of Submersible Equipment Submersible equipment cleaned of biofouling prior to entry to operational area	National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018)
Woodside Introduced Marine Species Risk Assessment and Approval Procedure (AOHSE-E-0018-001)	Woodside procedures and standards consistent with IMO Guidelines
Additional Opportunistic Controls	
None identified	-

8.8.5 Demonstration of ALARP

Given the potential introduction of invasive marine species during the *Minerva P&A and Field Maintenance activity* is considered a 'Type A' (lower order) risk and there are clearly defined and applicable regulatory, corporate and industry good practice controls to manage the risk, Woodside considers the risk has been managed to ALARP and no further detailed engineering evaluation of alternate, additional or improved controls is required.

8.8.6 Demonstration of Acceptability

All identified regulatory, corporate and industry good practice controls have been accepted for implementation. Consideration of actions prescribed in list species recovery plans, conservation advice and threat abatement plans (**Table** 4-5) have been assessed. While a number of these consider the threat of habitat degradation and modification, none are specifically relevant to the potential introduction and establishment of invasive marine species within the operational area. Other aspects of the activity relevant to these plans and advices are detailed within subsequent sections of this EP.

Woodside is satisfied that when the accepted controls are implemented the environmental performance outcome (EPO) of "No introduction of invasive marine species" will be met, therefore Woodside considers the impact to be managed to an acceptable level.

9 Environmental Performance

The following EPOs, EPSs and measurement criteria have been established to manage the environmental impacts and risks associated with the activity assuming the implementation of the accepted control measures detailed in Sections 7 & 8.

9.1 Environmental Performance: Planned Activities

Table 9-1: Environmental performance – physical presence

Physical Presence			
Environmental Performance Outcome	**EPO 01: No unplanned vessel interactions (including collision)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
01	**Navigation equipment** (including lighting, compass/radar), bridge and communication equipment will be compliant with appropriate marine navigation and vessel safety requirements.	Completed Vessel Assurance Questionnaire for each vessel prior to entering field demonstrating compliance with relevant Marine Orders and confirming functioning navigation equipment.	Woodside Logistics Supervisor
02	**Automatic Identification System (AIS)** shall be fitted aboard both the MODU and vessels and maintained in accordance with Regulation 19-1 of Chapter V of SOLAS.	Completed Vessel Assurance Questionnaire for each vessel prior to entering field demonstrating compliance Regulation 19-1 of Chapter V of SOLAS.	Vessel Master / MODU Operator
03.1	**Stakeholder Communication:** The following notifications shall be issued: • Australian Hydrographic Office (AHO) shall be notified no less than four working weeks prior to commencement of activity in order to promulgate 'Notice to Mariners' to be published;	Documented notification to AHO and AMSA's JRCC within required timeframes prior to undertaking the activity.	MODU OIM / Woodside Drilling Superintendent / Vessel Master

Physical Presence			
Environmental Performance Outcome	**EPO 01: No unplanned vessel interactions (including collision)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• AMSA's JRCC will be notified at least 24-48 hours prior to commencement of the activity to enable AMSA to distribute an AUSCOAST warning. Notification shall include: MODU's details (including name, callsign and Maritime Mobile Service Identity), satellite communications details (including INMARSAT-C and satellite telephone), and location of activity / operational area (500 m RSEZ & 1 km cautionary zone). • Department of Jobs, Precincts and Regions (DJPR) pre-start notification confirming the start date of the proposed activity		
03.2	**Stakeholder Communication:** Prior to undertaking the activity, relevant Stakeholders shall be notified of the proposed activity location, scope and timing if requested.	Consultation records confirm relevant Stakeholder informed of proposed activity scope and timing prior to undertaking the activity.	Woodside HSE Specialist
03.3	**Stakeholder Communication:** Relevant Stakeholders requiring ongoing consultation regarding the physical presence of the MODU during the activity shall be supplied information consistent with requirements identified during the Stakeholder consultation process (as detailed in Section 5 and 10.5.1 of this EP).	Consultation records confirm ongoing consultation with relevant Stakeholders undertaken during the activity.	Woodside HSE Specialist
04	**Public Information:** Woodside shall establish and maintain a publicly available interactive map which provides stakeholders with updated information on the offshore petroleum activities being conducted as part of the Minerva Field decommissioning program	Regional interactive map available	Woodside HSE Specialist
05	**Rig Safety Exclusion Zone:** When moored on location within the operational area:	MODU Marine Logbook records demonstrating:	MODU OIM (or delegate)

Physical Presence			
Environmental Performance Outcome	**EPO 01: No unplanned vessel interactions (including collision)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• A 500-m rig safety exclusion zone (RSEZ) shall be established and monitored around the MODU; and • Entry into the RSEZ shall be managed via the Control Room aboard the MODU.	• Managed & safe entry of AHTS vessels into RSEZ	
06.1	**Training & Competency:** Vessel and MODU crew undertaking vessel bridge-watch shall be qualified in accordance AMSA Marine Order Part 3: Seagoing Qualifications or certified training equivalent.	Completed Vessel Assurance Questionnaire for each vessel prior to entering field demonstrating compliance with AMSA Marine Order Part 3: Seagoing Qualifications	Vessel Master / MODU OIM (or delegate)

Table 9-2: Environmental performance – benthic habitat disturbance

Benthic Habitat Disturbance			
Environmental Performance Outcome	**EPO 02: Benthic habitat and biota disturbance limited to operational area**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
07	**Rig Mooring & Positioning Plan:** A Rig Move and Positioning Plan shall be developed inclusive of: • A site-specific mooring analysis consistent with API RP 2SK – 'Mooring Analysis' identifying the type, number and size of mooring equipment required to secure the MODU on location; • Provision for mooring tension monitoring aboard the MODU consistent with ISO 19901-7:2013 – 'mooring tensioning';	Documented Rig Move and Positioning Plan inclusive of identified performance standards. MODU control room logbook documenting monitoring of mooring tensions or validate of electronic monitoring via MODU inspection;	Woodside Drilling Superintendent / MODU OIM (or delegate)

Benthic Habitat Disturbance			
Environmental Performance Outcome	**EPO 02: Benthic habitat and biota disturbance limited to operational area**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• Pre-identified mooring locations within the 1km operational area including consideration of avoidance of existing subsea infrastructure; and • Consistent with the requirements of section 572 of the OPGGS Act, all mooring equipment shall be removed from the seabed upon completion of the P&A activity.	Site survey records and final deployment location considering benthic assemblages; Activity Report confirming removal of all mooring equipment following activity completion.	

Table 9-3: Environmental performance – noise emissions

Noise Emissions			
Environmental Performance Outcome	**EPO 03: No physical and/or observable biologically important behavioural disturbance on protected species (including breeding, foraging, resting or migration)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
08.1	**Project Induction:** Contracted Vessel Crew shall undertake a project-specific induction covering EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans to inform the following requirements for AHTS vessel whilst conducting activities in the operational area: • Vessels shall not knowingly travel greater than 6 knots within 300 m of a cetacean or turtle (caution zone) and minimise noise; • Vessels shall not knowingly approach closer than 100 m for a large whale, or 50 m of a dolphin or turtle (except for bow riding); • Vessel Masters identifying a cetacean showing signs of being disturbed, shall immediately withdraw from the caution zone at a constant speed of less than 6 knots;	Environment induction attendance records demonstrate vessel crews are aware EPBC Regulations 2000 Part 8 Division 8.1	Woodside HSE Specialist / Logistics Supervisor

Noise Emissions			
Environmental Performance Outcome	**EPO 03: No physical and/or observable biologically important behavioural disturbance on protected species (including breeding, foraging, resting or migration)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• Vessels shall move at a constant slow speed and with minimal noise away from a cetacean that is approaching so that the vessel remains at least 300 m from the cetacean; and • Overview of Adaptive Management Plan for potential interactions with pygmy blue whales.		
08.2	**Project Induction:** Contracted aircraft service providers shall be provided a project-specific induction material covering EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans to inform the following requirement for aircraft transiting to and from the MODU: Whilst entering or departing the operational area helicopters shall not fly lower than 1,650 ft when within 500 m horizontal distance of a cetacean except when landing or taking off and shall not approach a cetacean from head on.	Records confirming EPBC Regulations 2000 Part 8 Division 8.1 relating to helicopter flight requirements relayed to aircraft service providers.	Woodside HSE Specialist / Logistics Supervisor
09	**Woodside Whale and Dolphin Sightings Cards:** Whilst undertaking petroleum activities Vessel and MODU Crew shall be requested to complete and submit Woodside Whale & Dolphin Sightings Cards upon sighting cetaceans. The completed cards are to be consolidated by the Vessel Master / MODU OIM (or delegate) and forwarded to the Woodside HSE Team for reporting to DAWE.	Completed Woodside Whale & Dolphin Sightings Cards consolidated and reported to DAWE.	Woodside HSE Specialist Vessel Master (or delegate) MODU OIM (or delegate)
10.1	**Preventative Maintenance System (PMS):** Whilst undertaking the activity, all engines, compressors and machinery aboard the MODU shall be maintained in accordance with Rig Contractor PMS with the aim of limiting unnecessary noise emissions from equipment.	Drilling Contractor PMS records	MODU OIM (or delegate)
10.2	**Preventative Maintenance System (PMS):** Whilst undertaking the activity, all engines, compressors and machinery aboard the AHTS vessels shall be maintained in accordance with Vessel Operator PMS with the aim of limiting unnecessary noise emissions from equipment.	Vessel Operator PMS records	Vessel Master (or delegate)

Noise Emissions			
Environmental Performance Outcome	**EPO 03: No physical and/or observable biologically important behavioural disturbance on protected species (including breeding, foraging, resting or migration)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
11	**Avoid Periods of Peak Blue Whale Aggregation / Feeding:** P&A activities shall only be undertaken from 1st April to 31st December (outside peak blue whale aggregation / feeding months).	Pre-start notifications to NOPSEMA	Woodside Drilling Manager
12	**Dedicated Marine Mammal Observers (MMOs) during periods of known blue whale aggregation / feeding (November - May)** Dedicated Marine Mammal Observers (MMOs) shall be stationed aboard the MODU and/or vessels during periods of known blue whale aggregation / feeding (November - May). Observation records of shall be used to inform the adaptive Management Plan (detailed below). During routine MODU operations, MMOs shall be instructed to observe a minimum of 2km from the MODU to inform adaptive management should a pygmy blue whale approach within 1km of the MODU. Prior to vessel resupply operations, MMOs shall be instructed to observe a minimum of 8km from the MODU to inform adaptive management should a pygmy blue whale approach within 7km of the MODU.	MMO Training Records Completed Woodside Whale and Dolphin Sightings Cards. Vessel and MODU logbooks.	
13	**Marine Mammal Observations (non-dedicated) June – October** Opportunistic marine mammal observation shall be undertaken aboard both the MODU and vessels within the permit boundaries over from June to October.	Completed Woodside Whale and Dolphin Sightings Cards. Vessel and MODU logbooks.	Vessel Master (or delegate) MODU OIM (or delegate)
14	**Adaptive Management Plan** Upon the detection of a pygmy blue whale from November to May, the following adaptive management controls shall be implemented: During routine MODU operations, should a pygmy blue whale approach within 1km of the MODU, MODU power generation shall be limited to the minimum required for safe operations. Vessel resupply operations shall only commence once the MMO has confirm no observations of pygmy blue whale within 7km of MODU.	Completed Woodside Whale and Dolphin Sightings Cards. Vessel and MODU logbooks.	Vessel Master (or delegate) MODU OIM (or delegate)

Noise Emissions			
Environmental Performance Outcome	**EPO 03: No physical and/or observable biologically important behavioural disturbance on protected species (including breeding, foraging, resting or migration)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	At all times, vessels shall comply with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.		

Table 9-4: Environmental performance – atmospheric emissions

Routine and Non-Routine Atmospheric Emissions			
Environmental Performance Outcome	**EPO 04: Planned atmospheric emissions limited to those necessary to undertake the activity and maintain well integrity.**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
15.1	**Well Operations Management Plan (WOMP)** (NOPSEMA accepted): Wells shall be managed in accordance with a NOPSEMA accepted WOMP, which includes well integrity management to prevent the risk of unplanned hydrocarbon releases and subsequent atmospheric emissions.	Acceptance letter from NOPSEMA demonstrated WOMP accepted prior to commencement of activities.	Woodside Drilling Superintendent
16.1	**MODU Safety Case** (NOPSEMA accepted): Includes standard operating procedures for venting / flaring gas and waste incineration requirements onboard the MODU.	Inspection records confirm standard operating procedure for venting off hydrocarbon gas volumes as required under NOPSEMA accepted MODU Safety Case.	MODU OIM (or delegate)
17	**Marine Order 97 (Marine Pollution Prevention – Air Pollution (as applicable to vessel class):** During the activities the follow shall apply: • Very low sulphur fuel oil (VLSFO) (e.g. maximum 0.50% S VLSFO-DM, maximum 0.50% S VLSFO-RM) shall be used in AHTS vessels and for power generation aboard the MODU.	Fuel bunkering receipts indicate only very low sulphur fuel used. Completed Vessel Assurance Questionnaire for each vessel	Woodside Logistics Supervisor / Vessel Master / MODU OIM (or delegate)

Routine and Non-Routine Atmospheric Emissions			
Environmental Performance Outcome	**EPO 04: Planned atmospheric emissions limited to those necessary to undertake the activity and maintain well integrity.**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• AHTS vessels shall hold a current International Air Pollution Prevention (IAPP) Certificate, as appropriate to vessel class. • AHTS vessels shall implement their Ship Energy Efficiency Management Plan (SEEMP) to monitor and reduce air emissions (as appropriate to vessel class). • Any equipment containing ozone-depleting substances (ODS) shall be maintained and, in the case of a vessel having rechargeable systems containing ODS, an ODS Record Book shall be maintained on board • There shall be no discharge of ODS. • No waste shall be incineration onboard the MODU.	prior to entering field demonstrating each vessel has: • Valid International Air Pollution Prevention Certificate (IAPP); • Documented SEEMP and • An ODS Record Book (where applicable) is current and maintained. No waste incineration recorded in the MODUs Garbage Record Book.	
10.3	**Preventative Maintenance System (PMS):** Whilst undertaking the activity, all engines, compressors and machinery aboard the MODU shall be maintained in accordance with Rig Contractor PMS with the aim of optimising fuel efficiency of equipment.	Drilling Contractor PMS records	MODU OIM (or delegate)
10.4	**Preventative Maintenance System (PMS):** Whilst undertaking the activity, all engines, compressors and machinery aboard the AHTS vessels shall be maintained in accordance with Vessel Operator PMS with the aim of with the aim of optimising fuel efficiency of equipment.	Vessel Operator PMS records	Vessel Master (or delegate)
18	**Vessel Tender Process:** Woodside shall include the following within the vessel tendering (procurement) process for the P&A program and priority shall be afforded to: • battery-assisted vessel options if minimum performance capacity can be demonstrated;	Vessel tender records Vessel contract records	Woodside Drilling Superintendent

Routine and Non-Routine Atmospheric Emissions			
Environmental Performance Outcome	**EPO 04: Planned atmospheric emissions limited to those necessary to undertake the activity and maintain well integrity.**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• vessels with 'drop-down' thrusters; and • vessels with inbuilt fuel oil flow monitoring equipment to enable real-time fuel use monitoring; and • Vessel Operators adopting measurable fuel efficiency KPIs within vessel contracts, linked to objectives of Vessel Emission Reduction Plans (see item below).		
19	**Vessel Emissions Reduction Plan:** Woodside shall develop a vessel emissions reduction plan. The plan shall be developed in consultation with the vessel Operator and Master with the aim of reducing overall fuel oil consumption during the activity and include: • a Daily Vessel Report (DVR) for monitoring vessel fuel oil consumption; • a process for review of data via the DVR; • a feedback process whereby recommendations of vessel power management systems for optimisation of the optimisation of fuel oil consumption when working in-field except whilst working within the MODU 500m RSEZ, station keeping or in port limits.	Daily Vessel Report (DVR) records Fuel use optimisation feedback recommendation records Vessel fuel consumption records	Woodside Drilling Superintendent / Vessel Master
20	**NGER Reporting:** Woodside will monitor atmospheric emission from the activity consistent with the National Greenhouse and Energy Reporting Act and report these emissions to the Clean Energy Regulator on an annual basis.	Woodside Emission Records	Woodside HSE Specialist
21	**Emissions Monitoring:** Woodside shall monitor and record emissions from the activity to enable the tracking of performance against Woodside Corporate emissions reductions targets.	Woodside Emission Records	Woodside HSE Specialist

Table 9-5: Environmental performance – marine discharges

Routine and Non-Routine Marine Discharges			
Environmental Performance Outcome	**EPO 05: Impacts to water quality from planned discharges reduced to ALARP**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
22	**Macerator for putrescible waste:** Whilst undertaking the activity putrescible and other food waste discharge from the MODU shall be macerated to ≤25 mm prior to overboard discharge.	Records confirm that putrescible waste macerated to ≤25mm within operational area. Maintenance records demonstrate that there is a functioning macerator onboard the MODU.	MODU OIM (or delegate)
23	**IOPP Certificate:** Prior to mobilisation to the operational area, Woodside shall confirm that both the MODU and AHTS vessels hold current IOPP certificate.	MODU inspection records and completed Vessel Assurance Questionnaire for each vessel prior to entering field demonstrating each vessel holds a current IOPP certificate accordance with Marine Order 91.	Woodside Logistics Supervisor
24	**MARPOL-compliant oily water filter system:** • Liquids with oil in water content exceeding 15 ppm must be contained and disposed of at a licensed onshore reception facility or to a carrier licensed to receive waste; and • Liquid from drains may only be discharged if the oil in water content does not exceed 15 ppm after treatment in a MARPOL-compliant oily water filter system.	Oil in water meter must be operational as evidenced by record of calibrations prior to discharge. Oil Record Book is in place in accordance with Marine Order 91. Documented use of oil record book to record all oil requiring disposal onshore.	Vessel Master / MODU OIM (or delegate)
25	**ISPP Certificate & Sewage Treatment Plant (STP):** Prior to mobilisation to the operational area, Woodside shall confirm that both the MODU and AHTS vessels hold current ISPP certificate and have functioning sewage treatment plants (STP).	MODU inspection records and completed Vessel Assurance Questionnaire for each vessel prior to entering field demonstrating each vessel has a	Woodside Logistics Supervisor

Routine and Non-Routine Marine Discharges			
Environmental Performance Outcome	**EPO 05: Impacts to water quality from planned discharges reduced to ALARP**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
		valid International Sewage Pollution Prevention (ISPP) Certificate in accordance with MARPOL Annex IV and Marine Order 96.	
26	**Discharge Location:** Whilst undertaking the activity there shall be: • No discharge of untreated sewage within 12 nmi of the territorial baseline. • No discharge of treated sewage within 3 nmi of the territorial baseline. • No discharge of sewage to cause discoloration or visible solids.	Inspection records confirm: • No discharge of untreated sewage within 12 nmi of territorial baseline; and • No discharge of treated sewage within 3 nmi of the territorial baseline. • No discharge of sewage to cause discoloration or visible solids.	Vessel Master
27	**Chemical Assessment Process:** Cement products and other chemicals that may be discharged to the marine environment shall be assessed based upon the following criteria: Where Offshore Chemical Notification Scheme (OCNS) rating of D or E or a CHARM rating of Silver or Gold rated chemicals with no substitution warning intended for liquid discharge are used, no further control required; If other non-rated chemicals intended for liquid discharge are used, or rated chemicals with a substitution warning, chemical selection procedures described in Hazardous Materials Acquisition Environmental Supplement (AO-HSE S-0002) shall be followed; and Additionally, deck cleaning products planned to be released to sea from the vessel meet the criteria for not being harmful to the marine environment according to MARPOL Annex II	Documentation showing that chemicals discharged to the marine environment are ranked D or better on OCNS ranked list or Silver or better on CHARM rating with no substitution warning. Where chemicals are to be discharged to the marine environment are not D/ E rated through OCNS or Gold/ Silver rated through CHARM, or rated chemicals with a substitution warning, then documented evidence to show that Hazardous Material Procedure has been followed.	Woodside HSE Specialist

Routine and Non-Routine Marine Discharges			
Environmental Performance Outcome	**EPO 05: Impacts to water quality from planned discharges reduced to ALARP**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
		Inspection records show deck cleaning products meet MARPOL Annex II requirements.	
28	**Cement Management:** • Cement volume requirements shall be calculated to determine the required volume of cement to reduce the potential for overboard discharge of surplus cement (dry or slurry); and • Records of cement volumes used and discharged shall be maintained.	Records of cement calculations done prior to the cement job. Well cement report documents volumes of cement used and discharged.	Woodside Drilling Engineer

Table 9-6: Environmental performance – waste management

Waste Management			
Environmental Performance Outcome	**EPO 06: No unplanned release of solid waste or objects to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
29.1	**Waste Management:** Whilst undertaking the activity the following shall apply: • all solid, liquid and hazardous waste (other than sewage, grey water, putrescible wastes and surplus cement) generated during the activity shall be sent ashore for recycling, disposal or treatment; • machinery space oily water exceeding 15 ppm must be contained and disposed of at a licensed onshore reception facility or to a carrier licensed to receive waste. • Waste to be stored in clearly marked and covered waste containers and inspected by containment specialist; and	Waste records for the MODU and vessels maintained in Garbage Record Book or manifests, including transport, treatment, recycling and disposal. Fate of dropped objects documented.	MODU OIM (or delegate) / Vessel Master

Waste Management			
Environmental Performance Outcome	**EPO 06: No unplanned release of solid waste or objects to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• Dropped objects or waste lost overboard shall be recovered where safe and practicable to do so.		
08.3	**Project Induction:** MODU & contracted Vessel Crew shall undertake a project-specific induction covering waste management requirements for the project.	Environment induction attendance records demonstrate MODU & vessel crews are aware of project waste management requirements.	Woodside HSE Specialist

9.2 Environmental Performance: Unplanned Events

Table 9-7: Environmental performance – loss of well control

Hydrocarbon Release – Loss of Well Control			
Environmental Performance Outcome	**EPO 08: No accidental release of chemicals or hydrocarbons to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
15.2	**Woodside WOMP** (NOPSEMA accepted) demonstrating compliance with: • Regulatory requirements; • Woodside Petroleum Well Integrity Standard (DR-STD-PET-DC-0193); • Woodside Petroleum Well Control Standard (DR-STD-PET-DC-0211); • Woodside Well & Seismic Delivery (WSD) Organisation, Development and Training Standard (DR-STD-PET-DC-0123); and • Woodside Petroleum Cementing Standard (DR-PET-STD-DC-0142).	Acceptance letter from NOPSEMA demonstrates WOMP accepted prior to commencement of activities.	Woodside Drilling Superintendent
16.2	**MODU Safety Case** (NOPSEMA accepted): Demonstrating compliance with regulatory requirements & MODU Operator systems & procedures inclusive of well control arrangements.	Records confirm NOPSEMA accepted MODU Safety Case.	MODU OIM (or delegate)
30	**Woodside MODU Safety Case Revision** consistent with: • MODU Operator systems & procedures; • Woodside Incident and Crisis Management Procedure (WM0000PG10078169); and • Critical Control Performance Standard: Weather Monitoring and Planning (PET-GDC20-DR-PRD-00061)	Records confirm Woodside MODU Safety Case Revision in place prior to undertaking the activity.	Woodside Drilling Superintendent
06.2	**Training and Competency:** Supervisors involved in well control, shall have a valid supervisory-level certificate from a well control accredited program (IWCF or IADC WellSharp) renewed every two years. No one shall relieve the Driller/Operator without the appropriate well control certification. Driller and Assistant Drillers shall hold a valid Driller-level Well Control Certificate, renewed every two years.	Well control training records confirm minimum well control training standards for relevant personnel.	Woodside Head of Drilling & Completions (D&C) Australia (or delegate)

Hydrocarbon Release – Loss of Well Control			
Environmental Performance Outcome	**EPO 08: No accidental release of chemicals or hydrocarbons to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
31	**Blowout Preventer (BOP):** As a minimum, the BOP is required to contain at least one annular sealing element and one blind-shear ram capable of shearing and then sealing the wellbore; and contain at least four rams, one of which shall have shear capability.	BOP design specifications confirm adherence to minimum design standards.	MODU OIM (or delegate) / Woodside Drilling Superintendent (or delegate)
32	**BOP Pressure and Function Testing:** The following tests shall be performed after the subsea BOP stack is initially installed on each well: • A BOP function-test, and wellhead connector pressure-test; and • A full pressure-test no later than 21 days from previous BOP pressure test After the initial test, and for the duration of the drilling activity, all BOP components (excluding hydraulic connectors and shear rams) shall be function tested every seven (7) days and pressure tested at intervals not exceeding 21 days.	BOP pressure and function test records.	MODU OIM (or delegate) / Woodside Drilling Supervisor

Table 9-8: Environmental performance – vessel collision

Hydrocarbon Release – Vessel Collision			
Environmental Performance Outcome	**EPO 01: No unplanned vessel interactions (including collision)** **EPO 08: No accidental release of chemicals or hydrocarbons to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
01	**Navigation equipment** (including lighting, compass/radar), bridge and communication equipment will be compliant with appropriate marine navigation and vessel safety requirements.	Completed Vessel Assurance Questionnaire for each vessel prior to entering field demonstrating compliance with	Woodside Logistics Supervisor

Hydrocarbon Release – Vessel Collision			
Environmental Performance Outcome	**EPO 01: No unplanned vessel interactions (including collision)** **EPO 08: No accidental release of chemicals or hydrocarbons to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
		relevant Marine Orders and confirming functioning navigation equipment.	
02	**Automatic Identification System (AIS)** shall be fitted aboard both the MODU and vessels and maintained in accordance with Regulation 19-1 of Chapter V of SOLAS.	Completed Vessel Assurance Questionnaire for each vessel prior to entering field demonstrating compliance Regulation 19-1 of Chapter V of SOLAS.	Vessel Master / MODU Operator
03.1	**Stakeholder Communication:** The following notifications shall be issued: • Australian Hydrographic Office (AHO) shall be notified no less than four working weeks prior to commencement of activity in order to promulgate 'Notice to Mariners' to be published; • AMSA's JRCC will be notified at least 24-48 hours prior to commencement of the activity to enable AMSA to distribute an AUSCOAST warning. Notification shall include: MODU's details (including name, callsign and Maritime Mobile Service Identity), satellite communications details (including INMARSAT-C and satellite telephone), and location of activity / operational area (500 m RSEZ & 1 km cautionary zone). • Department of Jobs, Precincts and Regions (DJPR) pre-start notification confirming the start date of the proposed activity	Documented notification to AHO and AMSA's JRCC within required timeframes prior to undertaking the activity.	MODU OIM / Woodside Drilling Superintendent / Vessel Master
03.2	**Stakeholder Communication:** Prior to undertaking the activity, relevant Stakeholders shall be notified of the proposed activity location, scope and timing if requested.	Consultation records confirm relevant Stakeholder informed of proposed activity scope and timing prior to undertaking the activity.	Woodside HSE Specialist

Hydrocarbon Release – Vessel Collision			
Environmental Performance Outcome	**EPO 01: No unplanned vessel interactions (including collision)** **EPO 08: No accidental release of chemicals or hydrocarbons to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
03.3	**Stakeholder Communication:** Relevant Stakeholders requiring ongoing consultation regarding the physical presence of the MODU during the activity shall be supplied information consistent with requirements identified during the Stakeholder consultation process (as detailed in Section 5 and 10.5.1 of this EP).	Consultation records confirm ongoing consultation with relevant Stakeholders undertaken during the activity.	Woodside HSE Specialist
04	**Public Information:** Woodside shall establish and maintain a publicly available interactive map which provides stakeholders with updated information on the offshore petroleum activities being conducted as part of the Minerva Field decommissioning program	Regional interactive map available	Woodside HSE Specialist
05	**Rig Safety Exclusion Zone:** When moored on location within the operational area: • A 500-m rig safety exclusion zone (RSEZ) shall be established and monitored around the MODU; and • Entry into the RSEZ shall be managed via the Control Room aboard the MODU.	MODU Marine Logbook records demonstrating: Managed & safe entry of AHTS vessels into RSEZ	MODU OIM (or delegate)
06.1	**Training & Competency:** Vessel and MODU crew undertaking vessel bridge-watch shall be qualified in accordance AMSA Marine Order Part 3: Seagoing Qualifications or certified training equivalent.	Completed Vessel Assurance Questionnaire for each vessel prior to entering field demonstrating compliance with AMSA Marine Order Part 3: Seagoing Qualifications	Vessel Master / MODU OIM (or delegate)

Table 9-9: Environmental performance – chemical and minor hydrocarbon spills

Unplanned Discharges – Chemicals and Minor Hydrocarbon Spills			
Environmental Performance Outcome	**EPO 08: No accidental release of chemicals or hydrocarbons to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
33	**Bunding of equipment & chemicals**: The MODU shall have continuous bunding or drip trays around machinery or equipment with the potential to leak. The MODU shall have (and maintain) spill clean-up equipment and scupper plugs or equivalent deck drainage control measures located where hydrocarbons and chemicals are stored and frequently handled.	Inspection confirms suitable bunding of equipment and chemicals	MODU OIM (or delegate)
34	**Spill clean-up equipment** aboard the MODU shall be located where hydrocarbons and hazardous chemicals are frequently handled	Inspection confirms spill clean-up equipment locations and content	MODU OIM (or delegate)
10.5	**Preventative Maintenance System (PMS):** Whilst undertaking the activity, critical hoses outside bunded areas are identified and regularly inspected/ maintained/replaced aboard the MODU shall be maintained in accordance with Rig Contractor PMS with the aim of preventing spills to the marine environment.	Drilling Contractor PMS records	MODU OIM (or delegate)
35	**Diesel / liquid chemical bunkering checklist**: Whilst in the operational area a diesel / liquid chemical bunkering checklist shall be completed prior to each bulk liquid transfer activity during the activity including: • Transfer type, communications protocols, alarm criteria; • Direct line of sight between vessels maintained during transfer; • Use and monitoring of buoyant bunkering hose; • Emergency shut-down/dry-break couplings and bunkering valves are in place; • Relief valves are included on bunkering pumps; • Diesel / liquid chemical transfer to commence during daytime and only if sea conditions are such that it is safe to do so; • No concurrent operations taking place during fuel bunkering from the same vessel;	Completed diesel / chemical bunkering checklist for each bulk liquid transfer	Woodside Drilling Supervisor(s) / MODU OIM (or delegate)

Unplanned Discharges – Chemicals and Minor Hydrocarbon Spills			
Environmental Performance Outcome	**EPO 08: No accidental release of chemicals or hydrocarbons to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• Bunkering area drain points plugged prior to commencement of bunkering/ transfer activities; • Bunkering hoses drained at cessation of bunkering activities; • Diesel storage tanks on MODU equipped with level indicators, high level alarms and automatic shutoffs to enable quick detection and response to potential overfill situations; • Hose register (or PM record) will be maintained that contains details of date of manufacture, date of pressure test and test pressure and preventative maintenance and inspection; and • Dry break couplings (e.g. a KLAW coupling) will be used on hoses used for bulk transfer of diesel and liquid chemicals.		

Table 9-10: Environmental performance – unplanned discharge of solids

Unplanned Discharges – Solids			
Environmental Performance Outcome	**EPO 06: No unplanned release of solid waste or objects to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
10.6	**Preventative Maintenance System (PMS):** Whilst undertaking the activity, lifting equipment shall be maintained in accordance with Drilling Contractor PMS with the aim of preventing lifting equipment failure.	Drilling Contractor PMS records	MODU OIM (or delegate)
16.2	**MODU Safety Case** (NOPSEMA accepted) demonstrating compliance with regulatory requirements & MODU Operator systems & procedures. MODU Safety Case includes control measures for dropped objects: • Lifting equipment certification and inspection; • Heavy-lift procedures; • Preventative maintenance on lifting gear (e.g. cranes); and	Inspection records confirm NOPSEMA accepted MODU Safety Case.	MODU OIM (or delegate)

Unplanned Discharges – Solids			
Environmental Performance Outcome	**EPO 06: No unplanned release of solid waste or objects to the marine environment**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• Crane Operator & Dogman competencies/ certification.		
29.2	**Waste Management:** Whilst undertaking the activity the following shall apply: • Waste to be stored in clearly marked and covered waste containers; and • Dropped objects or waste lost overboard shall be recovered where safe and practicable to do so.	Fate of dropped objects documented.	MODU OIM (or delegate) / Vessel Masters

Table 9-11: Environmental performance – marine fauna interaction

Marine Fauna Interaction			
Environmental Performance Outcome	**EPO 03: No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
08.1	**Project Induction:** Contracted Vessel Crew shall undertake a project-specific induction covering EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans to inform the following requirements for AHTS vessel whilst conducting activities in the operational area: • Vessels shall not knowingly travel greater than 6 knots within 300 m of a cetacean or turtle (caution zone) and minimise noise; • Vessels shall not knowingly approach closer than 100 m for a large whale, or 50 m of a dolphin or turtle (except for bow riding); • Vessel Masters identifying a cetacean showing signs of being disturbed, shall immediately withdraw from the caution zone at a constant speed of less than 6 knots; and	Environment induction attendance records demonstrate vessel crews are aware EPBC Regulations 2000 Part 8 Division 8.1	Woodside HSE Specialist / Logistics Supervisor

Marine Fauna Interaction			
Environmental Performance Outcome	**EPO 03: No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	• Vessels shall move at a constant slow speed and with minimal noise away from a cetacean that is approaching so that the vessel remains at least 300 m from the cetacean; and • Overview of Adaptive Management Plan for potential interactions with pygmy blue whales.		
08.2	**Project Induction:** Contracted aircraft service providers shall be provided a project-specific induction material covering EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans to inform the following requirement for aircraft transiting to and from the MODU: Whilst entering or departing the operational area helicopters shall not fly lower than 1,650 ft when within 500 m horizontal distance of a cetacean except when landing or taking off and shall not approach a cetacean from head on.	Records confirming EPBC Regulations 2000 Part 8 Division 8.1 relating to helicopter flight requirements relayed to aircraft service providers.	Woodside HSE Specialist / Logistics Supervisor
09	**Woodside Whale and Dolphin Sightings Cards:** Whilst undertaking petroleum activities Vessel and MODU Crew shall be requested to complete and submit Woodside Whale & Dolphin Sightings Cards upon sighting cetaceans. The completed cards are to be consolidated by the Vessel Master / MODU OIM (or delegate) and forwarded to the Woodside HSE Team for reporting to DAWE.	Completed Woodside Whale & Dolphin Sightings Cards consolidated and reported to DAWE.	Woodside HSE Specialist Vessel Master (or delegate) MODU OIM (or delegate)
10.1	**Preventative Maintenance System (PMS):** Whilst undertaking the activity, all engines, compressors and machinery aboard the MODU shall be maintained in accordance with Rig Contractor PMS with the aim of limiting unnecessary noise emissions from equipment.	Drilling Contractor PMS records	MODU OIM (or delegate)
10.2	**Preventative Maintenance System (PMS):** Whilst undertaking the activity, all engines, compressors and machinery aboard the AHTS vessels shall be maintained in accordance with Vessel Operator PMS with the aim of limiting unnecessary noise emissions from equipment.	Vessel Operator PMS records	Vessel Master (or delegate)

Marine Fauna Interaction			
Environmental Performance Outcome	**EPO 03: No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
11	**Avoid Periods of Peak Blue Whale Aggregation / Feeding:** P&A activities shall only be undertaken from 1st April to 31st December (outside peak blue whale aggregation / feeding months).	Pre-start notifications to NOPSEMA	Woodside Drilling Manager
12	**Dedicated Marine Mammal Observers (MMOs) during periods of known blue whale aggregation / feeding (November - May)** Dedicated Marine Mammal Observers (MMOs) shall be stationed aboard the MODU and/or vessels during periods of known blue whale aggregation / feeding (November - May). Observation records of shall be used to inform the adaptive Management Plan (detailed below). During routine MODU operations, MMOs shall be instructed to observe a minimum of 2km from the MODU to inform adaptive management should a pygmy blue whale approach within 1km of the MODU. Prior to vessel resupply operations, MMOs shall be instructed to observe a minimum of 8km from the MODU to inform adaptive management should a pygmy blue whale approach within 7km of the MODU.	MMO Training Records Completed Woodside Whale and Dolphin Sightings Cards. Vessel and MODU logbooks.	
13	**Marine Mammal Observations (non-dedicated) June – October** Opportunistic marine mammal observation shall be undertaken aboard both the MODU and vessels within the permit boundaries over from June to October.	Completed Woodside Whale and Dolphin Sightings Cards. Vessel and MODU logbooks.	Vessel Master (or delegate) MODU OIM (or delegate)
14	**Adaptive Management Plan** Upon the detection of a pygmy blue whale from November to May, the following adaptive management controls shall be implemented: During routine MODU operations, should a pygmy blue whale approach within 1km of the MODU, MODU power generation shall be limited to the minimum required for safe operations. Vessel resupply operations shall only commence once the MMO has confirm no observations of pygmy blue whale within 7km of MODU.	Completed Woodside Whale and Dolphin Sightings Cards. Vessel and MODU logbooks.	Vessel Master (or delegate) MODU OIM (or delegate)

Marine Fauna Interaction			
Environmental Performance Outcome	**EPO 03: No physical and/or observable biologically significant behavioural disturbance on protected species (including breeding, foraging, resting or migration)**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	At all times, vessels shall comply with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.		

Table 9-12: Environmental performance – introduction of invasive marine species

Introduction of Invasive Marine Species			
Environmental Performance Outcome	**EPO 07: No introduction of invasive marine species**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
36	**Woodside Introduced Marine Species Risk Assessment and Approval Procedure (AOHSE-E-0018-001):** An IMS risk assessment shall be completed for the MODU and AHTS vessels and associated immersible equipment (e.g. mooring equipment, ROV etc) before mobilisation to operational area, as described in Woodside Introduced Marine Species Management Procedure. The basis of evaluation considers: • Vessel details including the location and risk profile of the previous port of call / region of operation; • Biofouling prevention and biofouling risk profile; • Vessel inspection and ballast water requirements; • Submersible equipment biofouling risk profile requiring equipment to be free of biofouling; and • Validation of documented vessel and submersible equipment biofouling and ballast water management systems including validation of certification, ballast water and biofouling management plans and suitable recording systems. The IMS risk assessment must deem the MODU, AHTS vessels and submersible equipment ‘low risk’ prior to mobilisation into the operational area. The IMS risk assessment shall be consistent with the consistent with the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry; the Australian Ballast Water Management Requirements (Rev 8); and the Australian Biofouling Management Requirements (Proposed).	Completed IMS risk assessment for each vessel and MODU prior to entering field	Woodside Logistics Supervisor / WoodsideHSE Specialist

Introduction of Invasive Marine Species			
Environmental Performance Outcome	**EPO 07: No introduction of invasive marine species**		
EPS #	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
	International Anti-Fouling System Certificate: Prior to mobilisation to the operational area, and consistent with Marine Orders 8 - Part 98: Marine Pollution - Anti-fouling Systems and International Convention on the Control of Harmful Anti-fouling Systems on Ships (IMO, 2001), Vessel Operator shall: • supply a current International Anti-Fouling System Certificate for each AHTS vessel; and • confirm no harmful organotins in antifouling paints used on AHTS vessels.	Completed IMS risk assessment for each vessel prior to entering field confirms current International Anti-Fouling System Certificate and anti-fouling systems have not used harmful organotins.	Woodside Logistics Supervisor / Woodside HSE Specialist
37	**Australian Ballast Water Management Requirements (Rev 8):** Prior to mobilisation to the operational area, Woodside shall validate that the MODU and AHTS vessels comply with the Australian Ballast water Requirements (Rev 8), specifically, ensuring they have: • 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; and • exchange ballast water outside 12 nmi from the nearest land in water depths greater than 50 m or treat ballast water using approved ballast water treatment system (if mobilised from international waters).	IMS risk assessment for each vessel and MODU prior to entering field confirms compliance with Australian Ballast Water Management Requirements (Rev 8).	Woodside Logistics Supervisor / WOODSIDE HSE Specialist
38	**Biofouling Management Plan:** Prior to mobilisation to the operational area, the Vessel Operator shall confirm that each AHTS vessel has a biofouling management plan and record book consistent with IMO Biofouling Guidelines.	IMS risk assessment confirms compliance with Australian Ballast Water Management Requirements (Rev 8).	Woodside Logistics Supervisor / Woodside HSE Specialist

10 Implementation Strategy

In accordance with Regulation 14 of the Environment Regulations, the Environment Plan must contain an implementation strategy for the petroleum activity and monitoring, recording and reporting arrangements. The implementation strategy presented in this section provides specific practices and procedures to ensure:

- All the environmental impacts and risks of the petroleum activity will be continually identified and reduced to a level that is ALARP;
- Control measures identified in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and to acceptable levels;
- That environmental performance outcomes and environmental performance standards are met;
- Arrangements are in place to respond to, and monitor, impacts of oil pollution emergencies; and
- Arrangements for on-going consultation with relevant authorities, persons and organisations are in place and maintained through the activity.

10.1 Systems, Practices and Procedures

10.1.1 Woodside HSE Management System

The Woodside Health, Safety and Environment (HSE) Management System defines the boundaries within which all activities are conducted. It provides a structured framework to set common requirements, boundaries, expectations, governance and assurance for all activities. It also supports accountabilities and responsibilities as defined in the organisational structure. The overarching objective of the Woodside Management System is to aspire to zero harm to people, communities and the environment, and achieve leading industry practice. The structure of the Woodside Management System is hierarchical (Figure 10-1).

Figure 10-1: Woodside HSE Management System

The documents in Figure 10-1 address specific areas (e.g. corporate performance reporting, risk management, incident investigation) where it is important that activities are conducted consistently across the organisation.

The top level of the triangle shown in Figure 10-1 is the Company 'Our Values'; a copy of which is provided in Appendix A. 'Our Values' directs the approach to all activities within the Company. It also provides a means of aligning Company values with strategic direction and measures of success. 'Our Values' are supported by the Company Health, Safety and Environment Policy Appendix A.

The Woodside HSE Management System Framework establishes the foundation for continual improvement through the application of consistent requirements across all aspects of the petroleum activity including:

- Identification of statutory obligations and commitments to ensure maintenance of licence to operate;
- Implementation of petroleum risk management processes, including this Environment Plan;
- Establish and maintain the competencies for personnel, and provision of training to promote expected behaviours;
- Management of all contractors and suppliers of petroleum goods and services; and
- Completion of reviews, and reporting outcomes of these reviews.

The controls apply to the entire lifecycle of petroleum activities, processes and products. Contractors are required to comply with the controls, and partners and suppliers are encouraged to adopt the intent and nature of the performance requirements. The controls cover the following broad areas and are regularly monitored through scheduled audit and verification activities:

- Hazards and risk management;
- Crisis and emergency management;
- Security;
- Health and hygiene;
- Aviation;
- Marine operations;
- Fatal risks;
- Environment; and
- Data reporting.

10.2 Environment Plan Organisation, Roles and Responsibilities

A defined chain of command with the roles and responsibilities for key Company and contractor personnel in relation to Environment Plan implementation, management and review are described below in Table 10-1. It is the responsibility of all Company employees and contractors to ensure that Company requirements and 'Our Values (Appendix A) are applied in their areas of responsibility.

Table 10-1: Key personnel and environmental responsibilities

Title	Environmental Responsibilities
Office-based Roles	
Director Projects Australia	• Have Technical Authority and manage team of projects and decommissioning professionals • Ensure sufficient resources are provided to implement the commitments made in this EP
Decommissioning Engineering Manager (or equivalent)	• Supervise decommissioning operations, including management of change • Be accountable for developing the decommissioning engineering and associated programs • Ensure compliance with company policies, standards and statutory requirements
Head of Drilling & Completions (D&C) Australia	• Technical Authority and Manager of team of well construction professionals to support production phase; • Ownership transfer for well construction, completion, workover, intervention and abandonment operations; • Ensure sufficient resources are provided to implement the commitments made in this EP; and • Establish Source Control Section (SCS) within the Corporate Incident Coordination Centre (CICC) in the event of a LOWC incident.
Drilling Superintendent	• Supervision of D&C operations including management of change; and • Ensures compliance with company policies, standards and statutory requirements.
Drilling / Completions Engineer (or equivalent)	• Accountable for the development of well designs and associated programs; and • Ensures compliance with company policies, standards and statutory requirements.
Regional HSE Lead	• Ensure compliance with Management Standards, this EP and regulatory responsibilities; and • Environmental incidents or breaches of environmental performance outcomes, standards or measurement criteria, are reported in line with Company incident reporting requirements.
HSE Specialist	• Liaise with the Drilling Superintendent to ensure compliance to legislation, procedures, standards and commitments; • Carry out environmental education and inductions; • Ensure compliance with this EP, regulatory and HSE responsibilities; • Participate in the hydrocarbon spill response drills; • Complete environmental audits to ensure compliance with this EP; and • Report environmental recordable incidents to NOPSEMA.
Logistics Supervisor	• Liaise with Vessel Masters and aircraft operators to maintain compliance with this EP.
Field-based Roles	
Drilling Supervisor (or equivalent)	• Responsible for management and supervision of well engineering activities at the well site; • Ensures operations are conducted according to the approved programme requirements; and • Management of change during operations.
HSE Advisor	• Monitor and audit the activity to ensure compliance with this EP;

	• Ensures environmental incidents or breaches of environmental performance outcomes, standards or measurement criteria are reported and recorded in line with Company incident reporting requirements; and • Disseminate project-specific environmental compliance requirements to the MODU crew as required.
Offshore Installation Manager (OIM) – MODU Contractor	• Maintains operational control of the MODU • Manages the implementation of the Contractor MODU Management System and MODU procedural controls • Ensures MODU personnel are appropriately trained and competent to undertake role-specific tasks • Ensures MODU emergency response procedures are tested and implemented; • Liaison with Drilling Supervisor(s) on all aspects of drilling activities; and • Report environmental incidents or breaches of environmental performance outcomes, standards or criteria on MODU, are in line with Company incident reporting requirements.
Vessel Master	• Manage activities and safety on-board vessel for the duration at sea, and operate under Company Marine Controls, relevant Commonwealth Acts and regulations; • Ensure vessel operations are undertaken as per this EP and any approval conditions; • SOPEP drills are conducted as per vessel's schedule; • Report environmental incidents or breaches of environmental performance outcomes, standards or criteria on vessel, are in line with Company incident reporting requirements; and • Recordable incident reporting.
All crew	• Work in accordance with accepted HSE obligations and practices; • Comply with this EP, and all regulatory and project obligations applicable to their assigned role; • Report any hazardous condition, near miss, unsafe act, accident or environmental incident immediately to their supervisor; • Report sightings of marine fauna and marine pollution to their supervisor; • Attend HSE meetings and training/ drills when required; and • Understand their obligation to 'stop-the-job' due to HSE concerns.

10.3 Training and Competency

10.3.1 Competence, Environmental Awareness and Training

The Woodside HSE Management System Framework establishes the foundation for continual improvement through the application of consistent requirements across all aspects of petroleum activities including the establishing and maintenance of the competencies for personnel, and provision of training to promote expected behaviours.

For contractors, environmental risks in contracts are managed in accordance with the requirements outlined in Woodside HSE Management Standard. As part of the contractor management process, the MODU Contractor's Environmental Management System is assessed to ensure it is aligned with 'Our Values', the Woodside HSE Management Standard and meets all commitments made in this EP. If, and wherever, the Contractor's Management System is found to be deficient it will be required to be modified prior to mobilisation to site.

All personnel on the MODU and AHTS vessels are required to be competent and suitably trained to undertake their assigned positions. This may be in the form of 'On the Job' or external training. Contractors are responsible for identifying training needs and keeping records of training undertaken. Environmental awareness inductions (Section 10.3.2) are required to be undertaken by all offshore personnel as part of their induction to undertaking petroleum activity.

Competence in well control is a critical factor in conducting drilling and completions in a safe manner and with minimal environmental impact. The Well Operations Management Plan (WOMP) details critical positions that are required to hold a certificate of well control competency. Before drilling commences, Well Control

Competency assessments will be undertaken on the MODU. Details of processes by which the competency of supervisors, employees, and contractors to operate equipment and to execute procedures will be managed are detailed within the WOMP. The OPGGS (Resource Management and Administration Regulations) require that the WOMP must adequately demonstrate (among other matters) that competency of supervisors, employees and contractors are to a level such that risks to integrity of the well are reduced to ALARP.

10.3.2 Campaign Specific Environmental Awareness

Inductions are provided to all relevant personnel before the mobilisation to or on arrival at the activity location. This induction covers the HSE requirements and environmental information specific to the location of the activities. The induction will include the following environmental information:

- General description of the activity location, including any environmentally sensitive areas;
- Woodside HSE Management System Framework – ‘Our Values’ (Appendix A);
- Adherence to standards and procedures, and the use of Job Safety Analysis and Permit to Work hazard identification and management process;
- Incident reporting process;
- Spill management including prevention, response and clean-up, location of spill kits and reporting requirements;
- Waste management requirements and process (segregation of landfill, recycle and hazardous wastes) and location of bins;
- Reporting of vessel-to-vessel and vessel-to-MODU interactions; and
- Reporting procedure for sightings of cetaceans including the location of marine fauna sighting datasheets, and any relevant shut-down procedures.

All personnel who undertake the induction are required to sign an attendance sheet, which is retained by the MODU and/or vessel contractor.

The MODU will hold regular HSE meetings, which cover all crews. During these meetings, environmental incidents will be reviewed and awareness material presented. All personnel are required to attend the HSE meetings and attendance sheets are retained by the MODU Contractor. Daily Meetings held onboard the MODU also serve to reinforce environmental awareness during the decommissioning campaign.

A copy of Environment Plan is provided to the MODU and vessel contractor prior to undertaking the activity.

10.3.3 Well Control Training

In accordance with the Well & Seismic Delivery (WSD) Organisation, Development and Training Standard (DR-STD-PET-DC-0123), Company Supervisors involved in well control, shall have a valid supervisory-level certificate from a well control accredited program (IWCF or IADC WellSharp) renewed every two years. No one shall relieve the Driller/Operator without the appropriate well control certification. Driller and Assistant Drillers (or equivalent positions for non-drilling rigs) shall hold a valid Driller-level Well Control Certificate, renewed every two years.

The Well Operations Management Plan (WOMP) details critical positions that are required to hold a certificate of well control competency. Before drilling commences, Well Control Competency assessments will be undertaken on the MODU. Details of processes by which the competency of supervisors, employees, and contractors to operate equipment and to execute procedures will be managed are detailed within the WOMP. The OPGGS (Resource Management and Administration Regulations) require that the WOMP must adequately demonstrate (among other matters) that competency of supervisors, employees and contractors are to a level such that risks to integrity of the well are reduced to ALARP.

10.3.4 Corporate Incident Coordination Centre (CICC) Training

A competency-based training programme and supporting systems is maintained to ensure enough competent personnel are available to manage the activities and demands of an incident or crisis.

Woodside utilises a blend of Nationally Recognised Units of Competency and subject/role specific training programs for the ICC/CMT training and development program. Some courses are conducted using Woodside resources entirely, delivered by company EM Advisers. External providers may be utilised to deliver/co-deliver training modules/presentations as required.

Training and competency requirements are documented in the Woodside Emergency and Crisis Management Training Guideline, including a description of training modules and role-specific competency matrix for CICC positions.

Minimum training requirements for CICC roles are maintained within the CICC Dashboard Role Requirements.

10.3.5 Contractor Management

For contractors, HSE risks in contracts are managed in accordance with the requirements outlined in Woodside HSE Management Standard. As part of the contractor management process, Woodside implements pre- and post-contract award processes and activities aimed at ensuring that contracts consistently and effectively cover the management of HSE in line with Woodside HSE-related requirements, ‘Our Values’, and the HSE Management Standard.

Whilst the Woodside HSE Management Systems apply to the manner in which Woodside execute their responsibilities under this EP, operational control of the MODU remains the responsibility of the MODU Contractor and shall be managed in accordance with Contractor Management Systems as detailed within the NOPSEMA accepted Safety Case for the facility.

10.3.6 Marine Operations and Assurance

Systems and procedures are in place to ensure all marine operations for the activities are conducted in accordance with environmental regulatory requirements and Company marine controls, which cover management of marine operations and contracting of vessels.

The Woodside Marine Management Process comprising a Vessel Assurance Questionnaire require a number of audits be completed prior to hiring a vessel and marine operations suppliers to be audited and verified prior to engagement. This includes a search of Offshore Vessel Inspection Database (OVID) for all relevant records and certification, and/or additional audits for the following as identified in the risk assessment process:

- Marine Management Process;
- Dynamically positioned vessel review;
- Containment audit to ensure contained transport, storage and discharge of petroleum based and chemical products;
- Lifting and rigging audit;
- Invasive Marine Species (IMS) Risk Assessment; and
- Emergency response audit.

10.4 Monitoring, Auditing and Management of Non-Conformance and Review

10.4.1 Monitoring Environmental Performance

Environmental performance is required to be consistent with Woodside HSE Management Standard and commitments made in this EP. The on-going environmental performance of contractors is the responsibility of key personnel described in Table 10-1. Key data that will be monitored and recorded during the activity are summarised in Table 10-2.

Table 10-2: Monitoring and record keeping summary

Parameter	Monitoring	Record Keeping	Frequency
MODU	Rig Move and Positioning Plan	Rig Move and Positioning Plan	Prior to commencement of activity
Seabed Disturbance	Recovery of dropped objects where practicable to do so and where recovery will provide a net environmental benefit	Documentation of dropped object retrieval	As required
	Removal of all rig mooring equipment consistent with section 572 of the OPGGS Act	Drilling Report confirming removal of all rig mooring equipment from the seabed.	End of activity
	Location of temporarily wet-stored equipment	Survey of storage location	End of activity
Marine Fauna Interactions	Cetacean sightings and interactions (secondary to primary work activities/ responsibilities)	Fauna Sighting Datasheet. Incident Report Form. Monthly Incident Report; and Environmental Performance Report.	As required. As required. Monthly.
Introduced Marine Species	Management of biofouling	Marine Management process to be completed prior to hire of vessels	Prior to on-hire
		Record and review of IMS risk assessment by the Environmental Specialist for newly contracted MODU, AHTS vessels and immersible equipment entering the operational area.	Prior to mobilisation
		AHTS vessels Biofouling Management Plan and recordkeeping	Prior to mobilisation
	Management of ballast	Ballast Water Management Plan (BWMP). ballast water management certificate (IBWMC). Ballast water records.	Prior to entering Australian waters
Atmospheric Emissions	Details of diesel consumption, cold venting / flaring and monitoring/reporting of greenhouse gas, ozone-depleting substances, fluoride, nitrogen dioxide, sulphur dioxide and energy use.	Daily Drill Reports	Daily during activity
		Envirosys (or equivalent) Records	
		ODS Record Book	
		Daily Vessel Report (DVR) records includes vessel fuel consumption	
Cement	Volume of cement discharged	Well cement report	End of activity
	Volume of cement returned to shore		

Parameter	Monitoring	Record Keeping	Frequency
Waste	Sewage and grey water	MODU / Vessel log	End of activity
		Maintenance records for sewage/grey water equipment	End of activity
	Hazardous and non-hazardous solid waste	Garbage Record Book	End of activity
		Maintenance records demonstrate functioning macerator onboard Vessel	End of activity
	Oily water – Bilges and machinery spaces	Oil Record Book	End of activity
	Fuels and oils	Containment and inspections, maintenance records, PMS records, checklists	End of activity
	Hazardous chemicals	Hazardous chemical locker inspection	End of activity
	Loss or discharge to sea of harmful materials	Record log of report to AMSA RCC	As required
Marine user interactions	Interactions with shipping and commercial fishing vessels movements	MODU control room / vessel log. Incidents recorded in Company system	As required
Training	Details of crew inductions/drills	Induction Record Sheets / drill reports	As completed

10.4.2 Record Keeping

Compliance records will be maintained. Record keeping will be in accordance with Regulation 14(7) that addresses maintaining records of emissions and discharges (Table 10-2).

10.4.3 Auditing, Assurance, Management of Non-Conformance and Continuous Improvement

The environmental performance of Woodside activities will be reviewed in a number of ways in order to:

- Ensure all significant environmental aspects of the activity are covered in the EP;
- Ensure that management measures to achieve environmental performance outcomes are being implemented, reviewed and where necessary amended;
- Ensure that all environmental commitments have been met;
- Ensure that impacts and risks will be continuously identified and reduced to ALARP; and
- Identify potential non-conformances and opportunities for continuous improvement.

Woodside conducts reviews and audits of their contractors at various stages including pre-award of contract, pre-activity and during activity, in accordance with Woodside HSE Management System performance. The environmental performance of contractors to Woodside involved in activities will be reviewed through the following activities including (but not limited to):

- Inspections of Contractor HSE Management systems and procedures;
- Pre-activity audits;
- Review of reporting documentation;
- Monitoring of progress;
- Auditing and assurance program;
- Regular review of incident, audit, inspection, observation, safety meeting and daily operations reports;
- Action item tracking and closeout; and
- End of campaign reviews.

The environmental performance of Woodside activities will be reviewed through:

- An audit of the MODU carried out by the Woodside HSE Specialist or Woodside Site Representative before or during the activities to ensure that procedures and equipment are in place to enable compliance with the EP;
- The audit will be documented and actions tracked through a non-compliance register, which is monitored on a regular basis;
- The Environment Plan will be distributed to the MODU Contractor prior to undertaking the activity and compliance against EPOs, EPSs, and measurement criteria monitored on a regular basis by Woodside; and
- All environmental mitigation and management commitments from the EP will be documented and a description of compliance with each commitment will be maintained.

Audit findings, close-out reports and feedback from ongoing monitoring allow continuous improvement initiatives to be developed and inform the development of future Minerva Field Decommissioning EPs.

10.4.4 Management of Change

Permanent or temporary changes to organisation, equipment, plant, standards, or procedures that have a potential health, safety, integrity and/or environmental impact are assessed and subject to formal review and approval as outlined in Woodside HSE Management Standard. This standard requires the change to be justified and authorised, risk assessed to understand the potential impacts of the change, a plan to be in place that clearly specifies the timescale for the change and any control measures to be implemented and the situation to be reassessed if there is an unexpected change in circumstances. The level of management approval for each change is commensurate with the risk.

Management of changes relevant to this EP, for example timing of the activity, changes to the scope of the activity described in Section 3 of this EP will be made in accordance with Management of Change procedures outlined in the Woodside HSE Management Standard.

The Management of Change process also allows for the assessment of new information that may become available after the acceptance of the EP, such as new management plans for Australian Marine Parks, new recovery plans or conservation advice for species, and changes to the EPBC Protected Matters Search results.

The Management of Change will be assessed and subject to formal review to determine if a revision of the accepted EP in force for the P&A and Field Maintenance activities is required to be submitted to NOPSEMA pursuant to Regulation 17 of the OPGGS (Environment) Regulations.

10.5 Reporting

To meet the environmental performance outcomes and standards outline in the EP, Woodside undertake reporting at a number of levels as described in the following sub-sections.

10.5.1 Routine Reporting (External)

Start and End of Activity Notifications

In accordance with Regulation 29, Woodside will notify in writing NOPSEMA and DJPR of the commencement of the petroleum activity at least ten days before the activity commences and again within ten days of the completion of the activity.

Woodside will:

- Notify the Australian Hydrographic Office (AHO) no less than four weeks before operations, with details relevant to the operations in order for the AHO promulgate the appropriate Notice to Mariners.
- Notify AMSA's Joint Rescue Coordination Centre (JRCC) at least 24-48 hours before operations commence, in order to promulgate radio-navigation warnings.
- Notify JRCC when operations end.
- Provide updates to AHO and the JRCC on any changes to intended operations.
- Provide Victorian Department Jobs, Precincts and Regions (DJPR) pre-start notification confirming the start date of the proposed activity and a cessation notification upon completion of the activity to: reports@ecodev.vic.gov.au

Environmental Performance Review and Reporting

Routine external reporting requirements are summarised in Table 10-3.

Table 10-3: Routine external reporting requirements

Report	Recipient	Frequency	Content
Monthly Recordable Incident Reports	NOPSEMA	Monthly, by the 15th of each month.	Notification of a breach of an environmental performance outcome or standard, in the environment plan that applies to the activity that is not a reportable incident. Complete NOPSEMA's Recordable Environmental Incident Monthly Report form.
Environmental Performance Report	NOPSEMA	Annual, with the first report submitted within 12 months of the commencement of the petroleum activity covered by this EP	In accordance with the Regulation 26C, confirmation of compliance with the Performance Outcomes, Performance Standards and Measurement Criteria of this EP. Reporting period 1 July to 30 June. Report must include sufficient information to enable NOPSEMA to determine whether or not the environmental performance outcomes and performance standards in the EP have been met.

End of the Environmental Plan

The EP will end when Woodside notify NOPSEMA that petroleum activity has ended, and all of the obligations under the EP have been completed, and NOPSEMA has accepted the notification, in accordance with Regulation 25A of the Environment Regulations.

Notification will be through completion and submission of NOPSEMA's Regulation 25A – End of operation of environment plan form.

10.5.2 Incident Reporting (Internal)

Company employees and contractors are required to report all environmental incidents and non-conformance with commitments made in the EP. It is the responsibility of the Company HSE Lead to ensure that reporting of environmental incidents meets both regulatory reporting requirements and Woodside HSE Management Standard.

10.5.3 Incident Reporting (External) – Reportable and Recordable

Reportable Incidents

A reportable environmental incident is defined in Regulation 4 of the Environment Regulations as:

> *"…**reportable incident**, for an activity, means an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage"*.

A reportable incident for the activity includes, but are not limited to, those that have been identified through the risk assessment process as having a severity (consequence) level of ≥3 (refer to previous Table 6-2), or at a minimum:

- an uncontrolled release of hydrocarbons or environmentally hazardous chemicals of more than 80 litres to the marine environment;
- a vessel to vessel or vessel to MODU collision;
- a breach of RSEZ by an errant vessel;
- MODU loss of mooring;
- a confirmed or suspected introduction of an IMS to the operational area; or
- Injury or death of any marine fauna species listed as threatened or migratory under the EPBC Act.

In accordance with Regulations 26, 26A and 26AA, Woodside will:

- Report all reportable incidents orally to NOPSEMA, as soon as practicable, and in any case not later than 2 hours after the first occurrence of the reportable incident; or if the reportable incident was not detected at the time of the first occurrence, the time of becoming aware of the reportable incident.

  Oral notifications of a reportable incident to NOPSEMA will be via telephone: 1300 674 472.

  The oral notification must contain:

  - All material facts and circumstances concerning the reportable incident known or could be obtained by reasonable search or enquiry; and
  - Any action taken to avoid or mitigate any adverse environment impacts of the reportable incident; and
  - The corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident.
- Provide a written record of the reportable incident to NOPSEMA, as soon as practicable after making the oral notification, but within three days after the first occurrence of the reportable incident unless NOPSEMA specifies otherwise. The written report should use a format consistent with NOPSEMA's Report of an Accident, Dangerous Occurrence or Environmental Incident form FM0929.

- Within 7 days of giving a written report of a reportable incident to NOPSEMA, a copy of the same written report must be provided to the National Petroleum Titles Administrator (NOPTA), and the Department of Jobs, Precincts and Regions (DJPR).

Recordable Incidents

A recordable environmental incident is defined in Regulation 4 of the Environment Regulations as:

> *"…**recordable incident**, for an activity, means a breach of an environmental performance outcome or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident".*

In terms of the activities within the scope of this EP, a recordable incident is a breach of the performance outcome or performance standards listed in Section 9 of this EP.

In the event of a recordable in recordable incident, Woodside will report the occurrence to NOPSEMA as soon as is practicable after the end of the calendar month in which it occurs; and in any case, not later than 15 days after the end of the calendar month. If no recordable incidents have occurred, a 'nil incident' report will be submitted to NOPSEMA. Written reporting to NOPSEMA of recordable incidents and 'nil incidents' can be via completion of NOPSEMA's Form FM0928– Recordable Environmental Incident Monthly Report. The report will contain:

- a record of all the recordable incidents that occurred during the calendar month;
- all material facts and circumstances concerning the recordable incidents that are known or can, by reasonable search or enquiry, be found out;
- any action taken to avoid or mitigate any adverse environmental impacts of the recordable incidents;
- the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the recordable incident; and
- the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

Other External Incident Reporting Requirements

In addition to the notification and reporting of environmental incidents defined under the Environment Regulations and Woodside HSE Standard, the following incident reporting requirements apply:

Commonwealth Waters

- In accordance with the Navigation Act 2012, any oil pollution incidents in Commonwealth waters will be reported by the Vessel Master to AMSA within 2 hours via the national emergency notification contacts and a written report within 24 hours of the request by AMSA.

  The national 24-hour emergency notification contact details are:

  Freecall: 1800 641 792

  Fax: (02) 6230 6868

  Email: mdo@amsa.gov.au

- Any loss or discharge to sea of harmful materials is to be reported by the MODU OIM / Vessel Master using the prescribed Pollution Report (POLREP) form to the Rescue Coordination Centre (RCC).
- Director of National Parks (DNP) should be made aware of oil/gas pollution incidences that occur within a marine park or are likely to impact on a marine park as soon as possible. Notification should be made to:

  Marine Compliance Duty Officer on 0419 293 465 (24 hours).

  The notification should include:

  - titleholder details;
  - time and location of the incident (including name of marine park likely to be effected);

- proposed response arrangements as per the Oil Pollution Emergency Plan (e.g. dispersant, containment, etc.);
- confirmation of providing access to relevant monitoring and evaluation reports when available; and
- contact details for the response coordinator.

- In Commonwealth Waters– All suspected or known instances of introduced aquatic pests or disease detected in Commonwealth waters to be reported to the Department of Agriculture, Water and the Environment (DAWE) immediately, via the online reporting form: https://www.agriculture.gov.au/pests-diseases-weeds/report
- Any harm or mortality to EPBC Act-listed threatened marine fauna, whether attributable to the activity or not, within 7 days to the Department of Agriculture, Water and the Environment (DAWE) via email at: Email: EPBC.permits@environment.gov.au
- Any vessel strikes with cetaceans or whale sharks will be reported in the National Ship Strike Database at: https://data.marinemammals.gov.au/report/shipstrike

Victorian State Waters

Whilst the activity is being undertaken in Commonwealth jurisdiction, where an incident has caused, or has the potential to cause moderate to catastrophic environmental consequences within State jurisdiction;

The Vessel Master / Drilling Superintendent (or delegate) is responsible for reporting any oil pollution incident affecting or likely to affect State waters to the State Duty Officer (SDO) via the 24-hour reporting number 0409 858 715. The Duty Officer will then advise whether the following forms are required to be submitted:

- Marine Pollution Form (POLREP) and/ or
- Marine Pollution Situation Report (SITREP)

Within 3 days of oral notification provide written notification of any environmental incident that could potentially impact on any land or water in State jurisdiction via: marine.pollution@ecodev.vic.gov.au

Suspected or confirm invasive marine species introduction contact DJPR ASAP on 136186 or marine.pests@ecodev.vic.gov.au

10.6 Emergency Preparedness and Response

10.6.1 Overview

Under Regulation 14(8), the implementation strategy must contain an oil pollution emergency plan (OPEP) and provide for the updating of the OPEP. In accordance with Regulation 14, the sections below detail the implementation strategy for hydrocarbon spill emergency conditions during decommissioning activities. The section outlines the response framework in the event of a hydrocarbon spill. As part of the implementation strategy, Woodside Petroleum has developed a series of spill response documents, inclusive of an OPEP (Appendix E). Specific arrangements are presented to ensure that the environmental impacts and risks of spill response activities will be continuously identified and reduced to ALARP.

10.6.2 Oil Spill Response Jurisdictional Arrangements

In the event of an oil spill, Control Agencies are assigned to respond to the various levels of spills is outlined in Table 10-4. The 'Statutory Agency' and 'Control Agency' are defined as follows:

> **Jurisdictional Authority:** *the State or Commonwealth Agency assigned by legislation, administrative arrangements or within the relevant contingency plan, to control response activities to a maritime environmental emergency in their area of jurisdiction.*
>
> **Control Agency:** *is the agency with operational responsibility in accordance with the relevant contingency plan to take action to respond to an oil and/or chemical spill in the marine environment.*

Table 10-4: Statutory and lead control agencies for oil spill pollution incidents

<table>
<tr><th rowspan="2">Area</th><th rowspan="2">Spill Source</th><th rowspan="2">Jurisdictional Authority</th><th colspan="2">Lead Control Agency</th></tr>
<tr><th>Level 1</th><th>Level 2/3</th></tr>
<tr><td rowspan="2">Commonwealth Waters</td><td>Offshore Petroleum Activity</td><td>NOPSEMA</td><td colspan="2">Woodside</td></tr>
<tr><td>Vessels</td><td>AMSA</td><td>Vessel</td><td>AMSA</td></tr>
<tr><td rowspan="3">State Waters</td><td>Offshore Petroleum Activity</td><td>Vic DJPR</td><td colspan="2">Woodside / Vic DoT (JSCC)</td></tr>
<tr><td>Marine Pollution Oil spills in Victorian Coastal waters up to three nautical miles</td><td>Vic DoT</td><td>Vic DoT</td><td>Vic DoT</td></tr>
<tr><td>Wildlife affected by marine pollution</td><td>DELWP</td><td>DELWP</td><td>DELWP</td></tr>
<tr><td>Port Waters</td><td>Vessels</td><td>Port Authority</td><td colspan="2">Port Authority / Vic DoT</td></tr>
</table>

Note: When a wildlife response is required in State and Commonwealth waters, the Department of Environment, Land, Water and Planning (DELWP) will act as the lead agency and follow the relevant state based legislation.

Section 3 of the Victorian State Maritime Emergencies (non-search and rescue) (MENSAR) Subplan Edition 2 details the arrangements for the management of maritime emergencies in State jurisdiction. These arrangements are not replicated within the EP, but are applicable to an oil spill response in Victorian State jurisdiction. A summary of MENSAR Plan is provided in the section below.

Further detail on Victorian State oil pollution response and jurisdictional arrangements is presented within the Victorian Joint Industry and State Oil Pollution Responses Guidance Note V2 2020. These arrangements are not replicated within the EP, but are applicable to an oil spill response in Victorian State jurisdiction.

10.6.3 External Emergency Response Plans

The following external plans have been used to inform the development of oil pollution emergency documentation for the proposed activity:

- NatPlan - National Plan for Maritime Environmental Emergencies (NatPlan)
    - Sets out the national arrangements, policies and principles for the management of marine oil pollution. It defines obligations the States and various industry sectors in respect of marine oil pollution prevention, preparation, response and recovery.
- AMOSPlan – Australian Industry Cooperative Spill Response Arrangements
    - Managed by AMOSC, it details the cooperative arrangements for response to oil spills by Australian oil and associated industries.
- Victorian State Emergency Management Plan (SEMP) (2021)
    - The SEMP provides for an integrated, coordinated and comprehensive approach to emergency management (EM) at the state level. The EM Act 2013 requires the SEMP to contain provisions providing for the mitigation of, response to and recovery from emergencies (before, during and after), and to specify the roles and responsibilities of agencies in relation to EM.
- Victorian SEMP Maritime Emergencies (non-search and rescue) Sub-Plan (MENSAR) (edition 2) (2021)
    - This sub-plan exists to ensure that collaboration, co-operation and resources sharing is captured and agreed to by the stakeholders and a response to a complex maritime emergency will be a shared responsibility between the agencies. The Maritime Emergencies (Non Search and Rescue (NSR)) Subplan of the State Emergency Management Plan (SEMP) is developed in

accordance with the Emergency Management Act 2013 (External link), it also serves the purposes of being the Victorian Marine Pollution Contingency Plan in accordance with the Marine (Drug, Alcohol and Pollution Control) Act 1988 (the Act) (External link).

The sub-plan is two parts:

Part A is the Maritime Emergencies (NSR) Sub-Plan:

  - It provides an overview of the arrangements for managing maritime emergencies in Victoria.
  - It describes the integrated approach and shared responsibility between state and commonwealth governments, agencies, businesses and communities.
  - The sub-plan refers to national agreements, plans and documents, including the National Plan.

Part B is the Maritime Emergencies (NSR) Operational Plan and contains the operational details for preparing and planning for, responding to, and recovering from maritime emergencies.

The sub-plan applies to maritime emergencies (NSR) including marine pollution which results or may result in a prohibited discharge of oil, oily mixtures, undesirable or hazardous and noxious substances into state waters.

- Victorian SEMP Animal, Plant, Marine and Environmental Biosecurity Sub-Plan (2021)
  - The Animal, Plant, Marine and Environmental Biosecurity Sub-Plan ('the Plan') provides an overview of the current arrangements for the management of biosecurity emergencies (excluding human health emergencies and non-Emergency Animal Disease wildlife emergencies) in Victoria and contains information on biosecurity mitigation, preparedness, response, relief and recovery. The Department of Jobs, Precincts and Regions (DJPR) has developed this Plan consistent with national arrangements for biosecurity emergencies and with input from a range of other emergency management agencies. The Plan refers to a range of existing plans and documents but does not duplicate the information contained in these, instead providing directions to websites or other sources where the reader can obtain further information if required.
- Victorian Emergency Animal Welfare Plan (VEAWP) (Revision 2, October 2019)
  - The Victorian Emergency Animal Welfare Plan (the Plan) is intended to be a reference for all agencies, organisations, groups and individuals with responsibility for animal welfare during emergencies. It provides principles and policy for use in emergency planning, response and recovery phases. It defines the roles and responsibilities of agencies and organisations.

    The plan has the overarching objectives of:

    - Contributing to enhanced human safety and community resilience through effective planning and management of animals in emergencies; and
    - Ensuring animals are better considered and protected from suffering during and immediately following emergencies.

    The plan was developed following extensive consultation with emergency management and animal welfare stakeholders including the Victorian Emergency Animal Welfare Committee. It has been developed in line with the National Planning Principles established by the National Advisory Committee for Animals in Emergencies.

    The plan confirms that:

    - The Department of Jobs, Precincts and Regions is the primary state agency for the provision of welfare support for all animals other than wildlife in emergencies; and
    - The Department of Environment, Land, Water and Planning is the primary state agency for the provision of welfare support for wildlife in emergencies. https://www.wildlife.vic.gov.au/wildlife-emergencies/wildlife-emergencies

- Industry Joint Venture Plans: Various Plans developing general and assisted Oil Spill Response Capabilities
- AMSA Australian Government Coordination Arrangements for Maritime Environmental Emergencies
  - Provides a framework for the coordination of Australian Governmental departments and agencies in response to a maritime environmental emergency

The OPEP interfaces with National, State and Woodside plans as shown in Figure 10-2.

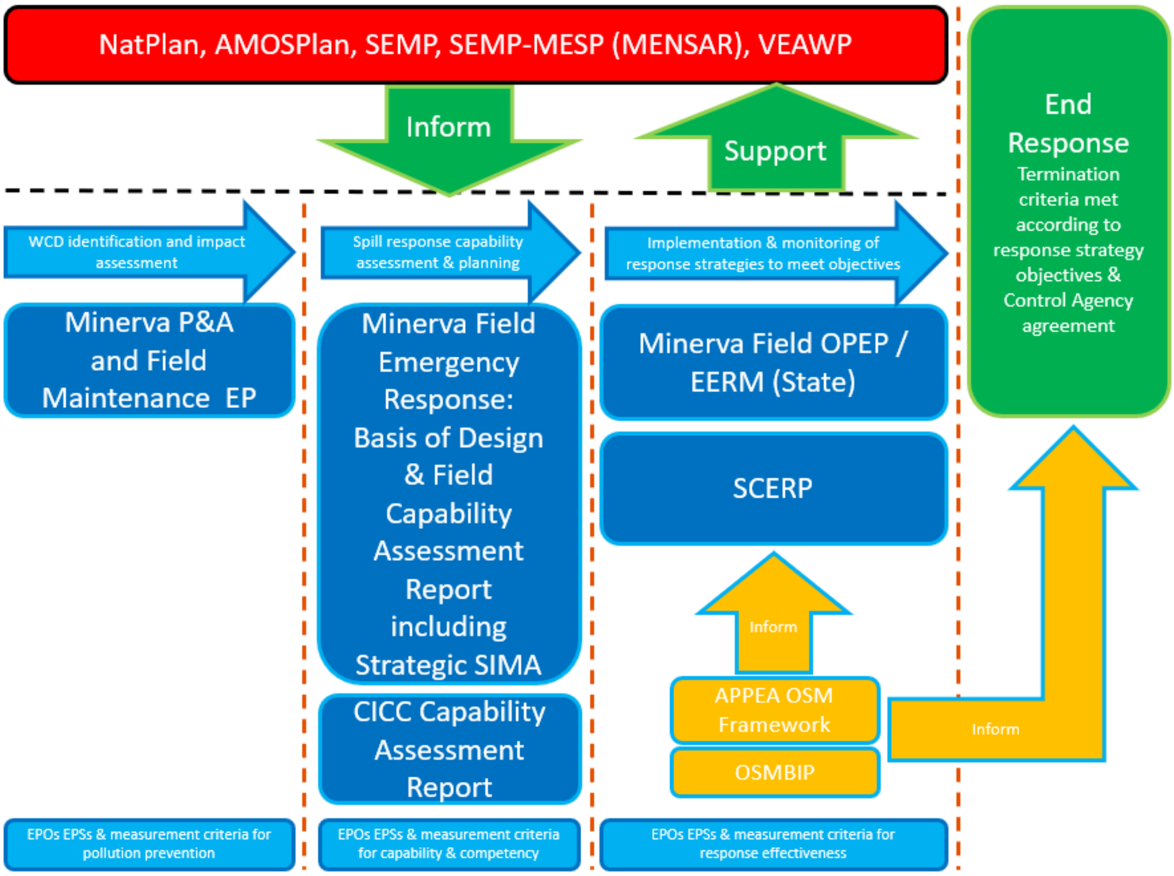


Figure 10-2: Spill response document framework for Minerva Field

10.6.4 Internal Emergency Response Plans

To support this requirement, the following documents have been adopted and implemented by Woodside:

- Incident and Crisis Management Procedure;
  - The objective of the Incident and Crisis Management (I&CM) Procedure is to describe the I&CM process requirements intended to ensure the Company remains prepared to manage incidents and crises effectively;
  - The I&CM process is based on the Prevention, Preparedness, Response and Recovery (PPRR) framework, shown in Figure 10-3;
  - The I&CM process categorises incidents into three levels, based on an assessment of the current consequences and the potential for escalation (Levels 1 to Level 3). This enables clear escalation criteria to be established, so that appropriate support and resources can be quickly applied to manage the incident.

- The I&CM Procedure details the organisational structure to enable effective incident control, coordination, and communication at all levels and the key accountabilities for those responsible for the oversight and implementation of the IC&M process. Further detail is provided within the *Corporate Incident Coordination Centre (CICC) Capability Assessment* document (AOHSE-ER-0071).

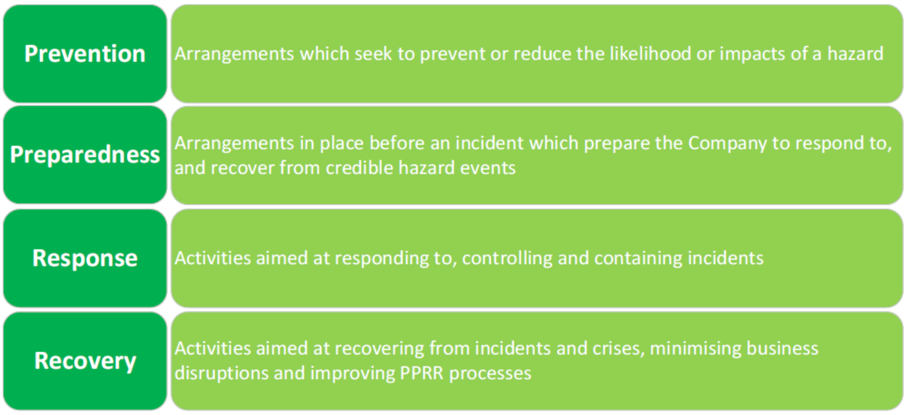


Figure 10-3: The I&CM Process

- Crisis Management Guideline
  - The objective of this guideline is to provide Crisis Management Team (CMT) with the appropriate resources and guidance to effectively manage a Level 3 incident. It supports the implementation of the I&CM Procedure.
- Corporate Incident Coordination Centre Guideline
  - The objective of this guideline is to provide the Corporate Incident Coordination Centre (CICC) team members with the resources and guidance to manage a Level 2 or 3 incident effectively. It supports the implementation of the I&CM Procedure.

Activity-specific documents to be applied by Woodside in the event of an oil pollution emergency in the Otway Basin include:

- *Minerva Field Well Operations Management Plan* (WOMP) demonstrating compliance with:
  - Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011;
  - Weather Monitoring and Planning (PET-GDC20-DR-PRD-00061): describing extreme weather forecasting and emergency disconnect protocols and timeframes;
  - Well Design (PET-GDC20-DR-PRD-00062): detailing minimum design requirements to ensure well integrity;
  - Well Integrity Standard (DR-STD-PET-DC-0193): detailing well integrity and barrier requirements including verification of barriers and barrier elements during well construction, well suspension, temporary abandonment and permanent abandonment.
  - Cementing Standard (DR-PET-STD-DC-0142): detailing minimum cementing standards to ensure formation isolation; and
  - Well & Seismic Delivery (WSD) Organisation, Development and Training Standard (DR-STD-PET-DC-0123): covering well control training requirements for Drillers, Assistant Drillers & Supervisors involved in well control.

The following documents form the Minerva Field Spill Response Document Framework:

- *Minerva Field Decommissioning Oil Pollution Emergency Plan (OPEP) (00MC-BHP-N00-0002)*: Detailed framework for spill response implementation inclusive of Environmental Performance Outcomes (EPOs), Environmental Performance Standards (EPSs) & Measurements Criteria for the effectiveness of the of response strategy implementation.

- *Minerva Field Emergency Response: Basis of Design & Field Capability Assessment* (00MC-BHP-N00-0003)

  The Basis of Design Assessment provides a detailed evaluation of response need based upon appropriate response strategies for the identified worst-case discharge (WCD) scenarios. The document includes:

  - The Spill Impact Mitigation Assessment (SIMA)

    The SIMA process developed by IPIECA (2017) is a pre-spill planning tool to facilitate response option selection and support the development of the overall response strategies by identifying and comparing the potential effectiveness and impacts of oil spill response strategies.
  - An environmental impact and risk evaluation for the implementation of each selected response strategy;
  - An evaluation of response need based upon WCD scenarios for each suitable response strategy;
  - An evaluation of response capability to implement each suitable response strategy in an effective and timely manner, including an assessment of personnel, equipment, procedures both internal and from State and National resources and oil spill response organisations (OSROs);
  - An evaluation of the immediate need (first strike) and additional resource to implement an extended response;
  - An evaluation of response timings for each response strategy including detailed response time models (RTMs) for source control strategies;
  - Spill response logistical arrangements;
  - A detailed ALARP evaluation for each response strategy to demonstrate all reasonable and practicable response capability in available to implement a timely response; and
  - Environmental Performance Outcomes (EPOs), Environmental Performance Standards (EPSs) & Measurements Criteria for response preparedness.
- *Corporate Incident Coordination Centre (CICC) Capability Assessment* (AOHSE-ER-0071)

  The CICC Capability Assessment provides a detailed evaluation of Company capability and competency to enable the implementation of response strategies for the full duration of the oil pollution emergency. The document includes:

  - CICC Incident and Crisis Management (I&CM) Organisation Structure;
  - Source Control Section (SCS) Structure including roles and responsibilities;
  - EMT & CICC roles & responsibilities;
  - CICC / SCS trainings & competency requirements;
  - CICC / SCS resourcing evaluation; and
  - Environmental Performance Outcomes (EPOs), Environmental Performance Standards (EPSs) & Measurements Criteria for maintenance of CICC / SCS capability & competency.

- *Source Control Emergency Response Plan* (SCERP):

  The SCERP is consistent with the requirements of the *Critical Control Performance Standards: Source Control* (PET-GDC20-DR-PRD-00063), the Source Control Framework detailed within the International Oil and Gas Producers (IOGP) Report 594 - Subsea Well Source Control Emergency Response Planning Guide for Subsea Wells (2019) and the APPEA Australian Offshore Titleholder’s Source Control Guideline (June 2021). The SCERP details:

  - Woodside’s access to industry resources under the APPEA Memorandum of Understanding: Mutual Aid;

- A program-specific evaluation of WCD consistent with Society of Petroleum Engineers (SPE), Technical Report on Calculation of Worst-Case Discharge, SPE-174705-TR;
- Primary well design details for identified blowout scenarios;
- An evaluation of surface access to undertake source control operations including subsea intervention, capping stack deployment and relief well locations;
- Detail the planning and resourcing requirements to initiate source control operations including: the SFRT, & relief well drilling; and
- A detailed timeline for the implementation of source control operations to the point of successful well kill.

The SCERP is in a format consistent with the APPEA Australian Offshore Titleholder's Source Control Guideline (June 2021) and includes:

- Purpose & objectives;
- Scope & overview of source control / kill strategy;
- References & applicable supporting documents;
- Source control incident levels & notification actions;
- Source control response actions & interface arrangements with the Woodside Incident and Crisis Management Procedure (I&CMP) & MODU Emergency Response Plans (ERP);
- APU Source Control Section (SCS) roles & responsibilities;
- Source control resources available via the APPEA Mutual Aid MoU, specialist contractors & organisations, contractual and mobilisation arrangements;
- MODU & vessel availability including tracking, securing, regulatory approvals and mobilisation;
- Detailed logistics (national and international) & SIMOPS plans including field exclusions and coordination;
- A Subsea Intervention Plan;
- A separate Relief Well Plan;
- SCERP training, exercises, & readiness validation; and
- Supporting technical appendices

- *Minerva Field: Operational and Scientific Monitoring Bridging Implementation Plan* (OSMBIP) (00MC-BHP-N00-0004)

  The OSMBIP provides the framework for environmental monitoring response to Level 2 and Level 3 offshore oil spills from petroleum activities undertaken by Woodside in the Minerva Gas Field located 11 kilometres off the Southern coast of Victoria. The document is consistent with the Joint Industry OSM Bridging Implementation Plan (APPEA, 2020) and supplements the APPEA Joint Industry Operational and Scientific Monitoring Plan Framework (APPEA, 2020) with Woodside -specific monitoring capability and procedures.

- Primary Tactical Response Plans (TRPs) for the Otway Region:
  - Aire River – Primary TRP
  - Curdies inlet – Primary TRP
  - Gellibrand River – Primary TRP
  - Warrnambool – Primary TRP
- Contractor Emergency Response Plans (ERPs), SOPEPs and bridging documents.

10.6.5 Notifications and IMT Activation

For Level 1 incidents, the MODU and/or AHTS vessel contractor responds to the incident and immediately notifies the Drilling Superintendent and/or Head of Drilling & Completions Australia.

For Level 2/3 incidents, the MODU and/or AHTS vessel contractor immediately notifies the Woodside Communications Centre (WCC).

The Woodside Communications Centre (WCC) is a 24/7, central communication and coordination point for personnel and sites. Initial notification of a potential or actual incident must be made through the WCC. The activation of the CICC (and supporting functions) will be actioned by the WCC.

The CICC provides operational level incident coordination and/or incident control of response and recovery activities and is supported by Functional Support Teams (FST).

10.6.6 Government Agency Notification

Emergency response teams are hierarchical in nature, and response teams and resources are progressively activated depending on the severity of an incident. Government Agencies and Industry Organisations may also be mobilised. A stakeholder database will be used to maintain contact with identified stakeholders.

10.6.7 Industry Joint Venture Programmes

Woodside Energy undertake Joint Venture Programmes with other operators and organisations including, but not limited to, Santos, Vermillion, and AMOSC. These programmes aim to develop operational guidelines, operational tests, training processes and plans to inform and prepare oil spill response strategies. The programmes also provide guidance and training around First Strike incident plans, key operational considerations, understanding of shoreline sensitivities and lists of resources required to implement response.

10.6.8 Review and Testing of the Oil Pollution Emergency Arrangements

Review and update of the OPEP and SCERP

Whilst the duration of the activity is approximately 2 months, this may be undertaken over a 2 calendar year period therefore the OPEP & SCERP shall be reviewed within 12 months of NOPSEMA acceptance to ensure currency of information unless the activity is completed prior to this 12 month period.

The Company HSE Lead is responsible for assessing any changes and deciding if the changes require a resubmission of the OPEP under Section 17 of the Environment Regulations.

The Head of Drilling & Completions Australia is responsible for the review, and where applicable, update of the SCERP.

Schedule of Response Testing

Woodside’s Testing of Arrangements Schedule aligns with international good practice for spill preparedness and response management; the testing is compatible with the International Petroleum Industry Environmental Conservation Association (IPIECA) Good Practice Guide and the Australian Emergency Management Institute Handbook. In the event of a spill, enacting these arrangements will underpin Woodside’s ability to implement a response across its petroleum activities, inclusive of those undertaken by Woodside in the Otway Basin.

The schedule identifies the type of test which will be conducted annually for each arrangement, and how this type will vary over a three-year rolling schedule. Testing methods may include (but are not limited to): audits, drills, field exercises, functional workshops, assurance reporting, assurance monitoring, and reviews of key external dependencies.

Woodside Energy will conduct a functional workshop, inclusive of source control arrangements as detailed within the SCERP, at least 1 month prior to the commencement of P&A activities based upon a WCD (LOWC) scenario within the Minerva Field. Additionally, provision will be made to test response arrangements:

- if they are significantly amended following the acceptance of the EP / OPEP, including the command structure and functional arrangements of the CICC and interface / contracting arrangements with OSROs and / or response service providers;
- not later than 12 months after the most recent test should the accepted EP / OPEP remain in-force for longer than a 12 month period; and
- 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 arrangements in relation to the new location will be undertaken as soon as practicable after it is added to the plan.

Response Testing Objectives

The functional workshop will incorporate the Perth CICC, Source Control Section (SCS) resources and selected support specialist contractors. The exercise may be conducted in a phased approach, or as a single oil spill response exercise. Where Company response strategies and CICC have been subject to a major exercise in the past 12 months, and the testing scenario is comparable to that of a Minerva Field oil pollution emergency in relation to oil type and resources at risk from oil pollution, results from previous exercises may be used to validate the response testing objectives detailed below.

The exercise objectives will include:

- Test establishment of Victorian Forward Operating Bases and interface with Perth CICC;
- Test establishment of Source Control Section and interface arrangements with CICC;
- Test ability to secure alternate MODU for theoretical deployment to Otway Basin;
- Test incident reporting protocols in relation to both internal and external requirements;
- Test activation of source control OSRO's and readiness to mobilise personnel and equipment within specified timeframes as detailed within the SCERP;
- Test communications with OSROs including arrangements for remote working;
- Test CICC communications and interface relationships with Victorian DoT IMT via JSCC;

Evaluation of effectiveness of response arrangements

Exercise evaluation of a functional workshop will be undertaken to determine if the exercise objectives have been achieved. Lessons learned throughout the exercise and during the post exercise debrief will be recorded including identified strengths and areas for improvement.

Response testing recommendations

Any actions from exercises will be tracked and lessons learnt incorporated into subsequent tests. Where required, response documentation shall be updated to incorporate learnings derived during response testing.

Audits

Audits of External Organisations

A formal audit of AMOSC is done by representatives of member companies annually. At the conclusion of an audit, improvement opportunities and corrective actions are formally noted and corrective actions assigned. In some instances changes may be required to the OPEP, but changes will only be made in accordance with the OPGGS (Environment) Regulations.

Audits of Internal Actions

Following an emergency spill incident there may be a requirement for legal and/ or other regulatory or formal HSE incident investigations to be conducted in accordance with the Woodside HSE Management System.

In addition to this, it is essential that the CICC response actions are reviewed as soon as practicable after an incident. The aim of the incident review is to identify any particular lessons that should be shared across the Company, and that can be used to improve the plans or response actions in the future.

Post-spill debriefs address:

- Spill causes, if known;
- Spill response;
- Speed;
- Operation;
- Effectiveness;
- Equipment suitability;
- Health and safety issues, as appropriate; and
- Integration of plan and procedures with other response organisations, consultants, and or agencies.

10.6.9 Emergency Preparedness Consultation

Woodside has undertaken stakeholder engagement during the development of the EP and associated OPEP consistent with the Victorian Joint Industry and State Oil Pollution Responses Guidance Note V2 2020. Additionally, a copy of the OPEP and associated emergency response documents was supplied to the Victorian Department for Transport (Vic DoT) and the Victorian Department of Jobs, Precincts and Regions (DJPR) for review on the 27 of June 2022. The outcomes of this review shall be incorporated into subsequent revisions of the OPEP and associated documents in further consultation with the Vic DoT.

10.6.10 Pollution Insurance

Woodside and all subsidiary companies, including BHP Petroleum (Victoria) Pty Ltd, maintain liability insurance for sudden and accidental pollution. The level of coverage is commensurate with the potential nature and scale of a WCD for the activity and has been calculated in accordance with the 2018 *APPEA Method for Estimating Levels of Financial Assurance*.

10.6.11 Pandemic Response

Management of COVID-19

The APPEA *Novel coronavirus (COVID-19) Australian Upstream Oil & Gas Industry Offshore and Offshore Protocols* (April 2020) have been developed by the Australian oil and gas industry to inform Governments of industry protocols in place to protect workers and the community. The protocol is intended to reinforce and operate concurrently with the public health arrangements as they are put in place by Australian state Governments to manage and address the impacts of COVID-19 including restrictions on borders or movement. The objectives of these protocols are to:

- Keep the oil and gas industry workforce safe and healthy,
- Ensure that the oil and gas industry does not adversely impact the health of regions and communities it operates in and does not undermine public health efforts, and
- Maintain operations, business continuity and production for the benefit of the Australia’s energy and fuel security, the industry, workers, and communities in which they operate

The APPEA Protocols shall be reviewed prior to the commencement of the activity, and if still relevant, shall be used to inform the development and/or review of a COVID-19 Management Plans for the activity.

All mandated and relevant State and National COVID-19 requirements shall be adopted.

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Appendix A

Our Values

Health, Safety and Environment Policy

WOODSIDE POLICY

Woodside

Health, Safety and Environment Policy

OBJECTIVES

Strong health, safety and environment (HSE) performance is essential for the success and growth of our business. Our aim is to be recognised as an industry leader in HSE through managing our activities in a sustainable manner with respect to our workforce, our communities and the environment.

At Woodside we believe that process and personal safety related incidents, and occupational illnesses, are preventable. We are committed to managing our activities to minimise adverse health, safety or environmental impacts.

PRINCIPLES

Woodside will achieve this by:

- implementing a systematic approach to HSE risk management
- complying with relevant laws and regulations and applying responsible standards where laws do not exist
- setting, measuring and reviewing objectives and targets that will drive continuous improvement in HSE performance
- embedding HSE considerations in our business planning and decision-making processes
- integrating HSE requirements when designing, purchasing, constructing and modifying equipment and facilities
- maintaining a culture in which everybody is aware of their HSE obligations and feels empowered to speak up and intervene on HSE issues
- undertaking and supporting research to improve our understanding of HSE and using science to support impact assessments and evidence-based decision making
- taking a collaborative and pro-active approach with our stakeholders
- requiring contractors to comply with our HSE expectations in a mutually beneficial manner
- publicly reporting on HSE performance

APPLICATION

Responsibility for the application of this Policy rests with all Woodside employees, contractors and joint venturers engaged in activities under Woodside operational control. Woodside managers are also responsible for promotion of this Policy in non-operated joint ventures.

Updated by the Board in April 2021

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Appendix B

RELEVANT LEGISLATION, REGULATIONS AND OTHER REQUIREMENTS

Commonwealth Legislation and Regulations

Legislation or Regulation	Description
Air Navigation Act 1920	The Act relates to the management of air navigation.
Australian Maritime Safety Authority Act 1990	The Australian Maritime Safety Authority (AMSA) is a Commonwealth agency responsible for regulation of maritime safety, search and rescue, and ship sourced pollution prevention functions under the Navigation Act 1912 (Cth), protection of the sea legislation, including the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth) and subordinate legislation made pursuant to these Acts.
Australian Ballast Water Management Requirements (Commonwealth of Australia, 2020)	The Australian Ballast Water Management Requirements (Rev 8) set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas.
Biosecurity Act 2015	This Act is about managing diseases and pests that may cause harm to human, animal or plant health or the environment. The proposed amendments also strengthen Australia's ability to manage ballast water in ships. They will provide additional protection for coastal environments from the risk of marine pest incursions by fostering new ballast water treatment technologies and phasing out ballast water exchange.
Biosecurity Regulation 2016	The Biosecurity Regulation prescribes a number of measures and obligations that are common between the Biosecurity Act. Pre-arrival reporting, cost recovery and the isolation and export power provisions all support business as usual activities that were available under the Quarantine Act and therefore represent no substantive change.
Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)	Commonwealth Department of Agriculture, Water and the Environment administers the Act that provides legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places—defined in the EPBC Act as matters of national environmental significance (NES). These include nationally threatened species and ecological communities, migratory species and Commonwealth marine areas. The Act regulates assessment and approval of proposed actions likely to have a significant impact on a matter of NES. The approval decision is made by a delegate of the Australian Government Environment Minister.
Environment Protection and Biodiversity Conservation Regulations 2000	Regulations provide for a wide range of detail essential for the operation of the Act, including regulations relating to management of Commonwealth reserves, information requirements for assessment processes, enforcement, granting of various permits, publication requirements and criteria that need to be met in relation to a wide variety of decision making processes provided for under the Act.
Environment Protection and Biodiversity Conservation Act 1999 - Proclamation - Ningaloo Marine Park (Commonwealth Waters)	Declaration of Ningaloo Marine Park in Commonwealth Waters.
Environment Protection (Sea Dumping) Act 1981 Environment Protection (Sea Dumping) Regulations 1983	The Act regulates the dumping at sea of controlled material (including certain wastes and other matter), the incineration at sea of controlled material, loading for the purpose of dumping or incineration, export for the purpose of dumping or incineration, and the placement of artificial reefs. Permits are required for any sea dumping activities. Operational discharges from vessels are not defined as 'dumping' under the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 and therefore not regulated under the Act.
Hazardous Waste (Regulation of Exports and Imports) Act 1989	Relates to controls over import and export of hazardous waste material. Permits are required to import waste into Australia.

Legislation or Regulation	Description
Industrial Chemicals (Notification and Assessment Act) 1989	The Act establishes the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) to regulate the supply of chemicals into Australia, and importers or manufacturers of chemicals or chemical products must comply. The Act involves assessing and registering industrial chemicals in a national scheme and applies to solvents, adhesives, plastics, laboratory chemicals and paints, as well as chemicals used in cleaning products. Chemicals are defined by exclusion: a substance is an industrial chemical if it is not an agricultural or veterinary product, medicine or medicinal product, food additive, contaminant or natural toxicant.
Maritime Transport and Offshore Facilities Security Act 2003	Department of Infrastructure & Transport (Maritime Security for Offshore Oil & Gas) regulate offshore security plans and Maritime Security Identification Cards (MSIC’s).
Maritime Transport and Offshore Facilities Security Regulations 2003	Department of Infrastructure & Transport (Maritime Security for Offshore Oil & Gas) regulate offshore security plans and MSICs.
National Environment Protection Council Act 1994	This Act provides for the establishment of a National Environment Protection Council (NEPC), and empowers the setting of National Environmental Protection Measures (NEPM). Under the NEPC Act, the Commonwealth has agreed to apply any adopted NEPM to its activities as part of the fulfilment of its obligations under the Intergovernmental Agreement on the Environment 1992 and enables application of State law to ensure uniformity in national pollution standards and environmental protection. NEPMs can only be made to address the following 7 environmental issues: 1.ambient air quality; 2.ambient marine, estuarine and fresh water quality; 3.noise standards; 4.site contamination assessment guidelines; 5.hazardous waste impacts; 6. re-use and recycling of used material; and 7.motor vehicle noise and emissions.
National Environment Protection (National Pollutant Inventory) Measure 1998	The National Pollutant Inventory (NPI) is a database established to provide information on substances being emitted to the air, land and water, and transported in waste. The inventory tracks the magnitude of emissions and the amounts transported in waste of 93 substances. While the NPI NEPM is a federal initiative, each state has legislation giving effect to the program.
National Greenhouse and Energy Reporting Act 2007	This Act provides for the reporting and dissemination of information related to greenhouse gas emissions, greenhouse gas projects, energy production and energy consumption, and for other purposes.
Navigation Act 2012	This Act establishes framework for controls on navigation, marine safety and shipping for ships in Australian waters or territories primarily proceeding on international or inter-state voyages.
Navigation (Orders) Regulations 1980	Details the penalty where Marine Orders are prescribed as “Penal Provisions”.
Marine Orders	Marine Orders (MO) are subordinate rules made pursuant to the Navigation Act 2012 and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 affecting the maritime industry. They are a means of implementing Australia’s international maritime obligations by giving effect to international conventions in Australian law.
Marine Order 32 - Cargo Handling Equipment	MO32 relates to loading and unloading of cargo, and the safe transfer of persons, from ships, off-shore industry vessels and off-shore industry mobile units
Marine Order 41 Carriage of Dangerous Goods	MO41 gives effect to Part A Chapter VII of SOLAS, in particular the International Maritime Dangerous Goods Code (IMGDC) which deals with the carriage of dangerous goods in packaged form, together with prescribing other matters related to carriage of dangerous goods in ships, notice of intention to ship dangerous goods, and provisions related to the loading, stowing, carriage or unloading in ships of cargo.
Marine Order 58 – International Safety Management Code	MO58 specifies the requirements of the International Safety Management (ISM) Code and gives effect to Chapter IX of SOLAS. The purpose of the ISM Code is to provide an international standard for the safe management and operation of ships and for pollution prevention.

Legislation or Regulation	Description
Marine Order 59 –Offshore Industry Supply Vessels	MO59 specifies a number of performance-based requirements for safe navigation and a safe system of operations for off-shore industry vessel operations, including arrangements for safe operations during emergencies. The Order specifies guidelines considered to satisfy these performance-based requirements. The Order also allows alternative practices to be considered and approved as equivalent to those practices in the specified guidelines (NWEA Guidelines). MO59 applies to vessels not registered in Australia, if vessel is engaged in operations associated with or incidental to petroleum exploration or production activity.
Marine Order 91 - Marine Pollution Prevention - Oil	MO91 gives effect to Annex I of the International Convention for the Prevention of Pollution from Ships 1973, as amended by the Protocol of 1978 (MARPOL 73/78).
Marine Order 93 - Marine Pollution Prevention - Noxious Liquid Substances	MO93 gives effect to Annex II of the International Convention for the Prevention of Pollution from Ships 1973, as amended by the Protocol of 1978 (MARPOL 73/78). Details the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk. It subdivides substances into and contains detailed operational standards and procedures. Some 250 substances are appended to the London Convention. The discharge of their residues is allowed only to reception facilities until certain concentrations and conditions (which vary with the category of substances) are compiled with. In any case, no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.
Marine Order 94 - Marine Pollution Prevention – Package Harmful Substances	MO94 gives effect to Annex III of the International Convention for the Prevention of Pollution from Ships 1973, as amended by the Protocol of 1978 (MARPOL 73/78) in relation to packaged harmful substances.
Marine Order 95 - Marine Pollution Prevention - Garbage	MO95 gives effect to Regulation 8 of Annex V (dealing with port State control on operational requirements) and prescribes matters in relation to Regulation 9 of Annex V (dealing with placards, garbage management plans and garbage record-keeping) to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).
Marine Order 96 Marine Pollution Prevention - Sewage	MO96 sets out MARPOL requirements in relation to survey and certification requirements; how sewage should be treated or held aboard ship; and the circumstances in which discharge into the sea may be allowed.
Marine Order 97 - Marine Pollution Prevention - Air Pollution	MO96 sets out MARPOL requirements in relation to air pollution.
Marine Order 98 Marine Pollution - Anti-fouling Systems	MO98 gives affect Articles 3, 4 and 10 of the Anti-Fouling System Convention and Annex 4 to that Convention which provides for controls on anti-fouling systems, and the survey, inspection and certification of ships in relation to those systems. MO98 also prescribes various matters, such as survey and certification requirements and forms to be used to report incidents, for the purposes of the Protection of the Sea (Harmful Anti-fouling Systems) Act 2006.
Notices to Mariners	Issues Nautical Charts. Manages marking of Safety Zones after NOPSEMA gazetting under OPGGSA Section 612 and Marine Cautionary Zones.
Offshore Petroleum and Greenhouse Gas Storage Act 2006	Legislation concerning Australian offshore petroleum exploration & production in Commonwealth Waters. National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) is an independent safety and environmental management Authority funded by levies on industry participants and regulates matters with powers conferred directly from OPGGSA and via Regulations concerned with: • Occupational Health & Safety law at Facilities and offshore operations under Schedule 3 • Environmental management • Structural integrity of Wells under Resource management regulations. NOPSEMA may also declare a 500 metre petroleum safety zone around wells associated with drilling operations.

Legislation or Regulation	Description
Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009	Regulations administered by NOPSEMA to ensure offshore petroleum activity is carried out in a manner consistent with the principles of ecologically sustainable development and in accordance with an accepted environment plan, in particular: • Assessment of environment plans (EP), including associated oil pollution emergency plans (OPEPs) [previously oil spill contingency plans (OSCPs)]; and • Investigation of accidents, occurrences and circumstances with regard to deficiencies in environmental management.
Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009	Regulations administered by NOPSEMA particularly requiring that an accepted Safety Case is in force for a facility. A facility can include a Mobile Offshore Drilling Unit, and aspects of the Safety Case may interrelate with environmental considerations, such as the Facility Description and matters related to technical integrity of the facility.
Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011	NOPSEMA acceptance of well operations management plan (WOMP) & administration of regulations associated with well integrity.
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Act 2003	Act to impose levies relating to the regulation of offshore petroleum activities, including well levies and environment plan levy.
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Regulations 2004	Regulations prescribing the amount and method of calculation for imposition of levies relating to the regulation of offshore petroleum activities, including well levies and environment plan levy.
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	This Act gives effect to Australia's obligations under the Vienna Convention and the Montreal Protocol by introducing, a system of controls on the manufacture, import and export of substances that deplete ozone in the atmosphere and synthetic greenhouse gases.
Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995	Regulation contain controls relating to: import/export/manufacture licensing; manufacture and disposal of scheduled substances; refrigeration and air-conditioning; methyl bromide; and fire protection; import and export of any products and equipment containing hydrofluorocarbons, perfluorocarbons and SF6; and a requirement for importers and manufacturers to pay a levy incorporating a carbon charge component based on the equivalent carbon price.
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006	Gives effect to the Control of Harmful Anti-Fouling Systems on Ships (HAF) Convention which makes it an offence for any ship bearing harmful chemical compounds on their hulls or external parts or surfaces to enter an Australian port, shipyard or offshore terminal, unless the ship bears a coating to prevent such compounds leaching into the water. A similar offence applies to Australian ships entering a port, shipyard or offshore terminal elsewhere in the world.
Protection of the Sea (Powers of Intervention) Act 1981	Act authorises AMSA to take measures for the purpose of protecting the sea from pollution by oil and other noxious substances discharged from ships and implements the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties and the Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil. Act enables AMSA to take measures on the high seas to prevent, mitigate or eliminate the danger apparent upon a maritime casualty where there is grave and imminent danger to the coastline of Australia, or to the related interests of Australia from pollution or threat of pollution of the sea by oil which may reasonably be expected to result in major harmful consequences. Similar powers apply in relation to a ship which is in internal waters, is in the Australian coastal sea, or any Australian ship on the high seas where oil or a noxious substance is escaping, and gives AMSA power to take such measures as it considers necessary to achieve a number of objectives detailed in the Act.

Legislation or Regulation	Description
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	Act administered by the Australian Maritime Safety Authority (AMSA), deals with the protection of the marine environment from ship-sourced pollution. The Act implements the International Convention for the Prevention of Pollution from Ships 1973 and the subsequent 1978 Protocol to the Convention (collectively MARPOL 73/78) and setting operational and construction standards for ships to prevent pollution and regulating normal operational discharges from ships. MARPOL 73/78 annexes regulate the discharge of oil (Annex I), noxious liquid substances (Annex II), the disposal from ships of sewage (Annex IV) and garbage (Annex V) and prohibit the disposal of harmful substances carried by sea in packaged forms (Annex III).
Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994	Sets penalty levels for non-compliance.
Protection of the Sea (Shipping Levy Collection) Act 1981	Levy is a charge against ships and is based on the "potential polluter pays" principle. The levy applies to vessels which are more than 24 metres in length and have onboard more than 10 tonnes of oil in bulk as fuel or cargo.
Underwater Cultural Heritage Act 2018	The Act replaces the *Historic Shipwrecks Act 1976* with a modernised framework for protecting and managing Australia underwater culture heritage. The Act protects shipwrecks, sunken aircraft that are at least 75 years old, whether their location is known or unknown, and associated relics. It also enables the Minister to protect shipwrecks that have been sunk for less than 75 years if they are of historic significance, such as ships wrecked during World War II. All relics associated with historic shipwrecks are protected both while associated with the shipwreck and after their removal, provided that they went down with the ship. The Act also enables the Minister to declare protected zones around historic shipwrecks. A permit is required to carry out prescribed activities, such as trawling, diving or mooring or using ships in a protected zone. The Act prohibits conduct that may interfere with protected shipwrecks and their associated relics.

Victorian State Legislation and Regulations

Legislation or Regulation	Description
Offshore Petroleum and Greenhouse Gas Storage Act 2010	Legislation concerning offshore petroleum exploration & production in Victorian State Waters. The purpose of this Act is to re-enact (with modifications) provisions regulating petroleum exploration and recovery activities and petroleum facilities; and provide for the regulation of geological storage of carbon dioxide in the Victorian offshore area.
Offshore Petroleum and Greenhouse Gas Storage Regulations 2021	The objective of these Regulations is to provide for the elimination and minimisation, so far as is practicable, of the environmental, health and safety hazards and risks involved in undertaking petroleum and greenhouse gas activities and, in particular, to make provision in relation to (a)the manner in which certain petroleum activities, greenhouse gas activities or greenhouse gas injection and storage activities are carried out in the offshore area; and (b) the manner in which certain facilities are designed, constructed, installed, operated, modified and decommissioned in the offshore area; and (c) to ensure that operations in the offshore area are carried out in accordance with good oilfield practice and are compatible with optimum long-term recovery of petroleum; and (d) to prescribe requirements for various administrative activities, fees and other matters.
Victorian Petroleum (Submerged Lands) Act, 1982 and Regulations 2004	The purpose of the Regulations is to introduce an objective based system for regulation of offshore petroleum well activities.
Victorian Environment Protection Act, 1970 and associated regulations	Key aims of the Act include sustainable use and holistic management of the environment, ensuring consultative processes are adopted so that community input is a key driver of environment protection goals and programs and encouraging a co-operative approach to environment protection.
Victorian Pollution of Waters by Oil and Noxious Substances Act 1986.	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).

Industry Standards, Codes of Practice, Guidelines and Commonwealth Guidance Material

AMSA Technical guidelines for preparing contingency plans for marine and coastal facilities (2015)
AMSA National Plan for Maritime Environmental Emergencies (the NatPlan)
APPEA Australian Offshore Titleholder's Source Control Guideline (June 2021)
Australia's Oceans Policy - Western Australia South-West, Western-Central and North-West Marine Plans
Australian Petroleum Production and Exploration Association (APPEA) Code of Practice 2008
Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000
Australian Ballast Water Management Requirements, Version 8, 2020
Australian National Guidelines for Whale and Dolphin Watching 2005
EPBC Act Policy Statement 2.1 - Interactions between Offshore Seismic Activities and Whales (May 2007)
DAWR Offshore Installations - Biosecurity Guide (2019)
DAWE Policy Statement: 'Indirect consequences' of an action: Section 527E of the EPBC Act (2013): https://www.environment.gov.au/system/files/resources/f96c4a92-ffb1-4b77-befe-e2fd9130b0d8/files/epbc-act-policy-indirect-consequences.pdf
Guidelines on Minimising Acoustic Disturbance to Marine Fauna 1997 – WA Department of Mines and Petroleum
IOGP Risk Assessment Data Directory: Blowout Frequencies, September 2019
IOGP Report 592 - Subsea Capping Response Time Model Toolkit User Guide
IOGP Report 594 - Subsea Well Source Control Emergency Response Planning Guide for Subsea Wells (2019)
National Biofouling Management Guidance for the Petroleum Production and Exploration Industry 2009
National Light Pollution Guidelines for Wildlife, January 2020
National Marine Safety Committee principal technical standard, the National Standard for commercial vessels. National Standard for Commercial Vessels (NSCV)
National Strategy for Ecologically Sustainable Development 1992
National Maritime Emergency Response Arrangement (NMERA)
NOPSEMA (2012). Control Measures and Performance Standards Guidance Note. N040300-GN0271 Revision No. 4. December 2012.

NOPSEMA (2020). Information Paper: Reducing Marine Pest Biosecurity Risks through Good Practice Biofouling Management, N-04750-IP1899, July 2021.
NOPSEMA Guidance note: Environment plan content requirements – (GN1344) 11.9.2020
NOPSEMA Guidance note: Petroleum activities and Australian marine parks – (GN1785) 3.6.2020
NOPSEMA Guidance note: Oil pollution risk management – Rev 2 (GN1488) (2018)
NOPSEMA Guidance note: Notification and reporting of environmental incidents – (GN0926) 8.6.2020
NOPSEMA Guidance note: ALARP – Rev 6 (GN0166) (2015)
NOPSEMA Policy: Environment plan assessment - (PL1347) 19.5.2020
NOPSEMA Guideline: Environment plan decision making – Rev 7 (GL1721) (2021)
NOPSEMA Guideline: Making submissions to NOPSEMA – (GL0255) 4.5.2020
NOPSEMA Guideline: Consultation with Commonwealth agencies with responsibilities in the marine area (GL1887) 3.7.2020
NOPSEMA Information paper: Operational and scientific monitoring programs – Rev2 (IP1349) (2016)
NOPSEMA Information Paper: Source Control Planning and Procedures (2021)
NOPSEMA Bulletin #1: Oil Spill Modelling – Rev 0 (A652993) (2019)
NOPSEMA Bulletin #2: Clarifying Statutory Requirements and Good Practice Consultation – Rev 0 (A696998) (2019)
NOPSEMA Explanatory Note: Australian dispersant acceptance process (N-04750-IP1597 A446655) (06/07/2020)
Offshore Petroleum Industry Guidance Note; Marine Oil Pollution: Response and Consultation Arrangements (Western Australian Department of Transport, July 2020).
SPE Technical Report; Calculation of Worst-Case Discharge (WCD), Rev 1 2016 (Society of Petroleum Engineers, 2015)

Appendix C

MINERVA FIELD DESCRIPTION OF ENVIRONMENT

Description of Environment for the Minerva Field

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1. Introduction

BHP Petroleum (Victoria) Pty Ltd (BHP) is the titleholder for the VIC/L22 petroleum title, also known as the Minerva Field. Since the merger completion on 1 June 2022, BHP Petroleum (Victoria) Pty Ltd and its parent company BHP Petroleum International Pty Ltd are owned 100% by Woodside Energy Group Ltd.

This document describes the existing environment that may be affected (EMBA) by petroleum activities undertaken within the Minerva field and includes details of the relevant values and sensitivities of that environment as required by the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*.

The EMBA encompasses the environmental values and sensitivities that have the potential to be contacted by low hydrocarbon thresholds in the event of worst-case release from petroleum activities in the Otway Basin.

This document describes the environmental values and sensitivities within the operational area, and the EMBA that may be contacted by either a marine diesel oil (MDO) release from a project vessel, or a worst-case loss of well control (LOWC) event from a gas-condensate well within the Minerva Field (permit area VIC/L22).

This document is informed by a search of the EPBC Act protected matters search tool (PMST) provided by the Department of Agriculture, Water and the Environment (DAWE) in May 2022, as well as published scientific literature and studies where applicable.

2. Geographic Extent

The EMBA is presented in Figure 2-1, noting the spatial extent of the EMBA is an over-representation of a single potential worst-case spill scenario.

The spatial extent of the EMBA has been defined using stochastic hydrocarbon fate and transport modelling of the worst-case hydrocarbon spills, based on the hydrocarbon exposure values (concentrations) for two scenarios: a subsea release of condensate from a LOWC from the Minerva-4 well, and a MDO surface spill at the Minerva-1 well arising from a vessel-to-vessel or vessel-to-MODU collision.

Each scenario consisted of 200 individual oil spill simulations based upon five years of historical hydrodynamic and wind data and covering both summer and winter seasonal variations.

The oil spill modelling considered four key hydrocarbons phases that pose differing environmental and socio-economic risks: surface (floating) oil, total submerged hydrocarbons (entrained oil droplets in the water column), dissolved oil in the water column, and shoreline accumulated oil. The modelling used defined oil exposure values (concentrations) to aid interpretation of the modelling, to identify when and where areas might be contacted by oil and to inform the subsequent environmental risk evaluation and spill response planning. The oil exposure values used to define the EMBA were guided by NOPSEMA's *Environment Bulletin – Oil Spill Modelling Guideline* (NOPSEMA, 2019) and are provided in Table 2-1.

Table 2-1: Hydrocarbon exposure values

Hydrocarbon phase	Exposure Value		
	Low	**Moderate**	**High**
Surface (floating) oil	1 g/m^2	10 g/m^2	50 g/m^2
Shoreline (accumulated) oil	10 g/m^2	100 g/m^2	1,000 g/m^2
Total submerged oil in the water column (a combination of entrained and dissolved oil components)	10 ppb	100 ppb	-
Dissolved oil in the water column	10 ppb	50 ppb	400 ppb

The LOWC spill EMBA presented in Figure 2-1, shows the combined stochastic modelling outputs for the worst-case condensate spill and marine diesel oil (MDO) spills, based on 200 individual spills for each spill scenario. By overlaying all of the individual spills onto a single figure, the stochastic modelling shows all the potential areas that could be affected in the event of a spill. While the EMBAs represent the area that could be contacted in the event of a spill, a single spill event would have a much smaller spatial extent.

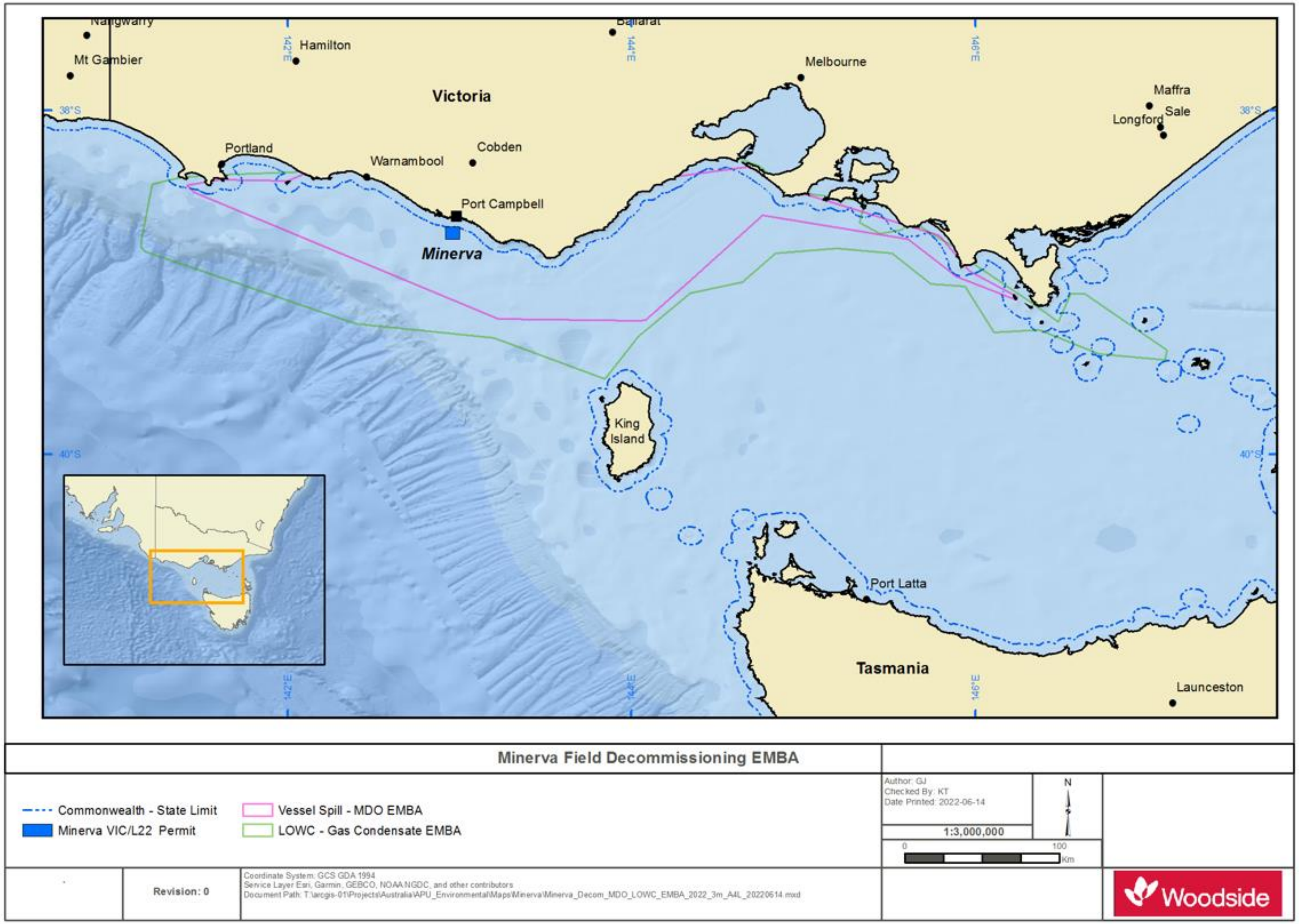


Figure 2-1: Environment that May Be Affected (EMBA) by the petroleum activity

3. South East Marine Region

Australia's offshore waters have been divided into six marine regions to facilitate their management by the Australian Government under the EPBC Act. The EMBA intersects the South East Marine Region (SEMR), which extends from the south coast of New South Wales to Kangaroo Island in South Australia and around Tasmania (DNP, 2013). The SEMR shows significant variation in seafloor features and water depth, contributing to the high level of species diversity in the region (DoE, 2015). There are areas of continental shelf, which includes Bass Strait and Otway Shelf, where rocky reefs and soft sediments 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 (DNP, 2013).

Compared to other marine areas, Australia's South East Marine Region is relatively low in nutrients and primary productivity; however, in some locations, water bodies converge and mix to create areas of relatively high biological productivity (DNP, 2013). One of these is the Bonney Upwelling Key Ecological Feature (KEF) (Section 14.14.1.10) in south-eastern South Australia which occurs during autumn and summer. This season of higher primary productivity attracts whale species and other species (including EPBC Act-listed species) to the area to feed on the plankton swarms (krill) (DoE, 2015).

The SEMR is recognised as a major marine biogeographic region with a high diversity of species and also a large number of endemic species (DNP, 2013). There is an abundance of fish species in the region of approximately 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).

The SEMR is further regionalised by the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) version 4.0, with the Minerva field located in the Otway mesoscale region (Figure 3-1). The Otway bioregion extends from Cape Otway (Victoria) to Cape Jaffa (South Australia) and includes the western islands of Bass Strait such as King Island (NOO, 2002).

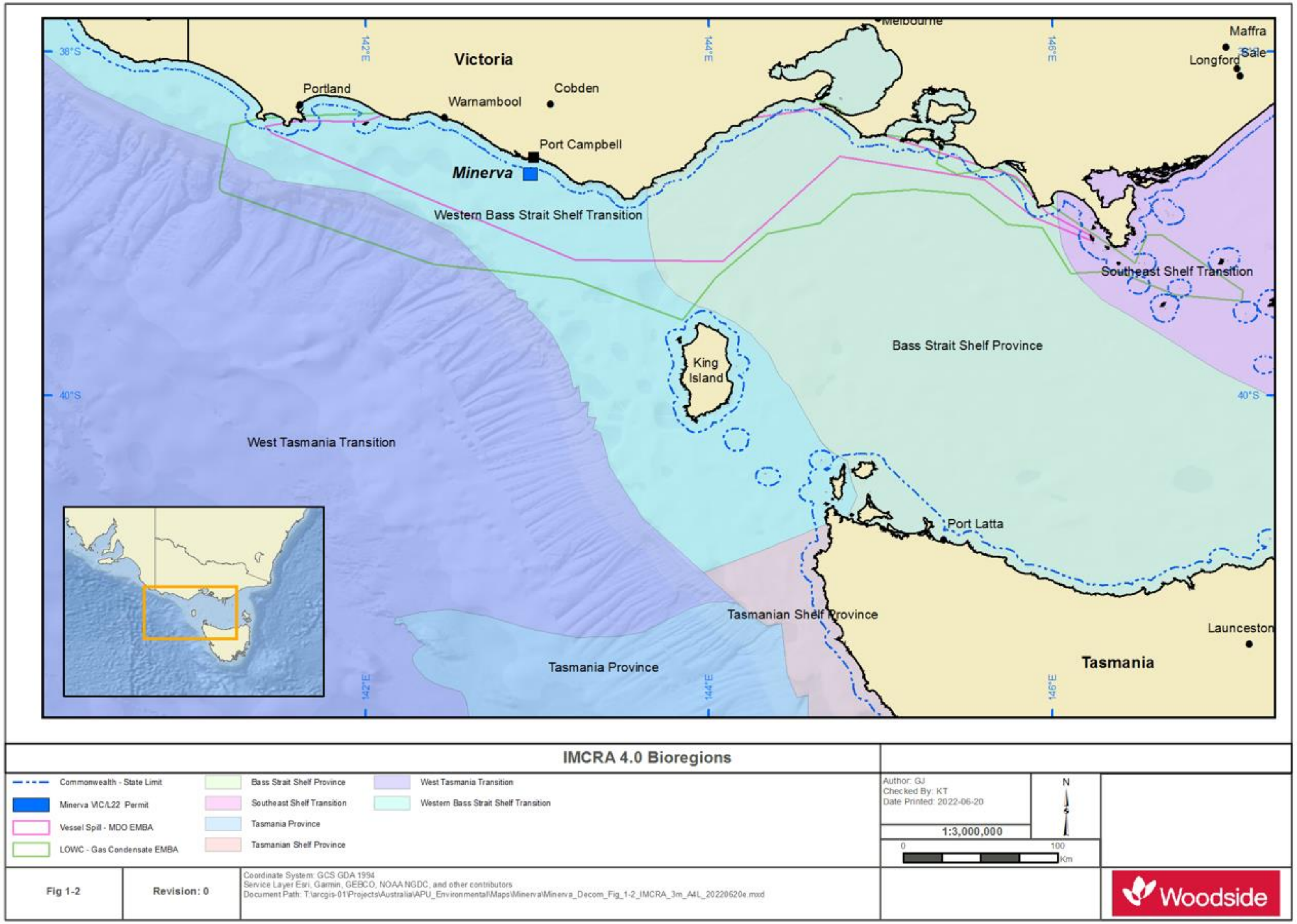


Figure 3-1: IMCRA 4.0 Bioregions in the South East Marine Region

4. Values and Sensitivities

Regulation 13(2) of OPGGS(E) Regulations (Cwth) and Sub-regulation 15(2) of the OPGGS Regulations (2021) (Vic State) states that "*the environment plan must:*

(2)(a) Describe the existing environment that may be affected by the activity; and

(2)(b) Include details of the particular relevant values and sensitivities (if any) of that environment".

Regulation 13(3) of the OPGGS (E) Regulations (Cwth) states that "*Without limiting paragraph 13(2)(b), particular relevant values and sensitivities may include any of the following:*

13(3)(f) Any values and sensitivities that exist in, or in relation to, part or all of:

(i) A Commonwealth marine area within the meaning of that Act; or

(ii) Commonwealth land within the meaning of that Act".

This section summarises environmental values and sensitivities, including physical, biological, socio-economic and cultural features in the marine and coastal environment that are relevant to the operational area and the EMBAs. Searches for matters of national environmental significance (MNES) and other matters protected by the EPBC Act were undertaken for the operational area and the EMBAs using the Protected Matters Search Tool (PMST).

4.1 Matters of National National Environmental Significance (EPBC Act)

A number of EPBC Act areas and species within the operational area and EMBA boundaries are protected under state and federal legislation.

Table 4-1 summaries the MNES areas identified as potentially occurring within the operational area and EMBAs, as determined by the PMST results. Table 4-2 highlights the Australian IUCN reserve management principles for the relevant IUCN categories associated with the marine parks identified by the PMST results.

The EPBC Act protected species that may be present and affected by planned and unplanned events within the operational area and EMBAs are presented in Table 4-4.

Additional information on identified MNES are provided in the following sections.

Table 4-1: Summary of protected areas in waters within the EMBA

Area Type	Title	IUCN Classification	Operational Area	MDO EMBA	LOWC EMBA	Relevant Section
World Heritage Areas	N/A	-	-	-	-	N/A
Wetlands of International Importance (RAMSAR)	Western Port	-	-	✓	✓	Section 4.1.5
	Port Phillip Bay	-	-	✓	✓	
Wetlands of National Importance	Western Port	-	-	✓	✓	Section 4.1.6
	Swan Bay and Swan Island	-	-	-	✓	
	Aire River	-	-	✓	✓	
	Yambuk Wetlands	-	-	-	✓	
	Tower Hill	-	-	✓	✓	

Area Type	Title	IUCN Classification	Operational Area	MDO EMBA	LOWC EMBA	Relevant Section
	Princetown Wetlands	-	-	✓	✓	
	Lake Connewarre State Wildlife Reserve	-	-	-	✓	
	Lower Aire River Wetlands	-	-	✓	✓	
	Lower Merri River Wetlands	-	-	✓	✓	
National Heritage Places	Point Napean Defence	-	-	✓	✓	Section 4.1.3
Commonwealth Heritage Places	N/A	-	-	-	-	N/A
Threatened Ecological Communities (TEC)	Subtropical and Temperate Coastal Saltmarsh	-	-	✓	✓	Section 4.1.7
	Karst springs and associated alkaline fens of the Naracoorte Coastal Plain Bioregion	-	-	-	✓	
	Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community	-	-	✓	✓	
	Natural Damp Grassland of the Victorian Coastal Plains	-	-	✓	✓	
	Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	-	-	✓	✓	
	Giant Kelp Marine Forests of South East Australia	-	-	✓	✓	
Key Ecological Features (KEF)	West Tasmania Canyons	-	-	✓	✓	Section 4.1.10

Area Type	Title	IUCN Classification	Operational Area	MDO EMBA	LOWC EMBA	Relevant Section
	Bonney Coast Upwelling	-	-	✓	✓	
Australian Marine Parks (AMP)	Apollo	Multiple Use Zone (IUCN VI)	-	✓	✓	Section 4.1.8
	Beagle	Multiple Use Zone (IUCN VI)	-	-	✓	
State Marine Parks	Bunurong Marine National Park	National Park (IUCN II)	-	✓	✓	Section 4.1.9
	Churchill Island Marine National Park	National Park (IUCN II)	-	-	✓	
	Discovery Bay Marine National Park	National Park (IUCN II)	-	-	✓	
	Point Addis Marine National Park	National Park (IUCN II)	-	✓	✓	
	Port Phillip Heads Marine National Park	National Park (IUCN II)	-	✓	✓	
	Twelve Apostles Marine National Park	National Park (IUCN II)	-	✓	✓	
	Wilsons Promontory Marine National Park	National Park (IUCN II)	-	✓	✓	
	Marengo Reefs Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓	
	The Arches Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓	
	Barwon Bluff Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	-	✓	
	Eagle Rock Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓	

Area Type	Title	IUCN Classification	Operational Area	MDO EMBA	LOWC EMBA	Relevant Section
	Merri Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓	
	Mushroom Reef Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	✓	✓	
	Point Danger Marine Sanctuary	Natural Monument or Feature (IUCN III)	-	-	✓	

Note: the PMST also identified several protected areas which were deemed to be irrelevant to petroleum activities in the Otway Basin due to their terrestrial location and have been excluded.

Table 4-2: Australian IUCN Reserve Management Principles

IUCN Classification	Description	IUCN Principles	Applicable Marine Parks / Sanctuaries
National Park **(IUCN II)**	Natural area of land and/or sea, designated to: (a) protect the ecological integrity of one or more ecosystems for this and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.	The reserve or zone should be protected and managed to preserve its natural condition according to the following principles.	Bunurong Marine National Park Churchill Island Marine National Park Discovery Bay Marine National Park Point Addis Marine National Park Port Phillip Heads Marine National Park Twelve Apostles Marine National Park Wilsons Promontory Marine National Park
		Natural and scenic areas of national and international significance should be protected for spiritual, scientific, educational, recreational or tourist purposes.	
		Representative examples of physiographic regions, biotic communities, genetic resources, and native species should be perpetuated in as natural a state as possible to provide ecological stability and diversity.	
		Visitor use should be managed for inspirational, educational, cultural and recreational purposes at a level that will maintain the reserve or zone in a natural or near natural state.	
		Management should seek to ensure that exploitation or	

IUCN Classification	Description	IUCN Principles	Applicable Marine Parks / Sanctuaries
		occupation inconsistent with these principles does not occur.	
		Respect should be maintained for the ecological, geomorphologic, sacred and aesthetic attributes for which the reserve or zone was assigned to this category.	
		The needs of Indigenous people should be taken into account, including subsistence resource use, to the extent that they do not conflict with these principles.	
		The aspirations of traditional owners of land within the reserve or zone, their continuing land management practices, the protection and maintenance of cultural heritage and the benefit the traditional owners derive from enterprises, established in the reserve or zone, consistent with these principles should be recognised and taken into account.	
Natural Monument or Feature **(IUCN III)**	Area containing one or more specific natural or natural / cultural feature which is of outstanding value because of its inherent rarity, representative or aesthetic qualities or cultural significance.	The reserve or zone should be protected and managed to preserve its natural or cultural features based on the following principles.	Marengo Reefs Marine Sanctuary The Arches Marine Sanctuary Barwon Bluff Marine Sanctuary Eagle Rock Marine Sanctuary Merri Marine Sanctuary Mushroom Reef Marine Sanctuary Point Danger Marine Sanctuary
		Specific outstanding natural features should be protected or preserved in perpetuity because of their natural significance, unique or representational quality or spiritual connotations.	
		Opportunities for research, education, interpretation and public appreciation should be provided to an extent consistent with these principles.	
		Management should seek to ensure that exploitation or occupation inconsistent with	

IUCN Classification	Description	IUCN Principles	Applicable Marine Parks / Sanctuaries
		these principles does not occur.	
		People with rights or interests in the reserve or zone should be entitled to benefits derived from activities in the reserve or zone that are consistent with these principles.	
Multiple Use Zone **(IUCN VI)**	Area containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.	The reserve or zone should be managed mainly for the sustainable use of natural ecosystems based on the following principles.	Apollo AMP Beagle AMP
		The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long-term.	
		Management practices should be applied to ensure ecologically sustainable use of the reserve or zone.	
		Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles.	

Source: Environment Australia, 2002

4.1.1 Commonwealth and International Marine Areas

The operational area and EMBAs are within the Australia's exclusive economic zone (EEZ) and Territorial Sea which is a Commonwealth Marine Area, and the wider EMBA also includes the extended continental shelf to Indonesian EEZ. The Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's EEZ and/or over the continental shelf of Australia, that is not State or Northern Territory waters. The Australian Commonwealth marine area stretches from 3 to 200 nautical miles (nmi) from the coast. Similarly Indonesian territorial waters extend 12 nmi from coastline.

4.1.2 World Heritage Properties

World Heritage Properties represent the best examples of the world's cultural and natural heritage. There are no World Heritage Properties within the operational area or EMBAs.

Note: heritage properties that are terrestrial and not linked to the shoreline EMBA, have been excluded as they are not relevant to consideration of potential affects from marine hydrocarbon spills.

4.1.3 National Heritage Places

National Heritage Places are natural, historic and Indigenous places of outstanding significance to the nation. The Point Napean National Heritage Property is located along the Victorian coastline which intersects the EMBAs. Point Nepean is the site of the oldest, surviving, purpose-built, barracks-style, quarantine accommodation buildings in Australia, as well as fortifications demonstrating the primary importance of coastal defence to the Australian colonies. As an island-nation, quarantine has played an important part in controlling the impact of ship-borne diseases on Australia from the early 1800s (DAWE, 2006). Point Nepean is an historic landscape, which features a range of values relating to both Victorian and national quarantine processes from the 1850s and to the history of coastal defence from the 1870s (DAWE, 2006).

Point Nepean is recognised for its broad historic landscape, featuring a considerable array of historic values relating to national quarantine and defence (DAWE, 2006). The historic fabric at Point Nepean includes mid-nineteenth century archaeological remains and over one hundred year's evidence of quarantine processes and defensive fortifications, which contribute to a richly layered historic cultural landscape (DAWE, 2006).

4.1.4 Commonwealth Heritage Places

The Commonwealth Heritage list is a list of the historic, cultural and natural heritage places on Commonwealth land, in Commonwealth waters, or owned or managed by the Commonwealth Government. These include places connected to defence, maritime safety, communications, customs and other government activities that also reflect Australia's development as a nation. No Commonwealth Heritage Places exist within the operational area or EMBAs.

Heritage places that are terrestrial and not linked to the shoreline, but occur in the EPBC Act Protected Matters search of the EMBA, have been excluded as they are not relevant to consideration of potential affects from marine hydrocarbon spills. Refer to complete EPBC Act Protected Matters searches results.

4.1.5 Wetlands of International Importance

There are no Ramsar Wetlands that intersect the operational area. However, there are two coastal Ramsar Wetlands sites located within the EMBAs: Western Port and Port Phillip Bay. Another site is located within 10 km of the EMBAs, Glenelg Estuary and Discovery Bay Wetlands, but outside the extent of the EMBAs. Refer to complete EPBC Act Protected Matters searches results.

Western Port

Western Port is a large bay in southern Victoria incorporating around 260 kilometres of coastline, connected to Bass Strait by a wide channel between Flinders and Phillip Island, and a narrow channel between San Remo and Phillip Island (DAWE, 2019a).

The Ramsar site has a wide variety of habitat types ranging from deep channels, seagrass flats, intertidal mudflats, extensive mangrove thickets and saltmarsh vegetation (DAWE, 2019a). The site is one of the three most important areas for waders in Victoria and supports numerous migratory species listed under international migratory bird conservation agreements (DAWE, 2019a). High numbers of eastern curlew, whimbrel, bar-tailed godwit, grey-tailed tattler, greenshank and terek sandpiper have been recorded at the site (DAWE, 2019a). Many threatened species utilise Western Port and include the fairy tern, orange-bellied parrot, swift parrot, helmeted honeyeater, little tern, and southern right whale (DAWE, 2019a).

Western Port is also recognised for a number of Indigenous cultural heritage sites and is used for commercial fishing and recreational activities (DAWE, 2019a).

Port Phillip Bay

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 (DAWE, 2019a). The Ramsar site is a low-lying area and a natural discharge point for the rivers in southern central Victoria (DAWE, 2019a).

The site includes freshwater lakes, estuaries, some with White Mangrove, saltmarshes, intertidal mudflats and seagrass beds (DAWE, 2019a). This Ramsar site is the sixth most important area in Australia for migratory waders and the most important in Victoria. Large numbers of bird species including Pied Oystercatchers, Banded Stilts, Red-necked Stint, Sharp-tailed Sandpiper, Fairy Tern, Australasian Shoveler, Red-necked Avocets, Blue-billed Duck, and Freckled Duck, have been recorded at the site (DAWE, 2019a). The site also provides important habitat for threatened species such as the Little Tern and, in particular, large numbers of the nationally threatened Orange-bellied Parrot who utilise Port Phillip Bay during the winter after their summer migration to Tasmania to breed (DAWE, 2019a).

4.1.6 Wetlands of National Importance

Wetlands of national importance are wetlands that are a good example in a particular area, an important habitat for native species, or that have outstanding heritage or cultural significance. The operational area does not overlap any nationally important wetlands, however, the MDO spill EMBA overlaps six wetlands of national importance with two having connectivity with the marine environment: Western Port and Aire River, and the LOWC spill EMBA overlaps nine wetlands of national importance with only three having connectivity with the marine environment: Western Port, Swan Bay and Swan Island, and Aire River. These wetlands have been described below.

Wetlands that are not linked to the shoreline, but occur in the EPBC Act Protected Matters search of the EMBAs, have been excluded from the descriptions below as they are not relevant to consideration of potential affects from marine hydrocarbon spills. Refer to complete EPBC Act Protected Matters searches results.

Western Port

See Section 4.1.5 for details on Western Port.

Swan Bay and Swan Island

Swan Bay is a shallow marine embayment partly enclosed by spits and barrier islands such as Swan Island. It is generally less than two metres in depth, with 700 - 1000 hectares (ha) of mudflats exposed at low tide, and has extensive seagrass beds (DAWE, 2019b).

The area is a high value wetland for its ecological, recreational and educational features. With an unusual shallow embayment and a mixture of relatively undisturbed seagrass species, it is of high value for avifauna and flora. It is very productive for birds, molluscs and fish (DAWE, 2019b).

Aire River

The Aire River is one of the largest rivers in south-western Victoria and is part of the Otway Coast catchment (DAWE, 2019b). Originating in the Otway Ranges, south-east of the township of Beech Forest, it has high water quality and low turbidity providing a high value habitat for a variety of flora and fauna species, some of which are considered threatened species (DAWE, 2019b).

The area is popular for recreational activities such as fishing, picnicking, camping and sight-seeing. There are also approximately 18 archaeological sites in the area, most of which are Aboriginal shell middens (DAWE, 2019b).

4.1.7 Threatened Ecological Communities

Threatened Ecological Communities (TECs) provide wildlife corridors and / or habitat refuges for many plant and animal species, and listing a TEC provides a form of landscape or systems-level conservation (including for threatened species). The PMST Report did not identify any TEC within the operational area. Although several TECs were identified with a presence in the MDO and LOWC spill EMBAsonly three have coastal connections and include:

- Giant kelp marine forests of South East Australia – listed as Endangered and may occur in the area,
- Subtropical and temperate coastal saltmarsh – listed as Vulnerable and likely to occur in the area, and
- Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community – listed Endangered and likely to occur in the area.

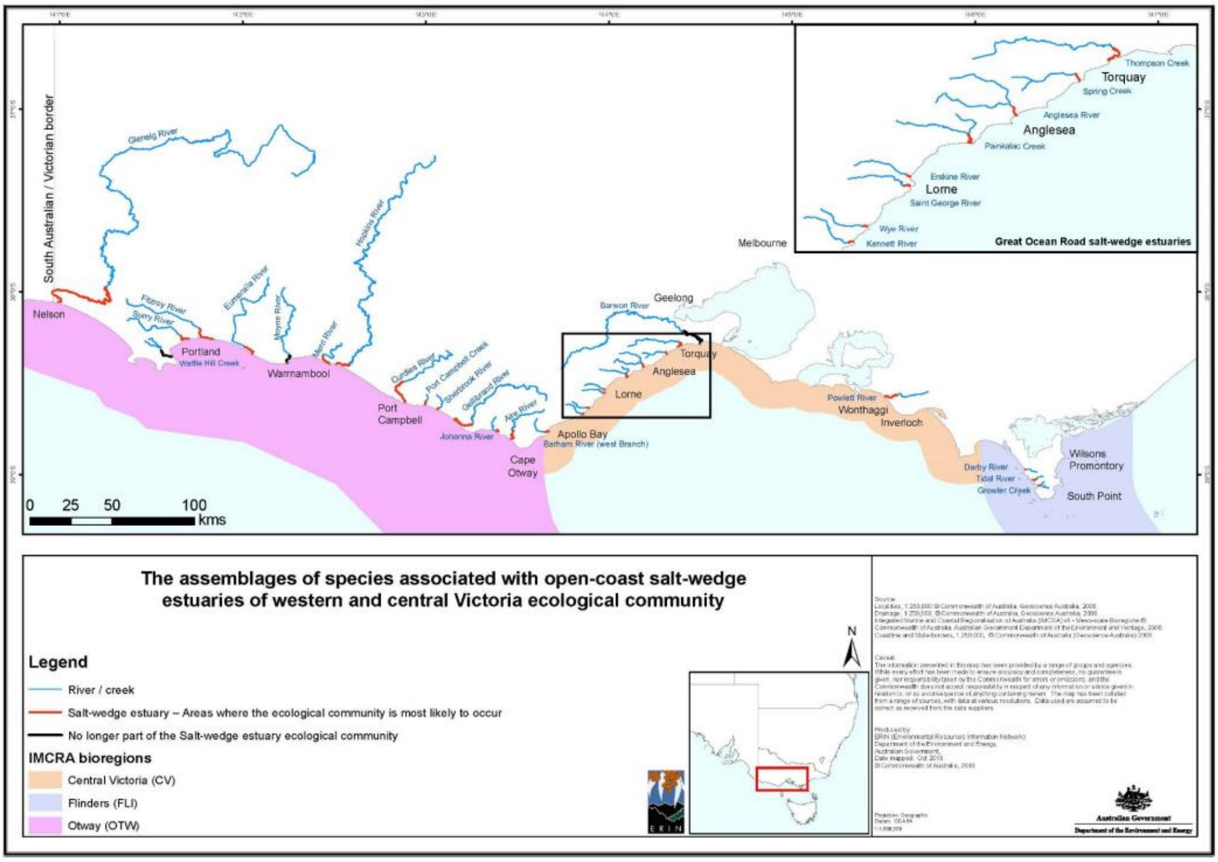
TECs that are not linked to the shoreline, but occur in the EPBC Act Protected Matters search of the EMBA, have been excluded from the description below as they are not relevant to consideration of potential affects from marine hydrocarbon spills. Refer to complete EPBC Act Protected Matters searches results.

The three TECs of relevance are described below.

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 microtidal (<2 m) coastline of western and central Victoria (DoEE, 2018). 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 (Figure 4-1) (DoEE, 2018).

Salt-wedge estuaries are usually highly stratified, with saline bottom waters forming a 'salt-wedge' below the inflowing freshwater layer of riverine waters (DoEE, 2018). The wedge of heavier marine waters is introduced into the estuary by high wave energy and tides. 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 (DoEE, 2018). Some species are dependent on the dynamics of these salt-wedge estuaries for their existence, refuge, increased productivity and reproductive success. This 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) (DoEE, 2018).



Source: DoEE, 2018

Figure 4-1: Distribution of Salt-wedge Estuaries in the SEMR

Giant Kelp Marine Forests of South East Australia

The ecological community is defined by the species *Macrocystis pyrifera,* or Giant Kelp, which grows in the nutrient rich waters of the temperate south east of Australia (DSEWPaC, 2012). Giant Kelp are defined by the 'forest-like' structures it forms from the rocky sea floor to the sea surface (DSEWPaC, 2012). However, 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 substrate adds vertical structure to the water column and altering the immediate light and hydrological environment that creates significant habitat for marine fauna, thereby increasing local marine biodiversity (DSEWPaC, 2012). 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*) (TSSC, 2012). The high primary and secondary productivity of the giant kelp forests create and provide a number of ecosystem services to the coastal environment, including habitat for juvenile life stages of commercially important fishes, improvements in local water quality, and coastal protection by acting as a buffer for strong waves (DSEWPaC, 2012).

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 metres 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).

Subtropical and Temperate Coastal Saltmarsh

The Subtropical and Temperate Coastal Saltmarsh TEC consists of organisms including and associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (DSEWPaC, 2013). The ecological community spans six state jurisdictions: Queensland (southern), New South Wales, Victoria, Tasmania, South Australia and Western Australia (south-western) (DSEWPaC, 2013). Occupying a relatively narrow strip along the Australian coast, in 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 (Saintilan, 2009a,b).

A wide range of infaunal and epifaunal invertebrates and low and high tide visitors such as fish, birds and prawns also inhabit the TEC (DSEWPaC, 2013). It is reported as an important nursery habitat for fish and prawn species. The dominant marine residents are benthic invertebrates, including molluscs and crabs (Ross *et al*., 2009) with insects also abundance and considered an important food source for fauna (DSEWPaC, 2013).

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 (DSEWPaC, 2013). 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 and loss of saltmarsh habitat could release stored carbon to the atmosphere (DSEWPaC, 2013).

4.1.8 Australian Marine Parks

Australian Marine Parks (AMPs) are recognised under the EPBC Act for protecting and maintaining biological diversity and contributing to a national representative network of marine protected areas.

Commonwealth Marine Reserves Network was established in 2012 for the purpose of protecting the biological diversity and sustainable use of the marine environment. There are six management plans – one for each of the five marine park networks. The operational area and EMBAs are within the South-east Commonwealth Marine Reserves Network.

The South-east Commonwealth Marine Reserves Network has been established to protect and maintain marine biodiversity, while allowing for the sustainable use of natural resources in some areas within the Commonwealth waters of the South-east Region and forms part of Australia's National Representative System of Marine Protected Areas (DNP, 2013). The South-east Marine Reserves Network comprises 14 Commonwealth marine reserves (DNP, 2013).

Under the various network management plans, AMPs are allocated conservation objectives (IUCN Protected Area Category) based on the Australian IUCN reserve management principles in Schedule 8 of the EPBC Regulations 2000. The relevant principles for each IUCN category identified within the EMBA is described in Table 4-2.

The operational area does not intersect any AMPs. While the MDO spill EMBA overlaps the Apollo AMP and the LOWC spill EMBA overlaps the Apollo and Beagle AMPs (Figure 4-2). Information on the AMPs is provided below.

Apollo AMP

The Apollo AMP is located in Bass Strait south of Cape Otway and Apollo Bay in western Victoria, and north-west of King Island in waters 80 m to 120 m deep on the continental shelf (DNP, 2013). The reserve covers 1,184 km^2 of Commonwealth ocean territory and is considered a Multiple Use Zone (IUCN VI) (DNP, 2013). This classification allows mining activities subject to approval in accordance with an Environment Plan accepted under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 by NOPSEMA.

The Apollo AMP is a relatively shallow reserve with waters less than 50 m deep near Cape Otway and up to 100 m at the Otway Depression, an undersea valley that joins the Bass Basin to the open ocean (DNP, 2013). The reserve is a part of the continental shelf ecosystem that extends from South Australia to the west of Tasmania where the region is exposed to big waves and strong tidal flows (DNP, 2013). The sea floor has many rocky reef patches interspersed with areas of sediment and, in places, has rich, benthic fauna dominated by sponges providing ideal foraging for seabirds, dolphins, seals and white sharks (DNP, 2013). Various whale species are also known to migrate through the region.

The major conservation values of the Apollo AMP include:

- Ecosystems, habitats and communities associated with the Western Bass Strait Shelf Transition and the Bass Strait Shelf Province and associated with the seafloor 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).

Beagle AMP

The Beagle AMP lies entirely within Bass Strait, with its north-western edge abutting Victorian waters south-east of Wilson's Promontory (DNP, 2013). It is a shallow-water reserve in an area of shallow continental shelf with depths of about 50 m to 70 m (DNP, 2013). Beagle AMP covers an area of 2,928 km^2 and is also considered a Multiple Use Zone (IUCN VI) where mining activities are subject to approval in accordance with an Environment Plan accepted under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 by NOPSEMA.

The reserve includes the fauna of central Bass Strait; an area known for its high biodiversity. 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 (DNP, 2013).

The major conservation values of the Beagle AMP include:

- Ecosystems, habitats and communities associated with the Southeast Shelf Transition and associated with the seafloor features: basin, plateau, shelf and sill.

- Important migration and resting areas for southern right whales.
- 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).

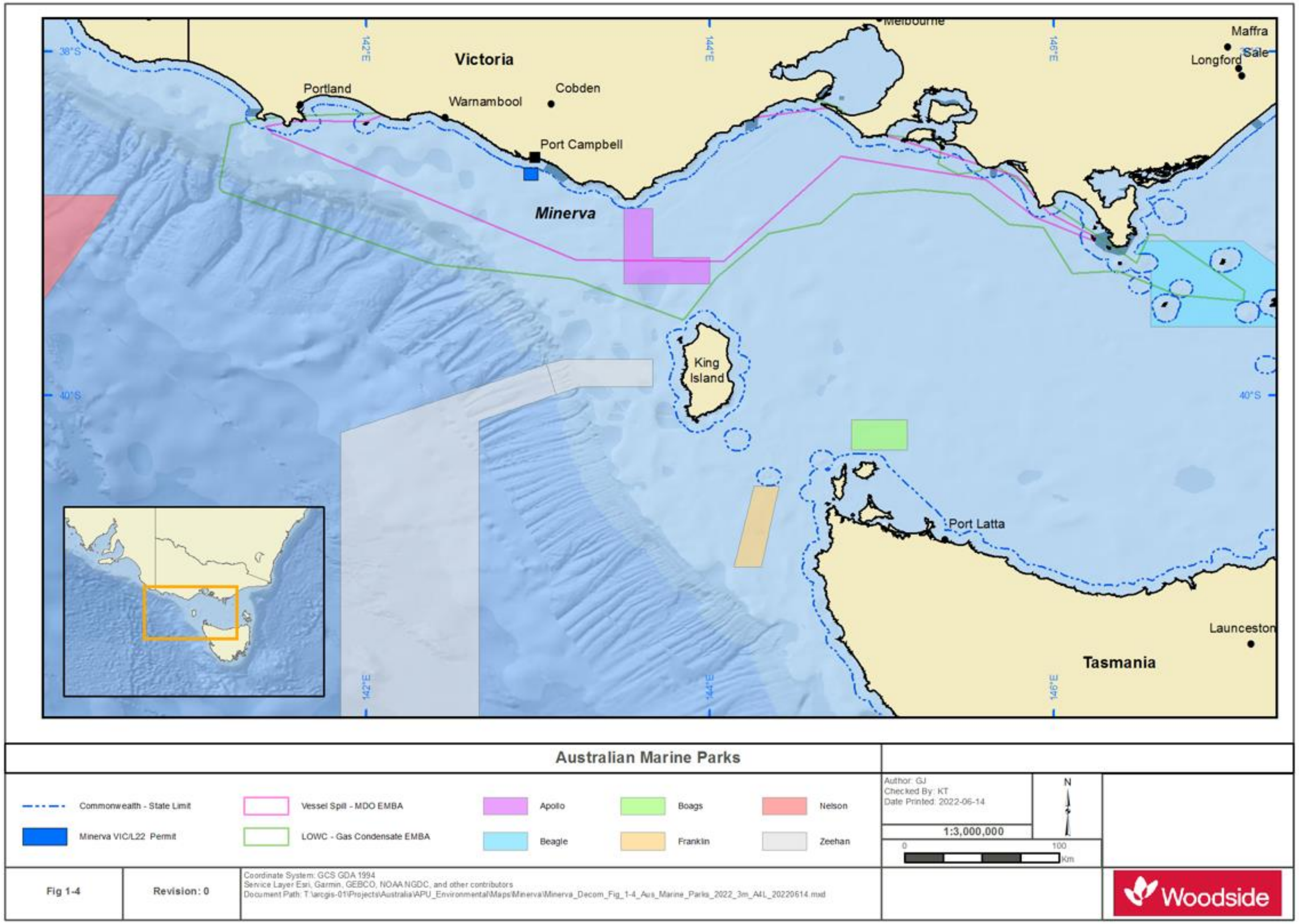


Figure 4-2: Australian Marine Parks within the Operational Area and EMBAs

4.1.9 Victorian State Marine Protected Areas

The operational area does not intercept any Victorian State Marine Protected Areas. The MDO spill EMBA overlaps ten Victorian State Marine Protected Areas and the LOWC spill EMBA overlaps 14 (Figure 4-3). These are described below.

Table 4-2 shows the relevant principles for each IUCN category for the protected state marine areas identified within the EMBA.

Terrestrial State Reserves that occur in the EPBC Act Protected Matters search of the EMBA, have been excluded from the descriptions below as they are not relevant to consideration of potential affects from marine hydrocarbon spills. Refer to complete EPBC Act Protected Matters searches results.

Bunurong Marine National Park

The Bunurong Marine National Park is classified as IUCN II (National Parks) and the Bunurong Marine Park as IUCN IV (Habitat / species management area) and both are managed through the Bunurong Marine National Park Management Plan (Parks Victoria, 2006a). The Plan identifies the key values of the Parks as:

Natural Values

- The largest continuous marine protected area in the Central Victorian Marine Bioregion.
- 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.
- Highest diversity of intertidal and shallow subtidal invertebrate fauna recorded in Victoria on sandstone.
- 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.
- 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.
- One of the richest Mesozoic fossil areas in Victoria.

Cultural Values

- 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.
- Opportunities for cultural values investigation in an area protected from human disturbance.

Tourism and Recreational Values

- 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.

Churchill Island Marine National Park

Churchill Island is located south of Rhyll, on the eastern shore of Phillip Island extending from Long Point to the north point of Churchill Island (Visit Victoria, 2019a). The park is part of the Western Port RAMSAR site (Section 4.1.5) and includes numerous marine habitats such as mangroves, sheltered intertidal mudflats, seagrass beds, subtidal soft sediments and rocky intertidal shores (Visit Victoria, 2019a).

Churchill Island is an important habitat for many bird species with migratory waders roosting and feeding within the Marine National Park including the bar-tailed Godwit and the red-necked stint (Visit Victoria, 2019a). The seagrass beds are major food sources for many commercially viable species such as King George whiting, black bream and yellow-eyed mullet (Visit Victoria, 2019a).

Discovery Bay Marine National Park

The Discovery Bay Marine National Park is situated 20 km west of Portland and covering 2,770 ha and is considered the marine gateway to the Great Australian Bight (PTA, 2020). This park protects part of a large coastal basalt formation in Western Victoria and the deep water (30 – 60 m) houses low reefs forms from ancient shorelines or dunes (PTA, 2020). 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 Fish and invertebrates such as the Southern Rock Lobster and Black Lip Abalone are supported by deep sponge gardens and shallow reefs (PTA, 2020). The waters also provide for great white shark populations and see blue whales during the summer breeding season.

The Discovery Bay National Park is protected as part of the Ngootyoong Gunditj 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 (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.

Point Addis Marine National Park

Point Addis Marine National Park lies on the eastern side of the EMBA and covers 4,600 hectares. This park protects representative samples of subtidal soft sediments, subtidal rocky reef, rhodolith beds and intertidal rocky reef habitats. Providing a suitable environment for a range of invertebrates, fish, algae, birds and other 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, 2005) and is classified as IUCN II. The Plan identifies the following environmental, cultural and social values for the parks and sanctuaries:

<u>Natural Values</u>

- 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 invertebrates.

<u>Cultural Values</u>

- 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.

- Coastal seascapes of significance for many who live in the area or visit.

Tourism and Recreational Values

- Surf breaks, including those at Bells Beach.
- 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.

Port Phillip Heads Marine National Park

Port Phillip Heads Marine National Park is located at the southern end of Port Phillip bay and occupies an area of 3,580 ha.The park is divided into six separate areas and protects a wide range of marine habitats, including rocky intertidal and subtidal reef, underwater gorges, sponge gardens, kelp forests, and seagrass beds (Parks Victoria, NA). These habitats support a high diversity and abundance of marine flora and fauna that provides a migratory site for wader birds (Visit Victoria, 2019b). The park also presents a range of recreational opportunities including internationally recognised dive sites (Parks Victoria, NA).

Twelve Apostles Marine National Park

The Twelve Apostles Marine National Park covers 75 km^2 and showcases the iconic pillars of the Twelve Apostles. Located 7 km east of Port Campbell, the marine park 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 canyons, caves, arches and walls housing a variety of seaweed and sponge gardens (Visit Victoria, NA). The underwater structures providing habitat for resident schools of reef fish as well as the greatest diversity of intertidal and sub-tidal invertebrates in Victoria (Visit Victoria, NA).

The park also 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.

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 (Parks Victoria, 2006b). 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, 2006b) and is classified as IUCN II (National Parks). The Plan describes the key environmental, cultural and social values as:

Natural Values

- 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.

Cultural Values

- 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).
- Opportunities for cultural values investigation and learning in an area with minimal human disturbance.

Tourism and Recreational Values

- Underwater seascapes presenting numerous opportunities for diving and snorkelling.
- Opportunities for passive recreation, relaxation and reflection on a wild and remote coastline.
- Boat-based camping in a remote and unique setting.

Marengo Reefs Marine Sanctuary

The Marengo Reefs Marine Sanctuary is located 150 m offshore from Apollo Bay in Victorian State waters and covers 12 ha (Parks Victoria, 2007a). The sanctuary protects two small reefs and a wide variety of microhabitats. The two sections of reef, known as the Inner Reef and the Outer Reef, are usually exposed and are separated by a narrow channel known as 'The Gap' (Parks Victoria, 2007a). This area supports many reefs species including sea snails, tubeworms, abalone, corals, sponges and sea urchins, while deeper waters 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 the *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:

Natural Values

- Subtidal soft sediments, subtidal rocky reefs and intertidal reefs.
- High diversity of algal, invertebrate and fish species.
- Australian fur seal haul out area.

Cultural Values

- 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.

Tourism and Recreational Values

- 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.

The Arches Marine Sanctuary

The Arches Marine Sanctuary protects 45 ha of ocean directly south of Port Campbell. Approximately 5-25 m below the water surface is a labyrinth of limestone formations, rocky arches and canyons that have been formed over time by high-energy waves (Parks Victoria, 2016). The complex limestone structures provide a foundation for seaweeds and sponges to grow in turn providing additional habitat to support schools of reef fish, seals and a range of invertebrates such as lobster, abalone and sea urchins (Parks Victoria, 2016). 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.

Barwon Bluff Marine Sanctuary

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

Natural Values

- 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.

Cultural Values

- 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.

Tourism and recreational Values

- Opportunities for underwater recreation, including visits to subtidal communities that are easily accessible from the shore.
- Outstanding coastal vistas, seascapes and underwater scenery.

Eagle Rock Marine Sanctuary

Eagle Rock Marine Sanctuary is approximately 40 km south-west of Geelong, and covers 17 ha of sea (Parks Victoria, 2016b) The sanctuary extends offshore for about 300 m and includes Eagle Rock and Table Rock. Within the marine park are and limestone cliffs and ledges, with the intertidal and subtidal reefs providing habitat for many species such as Neptune’s necklace (*Hormosira banksia*), a brown seaweed unique to Australia and New Zealand (Parks Victoria, 2016b). Formations of bull kelp, sea tulips and sponges provide habitat for wrasse, cat sharks, Port Jackson sharks, skates and rays (Parks Victoria, 2016). Several resident and migratory seabirds and shorebirds use the sanctuary, including the Caspian tern, white-bellied sea eagle and short-tailed shearwater (Parks Victoria, 2016b).

Merri Marine Sanctuary

The Merri Marine Sanctuary is on the Victorian south-west coast near Warrnambool, approximately 260 km west of Melbourne and occupies 25 ha (Parks Victoria, 2007c). Located at the mouth of the Merri River, west of Warrnambool Harbour, the sanctuary is characterised by cold water, high wave energy, a steep offshore gradient, and nutrient upwellings associated with the edge of the continental shelf. Host to a mixture of habitats, including intertidal reefs, sand, shallow reefs and rocky overhangs, these areas provide a nursery for a variety of fish species and a habitat for many algae species, hardy invertebrates and shorebirds (Parks Victoria, 2007c). Bottlenose dolphins and fur seals are regular visitors to the coastal waters (Parks Victoria, 2007c).

The Sanctuary is protected with the Merri Marine Sanctuary Management Plan (Parks Victoria, 2007c) and 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, invertebrates and shorebirds.

Mushroom Reef Marine Sanctuary

The Mushroom Reef Marine Sanctuary is on the Bass Strait coast at Flinders near the western entrance to Western Port. The sanctuary occupies 80 ha and abuts the Mornington Peninsula National Parkland extending from the high-water mark to approximately 1 km offshore (Parks Victoria, 2007d). The sanctuary protects a system of ancient basalt platforms and reefs on the southern Mornington Peninsula coast that form a rich variety of marine microhabitats supporting diverse flora and fauna (Parks Victoria, 2007d). The beaches and intertidal area within the sanctuary also provide significant roosting, feeding and breeding areas for migratory and threatened bird species (Parks Victoria, 2007d).

The sanctuary is protected under the Mushroom Reef Marine Sanctuary Management Plan (Parks Victoria, 2007d) which identifies the environmental, cultural and social values as:

Natural Values

- Numerous subtidal pools and boulders in the intertidal area that provide a high complexity of intertidal basalt substrates and a rich variety of micro-habitats.
- 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.

Cultural Values

- An important landmark and area for gathering fish and shellfish for the Boonwurrung people.

Tourism and Recreational Values

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

Point Danger Marine Sanctuary

Point Danger Marine Sanctuary is loacted 20 km south-west of Geelong, close to the township of Torquay and occupies 25 ha of marine environment. 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 (Parks Australia, 2005).

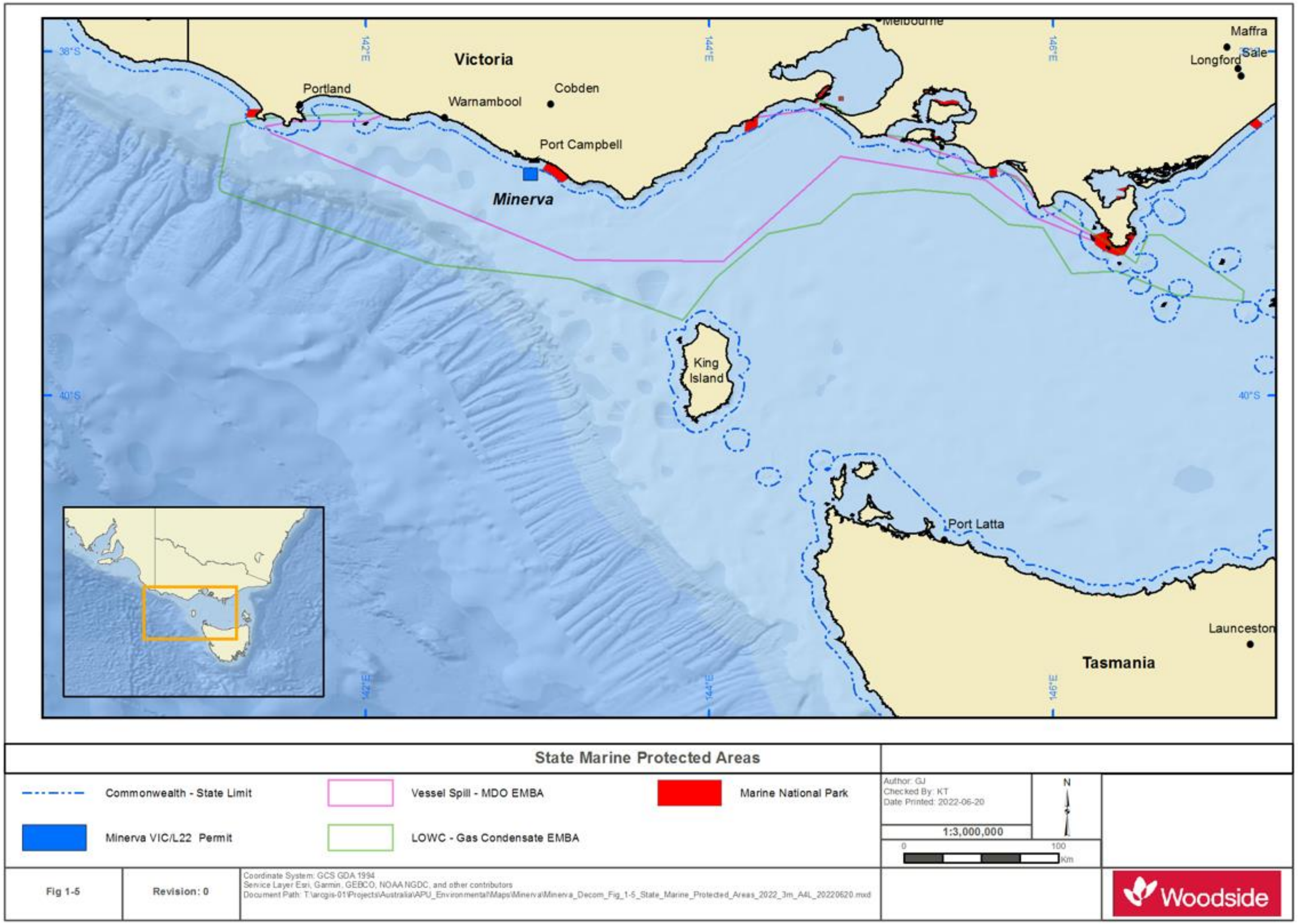


Figure 4-3: State marine management areas within the Operational Area and EMBA

4.1.10 Key Ecological Features

Key Ecological Features (KEFs) are elements of the Commonwealth marine environment that based on current scientific understanding, are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity.

The PMST Report indicates that the EMBAs overlap two KEFs: the West Tasmania Canyons and the Bonney Coast Upwelling (Figure 4-4). The operational area does not overlap any KEFs. Information on the relevant KEFs has been extracted from the DAWE (2022) Species Profile and Threats Database and is summarised below.

Bonney Coast Upwelling

The Bonney Coast Upwelling KEF is one of the largest and most predictable upwellings in south-eastern Australia and is recognised for the high productivity and aggregations of marine life (DAWE, 2022). Located on the continental shelf between Cape Jaffa, South Australia and Portland (Figure 4-4), the KEF is an annual phenomenon that generally starts in the eastern part of the Great Australian Bight in November / December and spreads eastwards to the Otway Basin around February, declining in April (Gill *et al*., 2011).

The upwelling occurs via Ekman dynamics, where the ocean surface experiences a steady wind stress resulting in a net transport of water at right angles to the left of the wind direction moving ringing cool, nutrient-rich deep waters closer to the surface where there is enough sunlight for primary production to take place (Hosack and Dambacher, 2012). This phenomenom is an attractive feeding ground for several whale species, in particular Pygmy Blue Whales where the Bonney Upwelling is recognised as one of 12 known areas worldwide where blue whales are known to feed in relatively high numbers (DAWE, 2022). In addition to whales, many endangered and listed species frequent the area, possibly also relying on the abundance of krill that provide a food source to many seabirds and fish (DAWE, 2022). The high productivity of the Bonney Upwelling is then capitalised on by other higher predator species such as little penguins and Australian fur seals feeding on baitfish.

West Tasmanian Canyons

The West Tasmanian Canyons are a series of submarine canyons whose size, complexity and configuration is able to affect currents, act as sinks for rich organic sediments and debris, and can trap waters or create upwellings that result in productivity and biodiversity hotspots (DAWE, 2022). This movement therefore influences local nutrients, prey, dispersal of eggs, larvae and juveniles and benthic diversity with subsequent effects which extend up the food chain.

Situated on the relatively narrow and steep continental slope west of Tasmania (Figure 4-4), 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). Sponges are concentrated near the canyon heads, with the greatest diversity between approximately 200 m and 350 m depth (DAWE, 2022). Sponges are associated with abundance of fishes and the canyons support a diversity of sponges comparable to that of seamounts (DAWE, 2022). 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.

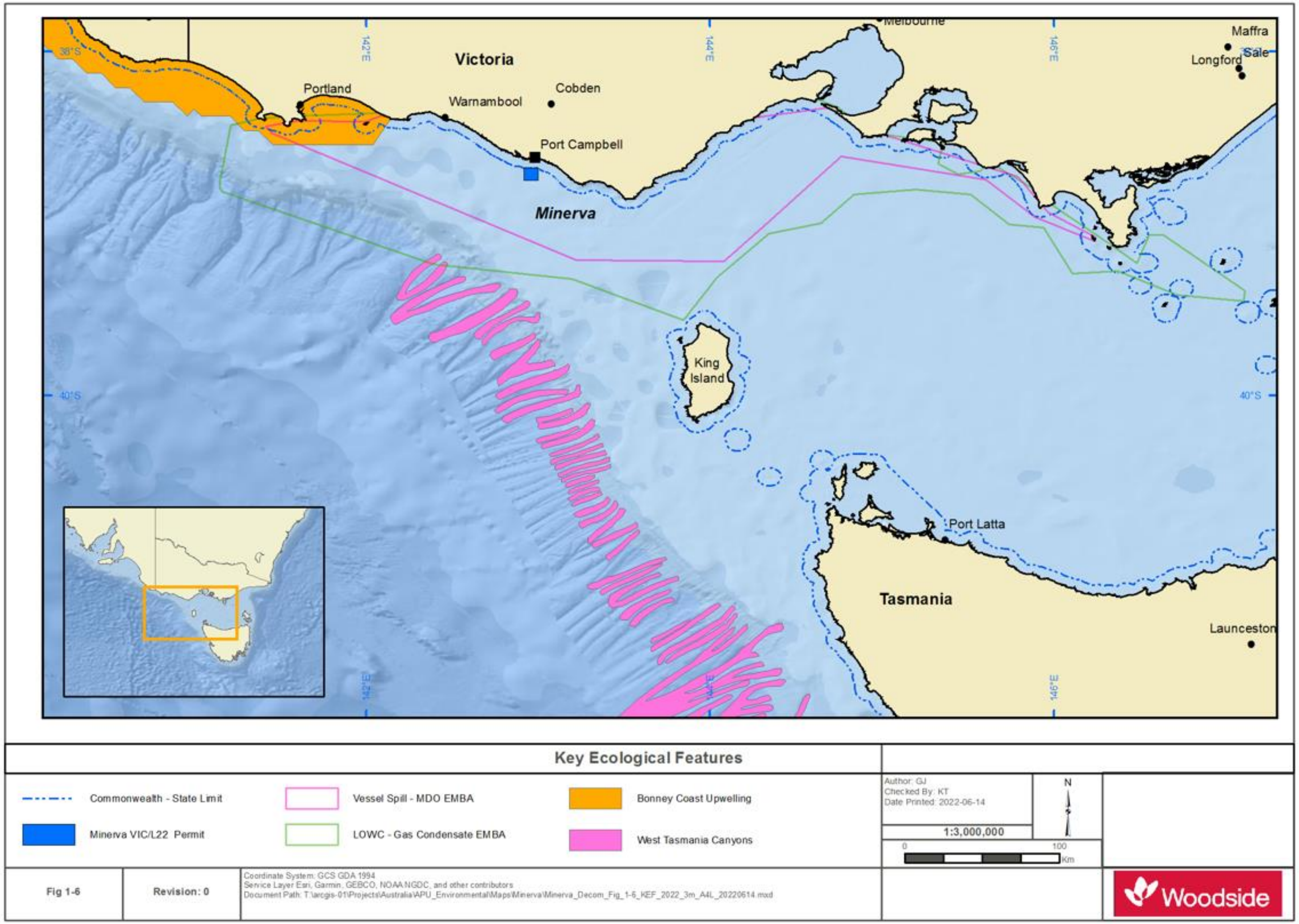


Figure 4-4: Key ecological features within the Operational Area and EMBAs

4.2 Physical Environment

4.2.1 Climate and Meteorology

The Otway bioregion is typical of a cool temperate region with cold, wet winters and warm dry summers (NOO, 2002). The area experiences a mean maximum temperature of 21.5ºC (February) and a mean minimum temperature of 7.6ºC (July) (Table 4-3). The annual average rainfall is 895 mm with the predominate rainfall occurring between June and August (Table 4-3).

Sub-tropical high-pressure systems dominate this region in the summer with sub-polar low-pressure systems in the 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. Meanwhile, 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.

The 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 & 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/hr) for 50% of the time and are typically between the range of 10-30 km/hr. Winds contribute to the predominant moderate to high wave-energy environment of area and are predominantly south-westerly cycling to north-westerly. Occasionally, intense mesoscale low-pressure systems occur in the region, bringing very strong winds, heavy rain, and high seas. These events are unpredictable in occurrence, intensity, and behaviour, but are most common between September and February (McInnes & Hubbert, 2003).

Table 4-3: Meteorological conditions representative of the operational area within the Otway Region

Month	Mean Maximum Monthly Temperature (ºC)	Mean Minimum Monthly Temperature (ºC)	Mean Rainfall (mm)
January	21.4	13.4	44.7
February	21.5	14.0	41.3
March	20.4	13.3	55.7
April	18.0	11.7	70.4
May	15.6	10.1	91.5
June	13.7	8.5	96.6
July	13.0	7.6	106.2
August	13.8	7.9	104.1
September	15.2	8.5	90.2
October	17.0	9.6	80.4
November	18.3	10.8	62.6
December	19.9	12.1	52.2
Annual Average	17.3	10.6	895.0

Source: BOM, 2022

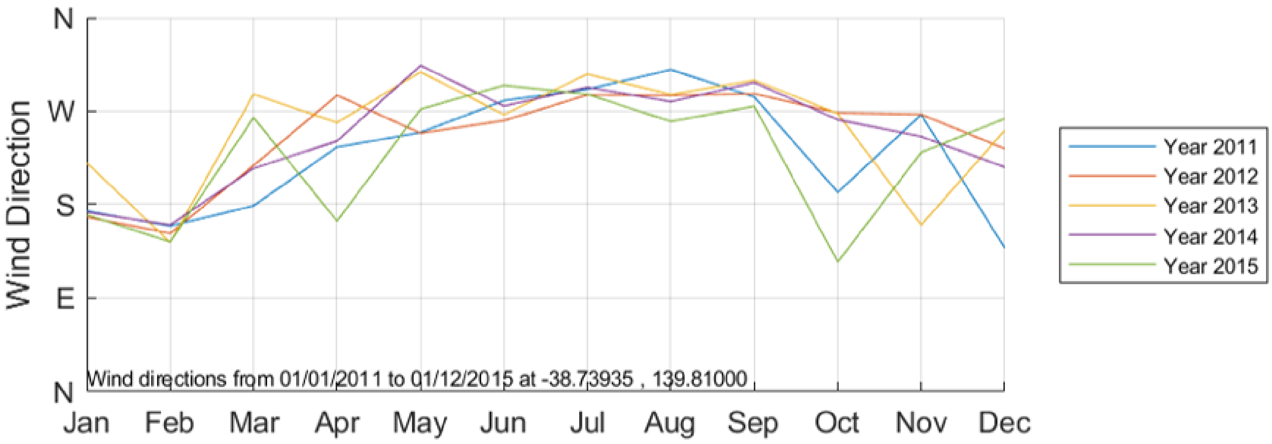


Figure 4-5: Average monthly wind direction (GHD, 2022)

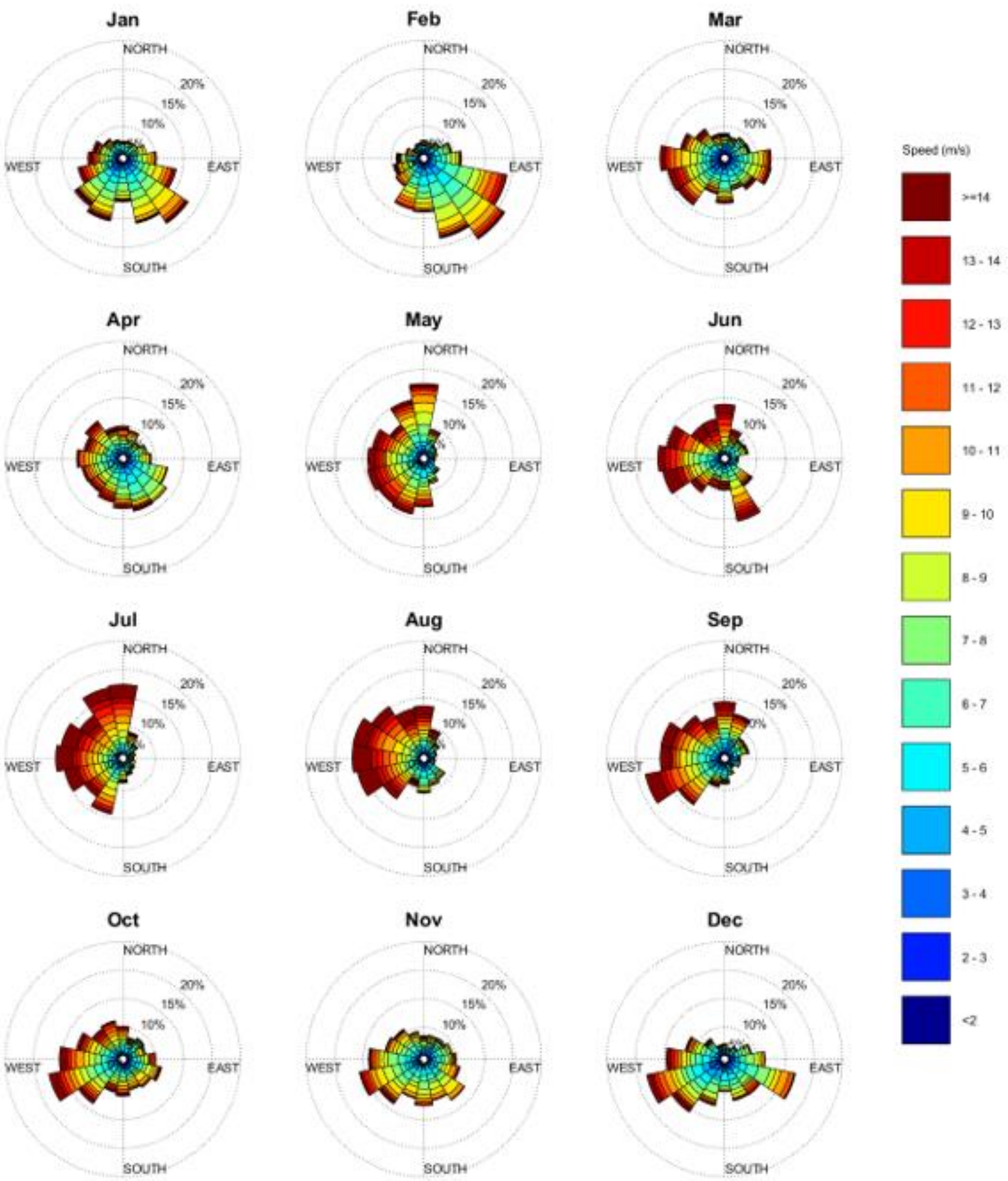


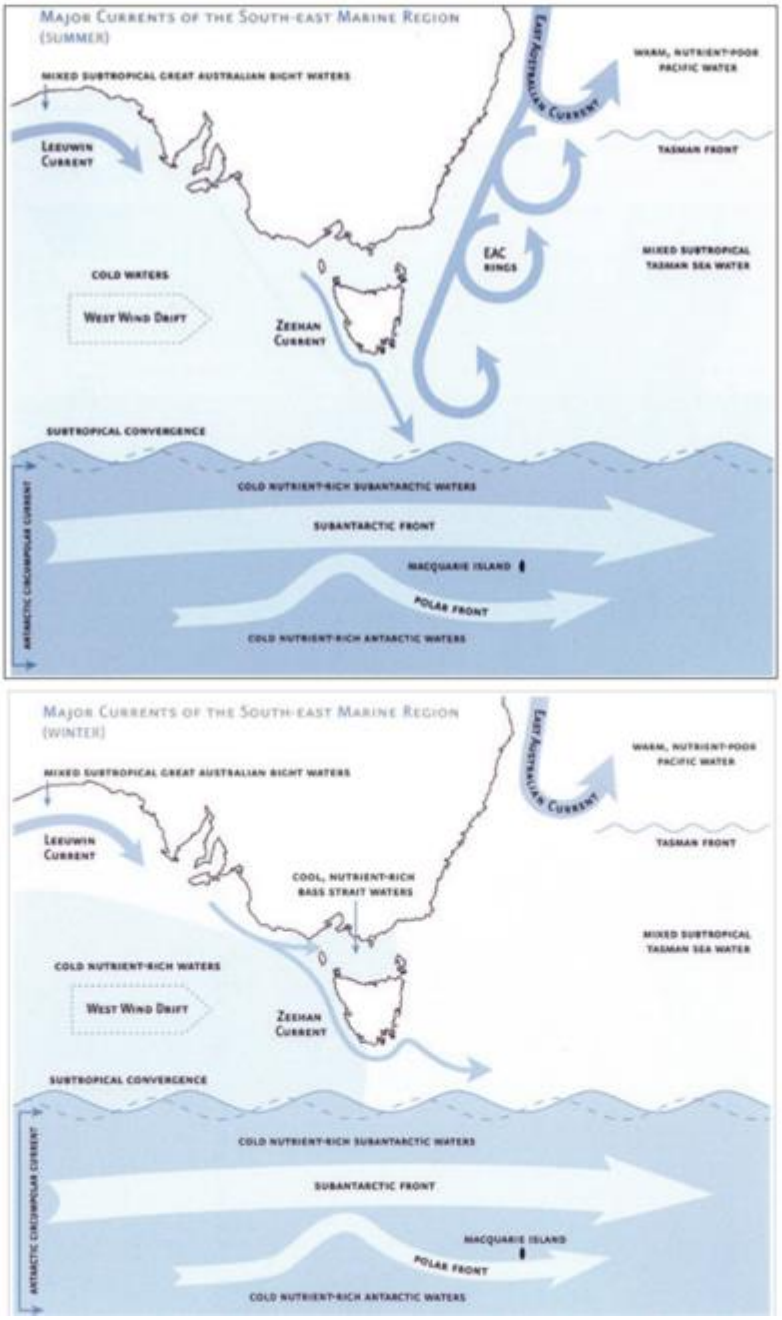
Figure 4-6: Average monthly wind roses (GHD, 2022)

4.2.2 Oceanography

Currents and Tides

Currents and oceanic properties, such as temperature and nutrients, play a vital role in the ecosystems of the Region. Ocean currents link marine systems, while fronts and upwellings drive the productivity of open ocean environments (DNP, 2013). The western reserves of the South-east Marine region, including the Otway, are predominantly influenced by the Leeuwin and Zeehan currents where there is a slow easterly flow of waters in the Bass Strait and a large anti-clockwise circulation (DNP, 2013). The Leeuwin Current transports warm, sub-tropical water southward along the Western Australian (WA) coast and then eastward into the Great Australian Bight (GAB), where it mixes with the cool waters from the Zeehan Current running along Tasmania's west coast (DNP, 2013). The Leeuwin and Zeehan currents are stronger in winter than in summer, with the latter flowing into Bass Strait during winter (Figure 4-7).

Tides in this region are semi-diurnal with some diurnal inequalities (Jones and Padman, 2006; Easton, 1970), generating tidal currents along a north-east/south-west axis with speeds generally ranging from 0.1 to 2.5 m/s (Baines and Fandry, 1983). The tides in the Otway are considered microtidal with a a range of approximately 0.8 to 1.2 m, however the tidal ranges and velocities vary rapidly in the western entrance to Bass Strait (DNP, 2013).



Source: DoE, 2015

Figure 4-7: Major ocean currents influencing Southern Australia (Summer and Winter)

Waves

The Otway coast has a predominantly south-westerly aspect and is highly exposed to swell from the Southern Ocean.

There are two principal sources of wave energy in the Otway Basin:

- Westerly swell from the Great Australian Bight and Southern Ocean; and
- Locally generated winds, generally from the west and east.

This region is typically one of high energy and is fully exposed to wave heights ranging from 1.5 m to 2 m with periods of 8 s to 13 s. Although waves heights up to 10 m can occur during storm events and a combination of wind forcing against tidal currents can cause greater turbulence.

Water Temperature and Salinity

The South East Marine Region (SEMR) is oceanographically complex, with subtropical influences from the north and subpolar influences from the south (Hosack & Dambacher 2012). Sea surface water temperatures in this region vary seasonally from a minimum of 12.6ºC to a maximum of 18.4ºC (APASA, 2013). While salinity remains at approximately 35.0 practical salinity units (PSU) year-round when tested at a water depth range of 30 m (RPS, 2020). During winter, the South Australian current moves dense, salty warmer water eastward from the Great Australian Bight into the western margin of Bass Strait. In winter and spring, waters within the strait are well mixed with no obvious stratification, while during summer the central regions of the straight become stratified (RPS, 2020). The southwest region of Victorian area has significant upwelling of colder, nutrient rich deep water during summer that can cause sea surface temperatures to decrease by 3°C compared with offshore waters (Butler *et al*., 2002).

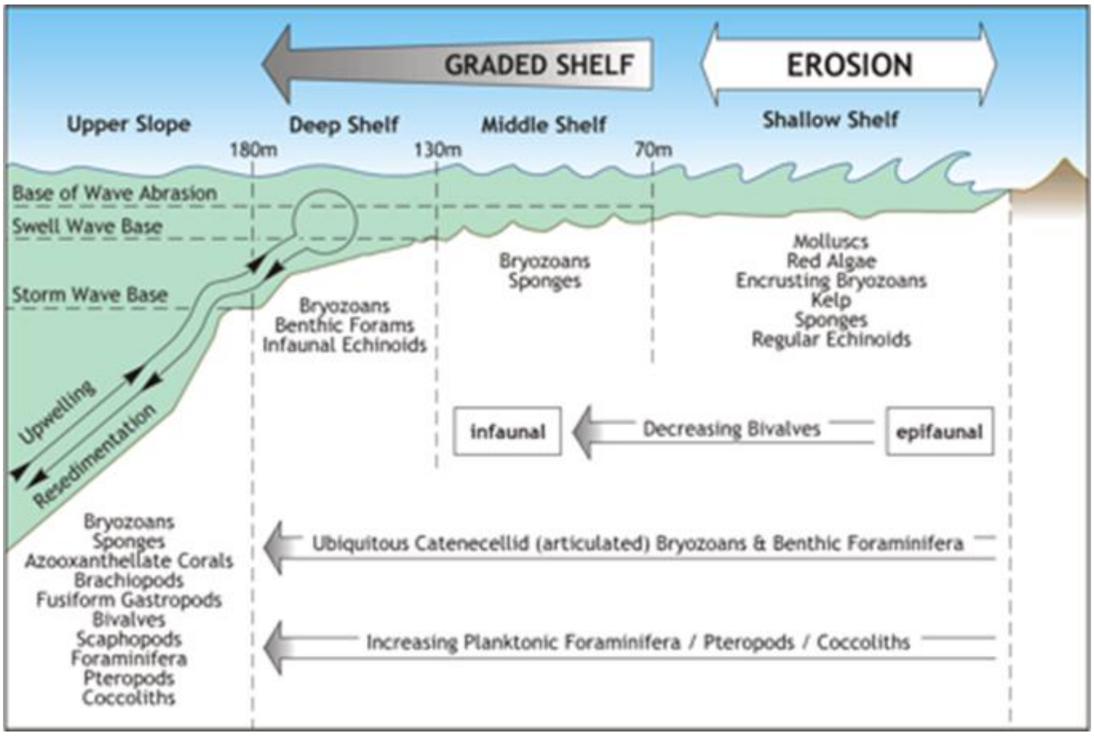
Bathymetry and Geomorphology

The SEMR shows significant variation in water depth and sea floor feaures (DNP, 2013). Included is the south-eastern section of Australia's continental margin comprising the Otway Shelf and the Bonney Coast, Bass Strait, and the western shelf of Tasmania. The Minerva field is located within the 400 km long Otway shelf, which 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 off Robe, SA, and eastward to 80 km off Warrnambool (James *et al*., 2013). 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 RV *Rig Seismic* using dredges, corers, grabs and a heatflow 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 that divided the Otway continental margin into five depth-related zones – shallow shelf, middle shelf, deep shelf, shelf edge and upper slope (Figure 4-8).

The shallow shelf consists of 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, bioclastic 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 cross-cut 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.



Source: Boreen *et al*., 1993

Figure 4-8: Model of the Geomorphology of the Otway Shelf

4.2.3 Air Quality

Air quality in the offshore Otway region is expected to be high given that air flow originates in the Southern Ocean, and there are no intervening land masses that could influence the quality of air from any anthropogenic or natural terrestrial sources. However, offshore anthropogenic activities (shipping, industry developments) would contribute to local variation in air quality.

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). Air monitoring reports shows Victoria's air quality is generally good with AAQ NEPM goals and standards being met, however, there were some exceedances for particles.

It is expected that air quality within the vicinity of the operational area and EMBAs will be typical of the Victorian offshore marine environment (i.e. high).

4.2.4 Ambient Noise

Ambient noise within the offshore Otway region is expected to be dominated by natural physical (e.g. wind, waves, rain) and biological (e.g. echolocation and communication noises generated by cetaceans and fish) sources. The southern ocean is also subject to iceberg calving, shoaling and disintegration which is identified as a dominant source of low-frequency (<100 Hz) noise.

Ambient ocean noise levels can vary considerably due to prevailing metocean conditions. For example, wind is a major contributor to noise between 100 Hz and 30 kHz (WDCS, 2004) and can reach 85-95 dB re 1µPa^2/Hz under extreme conditions. Rain may also produce short periods of high underwater sound with a flat frequency spectrum to levels of 80 dB re 1µPa^2/Hz. In exposed areas of ocean, ambient noise levels are frequently around 90–110 dB re 1 µPa (APPEA, 2005) and can vary on a daily basis by 10 to 20 dB re 1 µPa (Richardson *et al*., 1995).

Anthropogenic noise sources is also expected in the region with the SEMR supporting a range of marine industries including commercial fishing and aquaculture, offshore oil and gas production, shipping, ports, as well as recreation and tourism activities (DoE, 2015). Many vessels are expected, with the SEMR considered one of the busiest shipping regions in Australia (DoE, 2015). This anthropogenic influence is expected to affect ambient noise levels.

4.2.5 Sediment Quality

Marine sediment quality within the vicinity of the Minerva field and broader Otway region is expected to be representative of the typically pristine offshore Victorian waters. Variations to this state (e.g. increased metal concentrations) may occur closer to coastal regions that are subject to large tidal ranges, terrestrial run-off or anthropocentric factors (i.e. ports, industrial discharges, etc.).

4.2.6 Water Quality

Marine water quality considers chemical, physical and biological characteristics with respect to its suitability to support marine life, or for a purpose such as swimming or fishing. Marine water quality can be measured by several factors, such as the concentration of dissolved oxygen, the salinity, the amount of material suspended in the water (turbidity or total suspended solids) as well as the concentration of contaminants such as hydrocarbons and heavy metals.

The nutrient concentrations are considered to be relatively low in the South-east Marine Region with the exception of localised areas of high productiveity (DoE, 2015). It is hypothesised that this could be due to the biological demands of the Bass Strait waters consuming much of the nutrients before moving into Central Bass Strait (Gibbs, 1992). The Otway coastline is known for high energy wave activity and strong ocean currents (NOO, 2002), and therefore water column turbidity in this region is subject to high natural variability. Weather conditions in the coastal environment around Port Campbell and Port Ferry are known to influence offshore hydrodynamic conditions and are a driver of sediment dynamics, impacting benthic and pelagic habitats and changing water column turbidity. Wave-driven sediment resuspension generates high turbidity levels within coastal zones, commonly exceeding 50 mg/L (Larcombe *et al*., 1995; Whinney, 2007; Browne *et al*., 2013), but coastal communities appear generally well adapted to deal with these extrinsic stresses.

Marine water quality within the vicinity of the Minerva field and broader Otway region is expected to be representative of typical offshore Victorian waters. Variations to this state (e.g. increased metal concentrations) may occur closer to coastal regions that are subject to large tidal ranges, terrestrial run-off or anthropocentric factors (i.e. ports, industrial discharges, etc.).

4.3 Ecological Environment

4.3.1 Benthic Habitats and Infauna

Benthic communities are biological communities that live in or on the seabed. These communities typically contain light-dependent taxa such as algae, seagrass and corals, which obtain energy primarily from photosynthesis, and/or animals such as molluscs, sponges and worms that obtain their energy by consuming other organisms or organic matter. Benthic habitats are the seabed substrates that benthic communities grow on or in; these can range from unconsolidated sand to hard substrates (e.g. limestone) and occur either singly or in combination.

Benthic communities across the Bass Strait are determined by the seafloor habitat and have a wide distribution with high diversity. A series of benthic surveys were conducted by the Victorian Museum on the continental shelf of the Bass Strait between 1979 and 1984 (Poore *et al*., 1985; Wilson and Poore, 1987).

The Otway continental margin is a swell-dominated, open, cool-water carbonate platform which was divided into five depth-related zones by Boreen *et al*. (1993) (Figure 4-8):

- 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 bryozoan sands.

- Deep shelf: accumulations of intensely bioturbated, fine bioclastic sands.
- Shelf edge and top of slope: nutrient-rich upwelling currents support extensive, aphotic bryozoan / sponge / coral communities.

The dominant benthic habitat throughout the continental shelf, as described by the SEMR profile (DoE, 2015) is rocky reef and soft sediment.

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 Middle Otway Shelf (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. The Deep Otway Shelf (130 – 180 m) sediments consist of accumulations of intensely bioturbated, fine, bioclastic sands. The Upper Slope of Otway Shelf (>180 m) incorporates the edge/ top of the shelf which displays nutrient-rich upwelling currents support extensive, aphotic bryozoan / sponge / coral communities. The upper slope is dominated by bioturbated mixture of periplatform bioclastic debris and pelleted foraminiferal / nannofossil mud. Turbidites and resedimentation features are common. Bioturbation and shelf-derived skeletal content decrease progressively downslope and pelagic muds dominate below 500 m.

Scientific surveys have shown that some shallow Victorian sandy environments have the highest levels of animal diversity ever recorded (Parks Victoria, 2016a). Some of the larger animals found associated with 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).

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 spill 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).

Seagrass is expected in the EMBAs along the Victorian coastline.

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. Macroalgae is expected in the EMBAs along the Victorian coastline.

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 off-slope 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).

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.

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, found that 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*).

Basalt rises

There is no published information on the species assemblages of the basalt rises in the south-east and east of the EMBAs, 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 are 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. 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, 1991; Andrew 1999; Andrew and O'Neill, 2000). It is likely that similar species assemblages occur within the EMBAs 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. Wilsons 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 Head 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 EMBAs 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.

4.3.2 Shoreline Habitats

The coastal environment throughout southern and eastern Australia is varied, and includes areas of rocky cliffs, sandy beaches, and tidal flats. 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.

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 within the spill EMBA (Figure 4-9).

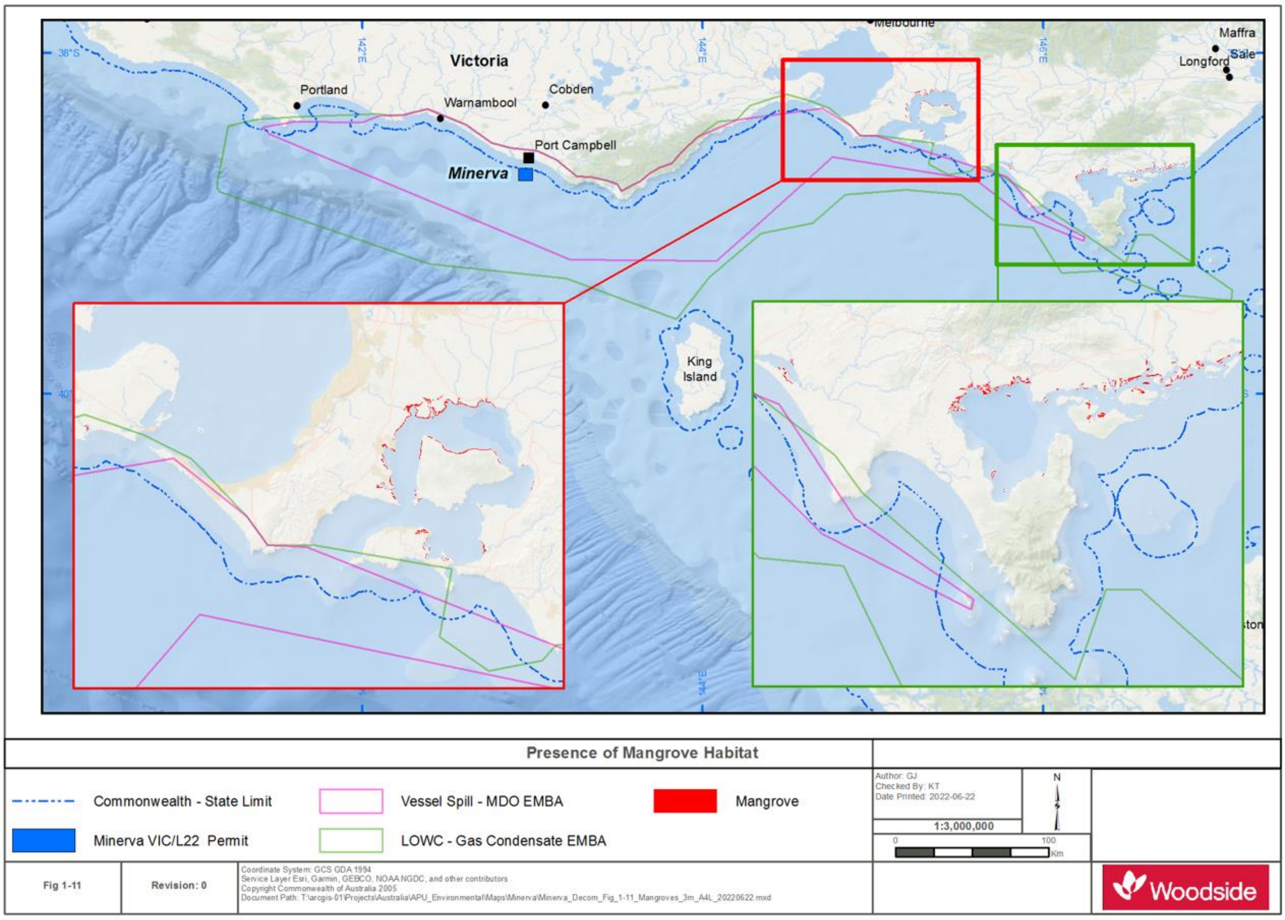


Figure 4-9: Presence of mangrove habitat within the EMBAs

Sandy Beaches

Sandy beaches are dynamic environments, naturally fluctuating in response to external forcing factors (e.g. waves, currents etc). Sandy beaches can support a variety of infauna and provide nesting habitat to birds and turtles. Sand particles vary in size, structure and mineral content; this in turn affects the shape, colour and inhabitants, of the beach. Sandy beaches within the EMBAs are expected to vary in length, width and gradient, and to be interspersed among areas of hard substrate (for example, sandstone) that form intertidal platforms and rocky outcrops. There is a wide range of variation in sediment type, composition, and grain size along the EMBAs.

Sandy beaches are present along the Victorian coastline and intercept the EMBAs. The following areas have known stretches of sandy beach:

- Portland to Port Fairy
- Port Fairy to Lady Bay (Warrnambool) coastline
- Small sections of sandy beach between Warrnambool and Cape Otway
- Marengo east to Anglesea

Rocky Shores and Limestone Platforms

Hard and soft rocky shores, including bedrock outcrops, platforms, low cliffs (less than five metres), and scarps. Depending on exposure, rocky shores can be host to a diverse range of flora and fauna, including barnacles, mussels, sea anemones, sponges, sea snails, starfish and algae.

Rocky shore habitats are present along the Victorian coastline and intercept the EMBAs. The following areas have known stretches of rocky shore:

- The Cape Nelson to Portland coastline
- The section of coast between Warrnambool and Cape Otway (covering a distance of ~100 km)
- Intertidal rocky shores stretch east to Marengo
- Interspersed areas between Marengo east to Anglesea

Wetlands

Wetlands are areas of land where water covers the soil – all year or just at certain times of the year. Wetlands may be natural or artificial and the water within a wetland may be static or flowing, fresh, brackish, saline or underground.

Wetlands perform an important range of environmental, social and economic services, such as protecting our shores from wave action, reducing the impacts of floods, absorbing pollutants and improving water quality. They also provide habitat for a variety of plants and animals, including nurseries for fish and other freshwater and marine life, and are critical to Australia's commercial and recreational fishing industries.

The operational area does not overlap any wetlands, however, the EMBAs overlap two wetlands of international importance (Ramsar wetlands): Western Port and Port Phillip Bay (Section 4.14.1.5). The MDO spill EMBA also overlaps six wetlands of national importance but only two have connectivity with the marine environment, while the LOWC spill EMBA overlaps nine wetlands of national importance with three having connectivity to the marine environment; Western Port, Swan Bay and Swan Island, and Aire River (Section 4.14.1.6).

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 (Figure 4-10) (Boon *et al*., 2011).

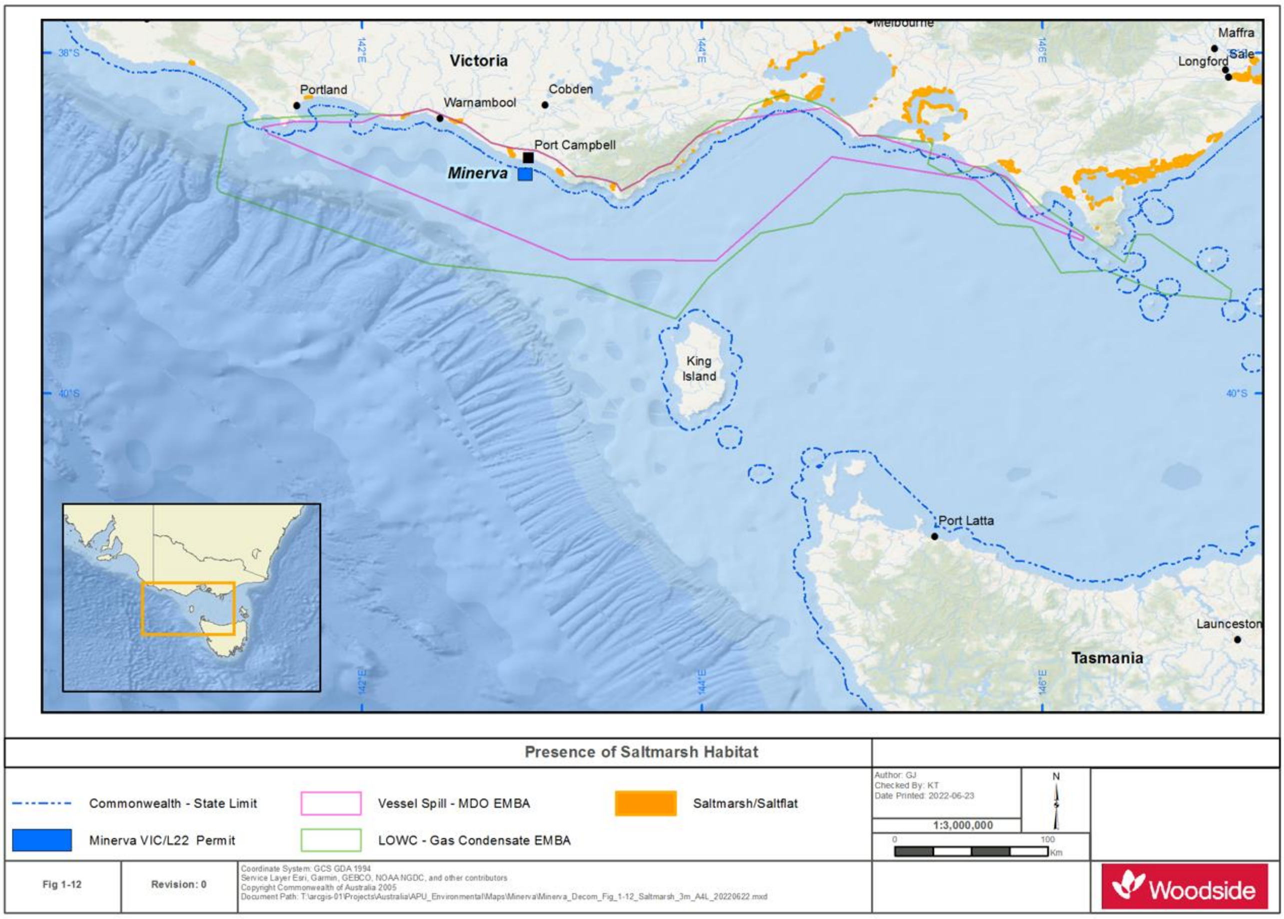


Figure 4-10: Presence of saltmarsh habitat within the EMBA

4.3.3 Plankton

Plankton consists of microscopic organisms typically divided into phytoplankton (algae) and zooplankton (fauna including larvae). Plankton play a major role in the trophic system with phytoplankton being a primary producer and zooplankton a primary consumer. They are both in turn consumed by other fauna species.

Phytoplankton are autotrophic planktonic organisms living within the photic zone and spend either part or all of their lifecycle drifting with the ocean currents. Phytoplankton are dependent on oceanographic processes (e.g. currents and vertical mixing), that supply nutrients needed for photosynthesis. Thus, phytoplankton biomass is typically variable (spatially and temporally) (Evans *et al*., 2016), but greatest in areas of upwelling, or in shallow waters where nutrient levels are high. Peak primary productivity, however, varies on a local and regional scale.

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. The Bonney coast upwelling, located within the EMBAs, 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.

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 region 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.

4.3.4 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 (DNP, 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.

4.3.5 Invasive / Introduced Marine Species

Invasive marine species 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 (AMSA, NA).

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 and 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), *Corbula gibba* and *Theora fragilis*);
- Crabs (*Carcinus maenas* (European shore crab) and *Pyromaia tuberculata* (spider crab);
- Macroalgae (*Undaria pinnatifida* (Japanese giant kelp) and *Codium fragile* ssp.*tormentosoides*; and
- The introduced New Zealand screw shell (*Maoricolpus roseus*), known to form extensive and dense beds on the sandy sea-floor in eastern Bass Strait spreading to the 80 m depth contour off eastern Victoria and NSW (Patil *et al*., 2004).

Other introduced species tend to remain confined to sheltered coastal environments rather than open waters (Hayes *et al*., 2005).

The Marine Pests Interactive Map (DAFF, 2016) indicates that the ports likely to be used by support vessels (Warrnambool, Apollo Bay or Port Fairy) do not currently harbour any marine pests.

4.3.6 Threatened and Migratory Species

Table 4-4 presents the environmental values and sensitivities (threatened and migratory species) within the EMBA. These include all relevant Matters of National Environmental Significance (MNES) protected under the EPBC Act 1999 as identified in the PMST search for the EMBA. For each species identified, the extent of likely presence is provided.

The BIAs and habitats critical to the survival of a species are which overlap the EMBA are shown in Table 4-6. BIAs such as an aggregation, breeding, resting, nesting or feeding areas or known migratory routes for these species are shown in Figure 4-11 to Figure 4-27.

Note that terrestrial species (such as terrestrial mammals, reptiles and bird species) that appear in the EPBC Act protected matters search of the EMBA and do not have habitats along shorelines are not relevant to the activity impacts and risks have been excluded from Table 4-4.

Relevant conservation advices, recovery plans and management plans for marine fauna identified in the PMST for the EMBA are provided in Table 4-5.

Table 4-4: EPBC Act threatened and migratory species potentially occurring within the EMBA

Scientific Name	Common Name	EPBC Act Threatened Status	Migratory	Presence in the Operational Area	Presence in the MDO EMBA	Presence in the LOWC EMBA	Website
FISH							
Sharks, Fish and Rays							
Carcharodon carcharias	White Shark	V	✓(M)	KO	FKO	BKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64470
Centrophorus zeehaani	Southern Dogfish	CD	-		LO	LO	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82679
Galeorhinus galeus	Eastern School Shark	CD	-	MO	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68453
Hoplostethus atlanticus	Orange Roughy	CD	-		LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68455
Isurus oxyrinchus	Shortfin Mako	-	✓(M)		LO	LO	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=79073
Lamna nasus	Porbeagle	-	✓(M)	LO	LO	LO	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83288
Protoroctes maraena	Australian Grayling	V	-	LO	KO	KO	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26179
Rhincodon typus	Whale Shark	V	✓(M)		-	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66680
Seriolella brama	Blue Warehou	CD	-	KO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=69374
Thunnus maccoyii	Southern Bluefin Tuna	CD	-	LO	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=69402
BIRDS							
Actitis hypoleucos	Common Sandpiper	-	✓(W)	KO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59309
Anous stolidus	Common Noddy	-	✓(M)	-	-	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=825
Apus pacificus	Fork-tailed Swift	-	✓(M)	LO	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678
Ardenna carneipes	Flesh-footed Shearwater	-	✓(M)	FLO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82404
Ardenna grisea	Sooty Shearwater	-	✓(M)	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82651
Ardenna tenuirostris	Short-tailed Shearwater	-	✓(M)	-	BKO	BKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82652
Arenaria interpres	Ruddy Turnstone	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=872
Botaurus poiciloptilus	Australasian Bittern	E	-	LO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1001
Calidris acuminata	Sharp-tailed Sandpiper	-	✓(W)	MO	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=874
Calidris alba	Sanderling	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=875
Calidris canutus	Red Knot	E	✓(W)	MO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=855
Calidris ferruginea	Curlew Sandpiper	CE	✓(W)	MO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=856
Calidris melanotos	Pectoral Sandpiper	-	✓(W)	MO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=858

Scientific Name	Common Name	EPBC Act Threatened Status	Migratory	Presence in the Operational Area	Presence in the MDO EMBA	Presence in the LOWC EMBA	Website
Calidris ruficollis	Red-necked Stint	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=860
Calidris tenuirostris	Great Knot	CE	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=862
Charadrius bicinctus	Double-banded Plover	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=895
Charadrius leschenaultii	Greater Sand Plover	V	✓(W)	-	LO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=877
Charadrius mongolus	Lesser Sand Plover	E	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=879
Diomedea antipodensis	Antipodean Albatross	V	✓(M)	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64458
Diomedea antipodensis gibsoni	Gibson's Albatross	V	-	-	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82270
Diomedea epomophora	Southern Royal Albatross	V	✓(M)	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=89221
Diomedea exulans	Wandering Albatross	V	✓(M)	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=89223
Diomedea sanfordi	Northern Royal Albatross	E	✓(M)	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64456
Eudyptula minor	Little Penguin	-	-	BKO	BKO	BKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1085
Fregetta grallaria	White-bellied Storm-Petrel	V	-	-	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64438
Gallinago hardwickii	Latham's Snipe	-	✓(W)	LO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=863
Gallinago megala	Swinhoe's Snipe	-	✓(W)	-	RLO	RLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=864
Gallinago stenura	Pin-tailed Snipe	-	✓(W)	-	RLO	RLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=841
Halobaena caerulea	Blue Petrel	V	-	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1059
Limicola falcinellus	Broad-billed Sandpiper	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=842
Limosa lapponica	Bar-tailed Godwit	-	✓(W)	LO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=844
Limosa lapponica baueri	Nunivak Bar-tailed Godwit	V	-	MO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=86380
Limosa limosa	Black-tailed Godwit	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=845
Macronectes giganteus	Southern Giant Petrel	E	✓(M)	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1060
Macronectes halli	Northern Giant Petrel	V	✓(M)	MO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1061
Morus serrator	Australasian Gannet	-	-	-	BKO	BKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1020
Neophema chrysogaster	Orange-bellied Parrot	CE	-	MLO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=747

Scientific Name	Common Name	EPBC Act Threatened Status	Migratory	Presence in the Operational Area	Presence in the MDO EMBA	Presence in the LOWC EMBA	Website
Numenius madagascariensis	Eastern Curlew	CE	✓(W)	MO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=847
Numenius minutus	Little Curlew	-	✓(W)	-	RLO	RLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=848
Numenius phaeopus	Whimbrel	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=849
Pachyptila turtur	Fairy Prion	-	-	KO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1066
Pachyptila turtur subantarctica	Fairy Prion (southern)	V	-	KO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64445
Pandion haliaetus	Osprey	-	✓(W)	-	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=952
Pelecanoides urinatrix	Common Diving-Petrel	-	-	-	BKO	BKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1018
Phalacrocorax fuscescens	Black-faced Cormorant	-	-	BKO	BKO	BKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59660
Phalaropus lobatus	Red-necked Phalarope	-	✓(W)	-	-	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=838
Phoebetria fusca	Sooty Albatross	V	✓(M)	LO	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1075
Pluvialis fulva	Pacific Golden Plover	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25545
Pluvialis squatarola	Grey Plover	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=865
Pterodroma leucoptera	Gould's Petrel	E	-	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26033
Pterodroma mollis	Soft-plumaged Petrel	V	-	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1036
Rostratula australis	Australian Painted Snipe	E	-	LO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=77037
Sternula albifrons	Little Tern	-	✓(M)	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82849
Sternula nereis nereis	Australian Fairy Tern	V	-	BLO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82950
Thalassarche bulleri	Buller's Albatross	V	✓(M)	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64460
Thalassarche bulleri platei	Northern Buller's Albatross	V	-	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82273
Thalassarche cauta	Shy Albatross	E	✓(M)	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=89224
Thalassarche carteri	Indian Yellow-nosed Albatross	V	✓(M)	LO	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64464
Thalassarche chrysostoma	Grey-headed Albatross	E	✓(M)	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66491
Thalassarche impavida	Campbell Albatross	V	✓(M)	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64459

Scientific Name	Common Name	EPBC Act Threatened Status	Migratory	Presence in the Operational Area	Presence in the MDO EMBA	Presence in the LOWC EMBA	Website
Thalassarche melanophris	Black-browed Albatross	V	✓(M)	MO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66472
Thalassarche salvini	Salvin's Albatross	V	✓(M)	FLO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64463
Thalassarche steadi	White-capped Albatross	V	✓(M)	FLO	FKO	FKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64462
Thalasseus bergii	Greater Crested Tern	-	✓(W)	-	BKO	BKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83000
Thinornis cucullatus	Eastern Hooded Plover	V	-	MO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=90381
Tringa brevipes	Grey-tailed Tattler	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=851
Tringa incana	Wandering Tattler	-	✓(W)	-	-	FKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=831
Tringa nebularia	Common Greenshank	-	✓(W)	LO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=832
Tringa stagnatilis	Marsh Sandpiper	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=833
Xenus cinereus	Terek Sandpiper	-	✓(W)	-	RKO	RKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59300
MARINE REPTILES							
Caretta caretta	Loggerhead Turtle	E	✓(M)	BLO	FKO	FKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1763
Chelonia mydas	Green Turtle	V	✓(M)	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1765
Dermochelys coriacea	Leatherback Turtle	E	✓(M)	BLO	FKO	FKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1768
MARINE MAMMALS							
Balaenoptera acutorostrata	Minke Whale	-	-	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=33
Balaenoptera bonaerensis	Antarctic Minke Whale	-	✓(M)	-	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67812
Balaenoptera borealis	Sei Whale	V	✓(M)	FLO	FKO	FKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=34
Balaenoptera musculus	Blue Whale	E	✓(M)	FKO	FKO	FKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=36
Balaenoptera physalus	Fin Whale	V	✓(M)	FLO	FKO	FKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=37
Berardius arnuxii	Arnoux's Beaked Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=70
Caperea marginate	Pygmy Right Whale	-	✓(M)	FMO	FLO	FLO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=39
Delphinus delphis	Common Dolphin	-	-	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=60
Eubalaena australis	Southern Right Whale	E	✓(M)	KO	BKO	BKO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=40
Globicephala macrorhynchus	Short-finned Pilot Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=62

Scientific Name	Common Name	EPBC Act Threatened Status	Migratory	Presence in the Operational Area	Presence in the MDO EMBA	Presence in the LOWC EMBA	Website
Globicephala melas	Long-finned Pilot Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59282
Grampus griseus	Risso's Dolphin	-	-	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64
Kogia breviceps	Pygmy Sperm Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=57
Kogia sima	Dwarf Sperm Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85043
Lagenorhynchus obscurus	Dusky Dolphin	-	✓(M)	MO	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=43
Lissodelphis peronii	Southern Right Whale Dolphin	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=44
Megaptera novaeangliae	Humpback Whale	-	✓(M)	LO	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=38
Mesoplodon bowdoini	Andrew's Beaked Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=73
Mesoplodon densirostris	Blainville's Beaked Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=74
Mesoplodon grayi	Gray's Beaked Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=75
Mesoplodon hectori	Hector's Beaked Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=76
Mesoplodon layardii	Strap-toothed Beaked Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25556
Mesoplodon mirus	True's Beaked Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=54
Neophoca cinerea	Australian Sea-lion	E	-	-	KO	KO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=22
Orcinus orca	Killer Whale	-	✓(M)	LO	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=46
Physeter macrocephalus	Sperm Whale	-	✓(M)	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59
Pseudorca crassidens	False Killer Whale	-	-	-	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=48
Tursiops aduncus	Indian Ocean Bottlenose Dolphin	-	-	LO	LO	LO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68418
Tursiops truncatus s. str.	Bottlenose Dolphin	-	-	MO	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68417
Ziphius cavirostris	Cuvier's Beaked Whale	-	-	-	MO	MO	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=56
Threatened Species: V – Vulnerable						Type of Presence: MO - Species or species habitat that may occur within the area	

Scientific Name	Common Name	EPBC Act Threatened Status	Migratory	Presence in the Operational Area	Presence in the MDO EMBA	Presence in the LOWC EMBA	Website
E – Endangered CE – Critically Endangered CD – Conservation Dependent <u>Migratory Status</u> (W) – Wetland (M) – Marine (T) – Terrestrial						LO - Species or species habitat likely to occur within area KO - Species or species habitat known to occur within area FMO - Foraging, feeding or related behaviour may occur within the area FLO - Foraging, feeding or related behaviour likely to occur within area FKO - Foraging, feeding or related behaviour known to occur within area BMO - Breeding may occur within the area BLO - Breeding likely to occur within the area BKO - Breeding known to occur within the area RMO - Roosting may occur within the area RLO - Roosting likely to occur within the area RKO - Roosting known to occur within the area	

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Listed Species Recovery Plans, Conservation Advice and Threat Abatement Plans

Woodside considered recent updates to Recovery Plans, Conservation Management Plans, Threat Abatement Plans or approved Conservation Advice in place for EPBC Act-listed threatened species that may potentially occur or utilise habitat within the EMBA (Table 4-5).

Recovery Plans set out the research and management actions necessary to stop the decline of, and support the recovery of listed threatened species. In addition, Threat Abatement Plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities. The Minister decides whether a threat abatement plan is required for key threatening processes listed under Section 183 of the EPBC Act. Table 4-5 provides information on the specific requirements of the relevant conservation advice, species recovery plans and threat abatement plans that is applicable to the petroleum activity, and demonstrates how current management requirements have been taken into account during the preparation of the EP. Through the implementation of relevant control measures, performance outcomes and performance standards, potential risks and impacts of the petroleum activity are managed to ALARP and acceptable levels.

Table 4-5: Summary of relevant species recovery plans, approved conservation plans and threat abatement plans

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
All Vertebrate Fauna				
All vertebrate fauna	Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	There are four main objectives: • Contribute to the long-term prevention of the incidence of harmful marine debris • Remove existing harmful marine debris from the marine environment • Mitigate the impacts of harmful marine debris on marine species and ecological communities • Monitor the quantities, origins and impacts of marine debris and assess the effectiveness of management arrangements over time for the strategic reduction of debris.	Ship-sourced marine debris as a risk to vertebrate marine life through entanglement or ingestion	No explicit management actions for non-fisheries related industries (note that management actions in the plan relate largely to management of fishing waste (for example 'ghost' gear), and State and Commonwealth management through regulation.
Marine Mammals				
Sei Whale	Conservation Advice for the Sei Whale (TSSC, 2015a)	Determine population abundance, trends and population structure for sei whales, and establish a long-term monitoring program in Australian waters. Describe the spatial and temporal distribution of Sei Whales and further define biologically important areas (feeding and breeding), and migratory routes within Australian and Antarctic waters.	Noise interference	Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).
			Habitat degradation including pollution	No explicit relevant management actions; habitat degradation and pollution identified as threats.
			Vessel strike	Minimising vessel collisions: • Develop a national vessel strike strategy that investigates the risk of vessel strikes on Sei Whales and also identifies potential mitigation measures. • Ensure all vessel strike incidents are reported in the National Vessel Strike Database.
Blue Whale	Conservation Management Plan for the Blue Whale 2015-2025 (DoE, 2015a) Guidance on key terms within the Blue Whale Conservation Management Plan (DAWE, 2021b)	The long-term recovery objective is to minimise anthropogenic threats to allow the conservation status of the Blue Whale to improve so that it can be removed from the threatened species list under the EPBC Act.	Noise interference	Assess and address anthropogenic noise: shipping, industrial and seismic noise.
			Habitat modification	No explicit relevant management actions; habitat modification identified as a threat.
			Vessel disturbance	Minimise vessel collisions: • Develop a national vessel strike strategy that investigates the risk of vessel strike on blue whales and also identifies potential mitigation measures. • Ensure all vessel strike incidents are reported in the National Ship Strike Database. • Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented.
			Marine debris	No explicit relevant management actions; marine debris identified as a threat.
Fin Whale	Approved Conservation Advice for the Fin Whale (TSSC, 2015b)	Determine population abundance, trends and population structure for fin whales, and establish a long-term monitoring program in Australian waters. Describe the spatial and temporal distribution of Fin Whales and further define biologically important areas (feeding and breeding), and migratory routes within Australian and Antarctic waters.	Noise interference	Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).
			Habitat degradation including pollution	No explicit relevant management actions; habitat degradation and pollution identified as threats.

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
			Vessel strike	Develop a national vessel strike strategy that investigates the risk of vessel strikes on Fin Whales and identifies potential mitigation measures. Ensure all vessel strike incidents are reported in the National Vessel Strike Database.
Southern Right Whale	Conservation Management Plan for the Southern Right Whale 2011-2021 (DSEWPaC, 2012a)	Long term recovery objective: • To minimise anthropogenic threats to allow the conservation status of the southern right whale to improve so that it can be removed from the threatened species list under the EPBC Act Interim Recovery Objective 5: • Anthropogenic threats are demonstrably minimised	Noise interference	Assess and address anthropogenic noise: shipping, industrial and seismic noise.
			Habitat modification	No explicit relevant management actions; habitat modification identified as a threat.
			Marine debris	No explicit relevant management actions; entanglement in marine debris identified as a threat.
			Vessel disturbance / strike	Address vessel collisions: • Develop a national ship strike strategy that quantifies vessel movements within the distribution ranges of southern right whales and outlines appropriate mitigation measures that reduce impacts from vessel collisions.
Australian Sea Lion	Recovery Plan for the Australian Sea Lion (DSEWPaC, 2013a)	The overarching objective of this recovery plan is to halt the decline and assist the recovery of the Australian sea lion throughout its range in Australian waters by increasing the total population size while maintaining the number and distribution of breeding colonies with a view to: • Improving the population status leading to the future removal of the Australian sea lion from the threatened species list of the EPBC Act • Ensuring that anthropogenic activities do not hinder recovery in the near future or impact on the conservation status of the species in the future.	Habitat degradation	No explicit management actions; habitat degradation recognised as a threat.
			Pollution and oil spills	Implement jurisdictional oil spill response strategies as required.
			Disease	No explicit management actions; disease and pathogens recognised as a threat.
			Marine debris	Identify the sources of marine debris having an impact on Australian sea lion populations. Assess the impacts of marine debris on Australian sea lion populations. Develop and implement measures to mitigate the impacts of marine debris on Australian sea lion populations, noting the linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life.
			Vessel Strike	Collect data on direct killings and confirmed vessel strikes.
	Approved Conservation Advice on *Neophoca cinerea* Australian Sea Lion (TSSC, 2020a)	Primary conservation actions: • Mitigate the impacts of marine debris on Australian Sea Lions	Marine debris	Assess the impacts of marine debris on Australian Sea Lion populations and identify the sources of marine debris which have an impact. Develop and implement measures to mitigate the impacts of marine debris on the species (including reducing the amount of these marine debris entering the oceans), noting linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life.
			Disease and Parasites	Improve human wastewater management to minimise dispersal of bacteria, parasites and pollutants into the marine environment.
			Hbitat degradation and pollution	Require all vessels to have oil spill mitigation measures in place, and implement jurisdictional oil spill response strategies as required.
			Noise interference	Monitor and mitigate impacts (including cumulative impacts) of human interactions on Australian Sea Lion colonies. Control access to breeding colonies to minimise the impacts of disturbance on Australian Sea Lions.
Marine Reptiles				

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
EPBC Act listed marine turtles in the EMBAs: • Loggerhead Turtle • Green Turtle • Leatherback Turtle	National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds (DoEE, 2020)	Lighting objectives will need to consider the regulatory requirements and Australian standards relevant to the activity, location and wildlife present. Objectives should be described in terms of specific locations and times for which artificial light is necessary. Consideration should be given to whether colour differentiation is required and if some areas should remain dark – either to contrast with lit areas or to avoid light spill. Where relevant, wildlife requirements should form part of the lighting objectives. A lighting installation will be deemed a success if it meets the lighting objectives (including wildlife needs) and areas of interest can be seen by humans clearly, easily, safely and without discomfort.	Light pollution	Best practice lighting design incorporates the following design principles: • Start with natural darkness and only add light for specific purposes. • Use adaptive light controls to manage light timing, intensity and colour. • Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill. • Use the lowest intensity lighting appropriate for the task. • Use non-reflective, dark-coloured surfaces. • Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.
	Recovery Plan for Marine Turtles (DoEE, 2017)	Long-term recovery objective: • 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. Interim objective 3: • Anthropogenic threats are demonstrably minimised.	Marine debris	Reduce the impacts from marine debris: • Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life.
			Chemical and Terrestrial Discharge	Minimise chemical and terrestrial discharge.
			Vessel disturbance	Vessel interactions identified as a threat; no specific management actions in relation to vessels prescribed in the plan.
			Light pollution	Minimise light pollution: • Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats. • Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches. • Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.
			Noise interference	Assess and address anthropogenic noise: • Understand the impacts of anthropogenic noise on marine turtle behaviour and biology.
			Habitat modification	Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival. Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue.
			Disease and pathogens	No explicit management actions; disease and pathogens recognised as a threat.
Leatherback Turtle	Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (DEWHA, 2008)	No explicit relevant objectives.	Boat strike	No explicit relevant management actions; vessel strikes identified as a threat.
			Habitat degradation (changes to breeding sites and degradation to foraging areas)	Identify and protect migratory corridors between nesting beaches and common foraging areas to facilitate colonization.
			Marine debris	No explicit relevant management actions; marine debris identified as a threat.
Fish, Sharks and Rays				

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
Whale Shark	Approved Conservation Advice for the Whale Shark (*Rhincodon typus)* (DoE, 2015b)	To maintain existing levels of protection for the whale shark in Australia while working to increase the level of protection afforded to the whale shark within the Indian Ocean and Southeast Asian region to enable population growth so that the species can be removed from the threatened species list of the EPBC Act.	Marine debris Habitat disruption Boat strike	Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with Whale Shark aggregations along the northward migration route that follows the northern Western Australian coastline along the 200 m isobath (as set out in the Conservation Values Atlas, DoE, 2014).
White Shark	National Recovery Plan for the White Shark (*Carcharodon carcharias* (DSEWPaC, 2013b)	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 with a view to: • Improving the population status leading to future removal of the white shark from the threatened species list of the EPBC Act • Ensuring that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future. The specific objectives of the recovery plan (relevant to industry) are: • Objective 7: Continue to identify and protect habitat critical to the survival of the white shark and minimise the impact of threatening processes within these areas.	Habitat modification	No explicit relevant management actions; habitat modification and climate change identified as threats.
Shorebirds				
Seabirds and migratory shorebirds	National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds (DoEE, 2020)	Lighting objectives will need to consider the regulatory requirements and Australian standards relevant to the activity, location and wildlife present. Objectives should be described in terms of specific locations and times for which artificial light is necessary. Consideration should be given to whether colour differentiation is required and if some areas should remain dark – either to contrast with lit areas or to avoid light spill. Where relevant, wildlife requirements should form part of the lighting objectives. A lighting installation will be deemed a success if it meets the lighting objectives (including wildlife needs) and areas of interest can be seen by humans clearly, easily, safely and without discomfort.	Light pollution	Best practice lighting design incorporates the following design principles: • Start with natural darkness and only add light for specific purposes. • Use adaptive light controls to manage light timing, intensity and colour. • Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill. • Use the lowest intensity lighting appropriate for the task. • Use non-reflective, dark-coloured surfaces. Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.
All Migratory Shorebirds	Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015)	Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.	Habitat degradation and modification	No explicit relevant management actions; identified as a threat.
			Anthropogenic disturbance	Investigate the significance of cumulative impacts on migratory shorebird habitat and populations in Australia. Ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes (specifically for coastal developments).
Australasian Bittern	Approved Conservation Advice for *Botaurus poiciloptilus* (Australasian bittern) (TSSC, 2019)	The objective of this conservation advice is to provide guidance for actions that will expand the range and the number of Australasian Bitterns in Australia.	Habitat loss, disturbance and modifications	No explicit relevant management actions; habitat loss and degradation recognised as a threat.
Australian Painted Snipe	Approved Conservation Advice for Australian painted snipe (*Rostratula australis*) (DSEWPaC, 2013c)	No explicit relevant objectives	Habitat loss, disturbance and modification	Habitat recovery actions are a priority.
Bar-Tailed Godwit (baueri)	Approved Conservation Advice for the bar-tailed godwit (western Alaskan) (*Limosa lapponica baueri*) (TSSC, 2016)	No explicit relevant objectives	Habitat loss and degradation from pollution	Protect important habitat in Australia.

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
Curlew Sandpiper	Approved Conservation Advice for the curlew sandpiper (*Calidris ferruginea*) (DoE, 2015c)	Australian Objective: • Reduce disturbance at key roosting and feeding sites	Habitat loss and degradation from pollution	No explicit relevant management actions; oil pollution recognised as a threat.
Eastern Curlew	Approved Conservation Advice for eastern curlew (*Numenius madagascariensis*) (TSSC, 2015c)	Australian objectives: • Achieve a stable or increasing population. • Maintain and enhance important habitat. • Reduce disturbance at key roosting and feeding sites.	Habitat loss and degradation from pollution	No explicit relevant management actions; habitat loss and degradation recognised as a threat.
Eastern Hooded Plover	Conservation Advice *Thinornis rubricollis rubricollis* hooded plover (eastern) (DoE, 2014)	Relevant Primary Conservation Objectives: • Maintain, enhance and restore habitat, and integrate the subspecies needs into coastal planning	Oil spills	Prepare oil spill response plans to ensure effective rehabilitation of oiled birds.
Great Knot	Approved Conservation Advice for the great knot (*Calidris tenuirostris*) (TSSC, 2016a)	No explicit relevant objectives	Habitat loss and degradation from pollution	Identifies research priorities and the need for actions to prevent destruction of key breeding and migratory staging sites.
			Disease	No explicit relevant management actions; disease recognised as a threat.
Greater Sand Plover	Approved Conservation Advice for the greater sand plover (*Charadruis leschenaultii*) (TSSC, 2016b)	No explicit relevant objectives	Habitat loss and degradation from pollution	Identifies research priorities and the need for actions to prevent destruction of key breeding and migratory staging sites. Protect important habitat in Australia.
			Introduced species / disease	No explicit relevant management actions; introduced species and disease recognised as threats.
Lesser Sand Plover	Approved Conservation Advice *Charadrius mongolus* (Lesser sand plover) (TSSC, 2016c)	No explicit relevant objectives	Habitat loss and degradation from pollution	Outlines research and survey priorities and recommends habitat restoration / maintenance.
			Introduced species / disease	No explicit relevant management actions; introduced species and disease recognised as threats.
Red Knot	Approved Conservation Advice for the red knot (*Calidris canutus*) (TSSC, 2016d)	No explicit relevant objectives	Habitat loss and degradation Pollution/ contamination impacts	Protect important habitat in Australia. Maintain and improve protection of roosting and feeding sites in Australia
Birds – Seabirds				
All Seabirds	Draft Wildlife Conservation Plan for Seabirds (CoA, 2019)	Seabirds and their habitats are protected and managed in Australia.	Habitat degradation and modification	No explicit relevant management actions; identified as a threat.
			Anthropogenic disturbance	Ensure all areas of important habitat for seabirds are considered in the development assessment process. Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas.
			Pollution (marine debris, light, water)	Enhance contingency plans to prevent and/or respond to environmental emergencies that have an impact on seabirds and their habitats.
			Invasive species	Ensure seabirds are protected from the adverse effects of invasive species.

Species or Group	Relevant Plan/Conservation Advice	Relevant Objectives	Threats and or Management Strategies Relevant to the Activity	Relevant Conservation Actions
Relevant EPBC Act-listed seabirds: • Antipodean Albatross • Black-Browed Albatross • Buller's Albatross • Campbell Albatross • Gibson's Albatross • Indian Yellow-Nosed Albatross • Northern Buller's Albtross • Northern Giant Petrel • Northern Royal Albatross • Soft-Plumaged Petrel • Southern Giant Petrel • Shy Albatross • Sooty Albatross • Southern Royal Albatross • Wandering Albatross • White-Capped Albatross	Background Paper, Population Status and Threats to Albatrosses and Giant Petrels Listed as Threatened under the EPBC Act 1999 (DSEWPaC, 2011a) National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPaC, 2011)	Overall objective: • To ensure the long-term survival and recovery of albatross and giant petrel populations breeding and foraging in Australian jurisdiction by reducing or eliminating human related threats at sea and on land. Specific objectives: • Land-based threats to the survival and breeding success of albatrosses and giant petrels breeding within areas under Australian jurisdiction are quantified and reduced. • Marine-based threats to the survival and breeding success of albatrosses and giant petrels foraging in waters under Australian jurisdiction are quantified and reduced.	Marine pollution	Where feasible, population monitoring programs also monitor, in a standardised manner, the incidence of oiled birds at the nest.
			Parasites and disease	No explicit management actions; parasites and disease recognised as a threat.
Australian Fairy Tern	Approved Conservation Advice for Australian fairy tern (*Sternula nereis nereis*) (DSEWPaC, 2011b)	No explicit relevant objectives.	Oil spills	Ensure appropriate oil spill contingency plans are in place for the subspecies' breeding sites that are vulnerable to oil spills.
Blue Petrel	Approved Conservation Advice for the blue petrel (*Halobaena caerulea*) (TSSC, 2015d)	No explicit relevant objectives.	Habitat loss, disturbance and modification	No explicit relevant management actions; habitat loss, disturbance and modification recognised as a threat.
Fairy Prion (southern)	Approved Conservation Advice for fairy prion (southern) (*Pachyptila turtur subantarctica*) (TSSC, 2015e)	No explicit relevant objectives.	Habitat loss, disturbance and modification	No explicit management actions; habitat loss, disturbance and modification recognised as a threat.
Grey-Headed Albatross	Approved Conservation Advice for *Thalassarche chrysostoma* (Grey-headed Albatross) (DEWHA, 2009)	No explicit relevant objectives.	Habitat loss, disturbance and modification	No explicit management actions; habitat loss, disturbance and modification recognised as a threat.
Shy Albatross	Approved Conservation Advice for *Thalassarche cauta* (Shy Albatross) (TSSC, 2020c)	Conservation Advice refers to the objectives set out in the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC 2011).	Marine debris (plastics)	No explicit management actions; marine debris recognised as a threat.
			Disease	No explicit management actions; disease recognised as a threat.
Soft-Plumaged Petrel	Approved Conservation Advice for the soft-plumaged petrel (*Pterodroma mollis*) (TSSC, 2015f)	No explicit relevant objectives.	Habitat loss, disturbance and modification	No explicit management actions; habitat loss, disturbance and modification recognised as a threat.

Biologically Important Areas and Habitat Critical to the Survival of a Species

The Protected Matters Search Tool (PMST) identifies biologically important areas (BIAs) for some of the region's protected species. These are areas that are considered to be particularly important for the conservation of protected species and where aggregations of individuals display biologically important behaviour such as breeding, foraging, resting or migration. BIAs are not protected matters and should not be confused with 'critical habitat' as defined in the EPBC Act.

A review of the PMSTs identified BIAs for 17 protected species that intersect with the operational area, MDO spill EMBA and LOWC spill EMBA. The identified protected species and the relevant BIAs are shown in Table 4-6.

Table 4-6: BIAs within the Operational Area and EMBAs

Species	BIA Type	Operational Area	MDO EMBA	LOWC EMBA	Closest approx. distance to operational area (km) [1]
Whales					
Blue whale and pygmy blue whale (Figure 4-11)	Distribution	✓	✓	✓	Within
	Foraging (annual high use area)	✓	✓	✓	Within
Southern right whale (Figure 4-12)	Aggregation	-	✓	✓	25 km
	Known Core Range	✓	✓	✓	Within
	Migration and Resting on Migration	✓	✓	✓	Within
Sharks					
White shark (Figure 4-13)	Breeding (nursing area)	-	-	✓	302 km
	Distribution	✓	✓	✓	Within
	Foraging	-	✓	✓	58 km
Seabirds					
Antipodean Albatross (Figure 4-14)	Forgaing	✓	✓	✓	Within
Australasian Gannet (Figure **4-15**)	Aggregation	-	✓	✓	117 km
	Foraging	-	✓	✓	83 km
Black-browed Albatross (Figure **4-16**)	Foraging	✓	✓	✓	Within
Black-faced Cormorant (Figure 4-17)	Foraging	-	-	✓	116 km
Buller's Albatross (Figure **4-18**)	Foraging	✓	✓	✓	Within
Campbell Albatross (Figure **4-19**)	Foraging	✓	✓	✓	Within
Common Diving Petrel (Figure **4-20**)	Breeding	-	✓	✓	90 km
	Foraging	✓	✓	✓	Within

Species	BIA Type	Operational Area	MDO EMBA	LOWC EMBA	Closest approx. distance to operational area (km) [1]
Indian Yellow-nosed Albatross (Figure 4-21)	Foraging	✓	✓	✓	Within
Little Penguin (Figure 4-22)	Breeding	-	✓	✓	190 km
	Foraging	-	✓	✓	120 km
Short-tailed Shearwater (Figure 4-23)	Breeding	-	✓	✓	192 km
	Foraging	-	✓	✓	20 km
Shy Albatross (Figure 4-24)	Foraging	✓	✓	✓	Within
Wandering Albatross (Figure **4-25**)	Foraging	✓	✓	✓	Within
Wedge-tailed shearwater (Figure 4-26)	Breeding	-	✓	✓	590 km
	Foraging	✓	✓	✓	Within
White-faced Storm Petrel (Figure 4-27)	Foraging	-	✓	✓	56 km

[1] *Where multiple BIAs overlap with the wider EMBA, the distance shown is the distance of the closest BIA to the operational area.*

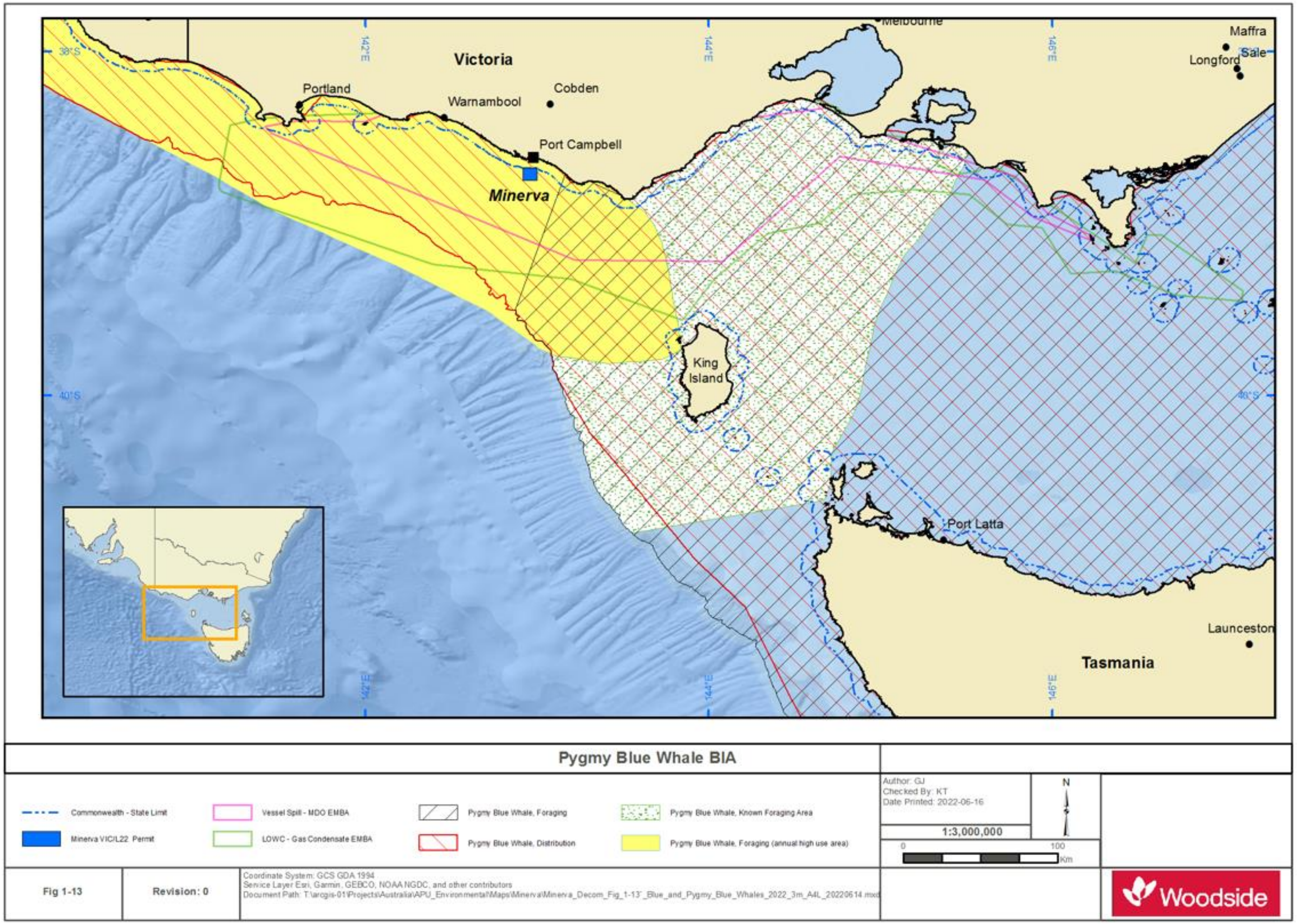


Figure 4-11: BIAs for Pygmy Blue Whales

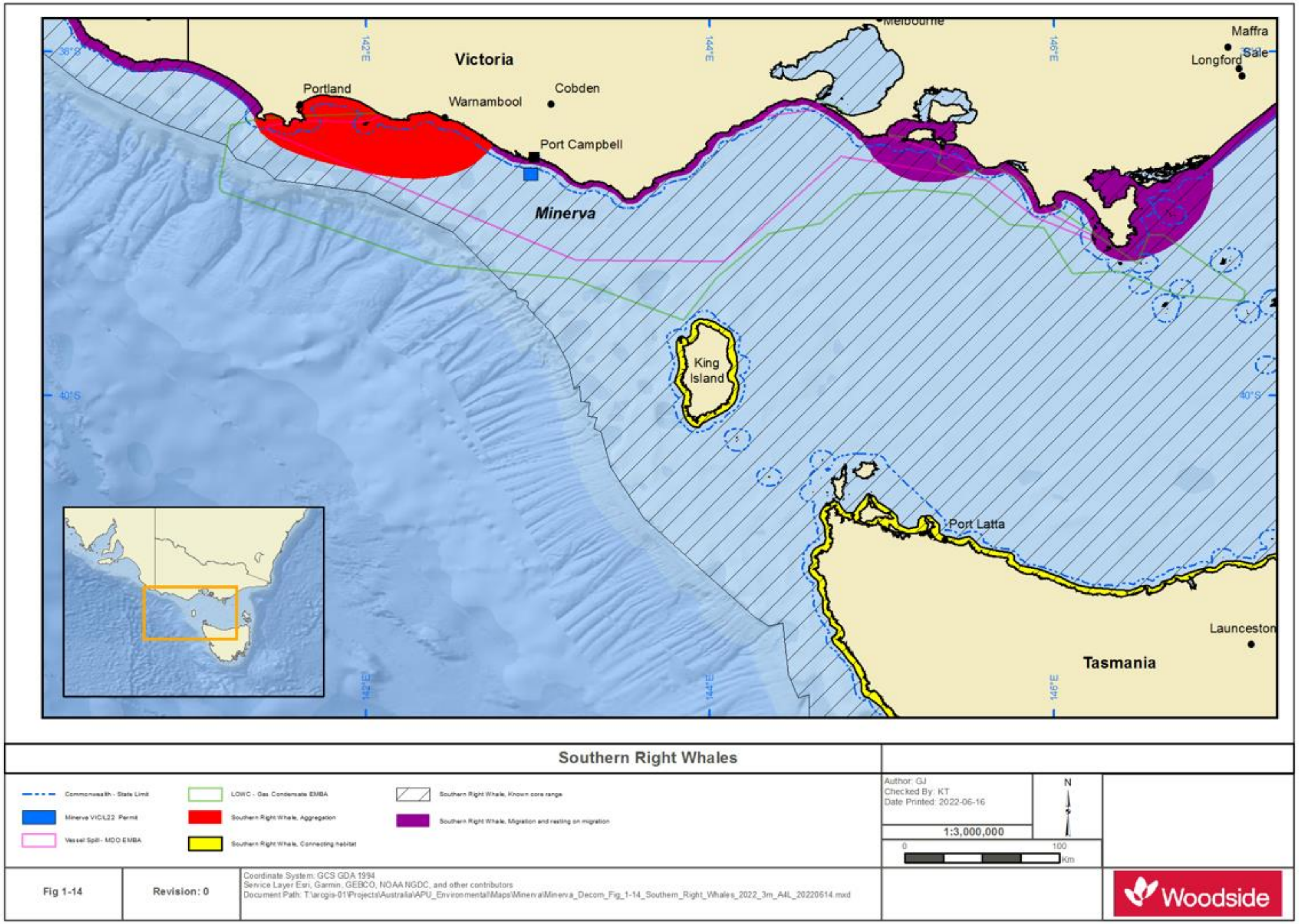


Figure 4-12: BIAs for Southern Right Whales

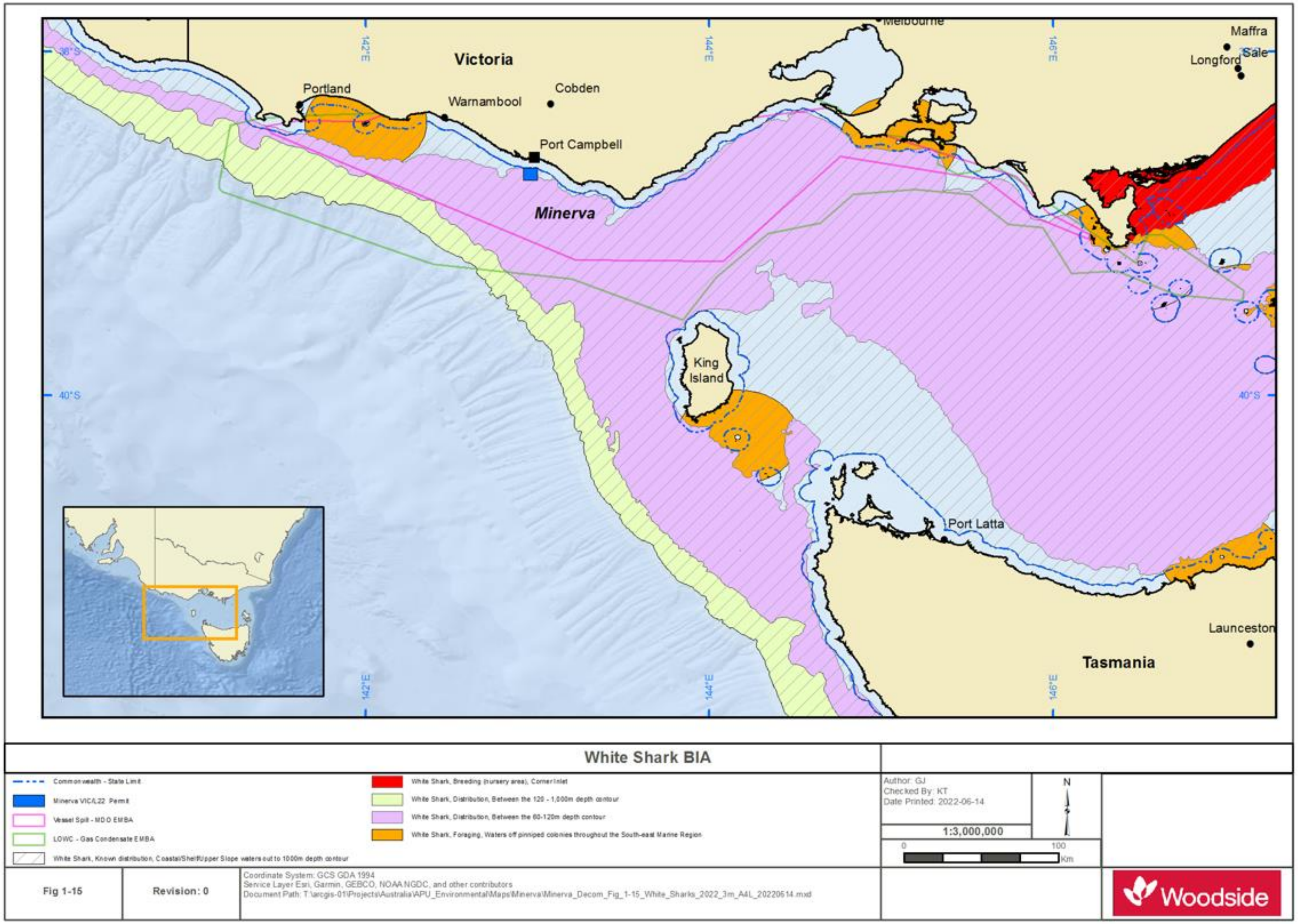


Figure 4-13: BIAs for White Sharks

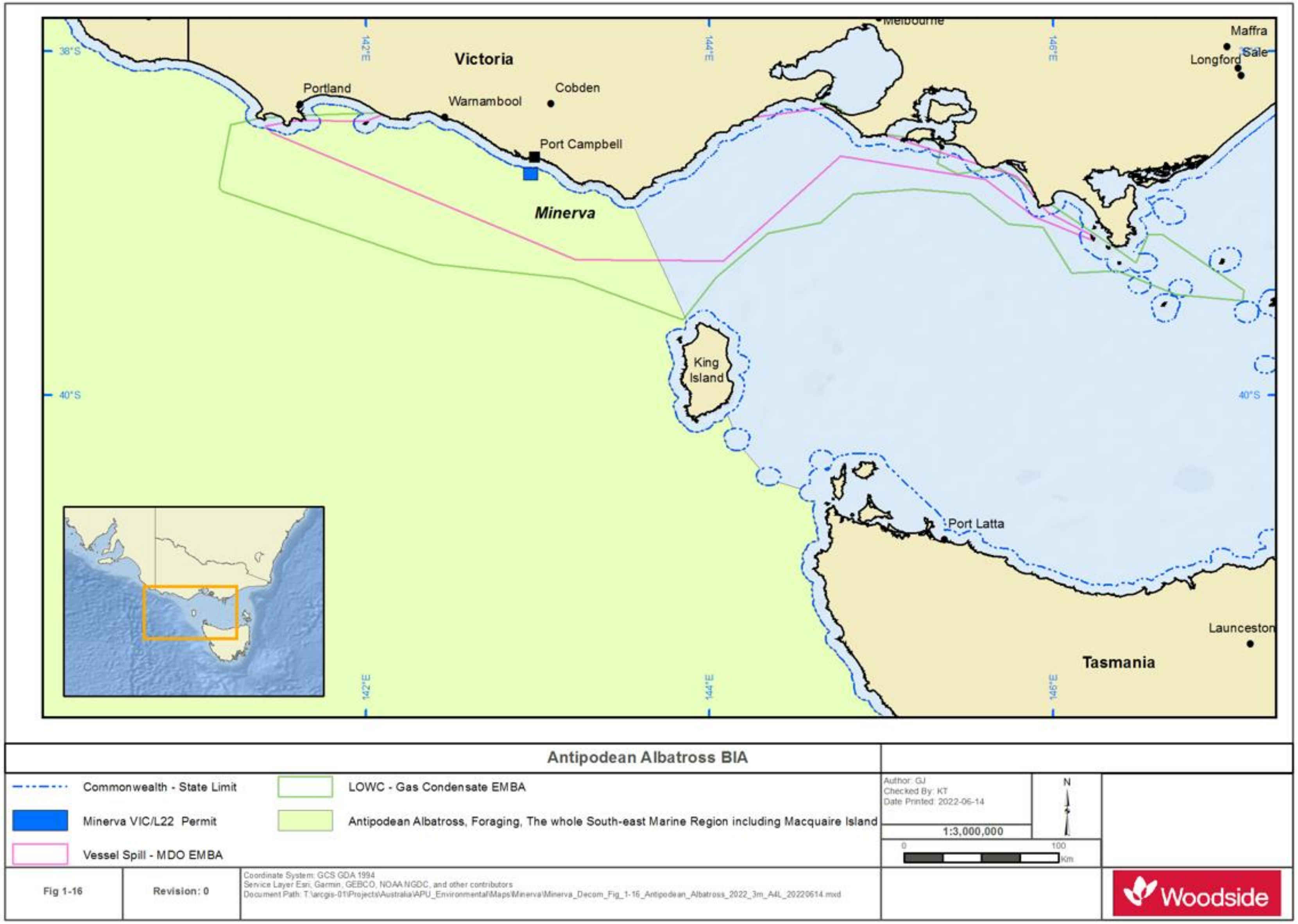


Figure 4-14 : BIAs for Antipodean Albatross

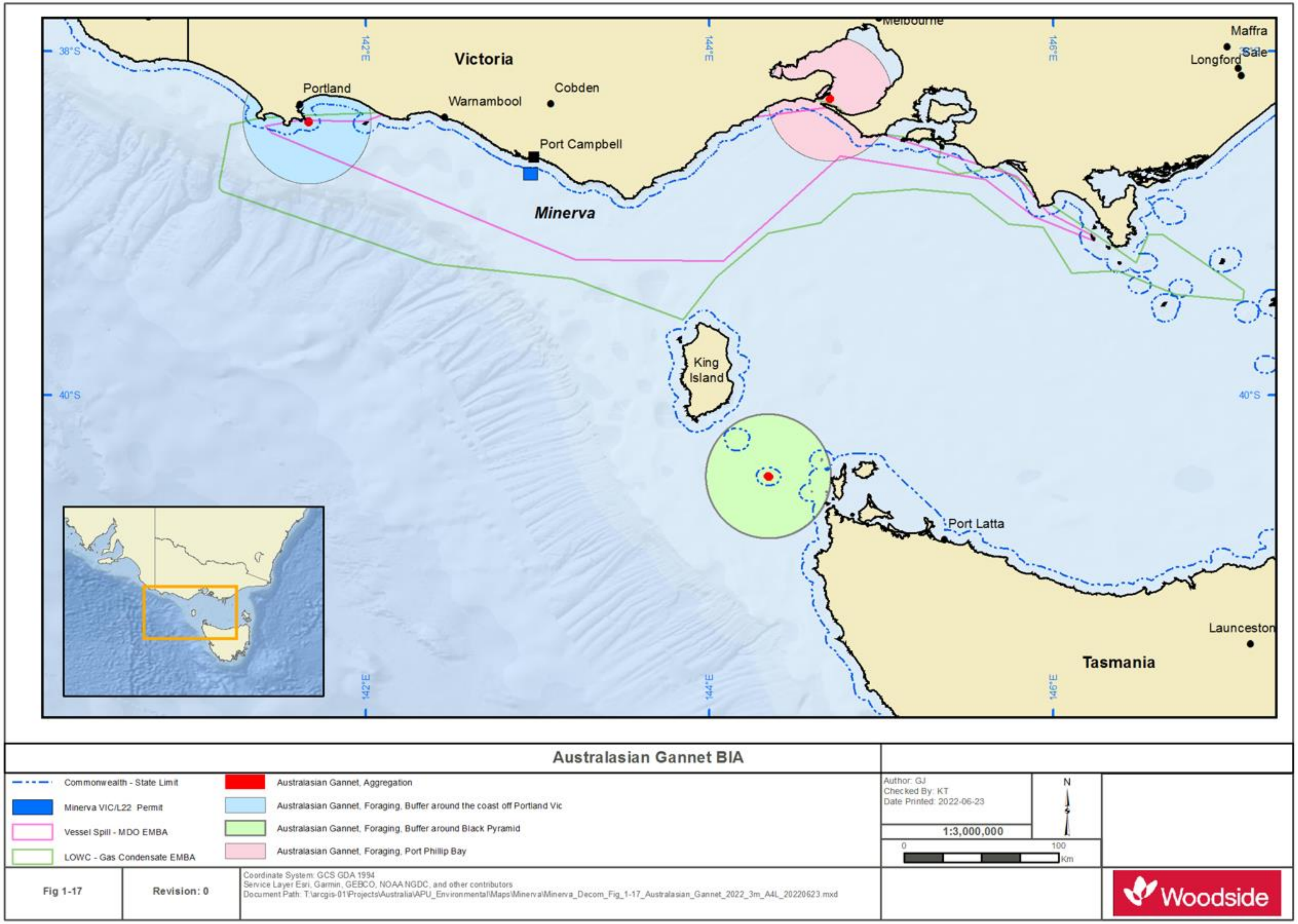


Figure 4-15: BIAs for Australasian Gannet

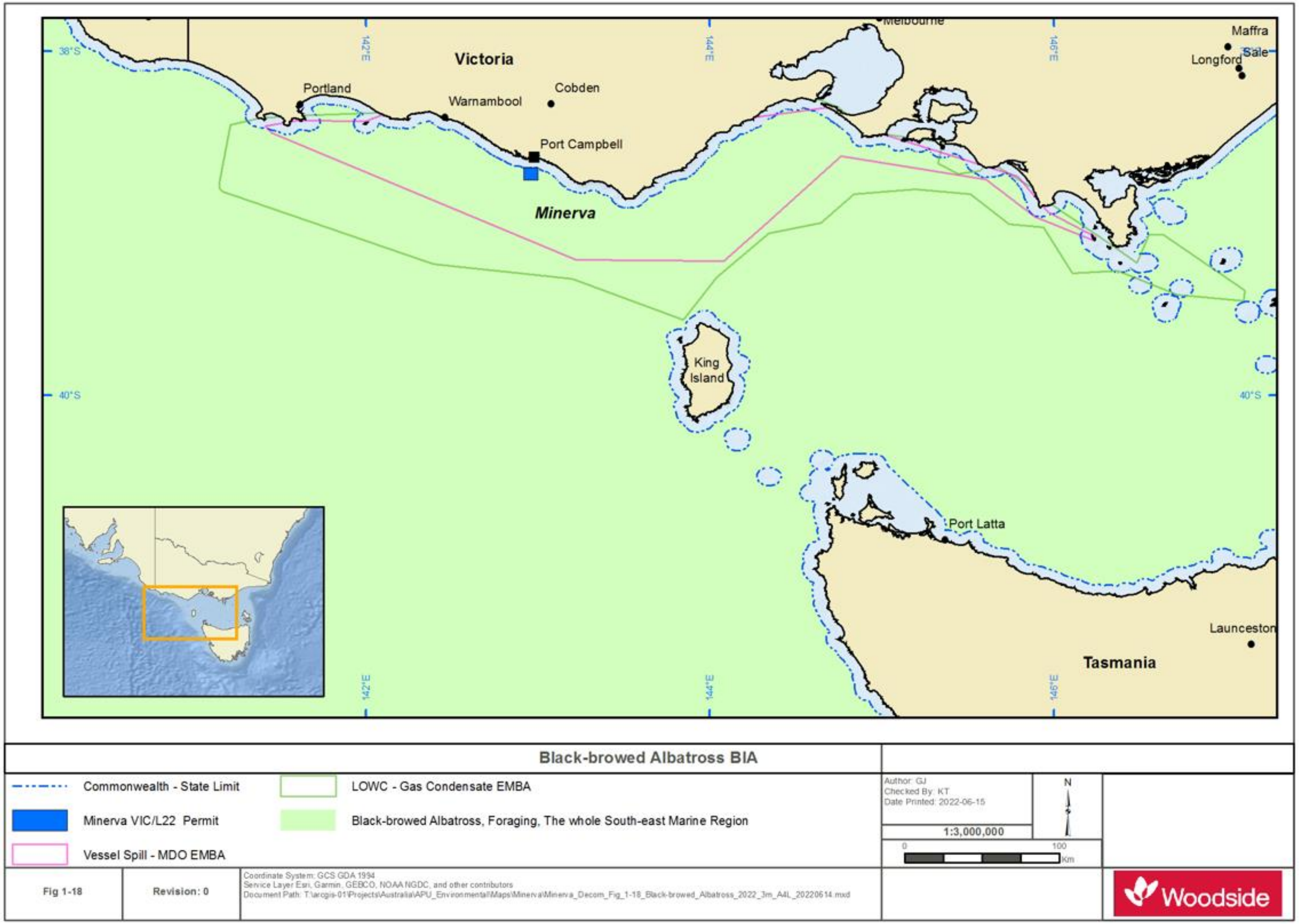


Figure 4-16: BIAs for Black-browed Albatross

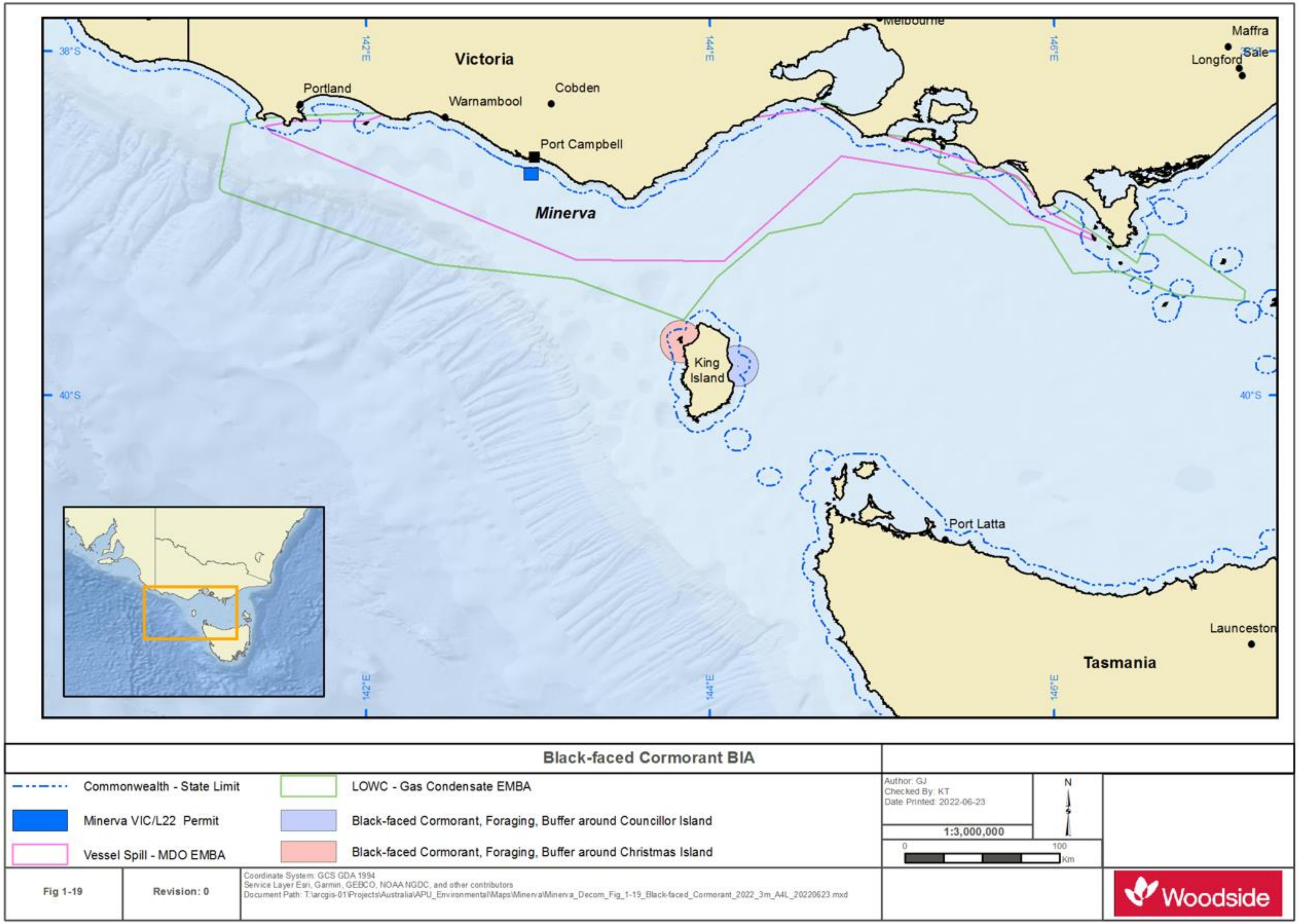


Figure 4-17: BIAs for Black-faced Cormorant

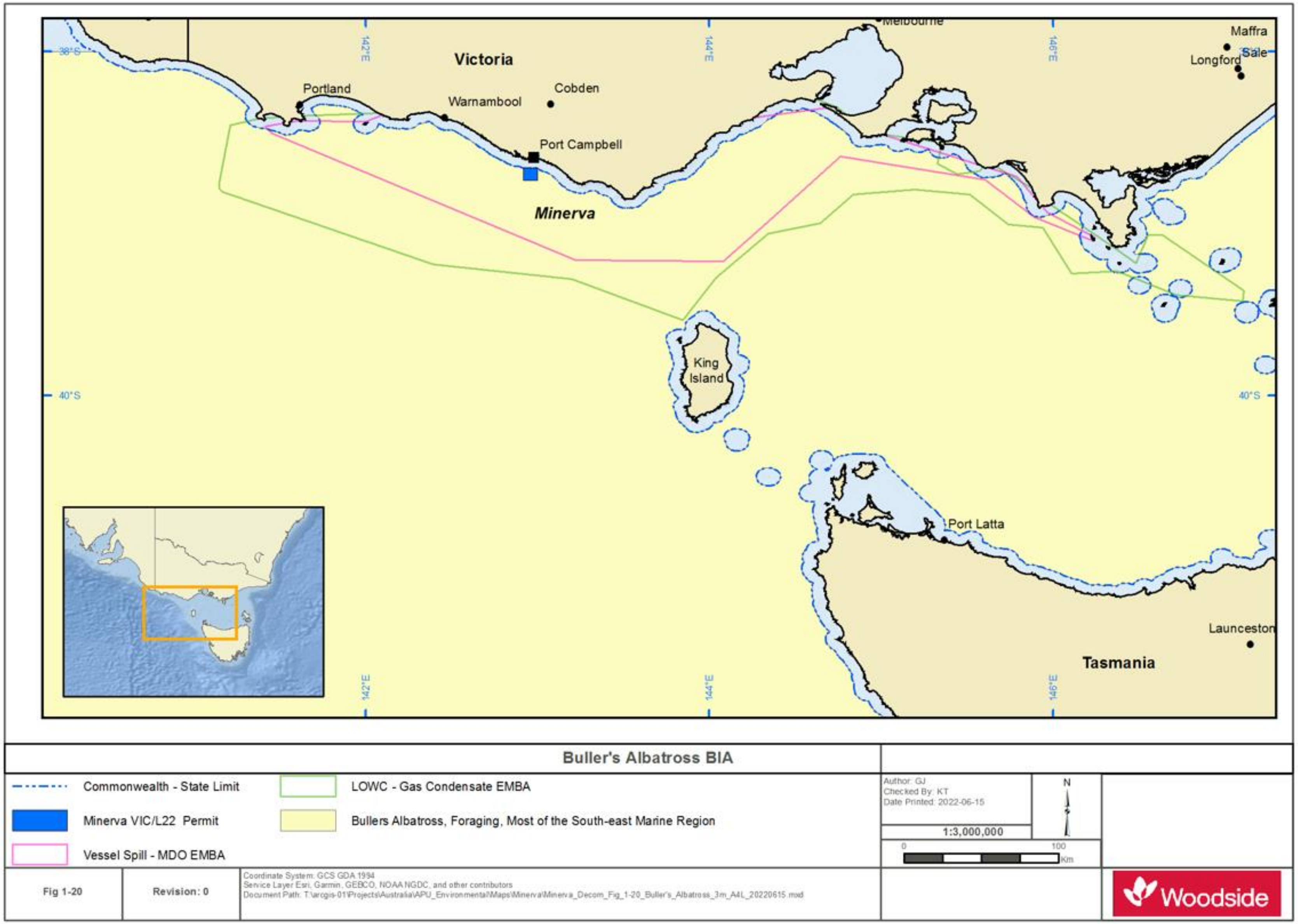


Figure 4-18: BIAs for Buller's Albatross

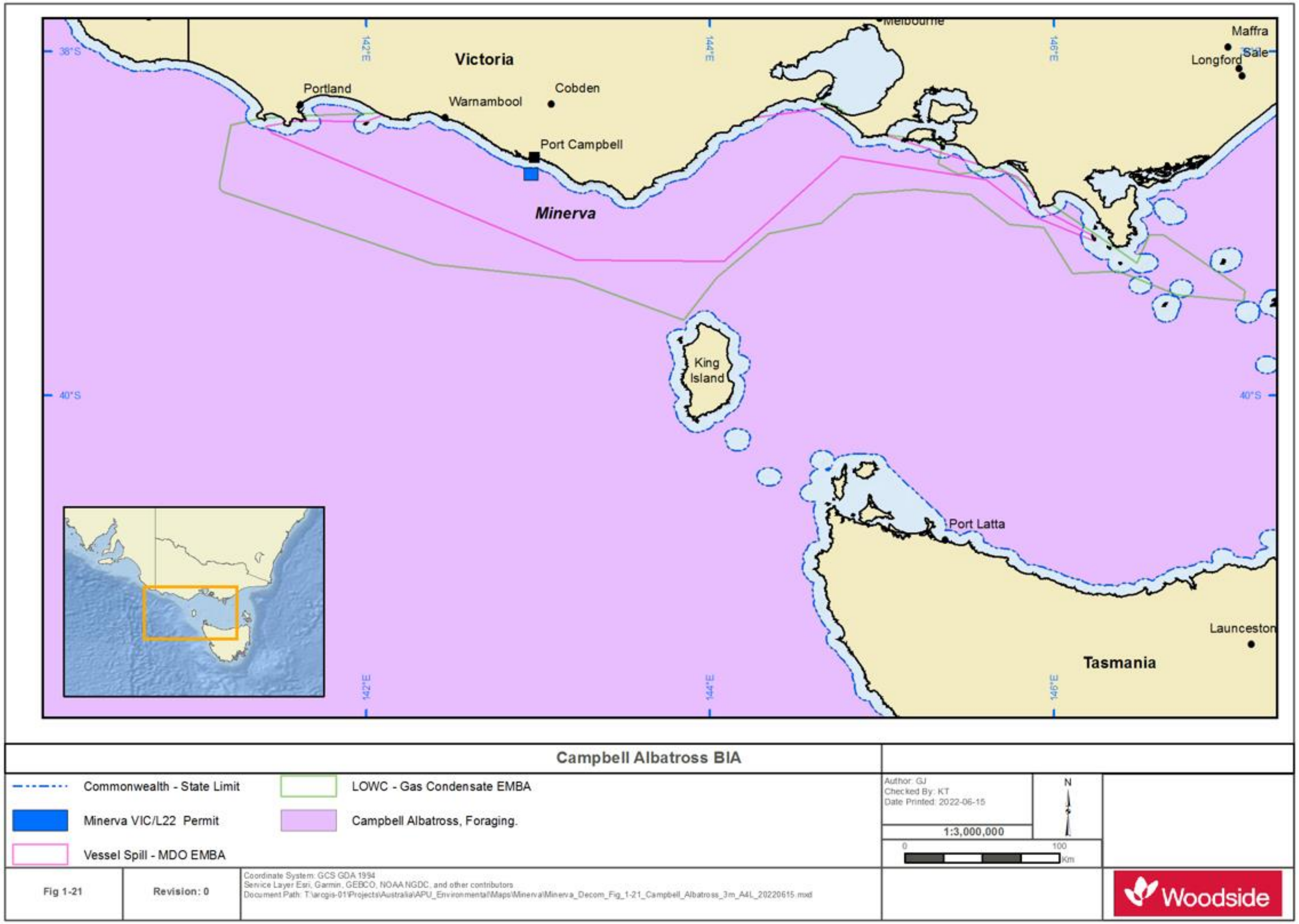


Figure 4-19: BIAs for Campbell Albatross

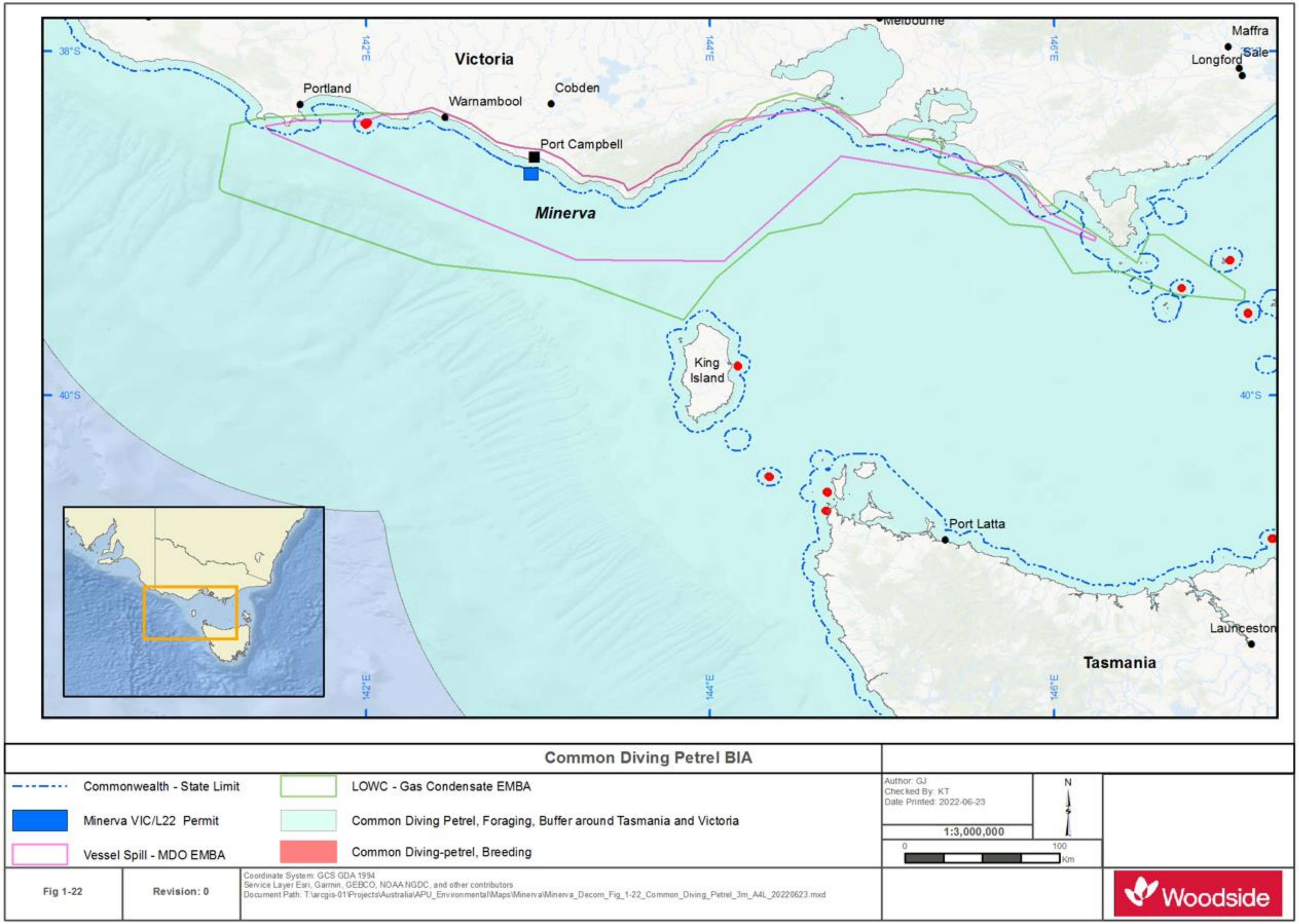


Figure 4-20: BIAs for Common Diving Petrel

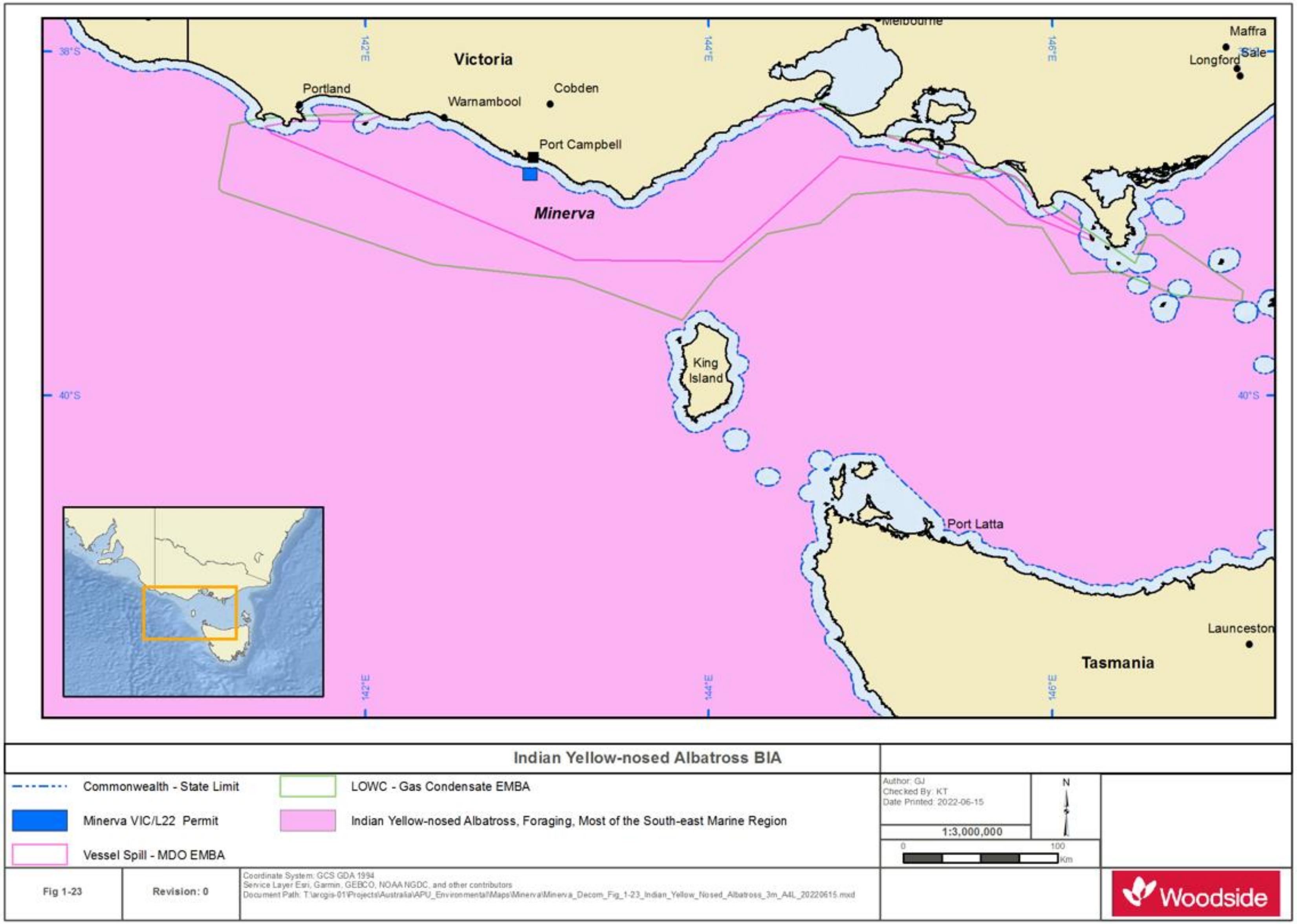


Figure 4-21: BIAs for Indian Yellow-nosed Albatross

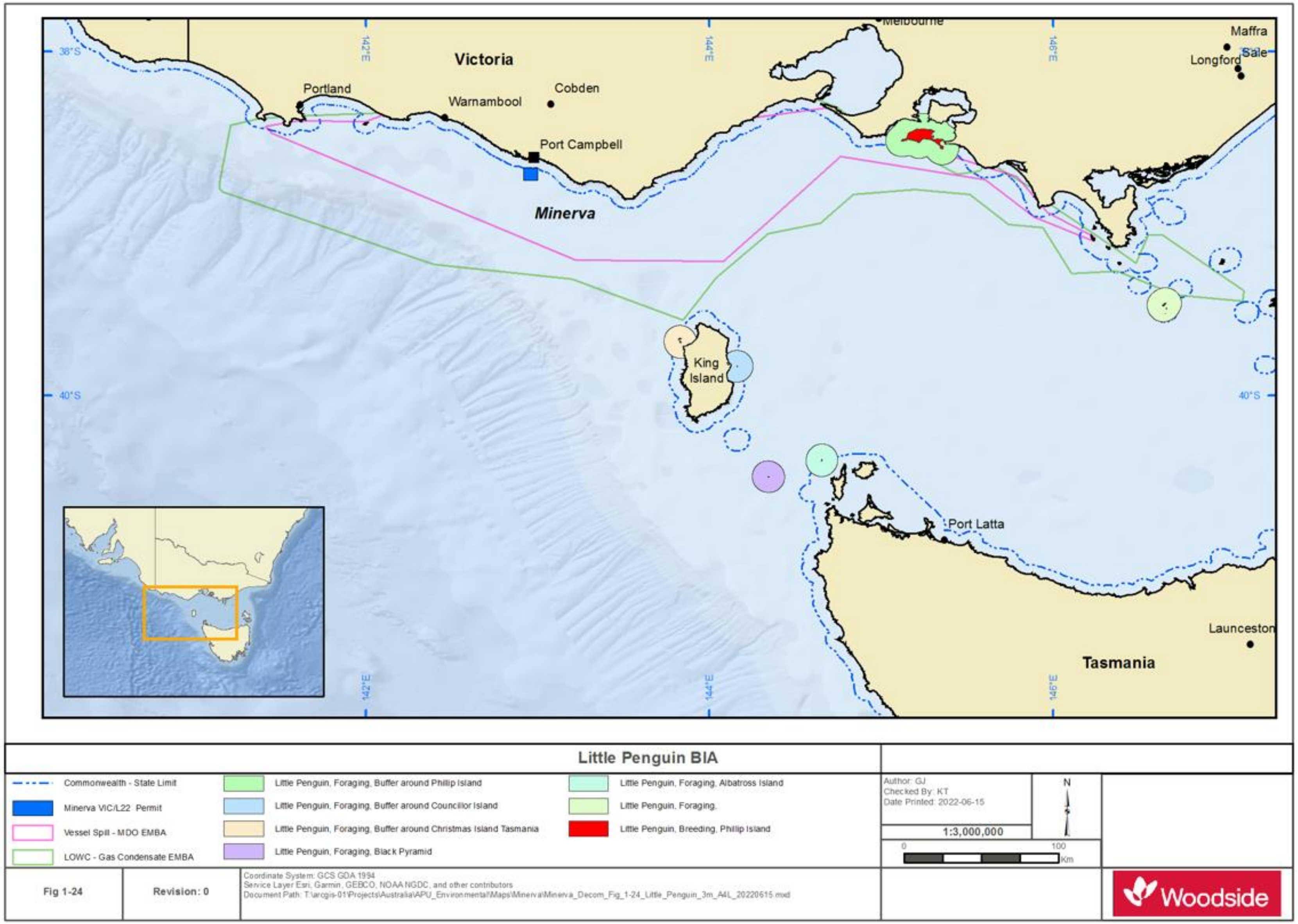


Figure 4-22: BIAs for Little Penguin

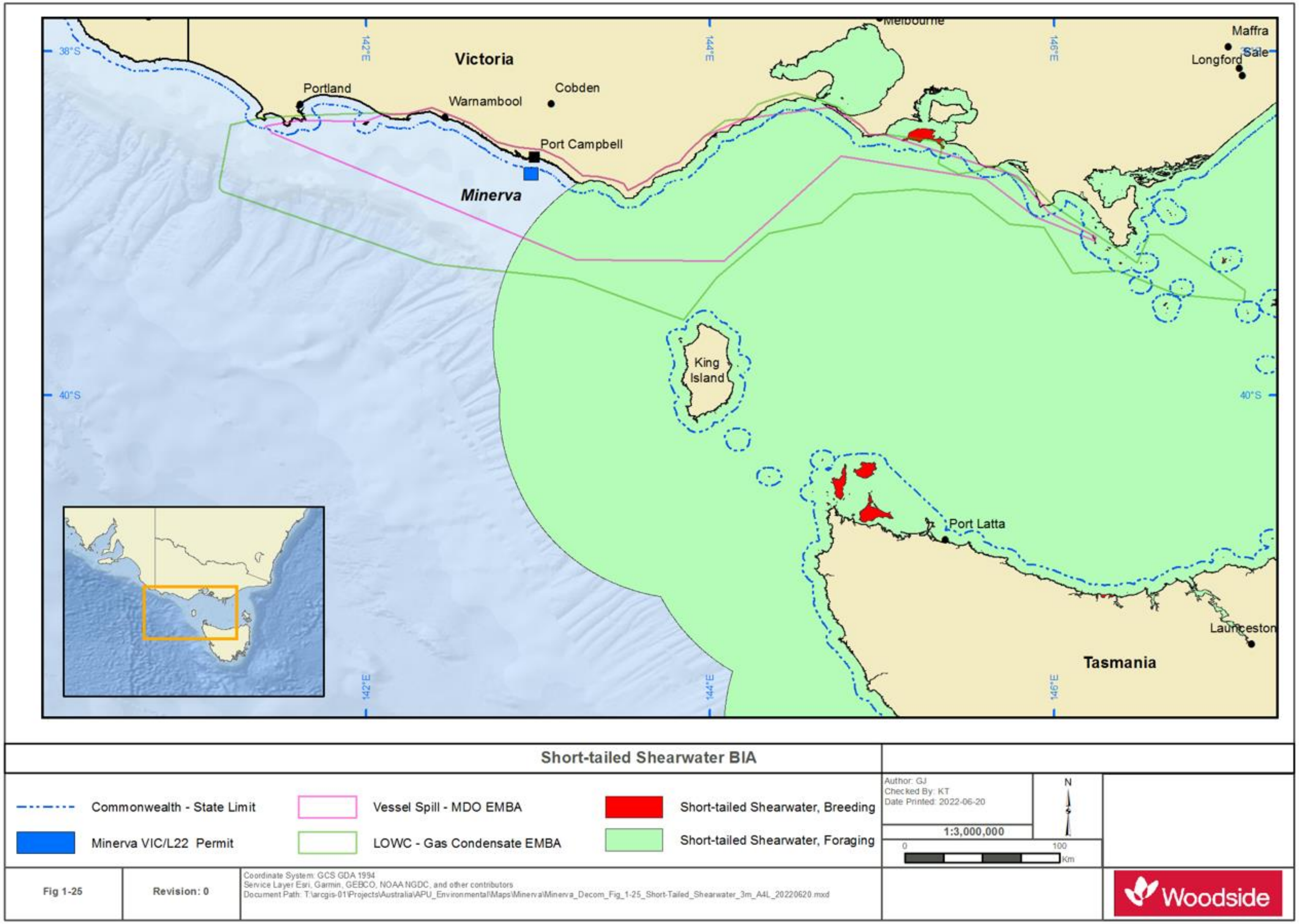


Figure 4-23: BIAs for Short-tailed Shearwater

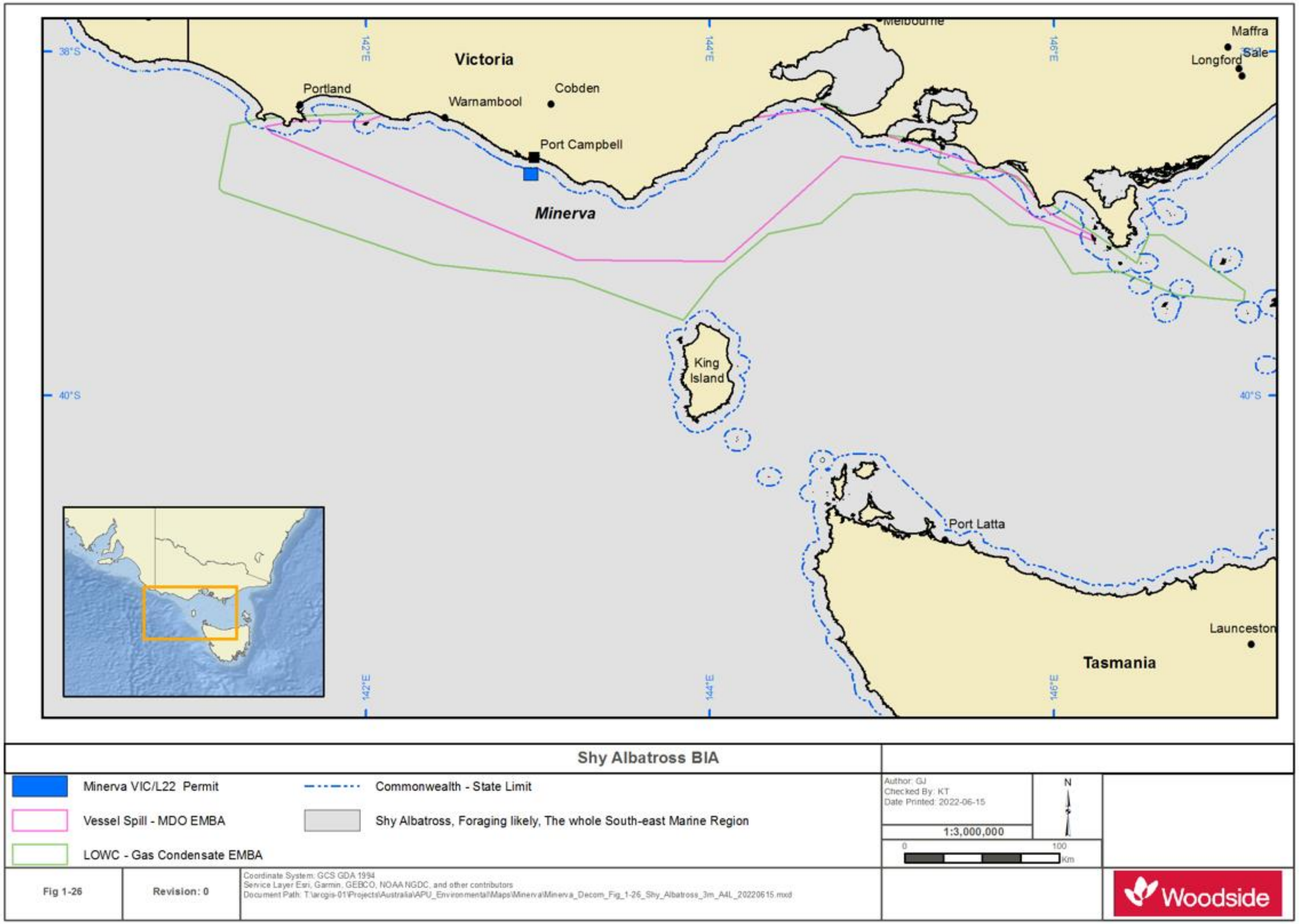


Figure 4-24: BIAs for Shy Albatross

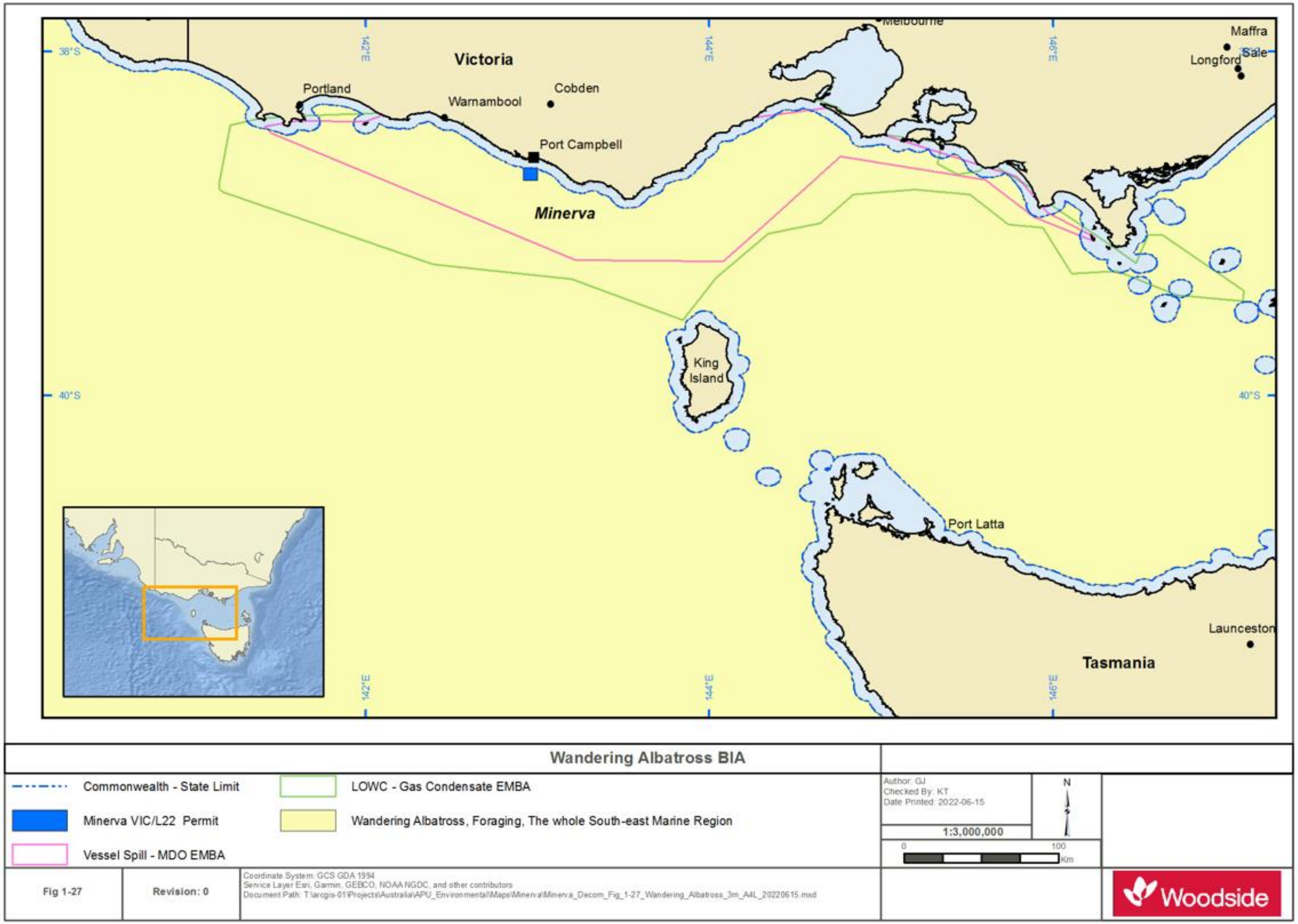


Figure 4-25: BIAs for Wandering Albatross

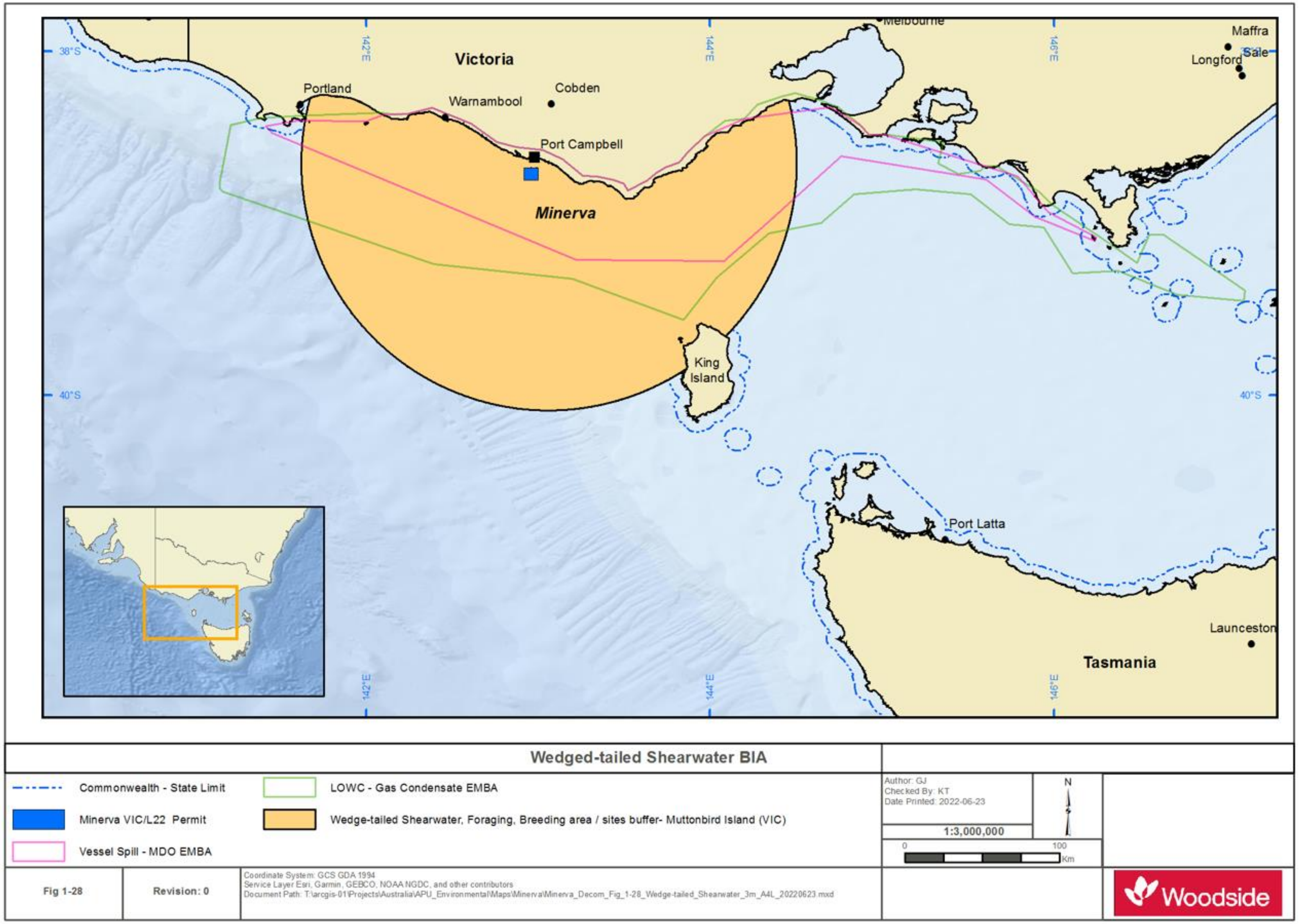


Figure 4-26: BIAs for Wedge-tailed Shearwater

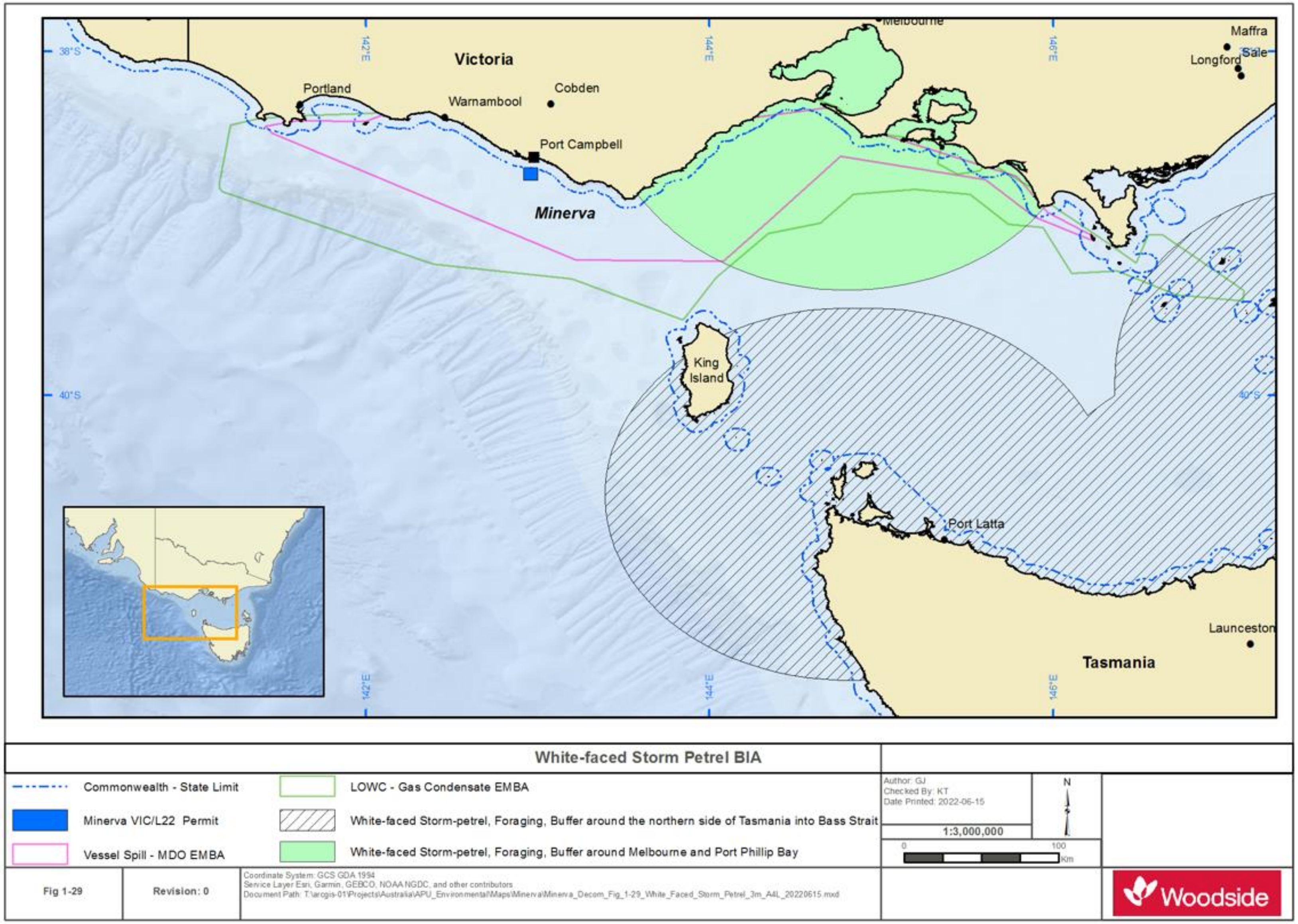


Figure 4-27: BIAs for White-faced Storm Petrel

Habitat Critical to the Survival of a Species

Habitat critical to the survival of a species is defined within the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE, 2013) as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal;
- For the long-term maintenance of the species (including the maintenance of species essential to the survival of the species);
- To maintain genetic diversity and long-term evolutionary development; or
- For the reintroduction of populations or recovery of the species.

However, there are no critical habitats identified within the operational area or EMBAs.

Summary of Windows of Ecological Sensitivity

Table 4-7 provides a summary of the windows of ecological sensitivity for values identified within and around the operational area and the wider EMBA. These receptors are considered throughout the EP in terms of the identified potential risk.

Table 4-7: Key environmental sensitivities and timing of biologically important activity

Category	Environmental Sensitivity	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Habitats / Communities	Phytoplankton abundance	Assumed peak occurrence associated with Bonney Upwelling				Present year-round							
	Zooplankton abundance	Assumed peak occurrence associated with Bonney Upwelling				Present year-round							
	Seagrass	Present year-round in coastal areas											
	Macroalgae	Present year-round											
TEC	Bonney Coast Upwelling	Upwelling event											
Marine Fauna (threatened/ migratory species)	**Marine Mammals**												
	Antarctic Minke Whale			Likely to occur in summer									
	Australian Sea Lion	Assumed present year-round – SEMR is a known range											
	Pygmy Blue Whale	Foraging occurs during Bonney Upwelling – BIA											
	Dusky Dolphin	Assumed present year-round – prefers inshore habitats but may also be pelagic at times											
	Fin Whale	Present during the Bonney Upwelling event											
	Humpback Whale				Nth Migration through SEMR						Sth Migration through SEMR		
	Killer Whale	Assumed present year-round – frequent sightings off Vic along the continental slope and shelf											
	Pygmy Right Whale	Uncommon / few or no records available for Vic.											
	Sei Whale	Sighted during the Bonney Upwelling event											
	Southern Right Whale					Aggregation and Migration and resting on migration BIAs							
	Sperm Whale	Prefer deep offshore environments >600 m											
	Marine Reptiles												
	Green turtle	Occurs in limited numbers in Vic and SA											

Category	Environmental Sensitivity	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Leatherback Turtle	Foraging in the SEMR is known to occur											
	Loggerhead Turtle	Uncommon in southern Australia											
	Fish, Sharks and Rays												
	Australian Grayling		Spawning from late Summer to Winter (freshwater)				Assumed present year-round – typically occurs in freshwater but can occur in coastal seas						
	Porbeagle	Assumed present year-round											
	Shortfin Mako Shark	Assumed present year-round											
	Whale Shark	Uncommon in southern Australia – isolated records for Vic.											
	White Shark	Assumed present year-round with breeding, distribution and foraging BIAs identified throughout the region											
	Blue Warehou	Assumed present year-round											
	Eastern School Shark	Assumed present year-round											
	Orange Roughy	Assumed present year-round											
	Southern Bluefin Tuna	Assumed present year-round											
	Southern Dogfish	Assumed present year-round											
	Syngnathids	Assumed present year-round in waters <50 m (sometimes recorded in deeper offshore waters)											
	Birds												
	Antipodean Albatross	Foraging known to occur all year											
	Australasian Gannet						Present year-round – foraging and aggregation BIAs				Breeding occurs Oct – May		
	Black-browed Albatross				Fledglings (Apr – May)		Present – foraging BIA			Breeding within SEMR on Macquarie Is.			
	Black-faced Cormorant	Assumed present year-round – foraging BIA (endemic to southern Australia)											
	Buller's Albatross	Foraging BIA – however, records indicate the species is mainly present around Tas when in the SEMR (species endemic to NZ)											

Category	Environmental Sensitivity	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Campbell Albatross					Present in the non-breeding season – foraging BIA			Breeds on Campbell Island, south of NZ Aug - May				
	Common Diving Petrel		Present year-round – foraging BIA					Breeding occurs Jul-Jan – breeding BIA					
	Indian Yellow-nosed Albatross			Fledgling Mar-Apr			Non-breeding visitor – foraging BIA			Breeding occurs in South Africa – eggs laid in Sep-Oct			
	Little Penguin			Present year-round – foraging BIA						Breeding Sept – Feb – breeding BIA			
	Short-tailed Shearwater	Present Sep-May – foraging and breeding BIAs					Migrates north for Winter				Breeding Oct – May		
	Shy Albatross	Assumed present year-round – foraging BIA. Breeding occurs in SEMR with eggs laid in Sept and fledglings in Apr											
	Wandering Albatross	Assumed present year-round – foraging BIA. Breeding occurs biennially on Macquarie Island with eggs laid in Dec and fledglings between mid-Nov and late-Feb											
	Wedge-tailed Shearwater	Present Aug-May – foraging and breeding BIA											
	White-faced Storm Petrel	Fledglings mid-Feb – mid-Mar			Migrates to tropical and subtropical locations in non-breeding season					Species arrive at breeding colonies late-Sept – early-Oct with egg laying occurring in early Summer			
	Birds – other seabirds (with no BIAs identified)	Various species – assumed present											
	Birds – shorebirds	Various species – assumed present											
Legend		Peak occurrence / activity (reliable and predictable)											
		Low level of occurrence/ activity (may vary from year to year)											
		Activity can occur throughout the year											
		No occurrence											

4.3.7 Marine Mammals

A search of the EPBC Act Protected Matters database identified 32 EPBC Act listed marine mammal species with potential to occur or have habitat within the EMBA. Of these, a total of five were listed as threatened and ten were listed as migratory marine mammal species. Within the operational area a total of 15 EPBC Act listed marine mammals (four threatened species and eight migratory listed) were identified.

Threatened and Migratory Species

Antarctic Minke Whale

The Antarctic Minke Whale (*Balaenoptera bonaerensis*) is listed as migratory under the EPBC Act. This species is found throughout the Southern Hemisphere from 55ºS to the Antarctic ice edge during the austral summer (Perrin and Brownell, 2002). In these areas, the distribution of the Antarctic Minke Whale is mainly oceanic, beyond the continental shelf break (DAWE, 2022). Limited movements patterns are known, however this species does undergo extensive migration between the summer Antarctic feeding grounds and winter sub-tropical to tropical breeding grounds (DAWE, 2022). In Australia, Antarctic Minke Whales have been recorded from all States but not in the Northern Territory (Bannister *et al*., 1996).

The Antarctic Minke Whale was identified as likely to occur within the EMBAs.

Australian Sea Lion

The Australian Sea Lion (*Neophoca cinerea*) is listed as endangered under the EPBC Act. The Australian Sea Lion is the only pinniped endemic to Australia (Strahan, 1983). The breeding range extends from Houtman Abrolhos, Western Australia, to the Pages Island, east of Kangaroo Island, South Australia (DAWE, 2022). Breeding colonies occur on islands or remote sections of coastline. Over 66 breeding colonies have been recorded: 28 in WA and 38 in SA (DAWE, 2022). The Australian Sea Lion exhibits high site fidelity and little movement of females between colonies have been observed, even between those separated by short distances (Campbell *et al*., 2008).

Australian Sea Lions use a wide variety of habitats for breeding sites (called rookeries), and during the non-breeding season, for haul-out sites (DAWE, 2022). Onshore habitats used include exposed islands and reefs, rocky terrain, sandy beaches and vegetate for dunes and swales (DAWE, 2022). They feed on a wide variety of prey, including cephalopods, fish, sharks, rock lobsters and sea birds (Gales & Cheal, 1992; Ling, 1992).

The Australian Sea Lion was identified as known to occur within the EMBAs.

Blue Whale

Blue whales (*Balaenoptera musculus*) are listed as endangered and migratory under the EPBC Act. There four sub-species of Blue Whale, two of these occur within Australian waters, the southern (or ‘true’ blue whale (*Balaenoptera musculus intermedia*) and the 'pygmy' blue whale (*Balaenoptera musculus brevicauda*) (DoE, 2015a). As with other baleen whales, they generally migrate between breeding grounds at lower latitudes where both mating and calving takes place during the winter, and feeding grounds at higher latitudes during the summer and have overlapping but different spatial distributions (DoE, 2015a). Blue whale habitat is variable between the two sub-species found in Australian waters. The Antarctic blue whale tends to remain at higher latitudes and migrate to lower latitudes for feeding, breeding and calving during the Australian summer, whilst some remain within the Antarctic waters year-round (Branch, 2007; Širovic *et al*., 2009). In comparison, the pygmy blue whale habitat is more diverse, expanding throughout the Indian Ocean, with individuals moving between Australia and the warmer waters of Indonesia (Branch et al. 2007, Double et al. 2014). The Bonney Upwelling (Section 4.14.1.10) is an important habitat and feeding ground for Pygmy Blue Whales and it is located within the EMBA. The Pygmy Blue Whale aggregates between Cape Otway, Victoria, and Robe, South Australia, in relatively shallow shelf waters enriched by seasonal cold water upwelling driven by south-east winds. Aggregation in the Bonney Upwelling between the Great Australian Bight and Bass Strait occurs November–May (Gill *et al*., 2011). This upwelling event allows whales to feed on abundant krill surface swarms (DAWE, 2022).

Blue whales were identified as likely to be foraging within the operational area and EMBAs. Foraging and distribution BIAs for the Pygmy Blue Whale intercept the operational area and EMBAs (Figure 4-11).

Dusky Dolphin

The Dusky Dolphin (*Lagenorhynchus obscurus*) is listed as migratory under the EPBC Act and occurs mostly in temperate and sub-Antarctic zones (DAWE, 2022). In Australia, the Dusky Dolphin has been sighted in southern Australia from WA to Tasmania (Gill *et al*., 2000). The area of occupancy is unknown, but it is considered to primarily inhabit inshore waters, but may also move offshore to seek out colder waters in summer months (DAWE, 2022).

Dusky Dolphins may occur within the operational area and have been identified as likely to occur within EMBAs.

Fin Whale

The Fin Whale (*Balaenoptera physalus*) is listed as vulnerable and migratory under the EPBC Act. The Fin Whale is considered a cosmopolitan species and occur from polar to tropical waters, but rarely in inshore waters (DAWE, 2022). The species distribution in Australian waters is known primarily from aerial surveys, stranding events and whaling records (DAWE, 2022). Due to scarcity of sighting records, the distribution cannot be accurately determined although it is thought to be present along the western coast of Australia, southern Australia around to Tasmania. The Australian Antarctic waters are important feeding grounds but there are no known mating or calving areas in Australian waters (Morrice *et al*., 2004). Sightings of fin whales feeding in the Bonney Upwelling (Section 4.14.1.10) area in summer and autumn months indicate that this area is also a potentially important feeding ground (Morrice *et al*., 2004).

Fin Whales were identified as showing likely foraging behaviour within the operational area and known foraging within the EMBAs.

Humpback Whale

The Humpback Whale (*Megaptera novaengliae*) is listed as migratory under the EPBC Act. The species was listed in the vulnerable category prior to the commencement of the EPBC Act and was listed as vulnerable under Schedule 1 of the *Endangered Species Protection Act 1992*. However, the Humpback Whale is no longer eligible for inclusion in any category of the list and is eligible for deletion from the listing (DAWE, 2022b) after it was deemed that the species has made a major recovery.

Humpback Whales are found in all ocean basins worldwide. Across this range there are multiple sub-populations with two sub-populations occuring within Australian waters; the west coast population and the east coast population (Scmitt *et al*., 2014). The species migrates north from their Antarctic feeding grounds, reaching the waters of the South-east Marine Region in April and May (DoE, 2015). Immature individuals and lactating females arrive first, followed by non-pregnant females arriving last. Breeding and calving takes place between mid-August and early September when the southern migration starts. The southern migration occurs in the South-east Marine Region from October to December (DoE, 2015). In Australian waters, migration occurs in close proximity to the coast (DoE, 2015).

Although feeding is primarily undertaken in their Antarctic feeding grounds, there is growing evidence that humpback whales may feed on migration. This is thought to primarily be opportunistic and forms only a small portion of their nutritional requirements (Thiele *et al*., 2004). Some feeding has been observed in Australia's coastal waters on various occasions throughout the South-east Marine Region (DoE, 2015).

Humpback Whales were identified as likely to occur within the operational area and known to occur within the EMBAs.

Killer Whale

Killer Whale (*Orcinus orca*) is listed as migratory under the EPBC Act and is the largest member of the dolphin family. The Killer Whale is probably the most cosmopolitan of all cetaceans and may be seen in any marine region. Killer Whales occur throughout all oceans and contiguous seas, from equatorial regions to the polar pack ice zones, and may even ascend rivers. However, they are most numerous in coastal waters and cooler regions where productivity is high (Dahlheim and Heyning, 1999; Jefferson *et al*., 1993). In Australia, Killer Whales are recorded from all states, with concentrations reported around Tasmania. Sightings are also frequent in South Australia and Victoria, most often along the continental slope and on the shelf (Ling 1991; DAWE, 2022).

As apex predators, Killer Whales feed on a variety of prey, including fish, birds and mammals with reports of attacks on dolphins, whales, dugongs and sea lions (Saulitis *et al*., 2000; Bannister *et al*., 1996). They are known to make seasonal migrations, and may follow regular migratory pathways; however little information is available for Australian Killer Whales (DAWE, 2022).

The Orca has been identified as likely to occur within the operational area and EMBAs.

Pygmy Right Whale

The Pygmy Right Whale (*Caperea marginata*) is listed as migratory under the EPBC Act. There is little known about this species with few sightings recorded (Kemper, 2002). In Australia, they have been recorded between 32°S and 47°S, but are not uniformly spread around the coast, with the distribution on the considered to be limited by the Leeuwin and East Australian currents (Kemper, 2002).

The Pygmy Right Whale may forage in the operational area and was identified as likely to forage within EMBAs.

Sei Whale

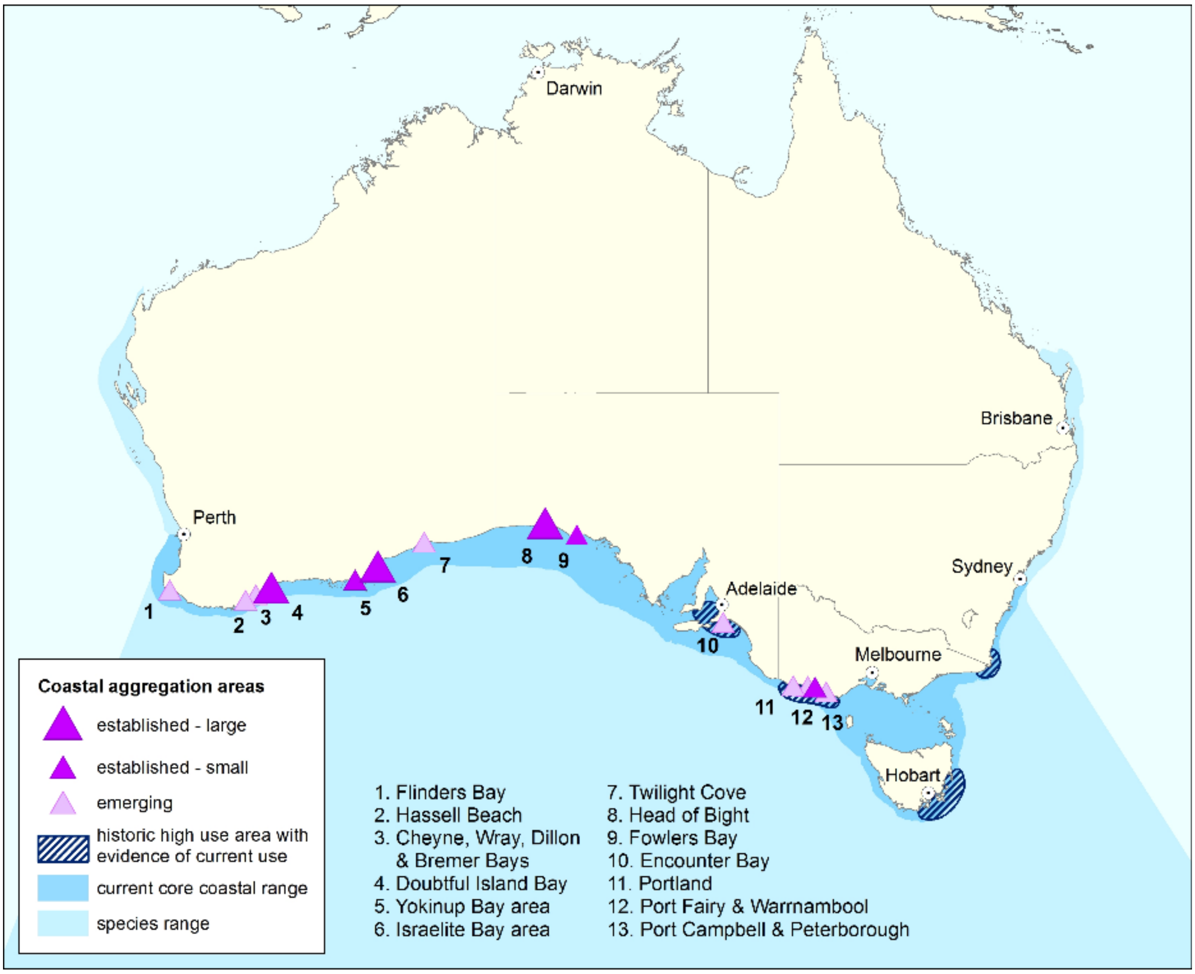
Sei whales (*Balaenoptera borealis*) are listed as vulnerable and migratory under the EPBC Act. They are considered a cosmopolitan species, ranging from polar to tropical waters, but tend to be found more offshore than other species of large whales (DAWE, 2022). Sei Whales have been infrequently recorded in Australian waters and the similarity in appearance between the Sei Whale and Bryde's Whale may have resulted on some confusion about occurrence (Bannister *et al*., 1996; DAWE, 2022). However, on a number of occasions the Sei Whale has been sighted in the Otway region with calves and for feeding, particularly 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). The species migrates between Australian waters and Antarctic feeding areas but there is insufficient data outside of observations in the proximity of the Bonney Upwelling during summer and autumn months (Gill, 2002).

Sei whales were identified to likely forage within the operational area and known to forage within the EMBAs.

Southern Right Whale

The Southern right whale (*Eubalaena australis*) is listed as endangered and migratory under the EPBC Act. The species is a seasonal visitor to the Australian coast, arriving between May and November (occasionally as early as April and as late as November) and recorded in the coastal waters of all Australian states (Bannister *et al*., 1996). More common between Sydney and Perth (Figure 4-28), the species generally occupy shallow sheltered bays that offer protection from south westerly weather, within 2 km of the shore and in water depth of less than 10 m (Charlton, 2017). Southern Right Whales migrate from their summer feeding grounds in the Southern Ocean to calve and breed in warmer coastal waters (DoE, 2015). The species are known to regularly aggregate for breeding and calving off of Warrnambool, Victoria, with calving areas tending to be very close to the shore. The known calving and aggregation areas in the south-east region are Warrnambool, Port Fairy, Port Campbell and Portland (Victoria), and Encounter Bay (South Australia) (Figure 4-28), with an aggregation BIA identified within the EMBAs (Figure 4-12).

Southern Right Whales are known to occur within the operational area, with breeding known to occur in the EMBAs. Several BIAs have been identified for this species with a known core range BIA and migration and resting on migration BIA within the operational area and an addition aggregation BIA identified for the EMBAs (Figure 4-12).



Source: DAWE, 2022

Figure 4-28: Range and Coastal Aggregation Areas for the Southern Right Whale

Sperm Whale

The Sperm Whale (*Physeter macrocephalus*) is listed as migratory under the EPBC Act. They are a pelagic species with a wide distribution extending from the polar regions to the equator (DAWE, 2022). Preferring water depths of 600 m or more, Sperm Whales are most common in submarine canyons at the edges of the continental shelf and mid-ocean, however, may occur close to coasts where water depths exceed 200 m (Bannister *et al*., 1996). Although Sperm Whales have been recorded from all Australian states (Bannister et al. 1996), limited information exists on their distribution in Australian waters given their preference for deep offshore environments. In general, movement appears to be southwards in summer and northwards in winter, particularly for males (Whitehead, 2002).

Sperm Whales are deep and prolonged divers and can therefore feed throughout the entire water column preying on other deep water species such as oceanic cephalopods, medium and large-sized demersal fishes, including rays, sharks and many teleosts (DAWE, 2022).

Sperm whales may occur within the EMBAs.

4.3.8 Marine Reptiles

A search of the EPBC Act Protected Matters database identified three EPBC Act listed marine reptile species, with potential to occur or have habitat within the operational area and EMBA. Of these, two are listed as endangered; Loggerhead and Leatherback turtles, and one was listed as vulnerable; Green turtle.

Threatened and Migratory Species

Green Turtle

The Green Turtle (*Chelonia mydas*) is listed as vulnerable and migratory under the EPBC Act. Green turtles nest, forage and migrate across tropical northern Australia (DAWE, 2022). They usually occur between the 20°C isotherms, although individuals can stray into temperate waters as vagrant visitors (Cogger *et al*., 1993). Green turtles spend their first 5-10 years drifting on ocean currents and during this pelagic (ocean-going) phase, they are often found in association with drift lines and floating rafts of *Sargassum* (DAWE, 2022). There is no known nesting or foraging grounds for green turtles offshore Victoria; they occur only in limited numbers in Victoria and South Australia (DoEE, 2017).

This species is not expected to occur within the operational area or EMBAs.

Leatherback Turtle

The Leatherback Turtle (*Dermochelys coriacea*) is listed as endangered and migratory under the EPBC Act. The leatherback turtle is a pelagic feeder found in tropical, sub-tropical and temperate waters throughout the world (Marquez, 1990). Unlike other marine turtles, the leatherback turtle utilises cold water foraging areas, with the species recorded feeding in the coastal waters of all Australian States, including offshore Victoria and Tasmania (Hamann *et al*., 2006). The SEMR is an important feeding area for the Leatherback turtle with the species commonly found foraging in the Bass Strait (DAWE, 2022; DoEE, 2017).

The species is highly pelagic, venturing close to shore mainly during the nesting season (Sarti Martinez, 2000). However, no major nesting has been recorded in Australia, with isolated nesting recorded in Queensland and the Northern Territory (DAWE, 2022).

The waters of the EMBA do not represent critical habitat for the species, however, the foraging behaviour for the Leatherback Turtle was identified as known to occur within the EMBAs.

Loggerhead Turtle

The Loggerhead Turtle (*Caretta caretta*) is listed as endangered and migratory under the EPBC Act. The species has a global distribution throughout tropical, sub-tropical and temperate waters and is rarely seen off the Victorian coast (Bolten and Witherington 2003; Marquez 1990). In Australia, the Loggerhead Turtle occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia with research considering two distinct genetic stocks between the western and eastern populations (DAWE, 2022; Dutton *et al*., 2002).

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 with no known loggerhead foraging areas identified in Victoria waters (DoEE, 2017).

This species is not expected to occur within the EMBA.

4.3.9 Fish, Sharks and Rays

A search of the EPBC Act Protected Matters database identified a total of three fish species that are listed as Threatened (two of which are also listed Migratory species), with potential to occur or have habitat within the EMBA. An additional two species were listed as migratory fish species, and five Conservation Dependent species. Within the operational area a total of six EPBC Act listed fish were identified.

Threatened and Migratory Species

Australian Grayling

The Australian Grayling (*Protoroctes margena*) is listed as a vulnerable species under the EPBC Act. The species typically occurs in streams and rivers from Sydney, southwards to the Otway Ranges of Victoria and in Tasmania (DAWE, 2022). Australian Grayling spends most of their life in freshwater with the larval and / or juvenile stages in coastal seas (Miles *et al*., 2013). Spawning occurs in freshwater from late summer to winter, with exact timing dependant on many variables including latitude and temperature regimes (DAWE, 2022). They are a short-lived species, usually dying after their second year with a small proportion who may reach four or five years (Backhouse *et al*., 2008).

The Australian grayling has been identified as likely to occur in the operational area and is known to occur in the EMBAs.

Porbeagle

The Porbeagle, also named Mackerel Shark (*Lamna nasus*) is listed as a migratory species under the EPBC Act. The Porbeagle is a wide-ranging, coastal and oceanic shark found in waters from southern Queensland to south-west Australia (DAWE, 2022). Primarily occupying oceanic waters and areas around the edge of the continental shelf, the species will occasionally move into coastal waters but these movements are temporary (DAWE, 2022). The species will dive to depths in excess of 1,300 m and is thought to be flexible in the type of habitat they use for foraging to prey upon bony fishes and cephalopods, catching prey in mid-water as well as at the seafloor (DAWE, 2022). It also conducts long-distance seasonal migrations, although the timing and details of these movements are not well understood (Saunders *et al*., 2011).

The Porbeagle was identified as likely to occur within the operational area and EMBAs.

Shortfin Mako Shark

The Shortfin Mako Shark (*Isurus oxyrinchus*) is listed as a migratory species under the EPBC Act. The species has a circum-global distribution inhabiting tropical and temperate waters (TSSC, 2014). It is a coastal, oceanic species recorded in offshore waters all around Australia's coastline, except for the Arafura Sea, Gulf of Carpentaria and Torres Strait (TSSC, 2014). The shortfin mako is highly migratory and can travel large distances, migrating from Australian waters to areas well beyond the Australian Exclusive Economic Zone (Rogers *et al*., 2009). A recent study tagging sharks in southern Australian waters recorded a two metre juvenile female shortfin mako that travelled over 13,000 km in the Southern and Indian Oceans in approximately nine months (Rogers *et al*., 2009). However, studies suggest that dispersal may be male-biased, with females having displaying breeding-ground fidelity due to the occurrence of gene flow between basins and hemispheres (Schrey and Heist, 2003). The diet of the Shortfin Mako consists mainly of fish and cephalopods (Last and Stevens, 2009).

The shortfin mako is taken as bycatch in a number of commercial fisheries operating in Australian waters (Stevens, 2008), and is also targeted by recreational fishers especially in game fishing activities (Rogers *et al*., 2009).This activity is placing pressure on the population (TSSC, 2014).

The species has been regularly recorded in the SEMR (DoE, 2015) and due to their widespread distribution in Australian waters, shortfin mako sharks are likely to be present in the EMBA.

Whale Shark

The Whale Shark (*Rhinocodon typus*) is listed as a vulnerable and migratory species under the EPBC Act. They have a global distribution in tropical and warm temperate waters (DoE, 2015b). In Australia, the whale shark is most commonly seen in waters off Western Australia, Northern Territory and Queensland with isolated records for Victoria and South Australia (Last and Stevens, 2009). As an oceanic and coastal shark, the species is often seen far offshore with the occasional inshore appearance (DAWE, 2022). The Whale Shark is generally encountered close to or at the surface, as single individuals or occasionally in schools or aggregations of up to hundreds of sharks (Compagno, 1984). It is a suction filter-feeder species and feeds on a variety of planktonic and nektonic prey, including small crustaceans, small schooling fishes and, to a lesser extent, on small tuna and squid (Compagno, 1984; Last and Stevens, 2009).

It is unlikely that the Whale Shark will be present in the EMBA.

White Shark

The White Shark (*Carcharodon carcharias*) is listed as vulnerable and migratory under the EPBC Act. The species are widely distributed throughout temperate and subtropical regions (Bruce *et al*., 2006; Last and Stevens, 2009). They are typically found from close inshore habitats (e.g. rocky reefs and shallow coastal bays) to the outer continental shelf and slope areas (Bruce ,1992; Bruce *et al*., 2006; Bruce and Bradford, 2008). The SEMR supports a white shark population that is thought to move seasonally along the southern and eastern Australian coasts, moving north along the east coast during autumn and winter, and returning to southern Australian waters by early summer (Bruce *et al*., 2006).

White sharks eat a variety of prey, including fish, other sharks and rays, marine mammals, squid and crustaceans (DEWHA, 2009). Juvenile white sharks feed on finfish, rays and other sharks and shift to include marine mammals when they reach approximately 3.4 m (Estrada *et al*., 2006). A recent study has found that the energy requirements of adult white sharks may be several times higher than previously estimated, and that seasonal feeding on seal colonies is important in meeting these energy needs (Semmens *et al*., 2013).

Distribution, breeding (nursery area) and foraging BIAs for the White Shark intersect the EMBA (Figure 4-13). It is therefore likely that White Sharks will be present in the EMBA.

Conservation Dependent Species

Blue Warehou

The Blue Warehou (*Seriolella brama*) is listed as conservation dependent under the EPBC Act. Globally, the blue warehou is confined to Australian and New Zealand waters (TSSC, 2015). Within the Australian Exclusive Economic Zone, the species occurs predominantly in coastal shelf, upper continental slope and seamount waters offshore from New South Wales, Tasmania, Victoria and South Australia (Bruce *et al*., 1998; Gomon, 2008). The species occurs at depths between 3 and 550 m (Bray and Gomon, 2011), although it is more abundant in waters shallower than 200 m (Gavrilov and Markina, 1979).

Evidence suggests that there are perhaps two distinct stocks with samples to the east and west of the Bass Strait showing differences in spawning behaviour, laval distribution and size / age compositions (Talman *et al*., 2004; Bruce *et al*., 2002). However, results are inconclusive at this stage (Robinson *et al*., 2008).

The blue warehou is taken in commercial fisheries working in southern Australian waters (TSSC, 2015). Historically, the species was taken as a byproduct species principally by gillnet fishers in Commonwealth managed fishing operations in southern Australian waters (AFMA, 2014). Currently, the blue warehou is caught as incidental byproduct in the Southern and Eastern Scalefish and Shark Fishery, which is managed by the Commonwealth statutory authority – the Australian Fisheries Management Authority (AFMA).

The species is also commercially targeted as part of the Tasmanian Scalefish Fishery, which is a multi-species and multi-gear fishery with many types and sizes of fishing vessels (DPIPWE, 2013). However, in recent years the blue warehou has not been considered a key component of the commercial catch in the Tasmanian Scalefish Fishery as fishers have invested in specialising their fishing operations towards targeting other species (TSSC, 2015).

It is possible the Blue Warehou will be present within the EMBA.

Eastern School Shark

The School Shark (*Galeorhinus galeus*) is listed as conservation dependent under the EPBC Act. It is a world-wide distribution within temperate waters. In Australia, the species occurs in temperate coastal waters of southern Australia. They are found from Moreton Bay, in southern Queensland, to Perth, Western Australia, including offshore waters of Lord Howe Island and Tasmania (Pogonoski *et al*., 2002). The School Shark moves extensively throughout the waters of southern Australia (TSSC, 2009). This species is mainly found in demersal waters, over the continental and insular shelves, but also over the upper slopes, in depths from near shore to 550 m (Last and Stevens, 1994). Inshore areas are particularly important as birthing and nursery sites (TSSC, 2009). The main threat operating against School Sharks has been identified as historic and ongoing fishing pressure with the species commercially fished and is primarily caught in the Gillnet, Hook and Trap (GHAT) sector of the Southern and Eastern Scalefish and Shark Fishery (SESSF) (DAWE, 2022).

The school shark is likely to be present within the EMBA.

Orange Roughy

The Orange Roughy (*Hoplostethus atlanticus*) is listed as conservation dependent under the EPBC Act. In Australia, Orange Roughy are found across the southern half of the continent, from central NSW, through to southwestern Australia, including Tasmania (Kailola *et al*., 1993). They also occur around seamounts and ridges south of Australia and on the South Tasman and Lord Howe rises (DEW, 2007). The species is commercially fished with most Orange Roughy taken in Commonwealth waters are from 11 discrete management zones in the Southern and Eastern Scalefish and Shark Fishery (SESSF) (DAWE, 2022).

Orange roughy are likely to be present within the southern reaches of the EMBAs.

Southern Bluefin Tuna

The Southern Bluefin Tuna (*Thunnus maccoyii*) is classified as critically endangered on the IUCN Red List of Threatened Species and was listed as a conservation dependent species under the EPBC Act. Adult Southern Bluefin Tuna in Australian waters, ranges widely from northern Western Australia to the southern region of the continent, including Tasmania, and to northern New South Wales, appearing in eastern Australian waters mainly during winter (DAWE, 2022). The species is a highly migratory species that occurs globally in waters between 30^{o}S and 50^{o}S, though is mainly found in the eastern Indian Ocean and in the south Western Pacific Ocean (DAWE, 2022).

Southern Bluefin Tuna are commercially targeted with juvenile Southern Bluefin Tuna are fished in the Great Australian Bight by Australian purse seine fishing vessels and taken to Port Lincoln where they are transferred to ocean cages where they are fed intensively for 6-8 months before being exported to Japan (DAWE, 2022). More than 95% of Australia's total catch is taken by this method (TSSC, 2010). The main threat to Southern Bluefin Tuna is historic and on-going fishing pressure.

Southern Bluefin Tuna are likely to be present in the operational area and EMBAs.

Southern Dogfish

The Southern Dogfish (*Centrophorus zeehaani*) is listed as conservation dependent under the EPBC Act. Southern dogfish are small, deepwater sharks that are endemic to Australia and inhabit the upper-slope of the southern continental shelf between 180 m to 900 m (Williams *et al*., 2012). They are a commercially fished species with life characteristics that make them vulnerable to overfishing, including slow growth rate, late age at maturity, low fecundity and low natural mortality (Stobuktzki *et al*., 2011). The core range for the species is from Newcastle, NSW around southern Australia to Mandurah south of Perth, Western Australia. However, the species is apparently absent from southern Tasmania through Bass Strait and from the Ceduna Terraces (TSSC, 2013). Therefore, there appears to be three distinct stocks of Southern Dogfish; an eastern stock along the east coast of Australia to eastern Tasmania, another central stock from western Tasmania through the Great Australian Bight, and then a third stock from the Great Australian Bight to south Western Australia (TSSC, 2013).

Southern Dogfish are likely to be present within the EMBAs.

4.3.10 Seabirds and Migratory Shorebirds

A search of the EPBC Act Protected Matters database identified a total of 70 EPBC Act listed bird species, with potential to occur or have habitat within the EMBA. Of these, a total of 34 were listed as threatened and

52 were listed as migratory bird species. Within the operational area a total of 42 EPBC Act listed birds (29 threatened species and 28 migratory listed) were identified.

Threatened and Migratory Species

Antipodean Albatross

The Antipodean albatross (*Diomedea antipodensis*) is listed as vulnerable and migratory under the EPBC Act.

Antipodean Albatrosses are a subspecies of the Wandering Albatross (*Diomedea exulans*) and are often difficult to distinguish. Adult Wandering Albatrosses are significantly larger, however juvenile Antipodean Albatrosses are very similar to juvenile Wandering Albatrosses.

The Antipodean Albatross is endemic to New Zealand and breeds on islands in the New Zealand subantarctic with egg-laying during the austral summer and fledging from December to March (ACAP, 2011). The species forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW (Elliott and Walker, 2005; Environment Australia, 2001f; Garnett and Crowley, 2000).

A foraging BIA has also been identified for the Antipodean Albatross with the species likely to occur in the EMBAs (Figure 4-14).

Australasian Bittern

The Australasian Bittern (*Botaurus poiciloptilus*) is listed as endangered under the EPBC Act. It is a large, stocky, thin-necked, heron-like bird (TSSC, 2019). In Australia, the population can be divided into two sub-populations, the south-eastern and south-western sub-populations. The south-eastern Australasian Bittern occurs from south-east Queensland to south-east South Australia as far as the Adelaide Region, southern Eyre Peninsula, Tasmania and in the southwest of Western Australia (Marchant and Higgins 1990; Garnett *et al*., 2011). The diet of the Australasian bittern includes aquatic animals such as small fish, frogs, freshwater crayfish, spiders, insects and small reptiles. Breeding occurs from October to February (TSSC, 2019).

The Australasian bittern was identified as likely to occur in the operational area and known to occur within the EMBAs.

Australasian Gannet

The Australasian Gannet (*Morus serrator*) is listed as marine under the EPBC Act with recognised foraging and aggregation BIAs within the EMBAs (Figure 4-15).

The Australasian Gannet generally feeds over continental shelves or inshore waters on pelagic fish, especially pilchard, anchovies and jack mackerel, but also squid and garfish (DoE, 2015). 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, 2015).

The Australasian Gannet was identified as known to breed within the EMBAs and has recognised foraging and aggregation BIAs within the EMBAs (Figure 4-15).

Australian Fairy Tern

The Australian fairy tern (*Sternula nereis nereis*) is listed as vulnerable under the EPBC Act. Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The sub-species has been known from New South Wales (NSW) in the past, but it is unknown if it persists there (Birdlife International 2010; Garnett and Crowley 2000). Breeding occurs between October to February on continental islands, coral cays, on sandy islands and beaches inside estuaries, and on open sandy beaches (DAWE, 2020).

The Australian fairy tern was identified as likely to breed within the operational area and known to occur within the EMBAs.

Australian Painted Snipe

The Australian painted snipe (*Rostratula australis*) is listed as endangered under the EPBC Act. The painted snipe is a wading shorebird that has been recorded at wetlands in all states of Australia. It is most common in eastern Australia, where it has been recorded at scattered locations throughout much of Queensland, NSW, Victoria and south-eastern South Australia. It is generally seen singly or in pairs, or less often in small flocks (Marchant and Higgins, 1993).

The Australian painted snipe was identified as likely to occur within the operational area and known to occur within the EMBAs.

Bar-tailed Godwit

The bar-tailed godwit (*Limosa laponica*) is a listed migratory species under the EPBC Act. It is a large wader slightly bigger and stockier than the black-tailed godwit (*Limosa limosa*). They have been recorded in coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands.The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh (Marchant and Higgins 1993).This godwit species breeds in the Northern Hemisphere and moves south for the Northern Hemisphere winter. They usually forage near the edge of water or in shallow water, preferring soft mud, mainly in estuaries and harbours. They have been known to forage among mangroves, coral reefs and rock platforms.

The bar-tailed godwit is likely to occur in the operational area and known to occur within the EMBAs.

Black-browed Albatross

The black-browed albatross (*Thalassarche melanophris*) is listed as vulnerable and migratory under the EPBC Act. It has a circumpolar distribution and is found over Antarctic, subantarctic and sub-tropical waters (DoE, 2015). Breeding occurs within Australian waters on Heard Island, McDonald Islands, Macquarie Island and Bishop and Clerk Islets. Individuals are mostly confined to sub-Antarctic and Antarctic waters surrounding these islands in the breeding season. The population migrates northward towards the end of the breeding season and the species is common in the non-breeding period at the continental shelf and shelf-break of South Australia, Victoria, Tasmania, western and eastern Bass Strait and NSW. Individuals are also observed at these times in lesser numbers at the continental shelf break of southern and south-western WA (DAWE, 2020).

A foraging BIA has been identified for the Black-browed Albatross within the operational area and EMBAs (Figure 4-16) with the species likely to occur.

Black-faced Cormorant

The black-faced cormorant (*Phalacrocorax fuscescens*) is listed as marine under the the EPBC Act. This species has a recognised foraging BIA within the LOWC EMBA (Figure 4-17).

The black-faced cormorant feeds in coastal waters, sometimes in sheltered places such as bays and islets and can be found entering rivers along the Victorian coast (DoE, 2015). Their diet consists of a variety of fish through pursuit-diving, sometimes in flocks of up to several thousand individuals (DoE, 2015). Breeding usually occurs on rocky islands, but also on stacks, slopes and sea cliffs in colonies of up to 2500 individuals (del Hoyo *et al*., 1992).

The black-faced cormorant was identified as known to breed within the operational area and EMBAs. The species also has a recognised foraging BIA within the LOWC EMBA (Figure 4-17).

Black-tailed Godwit

The black-tailed godwit (*Limosa limosa*) is a listed migratory species under the EPBC Act. This large wader occurs singularly or in groups and associates with other waders throughout the coastal regions of Australia. The largest populations are found between Darwin and Weipa in the NT,with small numbers found elsewhere (Watkins, 1993). The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mud and sandflats, and occasionally on rocky coasts. Their diet consists of worms, crustaceans, bivalves and fish eggs. The black-tailed godwit does not breed in Australia. They arrive in north-west Australia from late August and depart during March and April to breed in the northern hemisphere.

The black-tailed godwit was identified as known to roost within the EMBAs.

Blue Petrel

The blue petrel (*Halobaena caerulea*) is listed as vulnerable under the EPBC Act. The blue petrel has a circumpolar distribution ranging from the pack ice to 30^{o} S (DAWE, 2020). It breeds on offshore stacks near Macquarie island (500-600 breeding pairs).

The blue petrel may occur within the operational area and EMBAs.

Broad-billed Sandpiper

The broad-billed sandpiper (*Limicola falcinellus*) is a listed migratory seabird under the EPBC Act and breeds in the northern hemisphere, moving south for the non-breeding season. In Australia, the Broad-billed Sandpiper is most common on the north and north-west coasts and occur regularly at scattered localities in southern Australia, where they are usually seen singly (DAWE, 2022). In Victoria, they are an annual visitor in small numbers in coastal regions, with rare inland records (DAWE, 2022).

The broad-billed sandpiper was identified as known to breed within the EMBAs.

Buller's Albatross

The Buller's Albatross (*Thalassarche bulleri*) is listed as vulnerable and migratory under the EPBC Act. The species breed in New Zealand but are regular visitors to Australian waters (DAWE, 2022). This species is marine and pelagic, inhabiting subtropical and subantarctic waters of the southern Pacific Ocean (Marchant and Higgins, 1990) and mainly present around Tasmania from January to April (Environment Australia, 2001). Buller's Albatross feeds mostly on squid, supplemented by fish, krill and tunicates (Marchant and Higgins 1990).

The operational area and EMBA are recognised as overlapping a foraging BIA for the species (Figure 4-18).

Campbell Albatross

The Campbell albatross (*Thalassarche melanophris impavida*) is listed as vulnerable and migratory under the EPBC Act. The Campbell albatross is a sub-species of the Black-browed Albatross and is a non-breeding visitor to Australian waters. The Campbell albatross only breeds on Campbell Island, south of New Zealand with breeding occuring annually from early August to May (ACAP, 2011). The population migrates northward towards the end of the breeding season and the species is common during the non-breeding period in continental shelf waters around Australia, New Zealand and the Pacific Islands (DAWE, 2020).

The Campbell Albatross has a foraging BIA that overlaps the operational area and EMBAs (Figure 4-19).

Common Greenshank

The common greenshank (*Tringa negularia*) is a listed migratory species under the EPBC Act. It is a heavily built, elegant wader, seen singly or in small to large flocks (sometimes with hundreds) in a variety of coastal and inland wetlands (Higgins and Davies, 1996). It does not breed in Australia; however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (Higgins & Davies, 1996).

The common greenshank is likely to occur in the operational area and is known to occur in the coastal sections of the EMBAs.

Common Sandpiper

The common sandpiper (*Actitis hypoleucos*) is listed as a migratory species under the EPBC Act. Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers, although most concentrated in northern and western Australia (DAWE, 2022). The species inhabits a wide range of coastal wetlands, and is most often found around the muddy margins, mangroves and rocky shores (DAWE, 2022). Their diet consists of bivalves, crustaceans, and a variety of insects and are mostly found in coastal and inland locations.

The common sandpiper is known to occur within the operational area and EMBAs.

Common Noddy

The common noddy (*Anous stolidus*) is listed as migratory under the EPBC Act. There are four sub-species of the common noddy recognised, but only the sub-species *Anous stolidus pileatus* occurs in the Australian region. It occurs mainly off the Queensland coast, but also off the northwest and central WA coast.

The migratory movements of the species are poorly known. The common noddy is a gregarious bird, normally occurring in flocks, sometimes of hundreds of individuals, when feeding or roosting. They feed mainly on fish, but are also known to take squid, pelagic molluscs and aquatic insects by dipping or skimming the sea surface. The species usually feeds during the day, but will also feed at night when there is a full moon. Timing of breeding varies between sites and may be annual, or twice a year. On some islands, the species is known to breed throughout the year.

The common noddy is likely to occur within the EMBA.

Curlew Sandpiper

The curlew sandpiper (*Calidris ferruginea*) is a listed as critically endangered and migratory shorebird under the EPBC Act. Curlew sandpiper breeding grounds occur in Siberia and they reach the northern shores of Australia in late August and early September (Higgins and Davies, 1996). Curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.

The curlew sandpiper was identified as may occur within the operational area and known to occur in the EMBAs.

Double-banded Plover

The double-banded plover (*Charadrius bicinctus*) is a listed migratory species under the EPBC Act. The double-banded plover can be found in both coastal and inland areas. During the non-breeding season, it is common in eastern and southern Australia, mainly between the Tropic of Capricorn and western Eyre Peninsula, with occasional records in northern Queensland and Western Australia (Marchant and Higgins, 1993). The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. The species is sometimes associated with coastal lagoons, inland saltlakes and saltworks. It is also found on seagrass beds, especially *Zostera*, which, when exposed at low tide, remain heavily saturated or have numerous water-filled depressions. This species sometimes utilises kelp beds (R.J. Pierce in Marchant and Higgins 1993; DAWE, 2021).

The double-banded plover was identified as having roosting habitat that is known occur within the EMBAs.

Eastern Curlew

The eastern curlew (*Numenius madagascariensis*) is listed as a critically endangered and migratory under the EPBC Act. Within Australia, this shorebird has a primarily coastal distribution and is found in all states, particularly the north, east, and southeast regions including Tasmania. They have a continuous distribution from Barrow Island and Dampier Archipelago, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere. The eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. They are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. This shorebird is carnivorous, mainly eating crustaceans (including crabs, shrimps and prawns), small molluscs, as well as some insects.

The eastern curlew may occur within the operational area and is known to occur within the EMBAs.

Eastern Hooded Plover

The Eastern Hooded Plover (*Thinornis cucullatus cucullatus*) is listed as vulnerable under the EPBC Act. The species is widely dispersed on or near sandy beaches in south-eastern Australia with a range that extends from Jervis Bay in New South Wales to Fowlers Bay in South Australia and includes Tasmania and various offshore islands such as Kangaroo Island, King Island and Flinders Island (Marchant and Higgins, 1993; Garnett *et al*., 2011). It occurs in low densities in Victoria, which has about 570 individuals. Hooded plovers may be observed singly, in pairs, family groups or flocks on ocean beaches, creek mouths and inlet entrances. It may also occur on near-coastal saline and freshwater lakes and lagoons, tidal bays and estuaries, on rock platforms, or on rocky or sandy reefs close to shore (Marchant and Higgins, 1993; Garnett *et al*., 2011).

The hooded plover (eastern) is a largely sedentary species and maintains relatively constant territories from year to year, with 95% moving over distances of less than 20 km (Weston *et al*., 2009). The diet of hooded plovers consists of polychaetes, molluscs, crustaceans, insects, turions and seeds. Foraging occurs during day and night at all levels of the beach, from the water's edge to the base of the fore-dune, and on lagoons and saltpans (Marchant and Higgins, 1993; Weston, 2003).

The species may occur within the operational area and is known to occur within the EMBAs.

Fairy Prion (Southern)

The fairy prion (southern) (*Pachyptila turtur subantarctica*) is listed as vulnerable under the EPBC Act. It breeds on Macquarie Island, Langdon Point, Davis Point and Bishop and Clerk islands (Garnett and Crowley, 2000). There are 80 to 250 breeding pairs in Australia and a global population of ~80,000 (DAWE, 2020). Some individuals migrate towards New Zealand and southern Australia in winter.

The fairy prion (southern) was identified as known to occur within the operational area and EMBAs.

Flesh-Footed Shearwater

The flesh-footed shearwater (*Ardenna carneipes*) is a listed migratory species under the EPBC Act. It is a large broad-winged shearwater that typically forages over continental shelves / slopes and occasionally inshore waters. It is a trans-equatorial migrant widely distributed across the south-western Pacific during breeding season (early September to early May) with the distribution of the shearwater is mainly off southern Australia migrating between breeding colonies in the southern Indian and south-western to north-western Pacific Ocean (Marchant and Higgins, 1993). The species breeds in burrows on sloping ground in coastal forest, scrubland, shrubland or grassland, the majority of which lie off the coast of southern Western Australia, with the remaining 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.

The flesh-footed shearwater is likely to occur occur within the operational area and is known to occur within the wider EMBA.

Fork-Tailed Swift

The fork-tailed swift (*Apus pacificus*) is a listed migratory species under the EPBC Act. It is a medium to large swift that migrates between Australia and its breeding grounds in Siberia. The swift usually arrives in Australia around October and departs in April, passing via Indonesia (Higgins, 1999). Whilst in Australia the swift is highly mobile occurring mostly over inland plains but also coastal areas, over cliffs and on beaches.

The fork-tailed swift was identified as likely to occur within the operational area and EMBAs, most likely between October and April.

Great Knot

The great knot (*Calidris tenuirostris*) is listed as critically endangered and a migratory shorebird under the EPBC Act. The great knot has a global distribution, breeding in northeast Siberia and spending the non-breeding season along coasts from Arabia to Australia. Non-breeding birds migrate to inlets, bays, harbours, estuaries and lagoons with large intertidal mud and sand flats where they feed on bivalves, gastropods, crustaceans and other invertebrates (Higgins and Davies 1996 in Garnet *et al.*, 2011). The greatest numbers of the species are found in northern Australia, between the Pilbara and the Kimberley. The species typically roosts in the fringing vegetation surrounding coastal inlets where damp sediments lower temperatures.

The great knot was identified as known to roost within the EMBAs.

Greater Crested Tern

The crested tern (*Thalassarche bergii*) is listed as a migratory species under the EPBC Act. The crested tern inhabits tropical and subtropical coastlines and forages in the shallow waters of lagoons, coral reefs, bay, harbours, inlets and estuaries; along sandy, rocky, coral or muddy shores; on rocky outcrops in open sea; in mangrove swamps; and in offshore and pelagic waters (Higgins and Davies, 1996). The crested tern usually feeds from the surface of the sea to less than 1 m water depth but can also forage well out to sea. Its diet consists predominantly of pelagic fish, although it will also feed on crustaceans, insects and hatchling turtles opportunistically. The crested tern shows a preference for nesting on offshore islands, low-lying coral reefs, low-lying coral reefs, sandy or rocky coastal islets, coastal spits and lagoon mudflats.

The Greater crested tern was identified as known to breed within the EMBAs.

Greater Sand Plover

The greater sand plover (*Charadrius leschenaultia*) is listed as vulnerable and migratory under the EPBC Act. This plover breeds in China, Mongolia and Russia, and spends the non-breeding season along coasts from Japan through Southeast Asia to Australasia, (Bamford *et al*., 2008). Non-breeding birds occur along all Australian coasts, especially in the north for the greater sand plover. Non-breeding birds forage on beaches, saltmarshes, coastal bays and estuaries, and feed on marine invertebrates including molluscs, worms, crustaceans and insects (Marchant and Higgins 1993 in Garnet *et al*., 2011). The species typically roosts higher up the beach well above the high water mark of sand spits, rocky lagoons or salt marsh.

The greater sand plover was identified as likely to occur within the MDO EMBA and known to occur within the wider EMBA.

Grey-headed Albatross

The grey-headed albatross (*Thalassarche chrysostoma*) is listed as endangered and migratory under the EPBC Act. In Australian territory, Grey-headed Albatross breed on the southern and western flanks of Petrel Peak, Macquarie Island (Copson, 1988). The Grey-headed Albatross has bred in this same restricted area on Macquarie Island for at least the past 30 years (Terauds *et al*., 2005). This nesting area has been included on the EPBC Act register of Critical Habitat. Macquarie Island is classified as a World Heritage Area, a Biosphere reserve and a National Estate property. The entire island is also classified as a Tasmanian Nature Reserve and is managed by the Tasmanian Parks and Wildlife Service. Breeding and non-breeding birds disperse widely across the Southern Ocean, at more southerly latitudes in summer than in winter, when they frequent the waters off southern Australia and New Zealand (Marchant & Higgins, 1990; Waugh et al., 1999a). Most Australian records come from south and west of Tasmania, occasionally in Victorian waters, rarely in South Australia and Western Australia, and only as a vagrant in NSW. It has only been recorded once in southern Queensland (DEWHA, 2009s; Marchant and Higgins, 1990). The Grey-headed Albatross is marine, pelagic and migratory. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters in the Pacific, Indian, Atlantic and Southern Oceans (DAWE, 2021).

The grey-headed albatross was identified as having habitat that may occur within the operational area and EMBAs.

Grey Plover

The grey plover (*Pluvialis squatarola*) is a listed migratory species under the EPBC Act. It is a medium-sized plover that is found solitary, in small flocks, and larger flocks at communal roosts often with other waders. Widespread in coastal regions of Australia, it inhabits sheltered embayments, estuaries and lagoons with mud and sand flats, occasionally on rocky coasts with wave cut platforms. Their diet consists of mostly molluscs, insects, crustaceans and polychaete worms. The grey plover arrive in northern Australia from August to September where they remain until April when they return to their breeding grounds in northern Siberia.

The grey plover was identified as known to roost within the EMBAs.

Grey-tailed Tattler

The grey-tailed tattler (*Tringa brevipes*) is listed as a migratory species under the EPBC Act. This medium-sized wader is found in most coastal regions in Australia, but primarily in the north. The species is rarely recorded in Victoria, however sightings have been reported in Gippsland, and east of McLaughlans Beach. The largest populations in Victoria are located at Corner Inlet, west to Western Port and Port Phillip Bays. It has occasionally been sighted on the west coast near Killarney, Port Fairy and Discovery Bay. Sightings have also been reported at Sperm Whale Head (Higgins and Davies 1996). The bird is often found on sheltered coasts with reefs and rock platforms or intertidal mudflats. Their diet consists primarily of worms, molluscs, crustaceans, insects and occasionally fish. The grey-tailed tattler breeds in Siberia and moves south for the boreal winter, arriving in Australia around August and departing for its breeding grounds by early or mid-April.

The grey-tailed tattler was identified as known to roost within the EMBAs.

Indian Yellow-nosed Albatross

The Indian yellow-nosed albatross (*Thalassarche carteri*) is listed as vulnerable and migratory under the EPBC Act. This species forages mostly in the southern Indian Ocean where it is particularly abundant off WA. It also breeds on islands of the southern Indian Ocean. In breeding and non-breeding seasons, the species concentrates over the productive waters of continental shelves, often at coastal upwellings and the boundaries of currents (DAWE, 2020).

A foraging BIA was identified for the Indian yellow-nosed albatross within the operational area and EMBA.. (Figure 4-21).

Latham's Snipe

Latham's Snipe (*Gallinago hardwickii*) is listed as migratory under the EPBC Act. It is a non-breeding visitor to south-eastern Australia, preferring to breed in Japan and far eastern Russia during the northern summer and then migrating to Australia, where it remains for the duration of the northern winter (DAWE, 2022). The species has been recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia and is widespread in Tasmania and found in all regions of Victoria except for the north-west (DAWE, 2022). Often the distribution of Latham's Snipe is fragmented due to the fragmentation of preferred habitat, that being freshwater wetlands (DAWE, 2022). The species is an omnivore, feeding on seeds and other plant material as well as insects, worms and occasionally molluscs, isopods and centipedes (Frith *et al*., 1977; Todd, 2000).

Latham's Snipe was identified as likely to occur in the operational area and is known to occur in the EMBAs.

Lesser Sand Plover

The lesser sand plover (*Charadrius mongolus*) is listed as endangered and migratory under the EPBC Act. Within Australia, the Lesser Sand-Plover is widespread in coastal regions, and has been recorded in all states. The species does not breed in Australia. They roost near foraging areas, on beaches, banks, spits and banks of sand or shells, and occasionally on rocky spits, islets or reefs (DAWE, 2021).

The lesser sand plover was identified as known to roost within the EMBAs.

Little Curlew

The little curlew (*Numenius minutus*) is listed as a migratory species under the EPBC Act. The Little Curlew is most often found feeding in coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used (Higgins & Davies 1996). rarely occurs in Victoria, but has been recorded east of Wilson's Promontory and at Lake Tyers, Lake Wellington and Shallow Inlet, around Port Phillip Bay, and also from lakes in the western Victoria and in the region of Mystic Park (Higgins and Davies 1996).

The little curlew was identified as likely to roost within the EMBAs.

Little Penguin

The Little Penguin (*Eudyptula minor*) is listed as a marine species under the EPBC Act and has a recognised breeding and foraging BIA within the EMBAs (Figure 4-22). This species is the smallest of all penguins, standing about 30-35 cm in height and weighing approximately 1 kg when fully grown (DoE, 2015). Little Penguins are not endemic to the South-east Marine Region but the Bass Strait hosts 60 per cent of the known breeding population in Australia (Dann, 2013). 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.

The Little Penguin was identified as known to breed in the operational area and EMBAs with a breeding and foraging BIA recognised within the EMBAs (Figure 4-22).

Little Tern

The Little Tern (*Sternula albifrons*) is listed as a migratory species under the EPBC Act. The Australian breeding population can be divided into two major subpopulations: a northern subpopulation that breeds across northern Australia, and an eastern subpopulation that breeds on the eastern and south-eastern coast of the mainland and northern and eastern Tasmania, occasionally extending as far west as western Victoria and south-eastern South Australia (DAWE, 2022). Breeding for the eastern subpopulation occurs during in the austral spring-summer with nesting taking place in their preferred habitat of sand-splits, banks, ridges or islets in sheltered coastal environments (DAWE, 2022). Little Terns forage in shallow waters of estuaries, coastal lagoons and lakes, frequently over channels next to spits and banks or entrances, and often close to breeding colonies. They also forage along open coasts, especially around bars off the entrances to rivers and lagoons, less often at sea, and usually within 50 m of shore (DAWE, 2022). They feed mainly on small fish, crustaceans, insects, annelids and molluscs.

The Little Tern was identified as having habitat that may occur in the operational area and EMBAs.

Marsh Sandpiper

The marsh sandpiper (*Tringa stagnatilis*) is listed as a migratory species under the EPBC Act. The Marsh Sandpiper breeds from eastern Europe to eastern Siberia. The Marsh Sandpiper is found on coastal and inland wetlands throughout Australia. In Victoria, most are found in Port Phillip Bay, but also Gippsland, Westernport Bay and the Western Districts (DAWE, 2022). The Marsh Sandpiper lives in permanent or ephemeral wetlands where they also forage for insects, molluscs and crustaceans in shallow water (DAWE, 2022).

The marsh sandpiper has been identified as known to roost within the EMBAs.

Northern Giant Petrel

The northern giant petrel (*Macronectes halli*) occupies the Antarctic Polar Front (DAWE, 2021b). In summer, it occurs predominantly in sub-Antarctic to Antarctic waters, usually between 40°S and 64°S. The northern giant-petrel breeds on sub-Antarctic islands and visits areas off the Australian mainland mainly during winter months (May – October) (DAWE, 2021). Its breeding range extends into the Antarctic zone at South Georgia. It nests in coastal areas where vegetation or broken terrain offers shelter, on sea-facing slopes, headlands, in the lee of banks, under or against vegetation clumps, below cliffs or overhanging rocks, or in hollows. The northern giant petrel eats seal, whale, and penguin carrion, and seal placentae. It often attends and follows ships to obtain offal. It also eats substantial quantities of euphausiids (krill) and other crustaceans, cephalopods (octopus and squid), fish and a wide variety of seabirds (DAWE, 2021b).

The northern giant petrel may occur within the operational area and are likely to forage within the EMBAs.

Northern Royal Albatross

The northern royal albatross (*Diomedea sanfordi*) is listed as endangered and migratory under the EPBC Act. The northern royal albatross has a circumpolar distribution being most common between 36º S to at least 52º S with most sightings confined to the shelf edge and slope. Within Australia, they are regularly recorded throughout the year around Tasmania and SA at the edge of the continental shelf, and infrequently in waters off NSW (DSEWPaC, 2011b).

The northern royal albatross was identified as likely to have foraging behaviours within the operational area and EMBAs.

Orange-bellied Parrot

The Orange-bellied Parrot (*Neophema chrysogaster*) is a listed as critically endangered under the EPBC Act. The species is endemic to south-eastern Australia with non-breeding birds usually found along the coast of South Australia and Victoria (DELWP, 2016). Orange-bellied Parrots migrate to breed in Melaleuca in south-west Tasmania in summer with birds arriving in early October and departing after the breeding season usually in March and April (TSS,2021). After breeding, migrating birds move northwards up the west coast of Tasmania via King Island to the mainland during autumn (Holdsworth, 2006). The southward migration tends to be rapid (Stephenson, 1991), while northward migration in autumn across western Bass Strait is more prolonged (Higgins, 1999).

On the mainland, birds are usually found in locations associated with coastal saltmarshes and adjacent pastures, close to free-standing water bodies (DELWP, 2016). The parrot's breeding habitat is restricted to southwest Tasmania, where breeding occurs from November to mid-January mainly within 30 km of the coast (Brown and Wilson, 1980). During winter, on mainland Australia, Orange-bellied Parrots are found mostly within 3 km of the coast (DELWP, 2016).

Given its habitat preferences, this species is expected to occur within the EMBA and is likely to occur in the operational area.

Osprey

The osprey (*Pandion haliaetus*) is a listed migratory species under the EPBC Act. It is a medium-sized raptor that primarily inhabits coastal and estuarine habitats (Marchant and Higgins, 1993). The species prefers littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands (DAWE, 2020). Breeding range extends around the northern coast of Australia from Albany in WA to Lake Macquarie in NSW, with a second breeding population on the coast of SA. The total range of the species is much more widespread (DAWE, 2020).

The osprey was identified as known to occur within the EMBAs.

Pacific Golden Plover

The Pacific golden plover (*Pluvialis fulva*) is listed as migratory under the EPBC Act. Within Australia, the Pacific Golden Plover is widespread in coastal regions with most Pacific Golden Plovers occurring along the east coast and are especially widespread along Queensland and New South Wales coastlines (DAWE, 2022). Scattered records for the species exist in the south-east. The species is often also recorded on Australia's outlying islands, including Lord Howe and Norfolk Islands, as well as on Christmas and Cocos-Keeling Islands in the Indian Ocean (DAWE, 2021).

As the Pacific Golden Plover is a migratory species, it will breed in the Northern Hemisphere and fly south for the boreal winter (DAWE, 2022). The species is present in Australia mostly between September and May inhabiting coastal habitats, though occasionally occuring around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as Sarcocornia, or beds of seagrass) in sheltered areas including harbours, estuaries, and lagoons, and also in evaporation ponds in saltworks. The species is also sometimes recorded on islands, sand and coral cays and exposed reefs and rocks (DAWE, 2021).

The Pacific golden plover was identified as known to roost within the EMBAs.

Pectoral Sandpiper

The pectoral sandpiper (*Calidris melanotos*) is a listed migratory species under the EPBC Act. This small-medium wader spends non-breeding seasons across Australia, with Victorian records of the Pectoral Sandpiper mainly occuring from Port Phillip Bay and the valley of the Murray River between Kerang and Piangil. It has also been recorded at Coronet Bay (in Westernport Bay), Wimmera and Mallee (Higgins and Davies, 1996). The species feeds on algae, seeds, crustacean and insects. This species is most commonly found around coastal areas.

The pectoral sandpiper may occur within the operational area and is known to occur in the EMBAs.

Pin-tailed Snipe

The pin-tailed snipe (*Gallinago stenura*) is listed as a migratory species under the EPBC Act. The species distribution within Australia is not well understood. There are confirmed records from NSW, south-west Western Australia, Pilbara and the Top End. In NSW a single banded bird was reported near West Wyalong. In Western Australia the species was reported at Pilbara, Port Headland, Myaree Pool, Maitland River and near Karratha. In Pilbarra the distribution is believed to be bound by Pardoo (Banningarra Spring) and the lower Maitland River and Shay Gap. The Pin-tailed Snipe has also been reported on the Cocos-Keeling Islands as well as Christmas Island (Higgins and Davies 1996) (DAWE, 2021). During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation (DAWE, 2022).

The pin-tailed snipe has been identified as likely to roost within the EMBAs.

Red-necked Phalarope

The red-necked phalarope (*Phalaropus lobatus*) is listed as a migratory species under the EPBC Act. The Red-necked Phalarope breeds in the Arctic and sub-Arctic North America, Europe and Russia. In Victoria, the species has been sighted at the Werribee Sewage Farm, Altona, Seaholme, Lake Connewarre, Lake Tutchewop, Lake Victoria, Point Lonsdale, Lake Murdeduke and Lake Buloke. There have also been unconfirmed reports at the Laverton Saltworks (Higgins and Davies 1996). During non-breeding periods, the Red-necked Phalarope occurs mainly at sea and in Australia is recorded at both inland and coastal lakes and swamps (Higgins and Davies, 1996).

The red-necked phalarope has been identified as known to roost within the spill EMBA.

Red-necked Stint

One of the smallest shorebirds in Australia, the red-necked stint (*Calidris ruficollis*) is a listed migratory species under the EPBC Act. It is found in all states and territories with large densities on the Victorian and Tasmanian coasts inhabiting coastal areas such as bays, sheltered inlets, lagoons and estuaries. The species is present in Australia during the non-breeding season from August through to late September.

The red-necked stint was identified as known to roost within the EMBAs.

Red Knot

The red knot (*Calidris canutus*) is listed as endangered and migratory under the EPBC Act. The red knot breeds in Siberia and spends the non-breeding season in Australia and New Zealand. The non-breeding season is spent on tidal mudflats or sandflats where the omnivorous species feeds on intertidal invertebrates, especially shellfish (Garnet *et al*., 2011). Although the species is found throughout main suitable habitats in Australia, it is considered widespread along the coast south of Townsville, Queensalnd, and along the coasts of NSW and Victoria but not further west than Warranbool (DAWE, 2022).

The red knot was identified as may occur within the operational area and known to occur within the EMBAs.

Ruddy Turnstone

The ruddy turnstone (*Arenaria interpres*) is a listed migratory species under the EPBC Act. This medium-size bird is widespread within Australia during its non-breeding period of the year, when it is found in most coastal regions. It prefers rocky shores or beaches where there is plenty of stranded seaweed.

The ruddy turnstone was identified as known to roost within the EMBAs.

Salvin's Albatross

Salvin's Albatross (*Thalassarche salvini*) is listed as vulnerable and migratory under the EPBC Act. It is a non-breeding visitor to Australian waters that occurs in subantactic and subtropical waters (DAWE, 2022). The species feeds primarily in shelf waters, takes food from the surface or just below and has been observed diving to depths of two metres or more for offal (Nicholls 1979). The birds have been known to scavenge at commercial feeding grounds (Marchant and Higgins 1990) and also commonly follow fishing boats.

Salvin's Albatross was identified as likely to forage in the operational area and EMBAs.

Sanderling

Sanderling (*Calidris alba*) is a listed migratory species under the EPBC Act and occurs in most coastal areas. In Victoria, they are regular around Corner Inlet, Shallow Inlet and Wilson's Promontory, and on the southwest coast between Killarney and Nelson. In eastern Victoria they have been recorded at Mallacoota, Lakes Entrance and Kalimna. Widespread records occur between Venus Bay and the southern Bellarine Peninsula, west to Breamlea, with a few isolated records from further west at Anglesea and Apollo Bay (DAWE, 2022). The species has a circumpolar breeding distribution, migrating south to spend the non-breeding season predominantly on sandy coastal shores of all continents except Antarctica. Sanderling are omnivorous, foraging on beaches, mudflats and on the edges of shallow pools feeding on plants, seeds, worms, crustaceans, insects, and occasionally on fish, larger molluscs, and crustaceans taken as carrion.

Sanderling was identified as known to roost within the EMBAs.

Sharp-Tailed Sandpiper

The sharp-tailed sandpiper (*Calidris acuminata*) is listed as a migratory species under the EPBC Act and spends the non-breeding season in Australia. The species is known to be widespread in coastal areas of Victoria (DAWE, 2022). They also occasionally occur on islands in the Bass Strait. The species inhabits intertidal mudflats, sheltered bays, inlets, estuaries and seashores. Foraging habitat includes the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. They also forage among inundated vegetation of saltmarsh, grass or sedges for seeds, worms, mulluscs, crustaceans and insects (Higgins and Davies, 1996). The species are common throughout Australia between August and March.

The sharp-tailed sandpiper may occur within the operational area and is known to roost in the EMBAs.

Short-tailed Shearwater

The Short-tailed Shearwater (*Ardenna tenuirostris*) is listed as migratory under the EPBC Act. The Short-tailed Shearwater migrates to the Northern hemisphere for the austral winter and generally only present in Australian waters from September to May. They are common in the South-east Marine Region and largely found on numerous islands off Victoria and Tasmania during breeding (Baker and Hamilton 2013; (Skira *et al*., 1996). During breeding they conducts a bimodal feeding strategy, alternating short foraging trips to local waters with long foraging trips (up to 17 days) to the Polar Frontal Zone. Diet includes fish (particularly mycotphids), crustaceans and squid (Weimerskirch and Cherel, 1998). Feeding occurs in flocks of up to 20,000 birds, and it has been seen associated with cetaceans.

A breeding and foraging BIA has been identified within the EMBA (Figure 4-23).

Shy Albatross

The shy albatross (*Thalassarche cauta cauta*) is listed as vulnerable and migratory under the EPBC Act. The shy albatross appears to occur in all Australian coastal waters below 25°S. It is most commonly observed over the shelf waters around Tasmania and south-eastern Australia (DAWE, 2020). Breeding occurs on Albatross Island, Bass Strait, and Mewstone and Pedra Branca, off southern Tasmania. The shy albatross feeds in waters over the continental shelf as well as within harbours and bays (DAWE, 2020). This species may occur within the EMBA; although it is not an area this species uses for breeding or resting, however, it may be used as foraging ground with a foraging BIA recognised for the operational area and EMBA (Figure 4-24).

Soft-plumaged Petrel

The soft-plumaged petrel (*Pterodroma mollis*) is listed as vulnerable under the EPBC Act. This marine bird is found in temperate and sub-Antarctic regions. The petrel is a regular and quite common visitor to southern Australian seas, but is more common on the west than in the south and southeast (Marchant & Higgins, 1990). The population in Australia is currently unknown. Breeding is believed to take place on south Australian islands with fledglings dispersing mainly northwards during May and June.

The soft-plumaged petrel may occur within the operational area and the EMBAs.

Sooty Albatross

The sooty albatross (*Phoebetria fusca)* is listed as vulnerable and migratory under the EPBC Act. The sooty albatross breeds on islands in the southern Indian and Atlantic Oceans, and forages south of 30ºS, between southern NSW and Argentina (DAWE, 2020). In Australia, it has sometimes been observed foraging in inshore waters in southern Australia. The sooty albatross is a rare, but probably regular migrant to Australia, mostly in autumn and winter. The sooty albatross flies within 10 to 15 m of the sea surface, using updrafts from wave fronts for lift. It forages at the sea surface feeding on fish, cephalopods, crustaceans and penguin carrion (DAWE, 2020).

The sooty albatross is likely to occur within the operational area and EMBAs.

Sooty Shearwater

The sooty shearwater (*Ardenna grisea*) is a listed migratory species under the EPBC Act. It is found in the southern hemisphere during summer. This species breeds around New Zealand, southern Australia and southern South America (DAWE, 2021). In winter, these birds move to the North Pacific Ocean, but some move into the North Atlantic Ocean, or remain in the southern hemisphere (DAWE, 2021). It feeds on a wide variety of pelagic prey, including cephalopods, fish and crustaceans.

The sooty shearwater may occur within the operational area and EMBA.

Southern Giant Petrel

The southern giant petrel (*Macronectes giganteus*) is listed as endangered and migratory under the EPBC Act. The southern giant petrel is considered to be a sibling species to the northern giant petrel. It is a large seabird with a widespread distribution range through the Southern Ocean from the Antarctic to subtropical waters. The southern giant-petrel breeds once a year between August and September, returning from foraging locations to breeding grounds in Antarctic waters.

The southern giant petrel may occur within the operational area and EMBAs. There are no breeding, roosting grounds or critical feeding areas within the operational area, although this species may transit the EMBA from time-to-time, foraging for food.

Southern Royal Albatross

The southern royal albatross (*Diomedea epomophora*) is listed as vulnerable and migratory under the EPBC Act. The southern royal albatross has a circumpolar distribution within the Southern Oceans. Within Australia, they range over waters of SA at all time of year, especially between July and October and have been recorded from Byron Bay in the east to southwestern WA. Most records are from the shelf-break areas, particularly of western and southern Tasmanian and around Victoria (DSEWPaC, 2011b).

The southern royal albatross was identified to have likely foraging behaviours within the operational area and EMBAs.

Swinhoe’s Snipe

The Swinhoe’s snipe (*Gallinago megala*) is listed as a migratory species under the EPBC Act. Few definite records exist for Swinhoe's Snipe in Australia with these records being in northern Australia from October October to April in the Kimberley region and October – March in the Pibara (DAWE, 2022). During the non-breeding season, Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams (DAWE, 2022).

The Swinhoe’s snipe has been identified as having roosting behaviours likely to occur within the EMBAs.

Terek Sandpiper

The Terek sandpiper (*Xenus cinereus*) is a listed migratory species under the EPBC Act. This sandpiper primarily has a coastal distribution in Australia, being more widespread and common in the north and east than in the south of Australia (DAWE, 2022). In Victoria, the species has been recorded from Corner Inlet, Anderson Inlet, Westernport Bay and west Port Phillip Bay. The species is regularly seen in Tasmania and the South Australian coastline (DAWE, 2022). The species prefers intertidal mudflats and has also been recorded on sand spits, near mangroves and also rocky areas. The Terek sandpiper feeds on a variety of invertebrates including crustaceans, insects and molluscs. The species breeds in Eurasia before moving south for the boreal winter.

The Terek sandpiper was identified as known to roost within the EMBAs.

Wandering Albatross

The wandering albatross (*Diomedea exulans*) is listed as vulnerable and migratory under the EPBC Act. The species has a circumpolar distribution and breeds on six sub-Antarctic island groups including Macquarie Island in Australia (DELWP, 2011; Marchant and Higgins, 1990; ACAP, 2011). The Wandering Albatross breeds biennially, laying eggs in December and fledging chicks between mid-November and late February. Limited satellite tracking of Wandering Albatross from Macquarie Island shows that breeding females forage north of the Island in waters off southern Tasmania, while males forage in open waters of the Southern Ocean, south of 50°S, reflecting a spatial segregation seen in other populations of this species. Juveniles are concentrated in lower latitudes north and east of Macquarie Island in Pacific waters, off the south east coast of Australia and in New Zealand waters.The species feeds mainly on squid and fish but also crustaceans and carrion (Marchant and Higgins, 1990).

Foraging trips by breeding Wandering Albatross have exceeded 15,200 km between incubation bouts (Jouventin and Weimerskirch, 1990). Southern Australia is an important wintering ground for non-breeding and juvenile birds from the Atlantic and Indian Ocean breeding colonies. Non-breeding and juvenile birds remain north of 50° S. During the non-breeding season, birds disperse more widely with females generally foraging in more northerly latitudes of the southern hemisphere and males generally foraging further south (Baker and Hamilton, 2013).

This species is wide-ranging and may potentially over-fly the worst-case hydrocarbon EMBA from time-to-time in transit or for foraging.

The entire South-east Marine Region north of 50°S is recognised as a BIA for foraging for the species. Therefore, the operational area and EMBA overlap this foraging BIA (DoE, 2015).

Wandering Tattler

The Wandering Tattler (*Tringa incana*) is listed as migratory under the EPBC Act. This species is considered uncommon in Australia, although this could be partly due to confusion with the Grey-tailed Tattler (Bamford et al. 2008; Higgins & Davies, 1996). Wandering Tattlers breed outside of Australia from late May to August with eggs laid in June (DAWE, 2022). Following the breeding season, the birds migrate southwards for the boreal winter, residing in Pacific Islands, north-east Australia and New Zealand. Records indicate the species arrives in Australia from September and begins leaving in April-May (DAWE, 2022).

The Wandering Tattler generally inhabits rocky coasts with reefs and platforms, points, spits, piers, offshore islands and shingle beaches or beds (DAWE, 2022). The species feeds on worms, molluscs and crustaceans and forages among rocks or shingle, or in shallow pools at the edges of reefs or beaches, mainly along the tideline (DAWE, 2022).

Wedge-Tailed Shearwater

The wedge-tailed shearwater (*Ardenna pacifica*) is a listed migratory species under the EPBC Act. This medium-sized seabird is common in the Indian Ocean, the Coral Sea and the Tasman Sea (Lindsey, 1986), preferring tropical and sub-tropical waters where temperatures are greater than 21ºC. The species has been recorded in offshore waters of eastern Victoria and southern NSW, mostly over continental slope with sea-surface temperatures of 13.9–24.4°C (Drummond, 1985; Reid *et al*., 2002).. It forages at sea, feeding mostly on fish, cephalopods, insects, jellyfish and prawns. The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on offshore islands.

The wedge-tailed shearwater has an identified foraging BIA within the operational area and EMBA and a breeding BIA in the EMBA (Figure 4-26).

Whimbrel

The whimbrel (*Numenius phaeopus*) is a medium-sized curlew and a listed migratory species under the EPBC Act. It is a regular non-breeding migrant to Australia and New Zealand. Although scattered inland records of the species is found in all regions, its distribution is primarily coastal, and more common in the north of Australia. However, it is regularly found in some places in Victoria, Tasmania and South Australia (DAWE, 2022). The whimbrel forages on intertidal mudflats, along muddy banks of estuaries and in coastal lagoons and mangroves. The whimbrel begin their migration from breeding grounds in the northern hemisphere in July, arriving on the north coasts from August. They start their northern migration back to breeding grounds by late April.

The whimbrel was identified as known to roost within the EMBAs.

White-capped Albatross

The white-capped albatross (*Thalassarche cauta steadi*) is listed as vulnerable and migratory under the EPBC Act. This is a marine species that occurs in sub-Antarctic and subtropical waters. The white-capped albatross breeds on the subantarctic islands of New Zealand. Eggs are usually laid in mid-November and hatch in February (ACAP, 2011). Tracking data reveal that white-capped albatross forage extensively across the Tasman Sea, around southeastern Australia, during incubation and chick-rearing, with birds moving as far west as Tasmania and south-eastern Australia, and further westwards to southern and south-western Australia during nonbreeding (Thompson et al. 2011). The white-capped albatross is thought to have a diet of inshore cephalopods (squid) and fish (Gales, 1993; Marchant and Higgins 1990). It occurs in both inshore and offshore waters (DAWE, 2022). The entire South-east Marine Region as far south as latitude 50°, S is recognised as a biologically important area for foraging for the species (DoE, 2015).The white-capped albatross was identified as likely to forage within the operational area and EMBAs.

White-faced Storm Petrel

The White-faced Storm Petrel (*Pelagodroma marina*) is listed as marine under the EPBC Act and although it was not recognised as occurring in the PMST reports, the species has a recognised foraging BIA within the EMBAs (Figure 4-27).

The Australian population of White-faced Storm Petrels are estimated to account for 25 per cent of the global population (DoE, 2015). The species is migratory, moving from temperate breeding sites to tropical and subtropical waters in the non-breeding season. There are 15 breeding colonies identified in Tasmania and a further three sites in Port Phillip Bay, Victoria and include Tullaberga Island, Mud Island and South Channel Island (DoE, 2015). The species returns to colonies in late September to early October, with egg laying beginning in early summer and fledging occurring mid-February to mid-March (DoE, 2015).

White-faced Storm Petrels feed on pelagic crustaceans, small fish and other surface plankton (Marchant & Higgins 1990). There is a recognised foraging BIA within the EMBAs (Figure 4-27).

4.4 Socio-Economic Values and Sensitivities

4.4.1 Cultural Heritage

Indigenous 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 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, 1998).

Underwater Cultural Heritage

The *Underwater Cultural Heritage Act 2018* protects Australia’s underwater cultural heritage including shipwrecks, sunken aircraft and other types of underwater heritage. Under this Act, shipwrecks, sunken aircraft and their associated artefacts older than 75 years are protected.

Within the spill 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. The wrecks represent significant archaeological, educational and recreational (i.e., diving) opportunities for locals, students, and tourists (Flagstaff Hill, 2015). Wrecks closest to the CHN assets are listed below (Victorian Heritage Database, 2016; Australasian Underwater Cultural Heritage Database, 2018):

- *Napier* – wrecked in 1878, the vessel was contracted to undertake salvage on the Loch Ard wreck. While returning to Port Campbell it lost sternway while rounding the eastern reef and bluff, and swell forced it onto rocks on the western side of the cove.
- *Nowra* – wrecked in 1891 after experiencing very bad weather after leaving Penguin (Tasmania). It was unable to reach Port Phillip Heads and was driven onto the ‘London Bridge’ rocks.
- *Newfield* – wrecked in 1892, the vessel struck rocks approximately 100m from shore one mile east of Curdies Inlet due to navigational error when Cape Otway light was mistaken for King Island lighthouse.

- *Young Australian* – wrecked in 1877 at Curdies Inlet while on a voyage from Maryborough (Qld) to Adelaide (SA) it struck heavy weather off Cape Nelson.
- *Schomberg* – wrecked in 1855 at Curdies Inlet as a result of a navigational error.
- *Falls of Halladale* – wrecked in 1908 at Massacre bay Peterborough as a result of a navigational error.
- Unnamed – located west of Peterborough in waters less than 10 m deep.
- *Loch Ard* – wrecked in 1878 as a result of bad weather prevented navigational fixes from being made.
- Frankston – Fairey Firefly – wrecked in 1947 as a result of a collision with another Fairy Firefly at 1500 ft.
- RAAF – B25 – Wrecked in 1945 due to catching fire during weapons test resulting in ditching of the aircraft.
- USAF – B57 – wrecked due to loss of control resulting in plunging into the water.
- Twin Engine – Lady Julia Percy Is. – Unknown.

None of the wrecks on the Victorian west coast are covered by underwater heritage protected zones declared under Section 103 of the Victorian *Heritage Act 1995* (DELWP, 2016b) (Figure 4-29), with the nine protected zones that do exist occurring within Port Phillip Bay and adjacent to the west Gippsland coast (DELWP, 2016b).

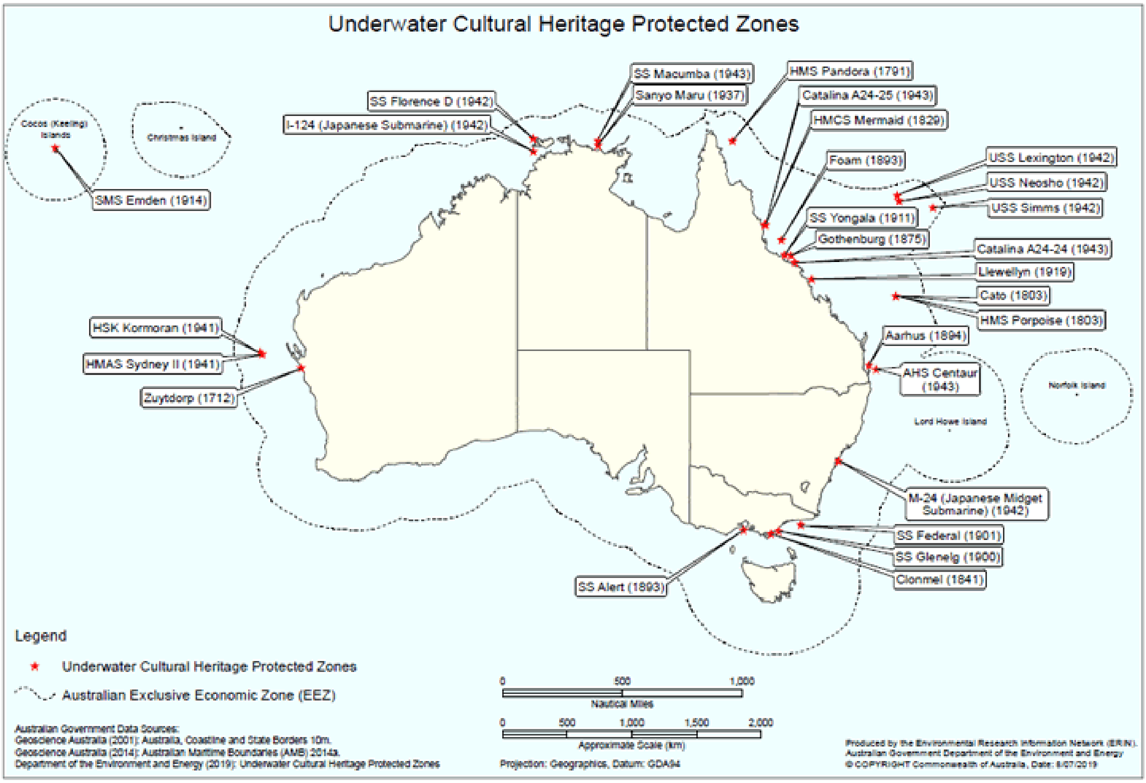


Figure 4-29: Underwater cultural heritage shipwreck protected zones

4.4.2 Australian Commercial Fisheries

A number of Commonwealth and State managed fisheries have boundaries that overlap with the operational area and EMBAs (Figure 4-30 to Figure 4-39). Table 4-8 provides a summary description of the commercial fisheries with management areas overlapping the operational area and / or EMBAs and therefore have the potential for their operations to be affected by the petroleum activity.

Table 4-8: Commonwealth and State managed fisheries within the EMBA

Fishery	Target Species	Description	Presence		
			Operational Area	MDO EMBA	LOWC EMBA
Commonwealth Managed Fisheries[1]					
Bass Strait Central Zone Scallop	Scallops (*Pecten fumatus*)	Towed dredge fishing method. Fishery managed via seasonal/area closures and total allowable catch (TAC) controls together with quota statutory fishing rights (48 permits for 2019 season and 43 permits for the 2020 season) and individual transferrable quotas. 9 vessels were active in the fishery in the 2020 season. Fishing season: typically July to 31 December	No 2020 fishing intensity data shows activity north and east of King Island (Figure 4-31).	Yes	Yes
Eastern Tuna and Billfish	Albacore tuna (*Thunnus alulunga*) Bigeye tuna (*Thunnus obesus*) Yellowfin tuna (*Thunnus albacares*) Broadbill swordfish (*Xiphias gladius*) Striped marlin (*Kaijikia audux*)	Pelagic longline, minor line (such as handline, troll, rod and reel). A total of 81 longline boat Statutory Fishing Rights, and 83 minor line Statutory Fishing Rights were issued in 2020. Vessels operating on 2019 and 2020 season –37 and 35 longline and 0 minor-line. Fishing season: 12 months beginning on 1 January	No Fishery effort is concentrated along the NSW coast and southern Queensland coast (Figure 4-32). No Victorian ports are used to land catches.	No	No
Skipjack (eastern)	Skipjack tuna (*Katsuwonus pelamis*).	Historically, over 98% of the catch was taken using purse seine catch method. Pole and line method was used for the remaining 2% of the catch. There were 17 fishing permits for the 2019-20 fishing season, but no active Australian vessels. Fishing season: not currently active	No No fishing effort in the fishery since 2008-9 fishing season (stock highly variable and Australia is at the edge of the species range) (Figure 4-33).	No	No
Small Pelagic (western sub-area)	Jack mackerel (*Trachurus declivis, T. symmetricus, T. murphyi*) Blue mackerel (*Scomber australasicus*),	Purse seine and mid-water trawl are the main fishing methods. There were 33 Statutory Fishing Rights in the 2020-21 fishing season, with 4 purse seine and 2 mid-water trawl vessels active. Fishing season: 12 months beginning 1 May	No Fishery effort concentrated in NSW and eastern Tasmania (Figure 4-34).	No	No

Fishery	Target Species	Description	Presence		
			Operational Area	MDO EMBA	LOWC EMBA
	Redbait (*Emmelichthys nitidus*) and Australian sardine (*Sardinops sagax*).				
Southern and Eastern Scalefish and Shark Fishey (SESSF) – CTS and Danish Seine	Blue grenadier (*Macruronus novaezelandiae*), Tiger flathead (*Platycephalus richardsoni*), Pink ling (*Genypterus blacodes*) Silver warehou (*Seriolella punctata*)	Fishing methods include otter trawl and Danish seine. There are 57 trawl licences with 30 trawl and 19 Danish seine vessels operational in the 2019/20 season. Fishing season: 12 months beginning 1 May	Unlikely (CTS) No (Danish Seine) Trawl sector is concentrated around shelf-break areas. Danish seine activity is located on the continental shelf and operate in sandy bottom environments (Figure 4-35).	Unlikely (CTS) No (Danish Seine)	Unlikely (CTS) No (Danish Seine)
SESSF – Shark Gillnet and Shark Hook Sectors	Gummy shark (*Mustelus antarcticus*)	Within the Shark Gillnet and Hook sector there were 61 gillnet fishing permits and 13 hook fishing permits issued in 2019-20 season. Vessels actively fishing during the season included 35 gillnet vessels and 36 hook vessels. Fishing season: 12 months beginning 1 May	Possible (Gillnet) No (Hook) Gillnet sector heavily utilises the continental shelf. Hook sector does not fish in the Gippsland Basin (Figure 4-35).	Possible (Gillnet) No (Hook)	Possible (Gillnet) No (Hook)
Southern Bluefin Tuna	Southern bluefin tuna (*Thunnus maccoyii*)	The primary fishing method is purse seine in waters off South Australia with a number of fishes captured by longline vessels off the East Coast. Tuna caught in SA are then transferred to aquaculture farming pens off Port Lincoln in South Australia. In the 2019-20 fishing season, there were 82 fishing permits with 7 active purse seine vessels and 23 longline vessels. Fishing season: 12 months beginning 1 December	No Fishery effort concentrated in the Great Australian Bight (GAB) off Kangaroo Island and in southern NSW coast off the continental shelf (Figure 4-36).	No	No
Southern Squid Jig	Gould's squid (*Nototodarus gouldi*)	Squid jigging is the fishing method used, mainly in water depths of 60 to 120 m, at night.	No	Possible	Possible

Fishery	Target Species	Description	Presence		
			Operational Area	MDO EMBA	LOWC EMBA
		In 2020, there were 5 active jig vessels in the Commonwealth fishery. Portland is a primary landing port. Fishing season: 12 month season beginning 1 January	Catches are concentrated in Commonwealth waters between Portland and Robe (SA). Low fishing intensity occurs in eastern Victoria and southern NSW (Figure 4-37 and Figure 4-38).		
State Managed Fisheries[2]					
Victorian Rock Lobster	Predominantly southern rock lobster (*Jasus edwardsii*), along with small quantities of eastern rock lobster (*Jasus verreauxi*).	71 licences in the Western zone, permitted to use baited rock lobster pots. In 2019/20, there were 43 vessels working in the western zone (VFA, 2021). In 2019/20, 225.6 tonnes were harvested in the western zone. Fished from rocky reefs in waters up to 150 m depth, with most of the catch coming from inshore waters less than 100 m deep. Pots are generally set and retrieved each day, marked with a surface buoy. Closed seasons: females 1 June to 15 November and males 15 September to 15 November.	Yes Fishing occurs throughout the area on rocky reefs.	Yes	Yes
Victorian Giant Crab	Giant crab (*Pseudocarcinus gigas*).	Giant crabs can only be taken using commercial rock lobster pots by Western Zone lobster fishers. Since the introduction of quota management in the Giant Crab Fishery in 2001, there have been <5 dedicated fishers active in the fishery and up to 20 fishers annually reporting Giant Crab catch as by-product from Rock Lobster fishing (VFA, 2021). In 2019/20 season 9.5t was landed (VFA, 2021). Fished mostly on the shelf break (150-350 m water depth).	Unlikely Although concentrated on the continental shelf, given that licence holdings are linked to southern rock lobster licences, there may be some fishing.	Unlikely	Unlikely
Abalone	Blacklip abalone (*Haliotis rubra*) and greenlip abalone (*Haliotis laevigata*).	The fishery consists of 71 fishery access licences of which 14 operate in the Western Zone, 34 in the Victorian Central Zone, and 23 in the Eastern Zone.	Likely Abalone diving activity occurs close to shoreline (generally to	Likely	Likely

Fishery	Target Species	Description	Presence		
			Operational Area	MDO EMBA	LOWC EMBA
		Commercial fishing methods use diving equipment such as a surface air supply to the diver (hookah system) from small high speed fishing boats. Diving is normally to depths less than 20 m. Fishing season: 12 months beginning 1 April	depths of 30 m on rocky reefs) and may operate around the assets.		
Wrasse	Blue-throat wrasse (*Notolabrus tetricus*) Saddled (or purple) wrasse (*Notolabrus fucicola*) Rosy Wrasse (*Pseudolabrus psittaculus*) Senator Wrasse (*Pictilabrus laticlavius*) Southern Maori Wrasse (*Ophthalmolepis lineolatus*)	The fishery is divided into three commercial management zones; west, central and east, with licence holders able to fish in any of these zones. There are 22 licences (2021) issued for this fishery. Licences are transferrable. Fishing method is via hand line fishing (other than longline which are not permitted) and rock lobster pots if also in possession of a Rock Lobster Access Fishing Licence.	Likely Wrasses are fished along the entire Victorian coast but in recent years, catches have been the highest off the central coast (Port Phillip Heads, Western Port, and Wilson's Promontory) and west coast of Victoria (Portland). Catches of saddled wrasse are highest in the Western part of Victoria, which is thought to be related to a greater proportion of suitable reef habitat in this area. Wrasse can inhabit depths up to 160 m but their preferred depths are approximately 30 m.	Likely	Likely
Scallop	Scallop (*Pecten fumatus*).	A total of 91 commercial licenses are issued each year and approximately 10-15 vessels operate within the fishery. Commercial vessels tow a single dredge that is dragged along the seabed. Dredges are deployed from the rear of the vessel and are up to 4.5 metres wide.	No Fishery boundary extends the entire length of the Victorian coastline and out to the 20 nmi point from the shoreline although mostly fished from	No	No

Fishery	Target Species	Description	Presence		
			Operational Area	MDO EMBA	LOWC EMBA
		Fishing season: 12 months beginning 1 April	Lakes Entrance and Welshpool.		
Snapper	Snapper (*Pagrus auratus*).	A total of 246 ocean fishery access licences issued (SIV, 2016). A variety of commercial fishing equipment is used including long lines, haul seines, mesh nets, and hand lines.	Likely	Likely	Likely
Octopus	Pale Octopus (*Octopus pallidus*) Maori octopus (*Macroctopus maorum*) Gloomy Octopus (*Octopus tetricus*)	The fishery has established three zones; western, central and eastern octopus zones to manage commercial octopus fishing in Victoria. The western and central zones are less established and are being managed through exploratory, temporary permits. While the Eastern Zone (East Gippsland) is operational and extends from Seaspray to the Victorian / NSW border and out to 20 nmi offshore, except for marine reserves. There are 11 transferable licences issued for the eastern octopus zone. The fishery uses purpose-built unbaited traps which aim to minimise bycatch.	No The estern octopus zone, from Seaspray to the Victorian / NSW border, is authorised for commercial take of octopus. Western and central octopus zones are less established.	No	No

[1] Commonwealth fisheries information sourced from DAWE, 2021 and AFMA, ND.
[2] State-managed fisheries information sourced from VFA, 2021a

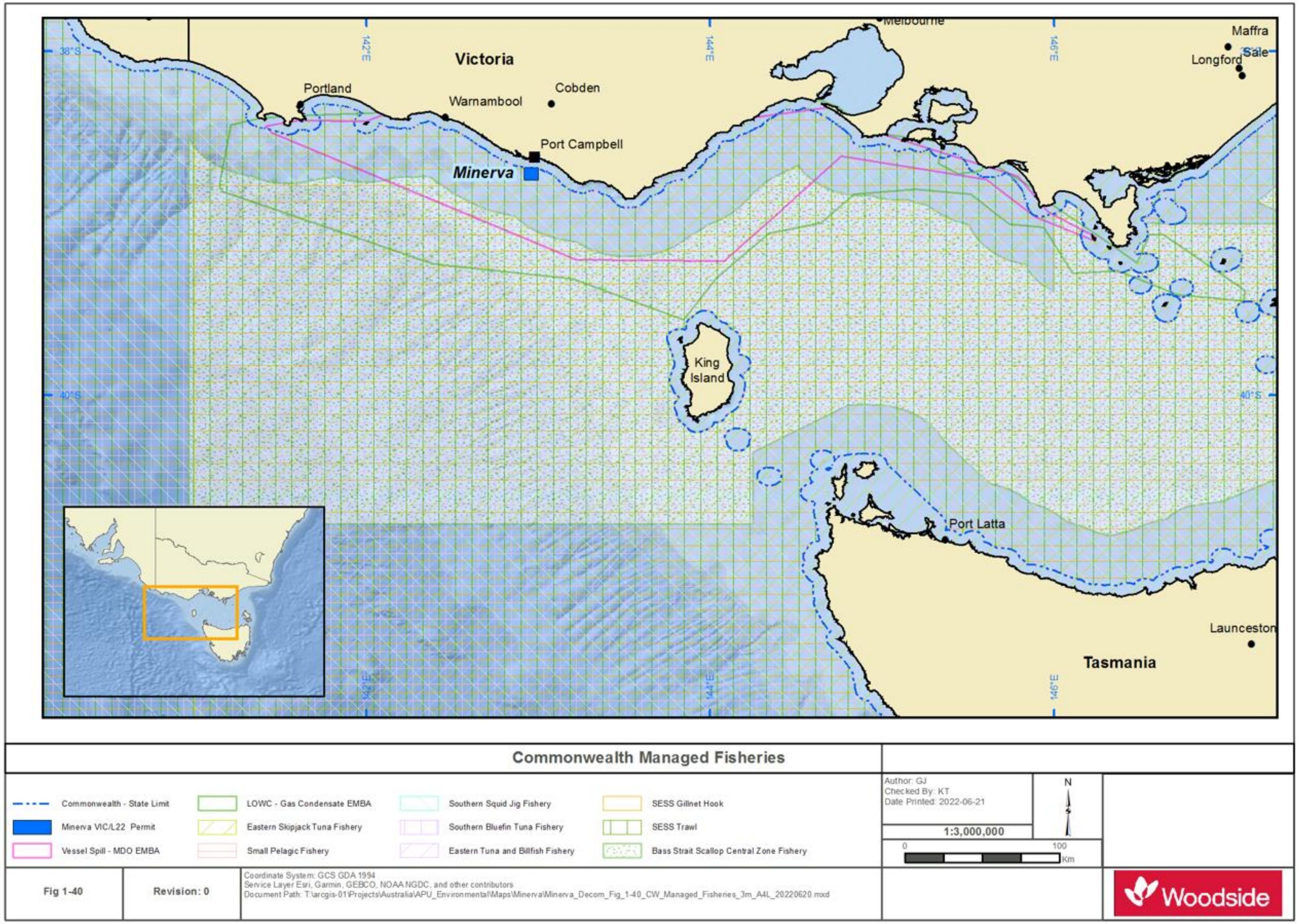
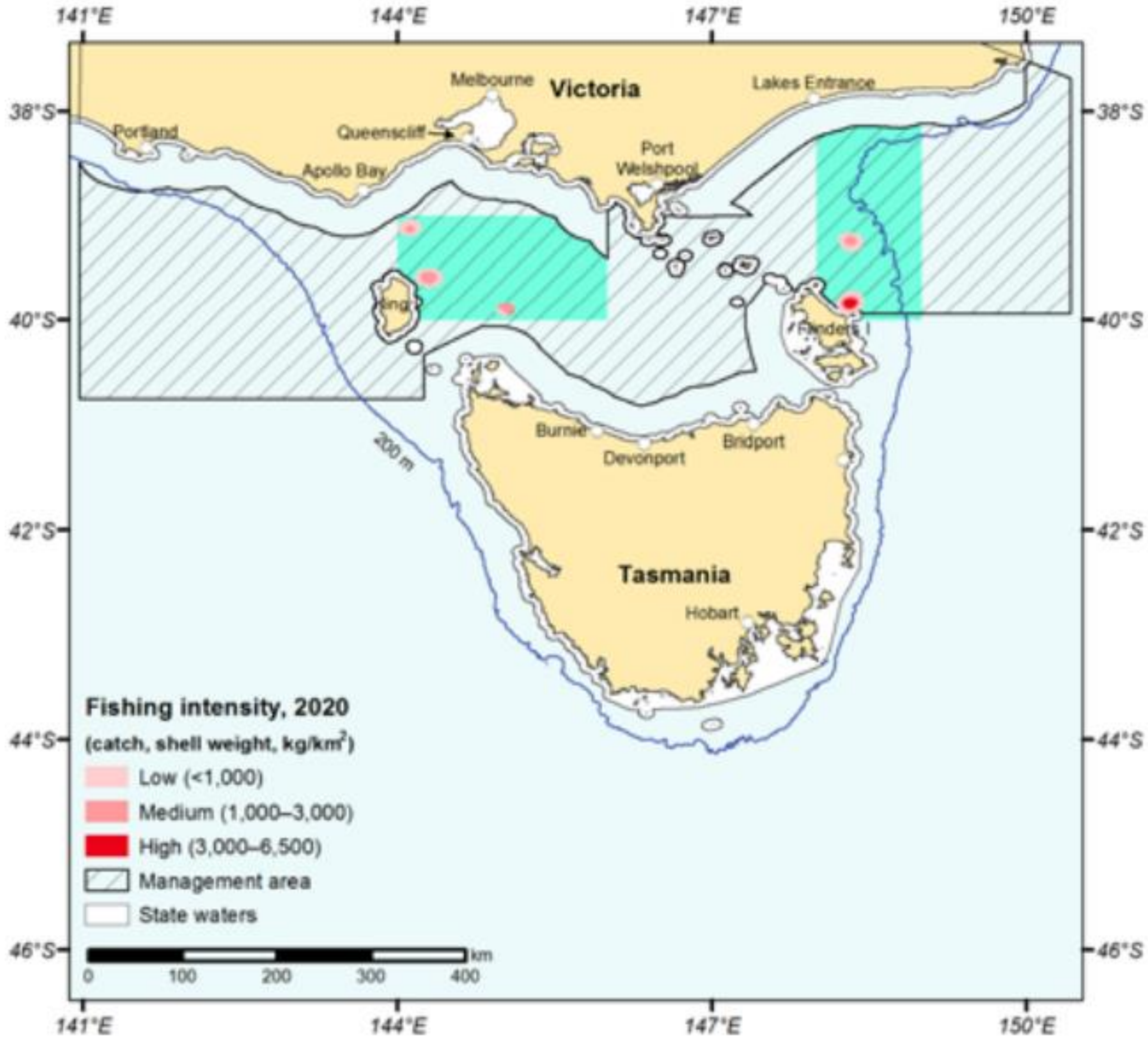
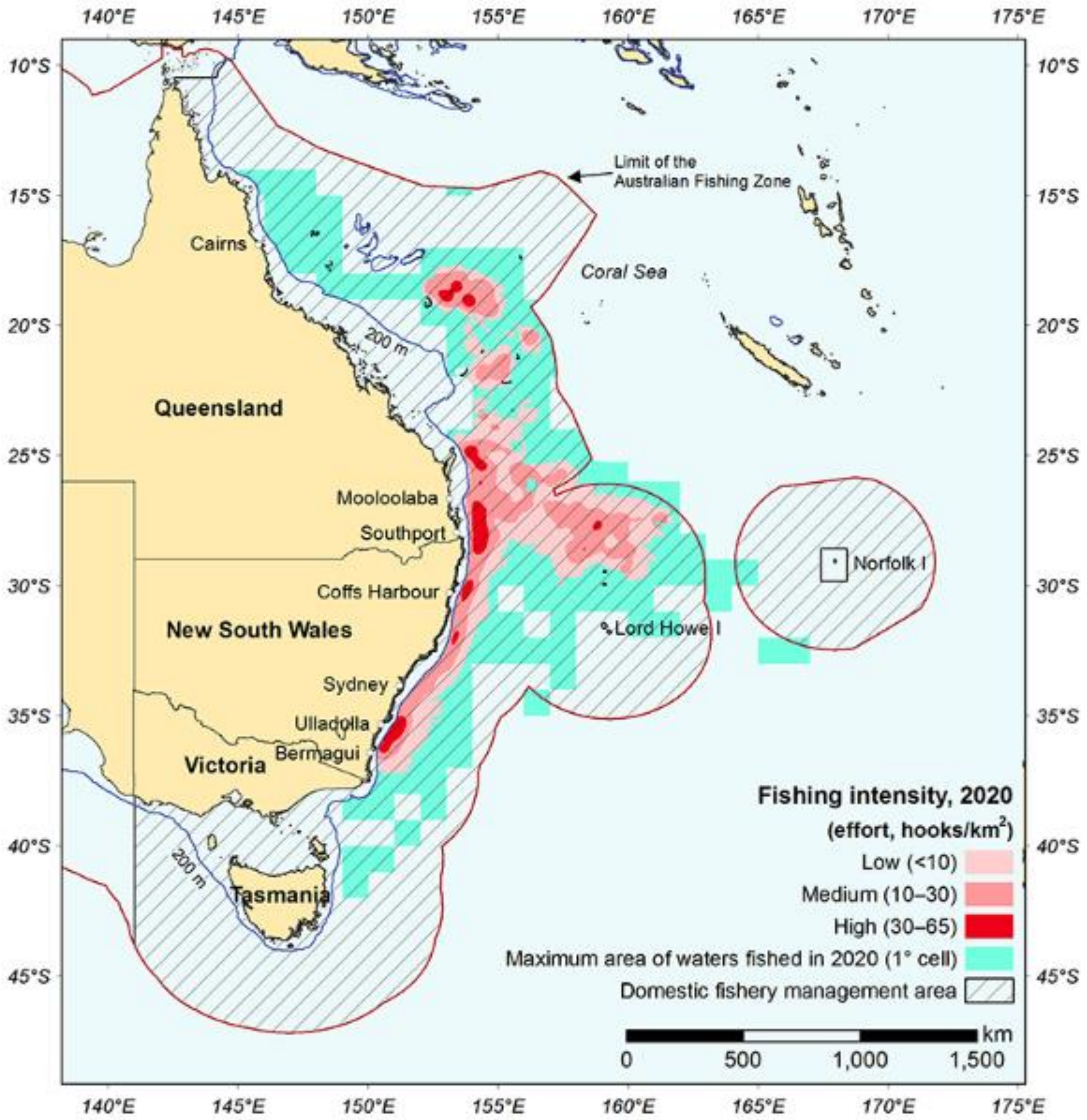


Figure 4-30: Commonwealth-managed Commercial Fisheries within the Operational Area and EMBAs



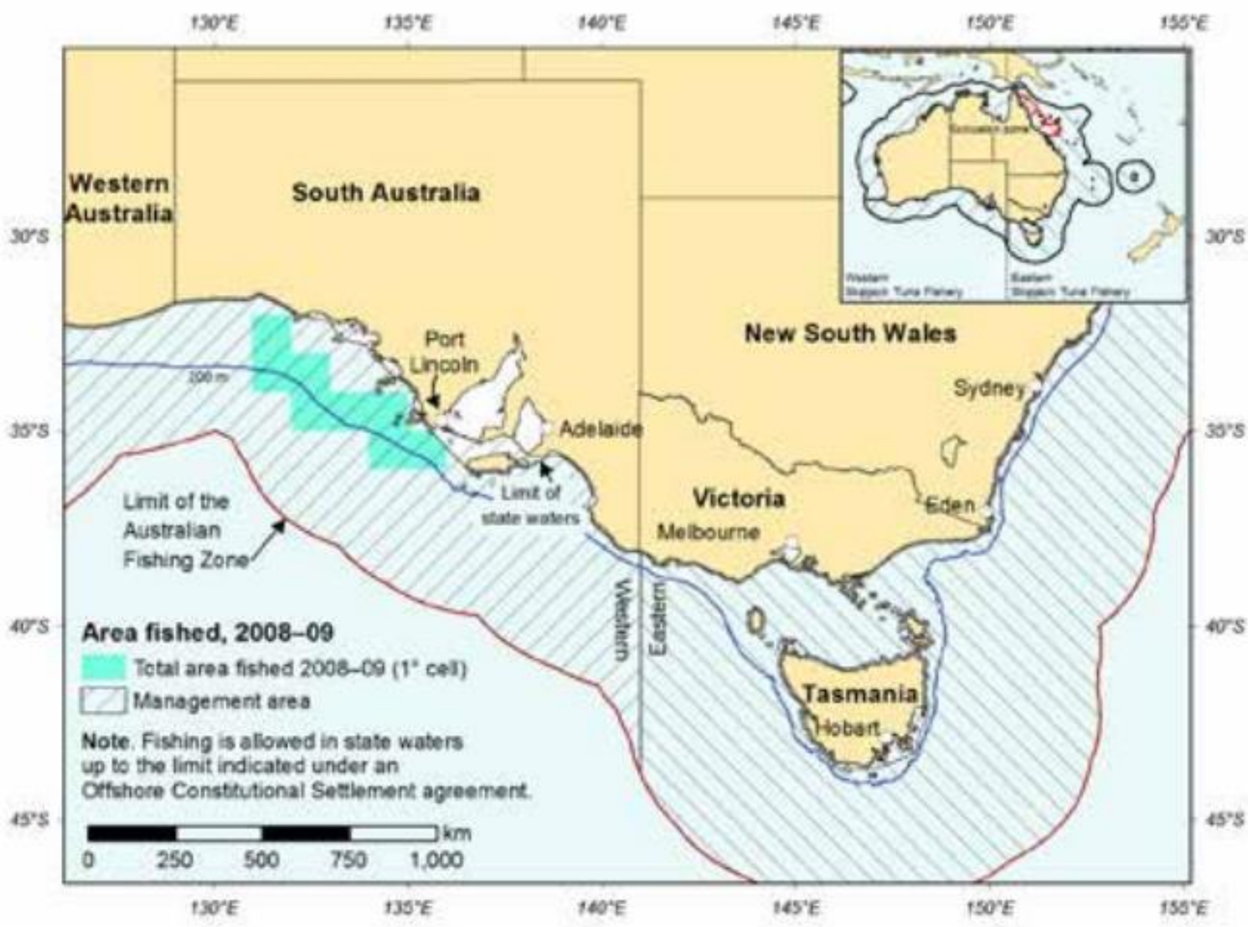
Source: DAWE, 2021

Figure 4-31: Area and Relative Fishing Intensity in the Bass Strait Central Zone Scallop Fishery, 2020



Source: DAWE, 2021

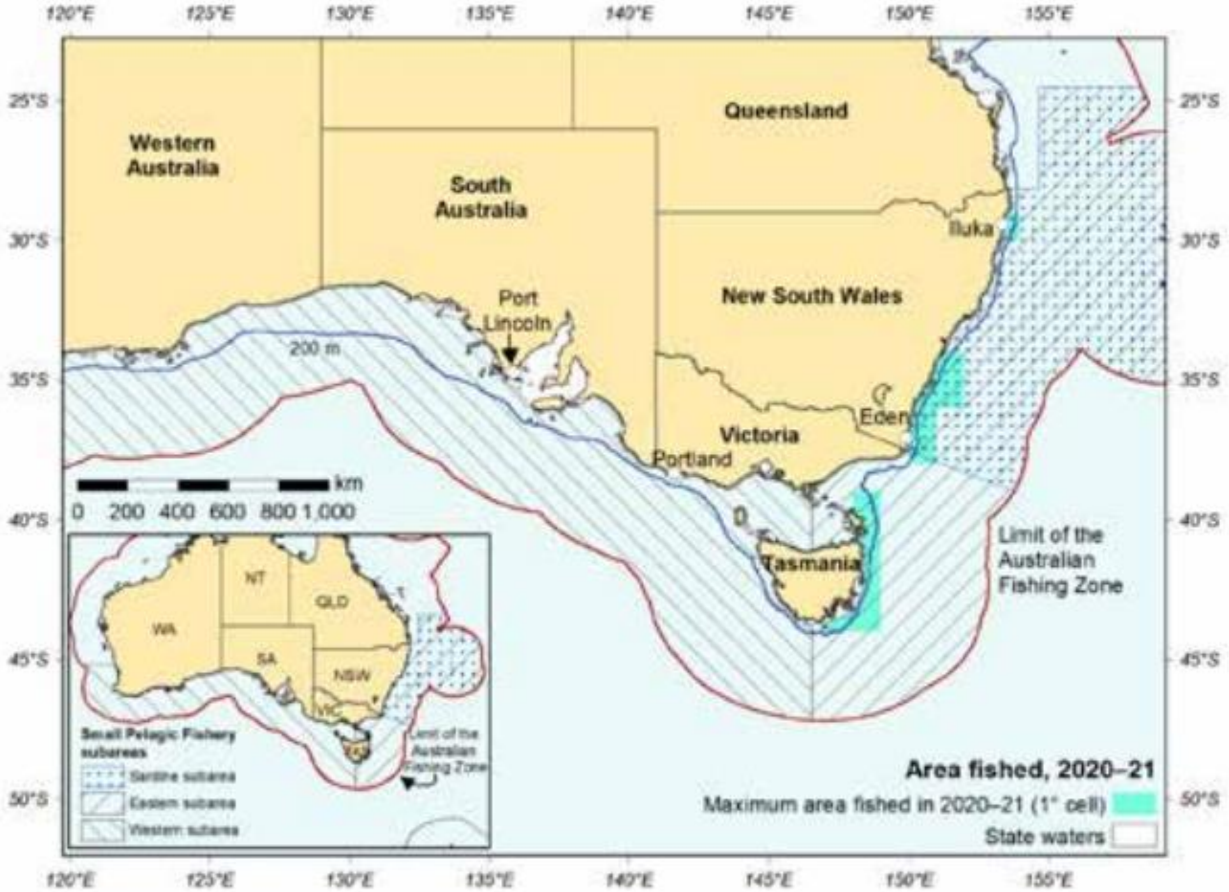
Figure 4-32: Fishing Intensity in the Eastern Tuna and Billfish Fishery, 2020



Note: The last effort in the fishery occurred in 2008–09.

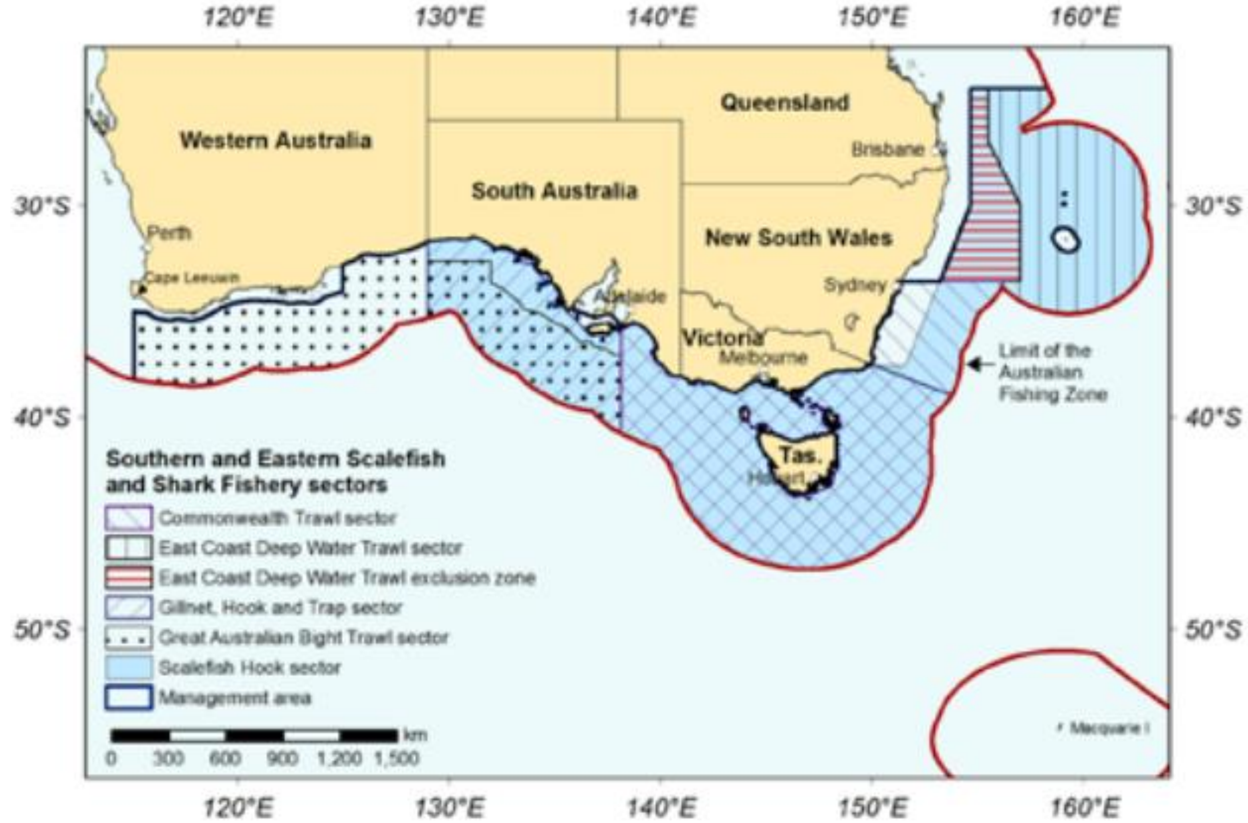
Source: DAWE, 2021

Figure 4-33: Area fished in the Skipjack Tuna Fishery, 2008-09 to 2019-20



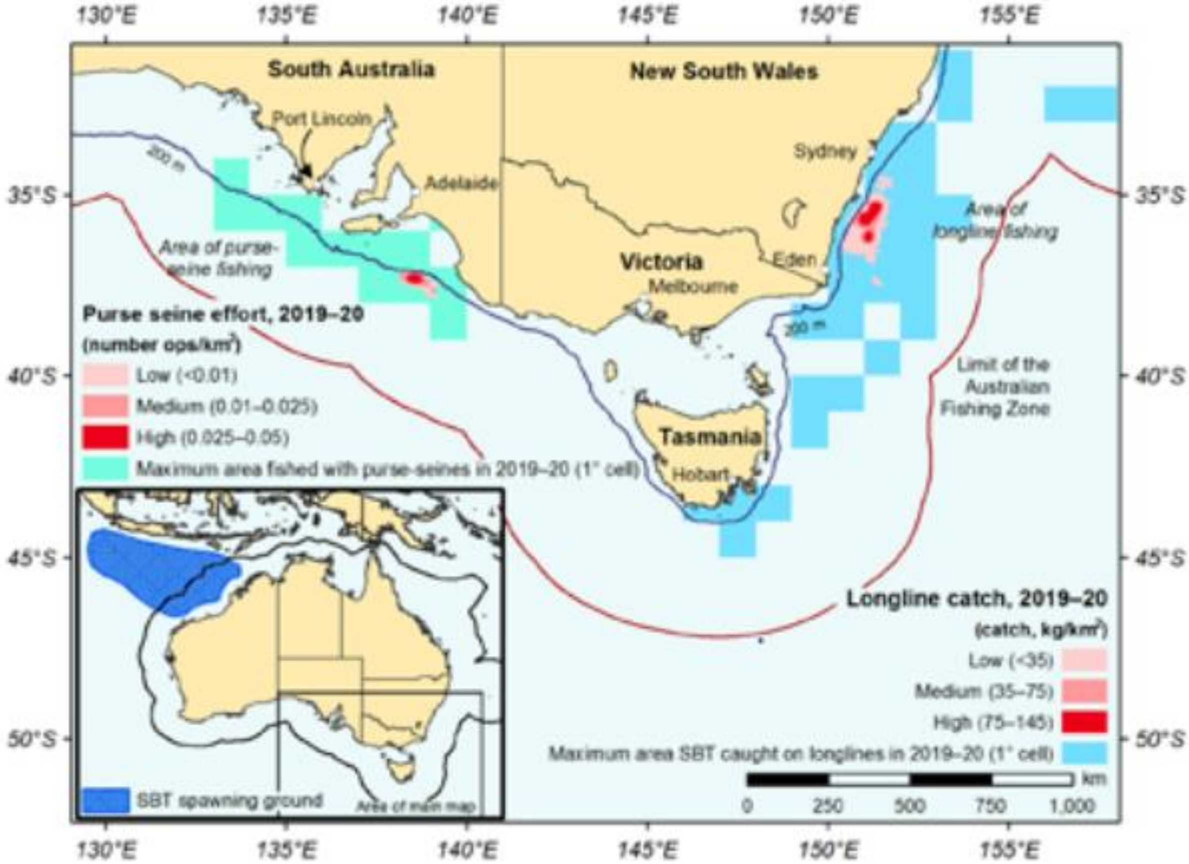
Source: DAWE, 2021

Figure 4-34: Area fished in the Small Pelagic Fishery, 2020-2021 fishing season



Source: DAWE, 2021

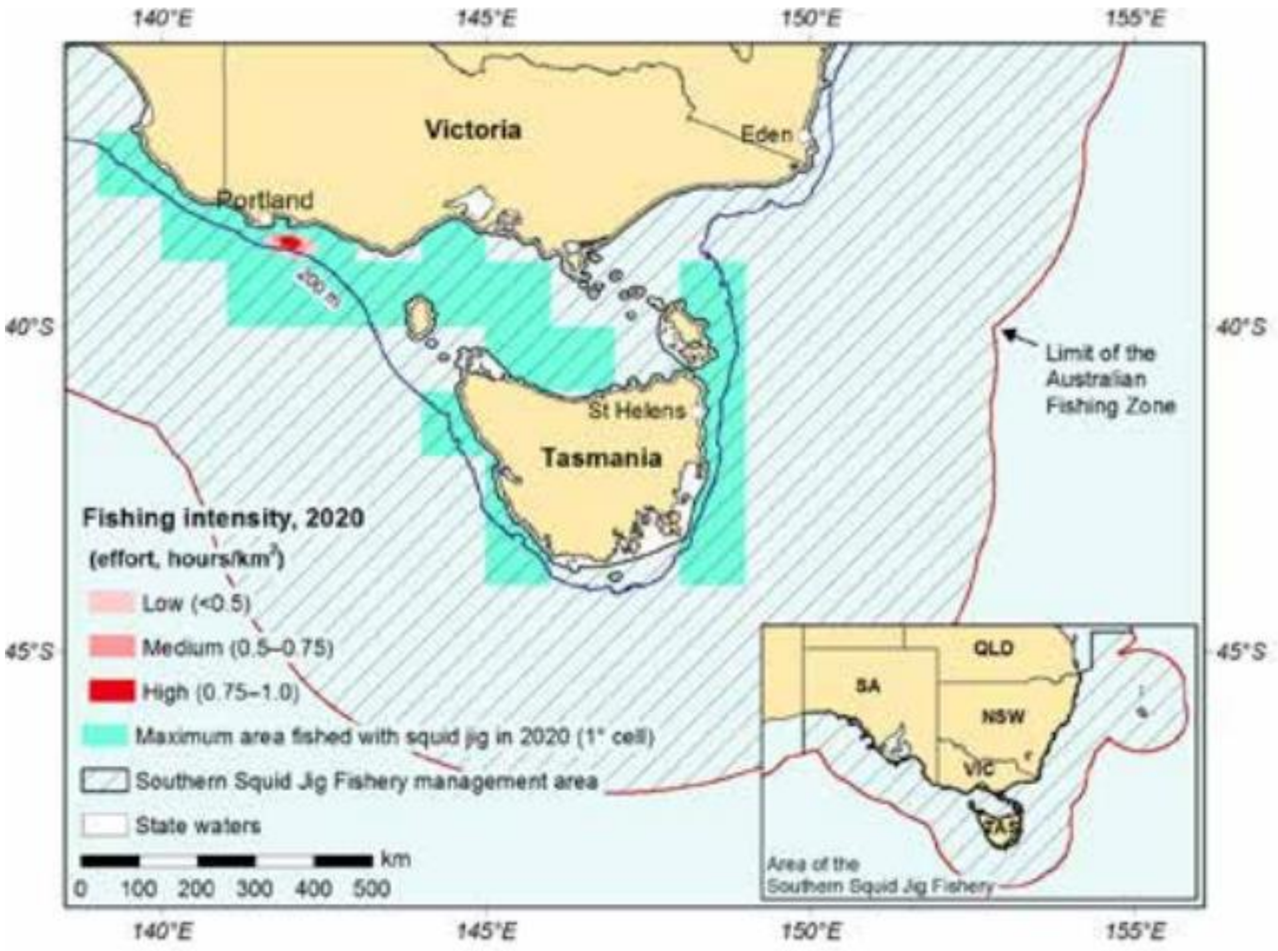
Figure 4-35: Area and sectors of the Southern and Eastern Scalefish and Shark Fishery



Note: **SBT** Southern bluefin tuna.

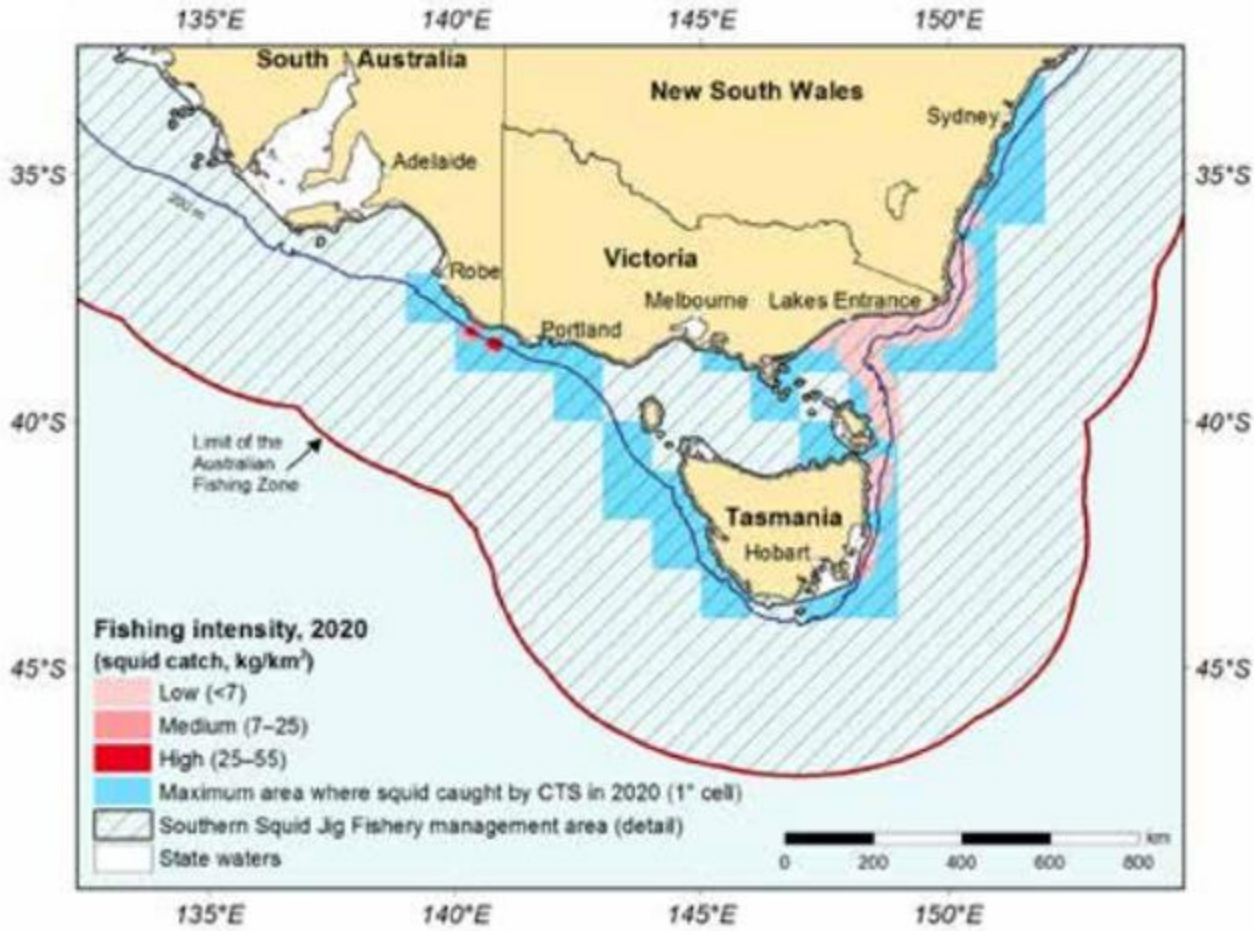
Source: DAWE, 2021

Figure 4-36: Purse-seine effort and longline catch in the Southern Bluefin Tuna Fishery, 2019-20 fishing season



Source: DAWE, 2021

Figure 4-37: Relative fishing intensity in the Southern Squid Jig Fishery



Note: **CTS** Commonwealth Trawl Sector.

Source: DAWE, 2021

Figure 4-38: Commonwealth Trawl Sector Squid Catch, 2020

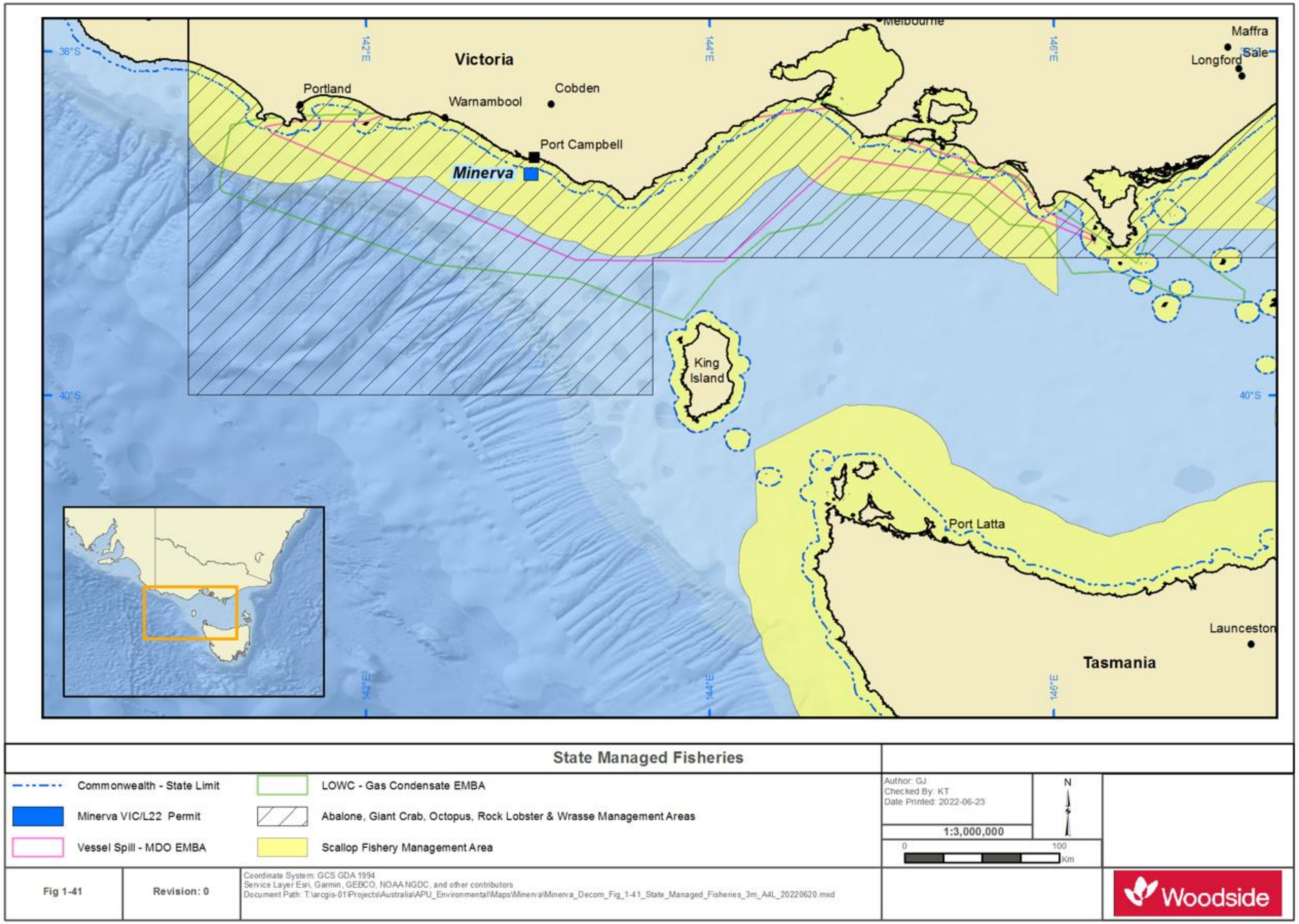


Figure 4-39: State managed fisheries within EMBAs

4.4.3 Tourism and Recreation

Recreational and tourism activities are extremely valuable foundations for the local and regional economy. Key activities include sight-seeing, surfing and fishing however, these are generally land-based or near-shore activities and are not impacted by the Minerva field activities.

Tourism

The Minerva field is located in an area of the Otway coastline where the Great Ocean Road is positioned. This landmark is considered one of the most famous drives in the world with Tourism Victoria (2017) reporting a total of approximately 8 million visitors to the Great Ocean Road region.

Tourist numbers peak in the area between mid-December and mid-February for the Chinese New Year, with tourist numbers still high in the shoulder periods between mid-February and end April; and November to mid-December.

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 EMBAs. Pipi harvesting occurs in Venus Bay, just outside the eastern portion of the EMBAs.

Surfing

The high energy of the ocean in western Victoria and high waves (associated with the rocky reefs) make this section of coastline ideal for surfing. Surfing is concentrated at Shelly Beach, Crumpets, Murrell's, Yellow Rock, Blacknose Point, White's Beach, Bridgewater, Water Tower, Rifle Range and Narrawong. Surfing, by its very nature, takes place close to the shoreline.

Diving and Snorkelling

Scuba diving and snorkelling usually take place around the offshore reefs and historic wrecks along the coast east of Port Campbell (e.g., Twelve Apostles Marine National Park and The Arches Marine Sanctuary), north east of the Minera field.

Sight-seeing

The visual beauty of the rugged coastal cliffs and the surf beaches make up the primary attractions to the area. This part of the Victorian coastline is promoted nationally as the ‘Shipwreck Coast.’ The sheer vertical coastal cliffs attract tourism, as does the promise of seeing migrating whales, such as the southern right whale, from vantage points around Warrnambool.

The Great Ocean Road tourist drive facilitates most tourist visits to the region. Numerous self-guided tours (e.g., Great South West Walk), picnic facilities and coastal lookouts are provided along the coast, with camping sites, caravan parks, guesthouses, motels and hotels encouraging tourism stays in the area. The Port Campbell visitor information centre provides visitors to the area with information on all these local attractions. A number of operators provide scenic helicopter flights around the Twelve Apostles coastal area.

4.4.4 Commercial 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 4-41). 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 (NOO, 2004). 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). 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.

The Australian Maritime Safety Authority (AMSA) indicates that there are no designated shipping lanes in the vicinity of the Minerva field, however local commercial fishing vessels utilise the area frequently. Ship tracking data from AMSA (Figure 4-41) provides details of the shipping traffic in the area.

The main shipping channel for vessels (e.g., cargo tankers) travelling between major Australian and foreign ports is located south of the Minerva field, about 75 km (40 nmi) south of Warrnambool. This shipping channel is used by over 1,000 vessels per year, or about 3-4 vessels per day.

4.4.5 Oil and Gas Activities

Petroleum exploration has been undertaken within the Otway Basin since the early 1960s. Gas reserves of approximately 2 trillion cubic feet have been discovered in the offshore Otway Basin since 1995, with production from five gas fields using 700 km of offshore and onshore pipeline. Numerous exploration wells have been drilled and seismic surveys have been undertaken in the permits of the Otway Basin.

Nearby production fields include the Otway Gas Field Development, operated by Beach Energy and the Casino, Henry, Netherby (CHN) gas field operated by Cooper Energy are within the EMBAs.

4.4.6 Defence Activities

The Defence Force uses offshore areas for training operations including live firing, bombing practice from aircraft, air-to-air and air-to-sea or ground firing, anti-aircraft firing, firing from shore batteries or ships, remote controlled craft firing, and rocket and guided weapons firing.

Five training and practice areas are located in and around Port Phillip Bay and Western Port Bay. This is to the east of the Minerva field and within the EMBAs (Figure 4-40).

Mine fields were laid in Australian waters during World War II. Post-war minefields were swept to remove mines and to make marine waters safe for maritime activities. There are three areas identified as dangerous due to unexploded ordnance (UXO), though these are located south and east of Wilson's Promontory (approximately 300 km east of the Minerva field).

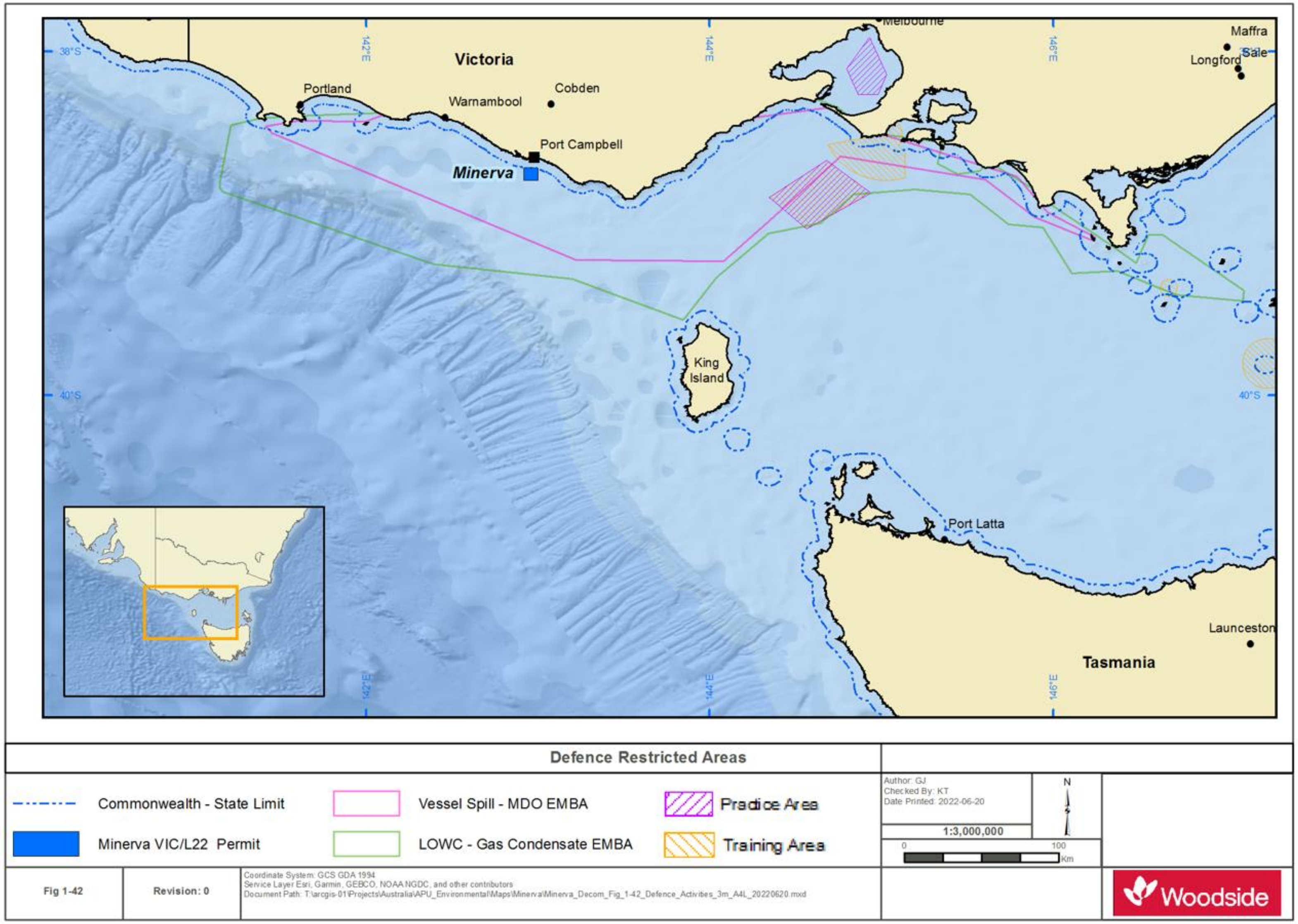


Figure 4-40: Defence activities within the region

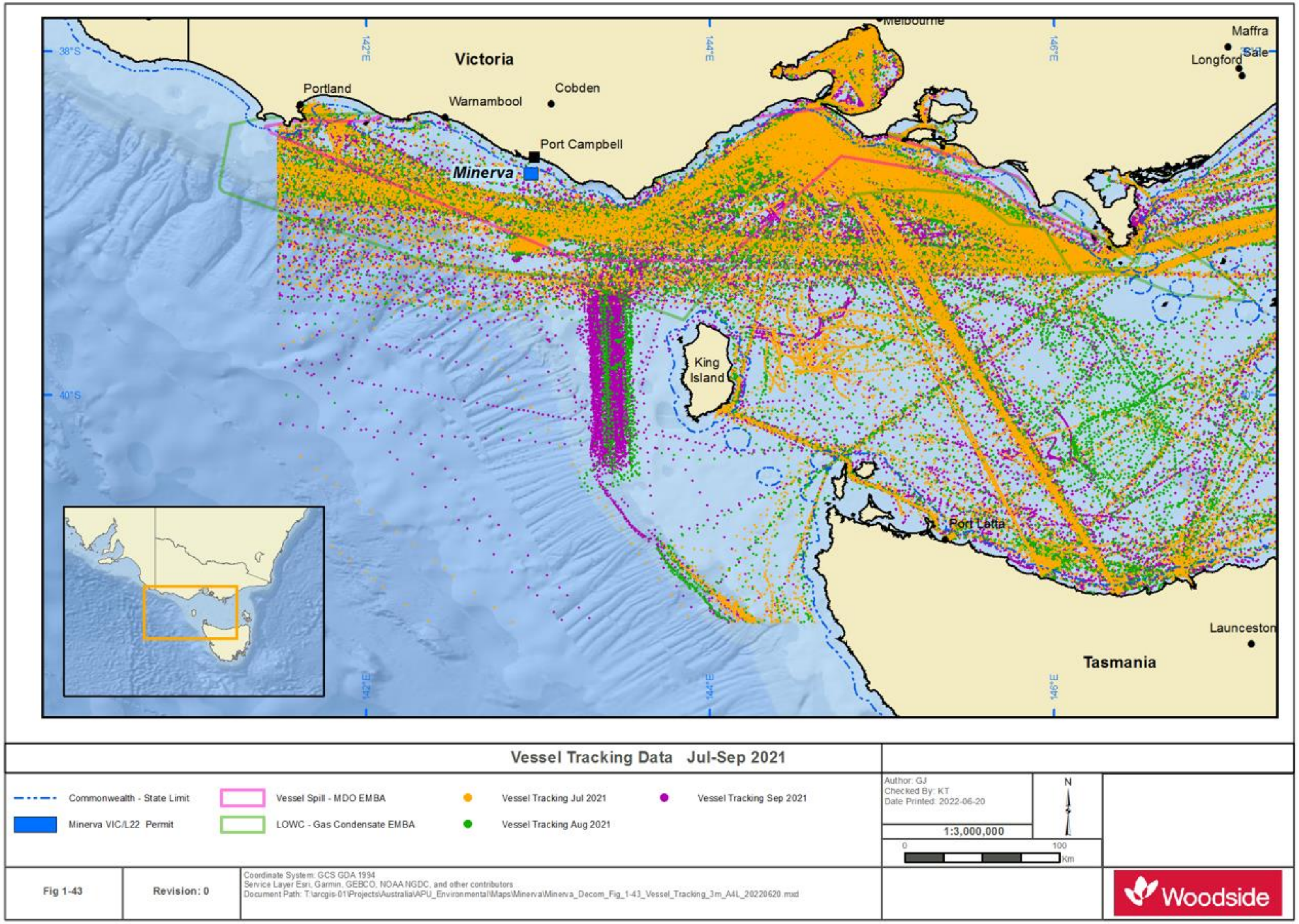


Figure 4-41: Vessel tracking data within the region

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EPBC ACT PROTECTED MATTERS SEARCH REPORT: OPERATIONAL AREA

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 04-May-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	65
Listed Migratory Species:	45

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

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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	80
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	13
Key Ecological Features (Marine):	None
Biologically Important Areas:	15
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

National Heritage Places [Resource Information]

Name	State	Legal Status
Historic		
Great Ocean Road and Scenic Environs	VIC	Listed place

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
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 sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	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	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	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

Scientific Name	Threatened Category	Presence Text
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may 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	Species or species habitat may 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
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat may occur within area
FISH		
Galaxiella pusilla Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Vulnerable	Species or species habitat may occur within area
Nannoperca obscura Yarra Pygmy Perch [26177]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Seriolella brama		
Blue Warehou [69374]	Conservation Dependent	Species or species habitat known to occur within area
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area
FROG		
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat likely to occur within area
MAMMAL		
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 likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Miniopterus orianae bassanii Southern Bent-wing Bat [87645]	Critically Endangered	Species or species habitat likely to occur within area
Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area
Potorous tridactylus trisulcatus Long-nosed Potoroo (southern mainland) [86367]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
PLANT		
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat may occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	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 may occur within area
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis tenuissima Swamp Greenhood, Dainty Swamp Orchid [13139]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Senecio psilocarpus Swamp Fireweed, Smooth-fruited Groundsel [64976]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat likely to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat may occur within area
REPTILE		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
SHARK		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Galeorhinus galeus School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur 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 sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	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]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may 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	Species or species habitat may 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		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]		Species or species habitat may occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine 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 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]		Species or species habitat likely to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat known to occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Stercorarius skua as Catharacta skua Great Skua [823]		Species or species habitat may occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche bulleri platei as Thalassarche sp. nov.		
Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may 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	Species or species habitat may 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
Thinornis cucullatus as Thinornis rubricollis		
Hooded Dotterel, Hooded Plover [87735]		Species or species habitat may occur within area overfly marine area
Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis		
Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area
Fish		
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
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
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

Scientific Name	Threatened Category	Presence Text
Maroubra perserrata Sawtooth Pipefish [66252]		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

Scientific Name	Threatened Category	Presence Text
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammal		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptile		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		

Current Scientific Name	Status	Type of Presence
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Orcinus orca Killer Whale, Orca [46]		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

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Port Campbell	National Park	VIC

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State
West Victoria RFA	Victoria

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Casino Gas Field Development	2003/1295	Controlled Action	Post-Approval
Otway Development	2002/621	Controlled Action	Post-Approval
Not controlled action			
Enterprise 1 Exploration Drilling Program, near Port Campbell, Vic	2019/8438	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Victorian Generator Project	2005/1984	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Moonlight Head' 3D seismic survey, VIC/P38(V), VIC/P43 and	2005/2236	Not Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
VIC/RL8		(Particular Manner)	
3D seismic program VIC/P38(v), VIC/P43 and VIC/RL8	2003/1137	Not Controlled Action (Particular Manner)	Post-Approval
Enterprise Three-dimensional Transition Zone Seismic Survey, Victoria	2016/7800	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
The Enterprise 3D Seismic Acquisition Survey, Otway Basin, Vic	2012/6565	Not Controlled Action (Particular Manner)	Post-Approval
Vic/P37(v) and Vic/P44 3D marine seismic survey	2003/1102	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
The Enterprise 3D Seismic Acquisition Survey, Otway Basin, VIC	2012/6545	Referral Decision	Completed

Biologically Important Areas

Scientific Name	Behaviour	Presence
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Foraging	Likely to occur
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Foraging	Known to occur
Diomedea exulans antipodensis Antipodean Albatross [82269]	Foraging	Known to occur
Pelecanoides urinatrix Common Diving-petrel [1018]	Foraging	Known to occur
Thalassarche bulleri Bullers Albatross [64460]	Foraging	Known to occur

Scientific Name	Behaviour	Presence
Thalassarche cauta cauta Shy Albatross [82345]	Foraging likely	Likely to occur
Thalassarche chlororhynchos bassi Indian Yellow-nosed Albatross [85249]	Foraging	Known to occur
Thalassarche melanophris Black-browed Albatross [66472]	Foraging	Known to occur
Thalassarche melanophris impavida Campbell Albatross [82449]	Foraging	Known to occur
Sharks		
Carcharodon carcharias White Shark [64470]	Distribution (low density)	Likely to occur
Carcharodon carcharias White Shark [64470]	Known distribution	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging (annual high use area)	Known to occur
Eubalaena australis Southern Right Whale [40]	Known core range	Known to occur
Eubalaena australis Southern Right Whale [40]	Migration and resting on migration	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

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

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

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

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EPBC ACT PROTECTED MATTERS SEARCH REPORT: WIDER EMBA

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 17-May-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	3
Wetlands of International Importance (Ramsar	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	11
Listed Threatened Species:	111
Listed Migratory Species:	75

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

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 Lands:	10
Commonwealth Heritage Places:	1
Listed Marine Species:	122
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	73
Regional Forest Agreements:	2
Nationally Important Wetlands:	9
EPBC Act Referrals:	157
Key Ecological Features (Marine):	2
Biologically Important Areas:	32
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

National Heritage Places [Resource Information]

Name	State	Legal 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 Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Glenelg estuary and discovery bay wetlands	Within 10km of Ramsar site
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 a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
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 known to occur within area

Community Name	Threatened Category	Presence Text
Karst springs and associated alkaline fens of the Naracoorte Coastal Plain Bioregion	Endangered	Community may 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 likely to occur within area
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (Eucalyptus ovata / E. brookeriana)	Critically Endangered	Community may occur within area
Tasmanian white gum (Eucalyptus viminalis) wet forest	Critically Endangered	Community may 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]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour 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

Scientific Name	Threatened Category	Presence Text
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
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
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat 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

Scientific Name	Threatened Category	Presence Text
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
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

Scientific Name	Threatened Category	Presence Text
Phoebetria fusca Sooty Albatross [1075]	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	Species or species habitat may occur within area
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat 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 bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 known to occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
CRUSTACEAN		
Euastacus bispinosus Glenelg Spiny Freshwater Crayfish, Pricklyback [81552]	Endangered	Species or species habitat likely to occur within area
FISH		
Galaxiella pusilla Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Vulnerable	Species or species habitat known to occur within area
Hoplostethus atlanticus Orange Roughy, Deep-sea Perch, Red Roughy [68455]	Conservation Dependent	Species or species habitat likely to occur within area
Nannoperca obscura Yarra Pygmy Perch [26177]	Vulnerable	Species or species habitat known to occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Seriolella brama		
Blue Warehou [69374]	Conservation Dependent	Species or species habitat known to occur within area
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area
FROG		
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
INSECT		
Synemon plana		
Golden Sun Moth [25234]	Vulnerable	Species or species habitat may occur within area
MAMMAL		
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
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

Scientific Name	Threatened Category	Presence Text
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
Miniopterus orianae bassanii Southern Bent-wing Bat [87645]	Critically Endangered	Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat known to occur within area
Perameles gunnii Victorian subspecies Eastern Barred Bandicoot (Mainland) [88020]	Endangered	Translocated population known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus trisulcatus Long-nosed Potoroo (southern mainland) [86367]	Vulnerable	Species or species habitat known to occur within area
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat may occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known 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

Scientific Name	Threatened Category	Presence Text
PLANT		
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat likely to occur within area
Astelia australiana Tall Astelia [10851]	Vulnerable	Species or species habitat may occur within area
Caladenia calcicola Limestone Spider-orchid [10065]	Vulnerable	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 orientalis Eastern Spider Orchid [83410]	Endangered	Species or species habitat known to occur within area
Caladenia ornata Ornate Pink Fingers [76213]	Vulnerable	Species or species habitat may 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 likely to occur within area
Dodonaea procumbens Trailing Hop-bush [12149]	Vulnerable	Species or species habitat may occur within area
Eucalyptus strzeleckii Strzelecki Gum [55400]	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

Scientific Name	Threatened Category	Presence Text
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 known to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat known 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
Lepidium aschersonii Spiny Pepper-cress [10976]	Vulnerable	Species or species habitat known to occur within area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat known to occur within area
Leucochrysum albicans subsp. tricolor Hoary Sunray, Grassland Paper-daisy [89104]	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
Prasophyllum diversiflorum Gorae Leek-orchid [13210]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
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 known to occur within area
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat known to occur within area
Pterostylis tenuissima Swamp Greenhood, Dainty Swamp Orchid [13139]	Vulnerable	Species or species habitat known to occur within area
Rutidosis leptorhynchoides Button Wrinklewort [67251]	Endangered	Species or species habitat may occur within area
Senecio macrocarpus Large-fruit Fireweed, Large-fruit Groundsel [16333]	Vulnerable	Species or species habitat likely to occur within area
Senecio psilocarpus Swamp Fireweed, Smooth-fruited Groundsel [64976]	Vulnerable	Species or species habitat known 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 known to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		

Scientific Name	Threatened Category	Presence Text
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
Delma impar		
Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Tympanocryptis pinguicolla		
Grassland Earless Dragon [66727]	Endangered	Species or species habitat may occur within area
SHARK		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Centrophorus zeehaani		
Southern Dogfish, Endeavour Dogfish, Little Gulper Shark [82679]	Conservation Dependent	Species or species habitat likely to occur within area
Galeorhinus galeus		
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat likely to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat known to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may 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 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
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may 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 known to occur within area

Migratory Marine Species

Scientific Name	Threatened Category	Presence Text
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 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	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
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]		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]	Vulnerable	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 area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
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	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat 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
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

Scientific Name	Threatened Category	Presence Text
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Foraging, feeding or related behaviour 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 Lands [Resource Information]

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

Commonwealth Land Name	State
Defence	
Defence - TRAINING CENTRE (Norris Barracks) - Portsea [21025]	VIC
Defence - WARRNAMBOOL TRAINING DEPOT [21111]	VIC
Defence - WEST HEAD GUNNERY RANGE [21112]	VIC
Unknown	
Commonwealth Land - [21509]	VIC

Commonwealth Land Name	State
Commonwealth Land - [21487]	VIC
Commonwealth Land - [21583]	VIC
Commonwealth Land - [21582]	VIC
Commonwealth Land - [22391]	VIC
Commonwealth Land - [21570]	VIC
Commonwealth Land - [21492]	VIC

Commonwealth Heritage Places

[Resource Information]

Name	State	Status
Historic		
Sorrento Post Office	VIC	Listed place

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat known to occur within area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Ardenna tenuirostris as Puffinus tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni as Diomedea 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
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area overfly marine area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area overfly marine area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area
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
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Larus dominicanus Kelp Gull [809]		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 overfly marine area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area overfly marine area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine 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 overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area overfly marine area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat known to occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area overfly marine 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
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 within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area overfly marine area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area overfly marine area
Stercorarius skua as Catharacta skua Great Skua [823]		Species or species habitat may occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may 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 as Thalassarche sp. nov. Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may 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 known to occur within area
Thalasseus bergii as Sterna bergii Greater Crested Tern [83000]		Breeding known to occur within area
Thinornis cucullatus as Thinornis rubricollis Hooded Dotterel, Hooded Plover [87735]		Species or species habitat known to occur within area overfly marine area
Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Tringa incana as Heteroscelus incanus Wandering Tattler [831]		Foraging, feeding or related behaviour known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area overfly marine area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area overfly marine area
Fish		
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

Scientific Name	Threatened Category	Presence Text
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 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

Scientific Name	Threatened Category	Presence Text
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
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

Scientific Name	Threatened Category	Presence Text
Vanacampus poecilolaemus		
Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammal		
Arctocephalus forsteri		
Long-nosed Fur-seal, New Zealand Fur-seal [20]		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]	Endangered	Species or species habitat known to occur within area
Reptile		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata		
Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis		
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Current Scientific Name	Status	Type of Presence
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
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
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 sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
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]		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 habitat may occur within area

Current Scientific Name	Status	Type of Presence
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]

Park Name	Zone & IUCN Categories
Apollo	Multiple Use Zone (IUCN VI)
Beagle	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves

[Resource Information]

Protected Area Name	Reserve Type	State
Aire River	Heritage River	VIC
Aire River W.R.	Natural Features Reserve	VIC
Aireys Inlet B.R.	Natural Features Reserve	VIC
Anglesea B.R.	Natural Features Reserve	VIC
Anser Island	Reference Area	VIC
Barham Paradise S.R.	Natural Features Reserve	VIC
Barwon Bluff	Marine Sanctuary	VIC
Bay of Islands Coastal Park	Conservation Park	VIC
Breamlea F.F.R.	Nature Conservation Reserve	VIC

Protected Area Name	Reserve Type	State
Bunurong	Marine National Park	VIC
Bunurong Marine Park	National Parks Act Schedule 4 park or reserve	VIC
Cape Liptrap Coastal Park	Conservation Park	VIC
Cape Nelson	State Park	VIC
Cape Patterson N.C.R	Natural Features Reserve	VIC
Churchill Island	Marine National Park	VIC
Conewarre K47 SS.R.	Natural Features Reserve	VIC
Conewarre K48 SS.R.	Natural Features Reserve	VIC
Curdie Vale N.C.R.	Natural Features Reserve	VIC
Deen Maar	Indigenous Protected Area	VIC
Devils Tower	Nature Reserve	TAS
Discovery Bay	Marine National Park	VIC
Discovery Bay Coastal Park	Conservation Park	VIC
Eagle Rock	Marine Sanctuary	VIC
East Moncoeur Island	Conservation Area	TAS
Edna Bowman N.C.R.	Natural Features Reserve	VIC
Fingal B.R	Natural Features Reserve	VIC
Goose Lagoon W.R	Natural Features Reserve	VIC
Great Otway	National Park	VIC
Johanna Falls S.R.	Natural Features Reserve	VIC
Lady Julia Percy Island W.R.	Nature Conservation Reserve	VIC
Lake Connewarre W.R	Natural Features Reserve	VIC

Protected Area Name	Reserve Type	State
Lake Gillear W.R	Natural Features Reserve	VIC
Latrobe B.R.	Natural Features Reserve	VIC
Lawrence Rocks W.R.	Nature Conservation Reserve	VIC
Lily Pond B.R.	Natural Features Reserve	VIC
Lonsdale Lakes W.R	Nature Conservation Reserve	VIC
Marengo N.C.R.	Nature Conservation Reserve	VIC
Marengo Reefs	Marine Sanctuary	VIC
Merri	Marine Sanctuary	VIC
Mornington Peninsula	National Park	VIC
Mushroom Reef	Marine Sanctuary	VIC
Painkalac Creek	Reference Area	VIC
Parker River	Reference Area	VIC
Phillip Island Nature Park	Other	VIC
Point Addis	Marine National Park	VIC
Point Danger	Marine Sanctuary	VIC
Point Nepean	National Park	VIC
Port Campbell	National Park	VIC
Portland H46 B.R.	Natural Features Reserve	VIC
Portland H47 B.R.	Natural Features Reserve	VIC
Port Phillip Heads	Marine National Park	VIC
Princetown W.R	Natural Features Reserve	VIC
Queenscliff N.F.R	Natural Features Reserve	VIC
Rodondo Island	Nature Reserve	TAS

Protected Area Name	Reserve Type	State
Southern Wilsons Promontory	Remote and Natural Area - Schedule 6, National Parks Act	VIC
Stony Creek (Otways)	Reference Area	VIC
Swan Bay - Edwards Point W.R	Nature Conservation Reserve	VIC
The Arches	Marine Sanctuary	VIC
Tower Hill W.R	Natural Features Reserve	VIC
Twelve Apostles	Marine National Park	VIC
Unnamed P0176	Private Nature Reserve	VIC
Waratah B.R	Natural Features Reserve	VIC
West Moncoeur Island	Nature Reserve	TAS
Wild Dog B.R.	Natural Features Reserve	VIC
Wild Dog Creek SS.R.	Natural Features Reserve	VIC
Wilsons Promontory	National Park	VIC
Wilsons Promontory	Marine National Park	VIC
Wilsons Promontory Islands	Remote and Natural Area - Schedule 6, National Parks Act	VIC
Wilsons Promontory Marine Park	National Parks Act Schedule 4 park or reserve	VIC
Wilsons Promontory Marine Reserve	National Parks Act Schedule 4 park or reserve	VIC
Wongarra B.R.	Natural Features Reserve	VIC
Wonthaggi Heathlands N.C.R	Natural Features Reserve	VIC
Yambuk F.F.R.	Nature Conservation Reserve	VIC

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State
Gippsland RFA	Victoria
West Victoria RFA	Victoria

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Aire River	VIC
Lake Connewarre State Wildlife Reserve	VIC
Lower Aire River Wetlands	VIC
Lower Merri River Wetlands	VIC
Princetown Wetlands	VIC
Swan Bay & Swan Island	VIC
Tower Hill	VIC
Western Port	VIC
Yambuk Wetlands	VIC

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Alston-1 petroleum exploration well, permit VIC/P44	2003/1315	Controlled Action	Post-Approval
Bald Hills Wind Farm 80 Turbines	2002/730	Controlled Action	Post-Approval
Casino Gas Field Development	2003/1295	Controlled Action	Post-Approval
City Of Greater Geelong Mosquito Control Program 2021-2030, Vic	2020/8782	Controlled Action	Further Information Request
Establishment of plantation for use of effluent water	2003/1063	Controlled Action	Completed
Lonsdale Golf Club Redevelopment	2003/969	Controlled Action	Post-Approval
Lorne Golf Course redevelopment	2004/1513	Controlled Action	Post-Approval
Marinus Link underground and subsea electricity interconnector cable	2021/9053	Controlled Action	Assessment Approach

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Mosquito Control	2005/2132	Controlled Action	Post-Approval
Otway Development	2002/621	Controlled Action	Post-Approval
Pacific Hydro (Portland) Wind Farm SW Victoria	2000/18	Controlled Action	Post-Approval
Port Phillip Bay Channel Deepening	2002/576	Controlled Action	Post-Approval
Redevelopment of post office and construction of dwellings	2007/3639	Controlled Action	Completed
Residential and Golf Course Development Project	2003/1144	Controlled Action	Post-Approval
Residential Subdivision & Infrastructure Parish of Belfast	2005/1954	Controlled Action	Completed
Schomberg 3D Marine Seismic Survey	2007/3754	Controlled Action	Completed
Strike Oil Gas Exploration Well, Otway Basin (VIC/P44)	2000/97	Controlled Action	Completed
Twelve Apostles Saddle Lookout	2019/8571	Controlled Action	Post-Approval
VIC Offshore Windfarm	2021/8966	Controlled Action	Assessment Approach
VICP61 2D Marine Seismic Survey	2008/4075	Controlled Action	Completed
Victorian Desalination Project, Bass Coast	2008/3948	Controlled Action	Post-Approval
Wind Turbines	2001/439	Controlled Action	Completed
Not controlled action			
accomodation units and associatedadministration and recreational facilities	2001/430	Not Controlled Action	Completed
Airey Inlet water reclamation plant to Anglesea sewerage system	2006/2539	Not Controlled Action	Completed
Alteration of Grass Maintenance Regime within Powling St Wetlands	2012/6527	Not Controlled Action	Completed
Amrit-1 exploration well	2004/1572	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Anglesea Mine South Wall Vegetation removal, Anglesea, Vic	2017/8060	Not Controlled Action	Completed
Apollo Bay Water Storage Basin, VIC	2012/6484	Not Controlled Action	Completed
Barwon Heads Rd gas pipeline installation	2006/2769	Not Controlled Action	Completed
Barwon Heads Stormwater Outfall upgrade, Victoria	2016/7650	Not Controlled Action	Completed
Bluff Heights Estate Stages 2 to 4	2003/1047	Not Controlled Action	Completed
Boneo Park Equestrian Centre	2008/4639	Not Controlled Action	Completed
CO2 geosequestration - Otway Basin Pilot Project	2006/2699	Not Controlled Action	Completed
Communications tower extension	2003/1099	Not Controlled Action	Completed
Construct a Recycled Water Pipeline from Somers Treatment Plant to Blue Scope S	2009/4982	Not Controlled Action	Completed
Construction and operation of Barwon Water biosolids treatment facility	2008/4345	Not Controlled Action	Completed
Construction of Barwon Heads Bridge	2005/2375	Not Controlled Action	Completed
Construction of Infrastructure to Extract, Treat & Transfer Groundwater to Wurde	2008/4104	Not Controlled Action	Completed
Construction of Overtaking Lanes on Great Ocean Rd	2008/4044	Not Controlled Action	Completed
construction of pump station for pump diversion from the Barham River	2003/1242	Not Controlled Action	Completed
Construction of the Edgars Road Extension, from Childs Road, Lalor to Cooper Street, Epping	2003/1135	Not Controlled Action	Completed
Development of Pt Nepean Quarantine Station (former) National Centre for Coasts and Climate	2008/4653	Not Controlled Action	Completed
Divestment of Norris Barracks	2003/963	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Drilling of Callister-1 exploration well in VIC/P51	2004/1633	Not Controlled Action	Completed
Enterprise 1 Exploration Drilling Program, near Port Campbell, Vic	2019/8438	Not Controlled Action	Completed
Exploration drilling for liquid/gaseous hydrocarbons	2004/1681	Not Controlled Action	Completed
Ferry Service Infrastructure Development	2001/269	Not Controlled Action	Completed
Gas Field Development	2006/2635	Not Controlled Action	Completed
Gas Fields Development	2011/5879	Not Controlled Action	Completed
Gas Pipeline Installation	2005/2495	Not Controlled Action	Completed
Golflinks Road Residential Development & Water Storage Facility at Barwon Heads	2004/1793	Not Controlled Action	Completed
Grevillea infecunda tip cuttings and soil samples	2005/1979	Not Controlled Action	Completed
Halladale and Speculant Gas Pipeline Project, North of Port Campbell, Vic	2015/7551	Not Controlled Action	Completed
Henry-1 Exploration Well, Petroleum Permit Area VIC/P44	2005/2147	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Installation of a 35 metre telecommunications facility at Jirrahlinga Animal San	2003/1151	Not Controlled Action	Completed
Installation of optic fibre cable from Inverloch, Victoria to Stanley, Tasmania	2002/906	Not Controlled Action	Completed
Kelly Swamp Boardwalk Construction	2010/5371	Not Controlled Action	Completed
Maintenance and priority works to heritage buildings at Point Nepean Quarantine	2006/3151	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Maintenance Dredging South Channel 2012	2011/6198	Not Controlled Action	Completed
Maintenance of Access Track and Weed Removal	2009/4973	Not Controlled Action	Completed
Maintenance works at Barwon Heads Bridge	2003/1199	Not Controlled Action	Completed
Marine and Freshwater Resources Institute (MAFRI) Facility	2000/121	Not Controlled Action	Completed
Minerva Cut Back Project, Vic	2017/8036	Not Controlled Action	Completed
Newfield wind farm	2007/3226	Not Controlled Action	Completed
Newhaven Yacht Squadron marina extension	2004/1450	Not Controlled Action	Completed
Nirranda South Wind Farm Pty Ltd	2002/763	Not Controlled Action	Completed
Ocean Grove rising main 2 upgrade	2009/4978	Not Controlled Action	Completed
Ocean Grove Rising Main 2 Upgrade (OGRM2) - East Section & River Crossing	2010/5508	Not Controlled Action	Completed
Offshore exploration drilling within permit area VIC/P 37(v)	2004/1466	Not Controlled Action	Completed
Optic fibre cable installation - San Remo to Cowes	2005/2386	Not Controlled Action	Completed
Point Nepean Quarantine Station (former)/Restoration of Medical Superintendent's	2006/3149	Not Controlled Action	Completed
Port Campbell Headland Walking Trail Realignment	2012/6676	Not Controlled Action	Completed
Portland Landfill Borehole Installation, Vic	2017/7886	Not Controlled Action	Completed
Port Phillip Channel Deepening Project - Trial Dredge Program	2005/2164	Not Controlled Action	Completed
Proposed replacement of existing road culvert	2013/7077	Not Controlled Action	Completed
Queenscliff Harbour Redevelopment	2004/1352	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Railway Bridge (H0151) Partial Demolition, Merri River	2010/5534	Not Controlled Action	Completed
Rehabilitation of Lake Connewarre State Game Reserve	2002/708	Not Controlled Action	Completed
Remedial Works to the Swan Island Bridge	2003/1129	Not Controlled Action	Completed
Replacement of sewer pipelines	2002/623	Not Controlled Action	Completed
Residential/Resort/Golf Course development	2002/907	Not Controlled Action	Completed
Residential Dwelling	2004/1896	Not Controlled Action	Completed
Ryan Corner Wind Farm	2005/2142	Not Controlled Action	Completed
Stage 1 residential subdivision, Anna Catherine Drive	2005/1992	Not Controlled Action	Completed
St Quentin Consulting Pty Ltd /Residential development/305 Great Ocean Road, Jan Juc/VIC/Development of approximately 10.3ha of land into 14 residential lots	2014/7184	Not Controlled Action	Completed
Telstra optic fibre cable across Bass Strait - Sub bottom profiler Surve	2002/779	Not Controlled Action	Completed
To construct a shared trail within the Arthurs Seat Road, road reserve south side from Mornington Flinders Road	2004/1565	Not Controlled Action	Completed
Torquay Sewerage Strategy - pipe replacement between Torquay and the Black Rock	2004/1704	Not Controlled Action	Completed
Track construction - Great Ocean Walk	2002/793	Not Controlled Action	Completed
Transfer of 90ha Point Nepean Quarantine Station from Commonwealth to Victorian	2008/4521	Not Controlled Action	Completed
Venus Bay Outfall Extension	2004/1555	Not Controlled Action	Completed
VIC-P44 Stage 2 Gas Field Development	2007/3767	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Victorian Generator Project	2005/1984	Not Controlled Action	Completed
Wind Farm Construction and Operation	2001/471	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Moonlight Head' 3D seismic survey, VIC/P38(V), VIC/P43 and VIC/RL8	2005/2236	Not Controlled Action (Particular Manner)	Post-Approval
2D Marine Seismic Survey	2005/2295	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2003/1214	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey in VIC/P50 and VIC/P46	2004/1810	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey VIC/P50	2005/2313	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey near King Island	2004/1461	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey within Torquay Sub-basin off sthn Victoria	2012/6256	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic program VIC/P38(v), VIC/P43 and VIC/RL8	2003/1137	Not Controlled Action (Particular Manner)	Post-Approval
Astrolabe 3D Marine Seismic Survey	2011/6048	Not Controlled Action (Particular Manner)	Post-Approval
Barwon Heads Rising Main No.11 Sewerage Pipe Upgrade	2008/4091	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Benbows Paddock residential development, Cape Bridgewater	2007/3247	Not Controlled Action (Particular Manner)	Post-Approval
Bernoulli 3D Seismic Survey	2006/3053	Not Controlled Action (Particular Manner)	Post-Approval
BHPBilliton Otway 3D Seismic Survey	2007/3443	Not Controlled Action (Particular Manner)	Post-Approval
Construction of bridge across Barwon River	2006/2947	Not Controlled Action (Particular Manner)	Post-Approval
Construct single dwelling	2008/4504	Not Controlled Action (Particular Manner)	Post-Approval
Controlled Burn, Understorey Clearance and Removal of UXO	2003/1030	Not Controlled Action (Particular Manner)	Post-Approval
Deepwater Sorell Basin 2001 Non-Exclusive 2D Seismic Survey	2001/156	Not Controlled Action (Particular Manner)	Post-Approval
Drill and Profile Exploration Well Somerset 1, License Area T34P	2009/5037	Not Controlled Action (Particular Manner)	Post-Approval
Enterprise Three-dimensional Transition Zone Seismic Survey, Victoria	2016/7800	Not Controlled Action (Particular Manner)	Post-Approval
Fuelbreak construction	2009/4915	Not Controlled Action (Particular Manner)	Post-Approval
Geelong Bypass Section 3	2005/2099	Not Controlled Action (Particular Manner)	Post-Approval
Geographe-A gas exploration well	2000/82	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Gippsland 2D Marine Seismic Survey - VIC/P-63, VIC/P-64 and T/46P	2009/5241	Not Controlled Action (Particular Manner)	Post-Approval
Hydrocarbon exploration wells	2003/1062	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
La Bella 3D Marine Seismic Survey, Otway Basin, VIC	2012/6683	Not Controlled Action (Particular Manner)	Post-Approval
Maintenance Dredging Program 2012-21 in Port of Melbourne	2012/6332	Not Controlled Action (Particular Manner)	Post-Approval
OTE10 2D Marine Seismic Survey	2009/5223	Not Controlled Action (Particular Manner)	Post-Approval
Otway Astrolabe 3D Marine Seismic Survey, Otway Basin	2012/6421	Not Controlled Action (Particular Manner)	Post-Approval
Otway Basin Exploration Drilling Campaign, Vic	2011/6125	Not Controlled Action (Particular Manner)	Post-Approval
Residential Development and Associated Infrastructure at Port Fairy	2012/6687	Not Controlled Action (Particular Manner)	Post-Approval
Santos 2D Seismic Survey VIC/P44 & VIC/P51	2003/1213	Not Controlled Action (Particular Manner)	Post-Approval
Santos Otway 3d Seismic VIC/P44	2007/3367	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Schomberg 3D Marine Seismic survey	2007/3868	Not Controlled Action (Particular Manner)	Post-Approval
SEA Gas Project transmission pipeline	2001/513	Not Controlled Action (Particular Manner)	Post-Approval
Seismic Survey VIC-P46	2002/826	Not Controlled Action (Particular Manner)	Post-Approval
Shaw River Power Station construct gas pipeline and associated infrastructure	2009/5089	Not Controlled Action (Particular Manner)	Post-Approval
Shaw River Power Station Project - Water Supply Pipeline	2009/5091	Not Controlled Action (Particular Manner)	Post-Approval
Southern Gas Pipeline Project	2002/619	Not Controlled Action (Particular Manner)	Post-Approval
Speculant 3D Transition Zone Seismic Survey	2010/5558	Not Controlled Action (Particular Manner)	Post-Approval
Strike Oil NL Seismic Surveys	2000/107	Not Controlled Action (Particular Manner)	Post-Approval
The Enterprise 3D Seismic Acquisition Survey, Otway Basin, Vic	2012/6565	Not Controlled Action (Particular Manner)	Post-Approval
Thylacine-A Exploration Well	2000/81	Not Controlled Action (Particular Manner)	Post-Approval
Torquay Sub-basin (VIC/P62) OTE12-3D Seismic Survey	2012/6655	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5700	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Vic/P37(v) and Vic/P44 3D marine seismic survey	2003/1102	Not Controlled Action (Particular Manner)	Post-Approval
VIC P44 Gas Exploration Wells	2002/662	Not Controlled Action (Particular Manner)	Post-Approval
Vic-P51 and Vic-P52 2D seismic survey	2002/811	Not Controlled Action (Particular Manner)	Post-Approval
Vic-P51 and Vic-P52 3D seismic survey	2002/799	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D & 3D Seismic Surveys - Permit Area - VIC/P50	2008/4517	Referral Decision	Completed
3D Marine Seismic Survey	2011/6156	Referral Decision	Completed
3D Seismic Survey	2008/4014	Referral Decision	Completed
All actions taken in response to the current severe bushfires in Victoria.	2009/4787	Referral Decision	Completed
Alteration Reconstruction Restoration and Repairs to Buildings	2008/4179	Referral Decision	Completed
Offshore Tidal Energy Facility and Submarine Cable	2008/4480	Referral Decision	Referral Publication
Portland Wave Energy Project	2008/3946	Referral Decision	Completed
Residential Development Elizabeth Avenue, Rosebud West, VIC	2015/7603	Referral Decision	Completed
The Enterprise 3D Seismic Acquisition Survey, Otway Basin, VIC	2012/6545	Referral Decision	Completed
Upgrade of Services Infrastructure Point Nepean Quarantine Station	2008/4591	Referral Decision	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
VICP61 2D Marine Seismic Survey	2008/3975	Referral Decision	Completed
Works to the buildings and surrounds at the former Point Nepean Quarantine Stati	2008/4156	Referral Decision	Completed

Key Ecological Features

[Resource Information]

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

Name	Region
Bonney Coast Upwelling	South-east
West Tasmania Canyons	South-east

Biologically Important Areas

Scientific Name	Behaviour	Presence
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Foraging	Likely to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Breeding	Known to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Known to occur
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Foraging	Known to occur
Diomedea exulans antipodensis Antipodean Albatross [82269]	Foraging	Known to occur
Eudyptula minor Little Penguin [1085]	Breeding	Known to occur
Eudyptula minor Little Penguin [1085]	Foraging	Known to occur

Scientific Name	Behaviour	Presence
Morus serrator Australasian Gannet [1020]	Aggregation	Known to occur
Morus serrator Australasian Gannet [1020]	Foraging	Known to occur
Pelagodroma marina White-faced Storm-petrel [1016]	Foraging	Known to occur
Pelecanoides urinatrix Common Diving-petrel [1018]	Breeding	Known to occur
Pelecanoides urinatrix Common Diving-petrel [1018]	Foraging	Known to occur
Phalacrocorax fuscescens Black-faced Cormorant [59660]	Foraging	Known to occur
Thalassarche bulleri Bullers Albatross [64460]	Foraging	Known to occur
Thalassarche cauta cauta Shy Albatross [82345]	Foraging likely	Likely to occur
Thalassarche chlororhynchos bassi Indian Yellow-nosed Albatross [85249]	Foraging	Known to occur
Thalassarche melanophris Black-browed Albatross [66472]	Foraging	Known to occur
Thalassarche melanophris impavida Campbell Albatross [82449]	Foraging	Known to occur
Sharks		
Carcharodon carcharias White Shark [64470]	Breeding (nursery area)	Known to occur
Carcharodon carcharias White Shark [64470]	Distribution	Known to occur
Carcharodon carcharias White Shark [64470]	Distribution	Likely to occur

Scientific Name	Behaviour	Presence
Carcharodon carcharias White Shark [64470]	Distribution (low density)	Likely to occur
Carcharodon carcharias White Shark [64470]	Foraging	Known to occur
Carcharodon carcharias White Shark [64470]	Known distribution	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Likely to be present
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging (annual high use area)	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Known Foraging Area	Known to occur
Eubalaena australis Southern Right Whale [40]	Aggregation	Known to occur
Eubalaena australis Southern Right Whale [40]	Known core range	Known to occur
Eubalaena australis Southern Right Whale [40]	Migration and resting on migration	Known to occur

Bioregional Assessments

SubRegion	BioRegion	Website
Gippsland	Gippsland Basin	BA website

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

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

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

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

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Appendix D

STAKEHOLDER CONSULTATION – STAKEHOLDER FACT SHEETS

Petroleum

Invitation for Feedback: Stakeholder Information Fact Sheet

Minerva Plug & Abandonment and Field Maintenance Environment Plan

Otway Basin, South East Australia

BHP Billiton Petroleum (Victoria) Pty Ltd (BHP) is planning to undertake subsea decommissioning activities at end of field life for the offshore Minerva gas field located in Production Licence (VIC/L22), and the Minerva subsea pipeline which runs from the Minerva wells to the boundary of the Victorian State Waters within Production licence VIC/PL33. The Minerva Petroleum Safety Zone (PSZ) (within VIC/L22) is located approximately 9 km south, south-west (SSW) of the township of Port Campbell, within water depths of approximately 60m.

Production of the Minerva field ceased in September 2019 and the producing wells (Minerva-3 and Minerva-4) were suspended. Additionally, the production pipeline was depressurised, and cleaned of hydrocarbons. A vessel-based campaign was conducted in Q1 2021 to disconnect flowlines from wells and install additional barrier plugs.

For this activity, BHP proposes to permanently plug and abandon (P&A) four wells using a moored semi-submersible mobile offshore drilling unit (MODU).These wells comprise two suspended gas production wells (Minerva-3 and Minerva-4) and two suspended exploration wells (Minerva-1 and Minerva-2A). Once permanently plugged, wellheads will be cut below the seafloor and removed. Minerva 2 well has already been permanently plugged and abandoned.

All subsea infrastructure not removed during the P&A activity, including the suspended production pipeline, shall be suitably maintained to the satisfaction of the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) to ensure removal of the property is not precluded through to planned final decommissioning in 2025.

P&A activities are required to be completed no later than 30 June 2025.

BHP is preparing an Environment Plan (EP) for this activity for submission to NOPSEMA under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. Given detailed project scheduling and MODU contracting is yet to be finalised, this EP will provide for the P&A scope to be undertaken from Q3 2023 to end June 2025. The EP will also cover maintenance activities from the date accepted by NOPSEMA until end June 2025, or until all decommissioning activities have been completed.

Whilst this EP will provide for the P&A activity to be undertaken within a 2-year window of opportunity, the anticipated duration of MODU-based infield operations is less than 2 months. Preparatory operations including pre-lay moorings, cleaning of wellheads and status check of valves are anticipated to be undertaken via an offshore support vessel approximately one month prior to the commencement of MODU-based activities. Preparatory operations are anticipated to take less than a week to complete.

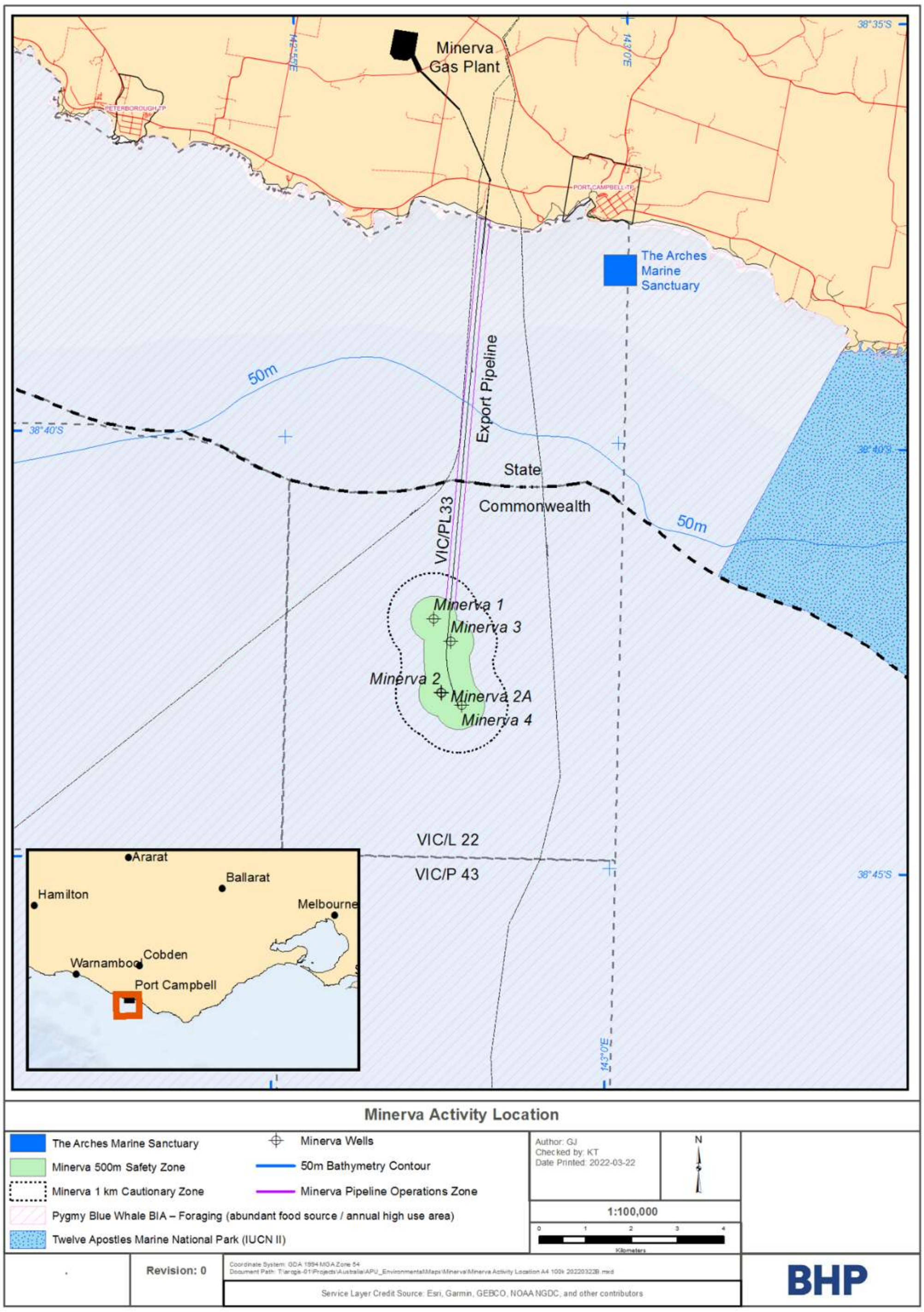
BHP is the designated operator on behalf of the VIC/L22 and VIC/PL33 titleholders, BHP and Cooper Energy (MF) Pty. Ltd. This Stakeholder Fact Sheet relates to the submission of a new Environment Plan for the proposed petroleum activities in VIC/L22 and VIC/PL33, supporting the decommissioning and maintenance of subsea infrastructure in the Minerva Field.

Future decommissioning activities will be covered under separate environmental approvals and relevant stakeholders will continue to be engaged as part of these work scopes.

Location of Operational Area

The Operational Area defines the spatial boundary within which the proposed activities will take place. The Operational Area is temporary for the duration of activities and will comprise a 1 km radius ‘Cautionary Zone’ around each of the wells to account for the anchor spread from the MODU. The approximate distance from the Minerva-1 well (closest to land) the Minerva-4 well (farthest from land) to particular environmental values and sensitivities is presented in the following table.

Value / Sensitivity	Approx. Distance from well centres (km)	
	Minerva-1 well	**Minerva-4 well**
Port Campbell	9.5	11.0
Peterborough	14.1	15.9
The Arches Marine Sanctuary	8.5	10.0
Twelve Apostles Marine National Park	6.2	6.2



Description of activity

	Description	
Earliest expected commencement date and completion date	Earliest P&A start is Q3 2023 calendar year, subject to approvals, MODU and vessel availability, and weather constraints. Pre-lay of mooring equipment may commence prior to MODU mobilisation. P&A complete no later than 30 June 2025. Subsea equipment suitably maintained until final decommissioning in 2025.	
	Coordinates (GDA94)	
Well locations	Latitude (South)	Longitude (East)
Minerva-1	-38° 42' 06.885"	142° 57' 17.278"
Minerva-2A	-38° 42' 59.190"	142° 57' 25.742"
Minerva-3	-38° 42 22.718"	142° 57 32.997"
Minerva-4	-38° 43 07.368"	142° 57 44.023"
Petroleum licences	VIC/L22 and VIC/PL33	
Activity duration (approx.)	P&A activity 60 days depending on weather conditions	
Water depth (approx.)	50-60 m	
Vessels	• Semi-submersible mobile offshore drilling unit (MODU) (moored). • Anchor handling vessels and offshore support vessels.	
Operational area	• A temporary 1 km radius 'Cautionary Zone' around each well – P&A only (VIC/L22). • The existing permanent 500 m radius Petroleum Safety Zone (PSZ) around each well (VIC/L22). • The Minerva Pipeline Operations Zone (VIC/PL33).	

Summary of potential environmental impacts and risks and mitigation measures

Potential Impacts / Risks	Management and / or Mitigations Measures
Planned Activities	
Emissions: Light	• Lighting is minimised to that required for safety and navigational purposes.
Emissions: Underwater noise	• Measures will be in place for interacting with protected marine fauna as per the EPBC Regulations (Part 8) and consistent with relevant Conservation Management Plans.
Physical presence: Interactions with other marine users	• BHP's existing infrastructure is marked on nautical charts. • Establishment of a 500-m safety exclusion zone around the MODU for the duration of the P&A activity. • Consultation with relevant stakeholders (e.g. adjacent petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies) to inform decision making for the proposed activity and the development of the Environment Plan. • BHP will notify relevant fishing industry representative organisations/associations and Government maritime safety agencies of the start and end dates for the activity, and MODU location details and exclusion / cautionary zones prior to commencement of the P&A activity.
Planned discharges to the marine environment	• Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures. • All routine marine discharges will be managed according to legislative and regulatory requirements and BHP's Environment Performance Standards where applicable.
Waste generation	• Waste generated aboard the MODU and support vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Wastes will be managed and disposed of in a safe and environmental responsible manner that prevents accidental loss to the marine environment.

Potential Impacts / Risks	Management and / or Mitigations Measures
	• Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licenced waste contractor.
Unplanned Risks	
Invasive marine species	• BHP contracted vessels comply with Australian biosecurity requirements and guidance, and Australian ballast water requirements. • Vessels will be assessed and managed in line with BHP procedures to prevent the introduction of invasive marine species.
Marine fauna interaction	• Measures will be in place for interacting with protected marine fauna as per the EPBC Regulations (Part 8) and consistent with relevant Conservation Management Plans.
Vessel collision	• Marine notifications will be made to relevant stakeholders, describing the location of the activity and exclusion / cautionary zones to prevent the risk of vessel collisions.
Unplanned releases including hydrocarbons	• All personnel undertaking activities will undergo relevant inductions and training. • Procedures for lifts, equipment maintenance, inspections and bunding. • All offshore activities will be managed in accordance with lifting and transfer procedures. • Well barrier management shall be implemented, tested and monitored. • Recovery of solid wastes lost overboard where safe and practicable to do so. • Oil Pollution Emergency Plan (OPEP) and Operational and Scientific Monitoring Plan (OSMP) in place and tested. • Appropriate vessel spill response plans, equipment and materials will be in place and maintained.

Protecting our people and the environment

Safety of our people and the communities in which we operate always comes first. Identifying, controlling and mitigating safety risks is managed through an overarching, consistent approach guided by BHP's Risk Management governance framework, with supporting processes and performance standards. All activities (routine and non-routine) will be performed in accordance with the industry leading standards established in BHP's Charter, HSEC Framework and Controls, BHP's Wells and Seismic Delivery Management System, Engineering Standards and Procedures, the Environment Plan, the NOPSEMA-accepted Well Operations Management Plan (WOMP) and NOPSEMA-accepted Vessel Safety Case.

Offshore petroleum activities are regulated through a robust and comprehensive environmental protection regime administered by NOPSEMA under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. BHP undertakes risk assessments for all environmental aspects of a petroleum activity and stringently adheres to the regulatory regime.

The objective of the Environment Plan is to ensure that potential adverse impacts and risks to the environment associated with activities, during both routine and non-routine activities, are identified, and will be continuously reduced to as low as reasonably practicable (ALARP) and an acceptable level. BHP is committed to understanding the impacts of our activities on stakeholders with an interest in the Minerva field and seeks feedback as part of the development of the EP.

Responding to emergencies

BHP's incident response plans are accepted by the regulator NOPSEMA. The Commonwealth Oil Pollution Emergency Plan (OPEP) is required by law under the Environmental Regulations and forms an appendix to the full EP. The OPEP outline responsibilities, specific procedures and identify resources available in the unlikely event of an oil pollution incident. BHP maintains a constant vigilance and readiness to prevent and/or respond to hydrocarbon loss of containment incidents. The readiness and competency of BHP to respond to incidents is maintained and tested by conducting activity-specific emergency response exercises.

Should you have any questions, concerns or grievances regarding these activities or any other BHP Petroleum activities, please call BHP WA Community Hotline on **1800 421 077** or send an email to **bhppetexternalaffairs@bhp.com**

BHP believes in putting health and safety first, being environmentally responsible and supporting our communities.

Appendix E

MINERVA FIELD OIL POLLUTION EMERGENCY PLAN