Otway Offshore Operations Environment Plan

Operations | Otway Basin | EP

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Acronyms and Abbreviations

Acronym	Definition
µm	Micrometre
µPa	Micro Pascal
0-pk	zero-to-peak
2D	Two-Dimensional
2DRMS	Twice the Distance Root Mean Square
3D	Three-dimensional
AAD	Australian Antarctic Division
ADIOS	Automated Data Inquiry for Oil Spills
AFMA	Australian Fisheries Management Authority
AGP	Athena Gas Plant
AHS	Australian Hydrographic Service
AHSV	Anchor Handling Support Vessels
ALARP	As Low as Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMOSPlan	Australian Industry Cooperative Oil Spill Plan
AMP	Australian Marine Parks
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment Conservation Council
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
ARS	Area Restricted Search
AS	Australian Standard
ASTM	American Society for Testing and Materials
ASX	Australian Stock exchange
AVCZ	Central Zone Abalone Victoria
AVG	Abalone Viral Ganglioneuritis
bbls	barrels
Bcf	Billion cubic feet
BIA	Biologically Important Area
BOD	Biological Oxygen Demand
BOM	Bureau of Meteorology
BOP	Blowout Preventer
BP	British Petroleum
BPEM	Best Practice Environmental Management
BW	Blackwatch
BWMC	Ballast Water and Sediments Convention

CA	Control Agency
CAMBA	China/Australia Migratory Birds Agreement
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMS	Cooper Energy Management System
CFA	Commonwealth Fisheries Association
CGR	Condensate to-gas Ratio
CH_4	Methane
CHARM	Chemical Hazard Assessment and Risk Management
CHIRP	Compressed High-Intensity Radar Pulse
Chl-A	Chlorophyll A
CHN	Casino-Henry-Netherby
CITES	Convention in International Trade in Endangered Species of Wildlife and Flora
CM	Casino - Matador
CMP	Conservation Management Plan
CMR	Commonwealth Marine Reserve now called Australian Marine Parks
CMT	Crisis Management Team
CO_2	Carbon Dioxide
CoA	Commonwealth of Australia
COE	Cooper Energy
COLREGS	International Regulations for Preventing Collisions at Sea
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSV	Construction Support Vessels
CTD	Conductivity, Temperature and Depth
CTS	Commonwealth Trawl Sector
DAFF	Department of Agriculture, Fisheries and Forestry
DAWE	Department of Agriculture Water and the Environment. Note, at the time of writing DAWE had recently split into DCCEEW and DAFF
DAWR	Department of Agriculture Water and Resources, superseded by Department of Agriculture Water and the Environment (DAWE)
dB	Decibels
dB re 1 µPa	Decibel with a reference level of 1 micro-Pascal
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCV	Domestic Commercial Vessels
DEDJTR EMD	Department of Economic Development Jobs Trade and Resources Emergency Management Division. Previously Department of Transport Planning and Local Infrastructure (DTPLI). Now Department of Jobs Precincts and Regions (DJPR) and Department of Transport (DoT).
DELWP	Department of Environment, Land, Water and Planning
DEWHA	Department of Environment Heritage Water and the Arts
DIIS	Department or Industry Innovation and Science now Department of Industry, Science, Energy and Resources (DISER)

DISER	Department of Industry, Science, Energy and Resources previously Department or Industry Innovation and Science (DIIS)
DJPR	Department of Jobs Precincts and Regions (formerly DEDJTR)
DNV	Det Norske Veritas
DoD	Department of Defence
DoE	Department of Environment
DoEE	Department of Environment and Energy (previously Department of Sustainability, Environment, Water, Population & Communities (SEWPC), Department of Environment Heritage Water and the Arts (DEWHA), Department of Environment and Heritage (DEH) and Environment Australia)
DP	Dynamic Positioning
DPI	Department of Primary Industry
DSE	Department of Sustainability and Environment
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DSV	Dive Support Vessel
EAC	East Australian Current
EEZ	Exclusive Economic Zone
EFL	Electrical Flying Lead
EHS	Environment Health & Safety
EHU	Electro-hydraulic umbilical
EIAPP	Engine International Air Pollution Prevention
EMBA	Environment that may be affected
EMSA	European Maritime Safety Agency
EMT	Emergency Management Team
ENVID	Environmental Identification
EP	Environment Plan
EPA	Environment Protection Authority
EPBC	Environment Protection Biodiversity Conservation
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ERA	Environmental Risk Assessment
ERP	Emergency Response Plan
ERR	Earth Resources Regulation
ERT	Emergency Response Team
ESD	Ecologically Sustainable Development
EU	Electrical Umbilical
FFG	Flora and Fauna Guarantee (Act)
GDA 94	Geocentric Datum Of Australia 1994
GHG	Greenhouse gases
GMP	Garbage Management Plan

GoM	Gulf of Mexico
GOMO	Guidelines for Offshore Marine Operations
GRS80	Geodetic Reference System 1980
GRT	Gross Tonnes
GSACUS	Great Southern Australian Coastal Upwelling System
HB	Handbook
HDD	Horizontal Directional Drill
HF	high frequency
HMCS	Harmonised Mandatory Control System
HN	Henry - Nestor
HP	High Pressure
HPU	Hydraulic Power Unit
HQ	Hazard Quotient
HSE	Health, Safety, Environment
HSEC	Health Safety Environment and Community
IAP	Incident Action Plan
IAP2	International Association for Public Participation
IAPP	International Air Pollution Prevention
IBA	Important Bird Area
ICC	Incident Control Centre
ILI	Internal Line inspection
ILT	In-line Tee
IMCRA	Interim Marine and Coastal Regionalisation for Australia
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organisation
IMP	Integrity Management Plan
IMR	Inspection Maintenance & Repair
IMS	Invasive Marine Species
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environmental Conservation Association
IR	Infrared
ISO	International Standards Organisation
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for the Conservation of Nature
IWCF	International Well Control Forum
JAMBA	Japan/Australia Migratory Birds Agreement
JHA	Job Hazard Analysis
JRCC	Joint Rescue Coordination Centre

KEF	Key Ecological Feature
Kg	Kilograms
kHz	Kilohertz
km	Kilometre
km^2	Square kilometres
kt	1000 tonnes
L	Litres
LC_{50}	Lethal Concentration (50% population)
LCM	Lost Circulation Material
LF	Low Frequency
LGA	Local Government Area
LOC	Loss of Containment
LOWC	Loss of Well Control
LWD	Logging While Drilling
m^3	Cubic Meters
MAH	Mono-aromatic hydrocarbon
MARPOL	International Convention for the Prevention of Pollution from Ships
MBC	Maritime Border Command
MCS	Master Control System
MDO	Marine Diesel Oil
MEG	Mono-ethylene glycol
MEPC	Marine Environment Protection Committee
MF	medium frequency
mg/l	milligrams per litre
MH	Matador - Henry
MLV	Mainline valve
MMO	Marine Mammal Observer
MMscf	Million standard cubic feet
MNES	Matters of National Environmental Significance
MOC	Management of Change
MODU	Mobile Offshore Drilling Unit
MOU	Memorandum of Understanding
MT	Metric Tonne
MWD	Measurement While Drilling
N2	Nitrogen
N_2O	Nitrous Oxide
NATPLAN	National Plan for Maritime Environmental Emergencies
NDT	Non-destructive testing

NEBA	Net Environmental Benefit Assessment
NERA	National Energy Resources Australia
Nm	Nautical Mile
NMFS	National Marine Fisheries Service
NNTT	National Native Title Tribunal
NOAA	National Oceanic and Atmospheric Administration
NOO	National Oceans Office
NOPSEMA	National Offshore Petroleum Safety & Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NOx	Nitrogen Oxides
NRC	National Research Council
NRDA	National Resource Damage Assessment
NSW	New South Wales
NWS	Northwest Shelf
NZ	New Zealand
NZS	New Zealand Standard
ºC	Degrees Celsius
OCNS	Offshore Chemical Notification System
ODS	Ozone Depleting Substances
OGP	Oil and Gas Producers
OHS	Occupational Health & Safety
OIM	Offshore Installation Manager
OIW	Oil in Water
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OPGGSA	Offshore Petroleum & Greenhouse Gas Storage Act
OPGGSER	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Com)
OPGGSR	Offshore Petroleum & Greenhouse Gas Storage Act 2010 & Regulations (Vic) 2021
OPRC	(Convention on) Oil Pollution Preparedness, Response and Cooperation
OSMP	Operational & Scientific Monitoring Plan
OSPAR	Oslo-Paris Convention
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
PAH	Poly-aromatic hydrocarbon
PAM	Passive Acoustic Modelling
PBW	Pygmy Blue Whale
PJ	Petajoule
PK	Peak

pk-pk	peak-to-peak
PLEM	Pipeline End Manifold
PLONOR	Pose Little or No Risk
PMS	Planned Maintenance System
PMST	Protected Matters Search Tool
POB	Persons on Board
POWBONS	Pollution by Oil and Noxious Substances Act 1983
ppb	Parts per billion
ppm	Parts per million
PSZ	Petroleum Safety Zone
PTS	Permanent threshold shift
PTW	Permit to Work
PV	Parks Victoria
rms	Root-mean-square
ROV	Remotely Operated Vehicle
SBM	Synthetic Based Muds
SBR	Sub-Bottom Profiler
SCAT	Shoreline Clean-up Assessment Technique
SCEMP	Source Control Emergency Management Plan
SCERP	Source Control Emergency Response Plan
SCM	Subsea Control Module
SEEMP	Shipboard Energy Efficiency Management Plan
SEL	Sound Exposure Level
SELcum	Cumulative sound exposure level
SEPP	State Environment Protection Policy
SESSF	Southern and Eastern Scale-fish and Shark Fishery
SETFIA	South East Trawl Fishing Industry Association
SG	Specific Gravity
SIMAP	Spill Impact Mapping Analysis Program
SIMOPS	Simultaneous Operations
SIV	Seafood Industry Victoria
SMPEP	Shipboard Marine Pollution Emergency Plan
SOLAS	Safety of Life at Sea
SOOB	Summary of Operational Boundaries
SOx	Sulphur Dioxides
SPL	Sound Pressure Level
SPS	Sanitary and Phytosanitary Measures
SSD	Species Sensitivity Distribution

SSF	Sustainable Shark Fishing Inc.
SSS	Side Scan Sonar
SST	Subsea Tree
SUDU	Subsea Umbilical Distribution Unit
SVP	Sound Velocity Profiler
TACC	Total Allowable Commercial Catch
TAP	Threat Abatement Plan
TEC	Threatened Ecological Community
TJ	Terajoule
TOFS	Time out for safety
TPC	Third Party Contractors
TPH	Total Petroleum Hydrocarbons
TSSC	Threatened Species Scientific Committee
TTS	Temporary Threshold Shift
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USBL	Ultra-Short Baseline
USEPA	United States Environment Protection Agency
UTA	Umbilical Terminal Assembly
UTM	Universal Transverse Mercator
VIC DoT	DJPR Emergency Management Branch (formerly DEDJTR EMD)
VRFish	Victorian Recreational Fishing Association
VRLA	Victorian Rock Lobster Association
WBDF	Water-Based Drilling Fluids
WCD	Worst Case Discharge
WOMP	Well Operations Management Plan

1. Introduction

1.1. Background

Gas and condensate are currently produced from the Otway offshore gas fields located in Production Licence Areas VIC/L24 (Casino) and VIC/L30 (Netherby and Henry); these areas are excised from the VIC/P44 Greater Casino Development Area (Figure 1-1). Gas and condensate are produced via subsea wells and transported through a subsea pipeline to the Athena Gas Plant (previously called the Minerva Gas Plant) for processing. Processed gas is directed to 3rd party pipelines where it is transported for use within the southern and eastern states.

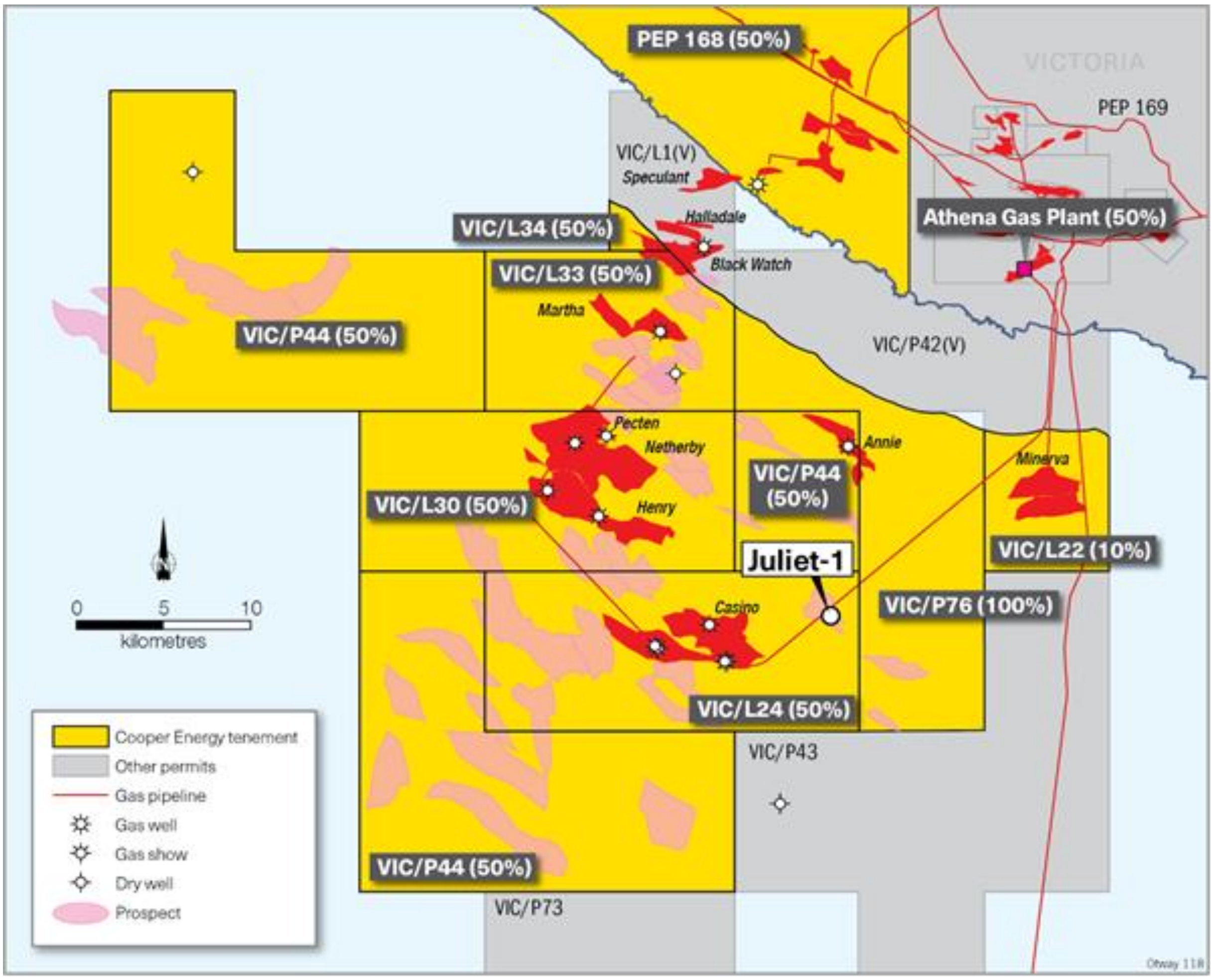


Figure 1-1: Cooper Energy Otway Offshore Petroleum Titles

The offshore facilities are shown in Figure 3-1 and comprise:

- Stage I, installed 2004:
  - Subsea production wells including Casino-4 and Casino-5.
  - A 32.6 kilometre (km) subsea pipeline (Casino pipeline) connecting the Casino wells to the onshore gas plant.
  - A 31.2 km electro-hydraulic umbilical (EHU) cable connecting the Casino wells to the onshore gas plant.
- Stage II, installed 2008:
  - Subsea production wells including Henry-2 and Netherby-1
  - A 22 km subsea pipeline (Casino to Pecten East pipeline) tying into the Casino Pipeline, carrying gas from the Henry-2 and Netherby-1 wells, with an additional section to the Pecten reservoir

where a future production well was anticipated. A production well at Pecten has not yet been drilled; drilling and construction would be subject to further planning.

  - A 22 km EHU cable (extension of the umbilical above) connecting the Henry and Netherby wells to the Athena Gas Plant.

- Stage III, planned installation circa 2024/25:
  - Subsea production wells Annie-2 and Juliet-1.
  - Circa 10.1 km 8” flexible flowline (Annie) and <1 km 8” flexible flowline (Juliet) and manifold, tying into the Casino pipeline, transporting gas from the Annie-2 and Juliet-1 wells.
  - EHUs connecting the Casino controls with Annie-2 and Juliet-1 wells.

1.2. Purpose

This EP provides an identification and assessment of the environmental impacts and risks associated with the operations and maintenance activities of the Otway offshore assets along with the activities relating to Stage III (Otway Offshore Operations) and provides a demonstration that known impacts and potential risks are reduced to ‘As Low As Reasonably Practicable’ (ALARP) and will be of an ‘acceptable’ level. Definitions for these terms are provided in Section 5.

As the Casino gas pipeline occurs within State and Commonwealth waters, this EP has been prepared to satisfy the requirements of Victorian and Commonwealth legislation, namely:

- The OPGGS Act 2010 and Regulations (Vic) [R15(3) Risk assessment to ALARP] 2021 (OPGGSR), administered by the Victorian Department of Jobs Precincts and Regions (DJPR), Earth Resources Regulation (ERR) branch; and
- The Commonwealth OPGGS (Environment) Regulations 2009 (OPGGS(E)R), administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

In this EP these regulations are collectively referred to as the Regulations.

This single EP has been submitted to both regulators. The EP structure and content is consistent with the requirements outlined in the Environment Plan Content Requirements Guidance Note (N04750-GN1344, 11/9/2020) produced by NOPSEMA and also meets the requirements of the Victorian OPGGSR.

1.3. Scope

This EP relates to the offshore operations, inspection, maintenance and repair activities of the Otway offshore assets, Stages I, II and III. Relevant Production Licences include VIC/L24, VIC/L30, exploration licence VIC/P44 (from which production licences are excised), and Pipeline Licences including VIC/PL37, VIC/PL37(V) and VIC/PL42.

In addition to the operational and maintenance activities this EP also covers the construction, installation and commissioning of Stage III elements within VIC/L24, a future production licence to be excised from VIC/P44 and future pipeline licences (if any) associated with Stage III. The development activities described within this EP in the area which is currently VIC/P44, will be undertaken once a production licence is in place.

The EP will cover a period of 5 years from the date of acceptance. Further details on the activities covered by the EP are provided in Section 3.

Activities specifically excluded from the scope of this EP are:

- Management of onshore activities including the Athena Gas Plant;
- Vessels transiting to or from the operational area. These vessels are deemed to be operating under the Commonwealth Navigation Act 2012 and not performing a petroleum activity; and
- Abandonment and decommissioning activities[1].

Figure 1-2 illustrates the scope of this plan and those plans which provide for the onshore activities.

[1] *Planning activities and deviations sought from Section 572 are described within this EP*

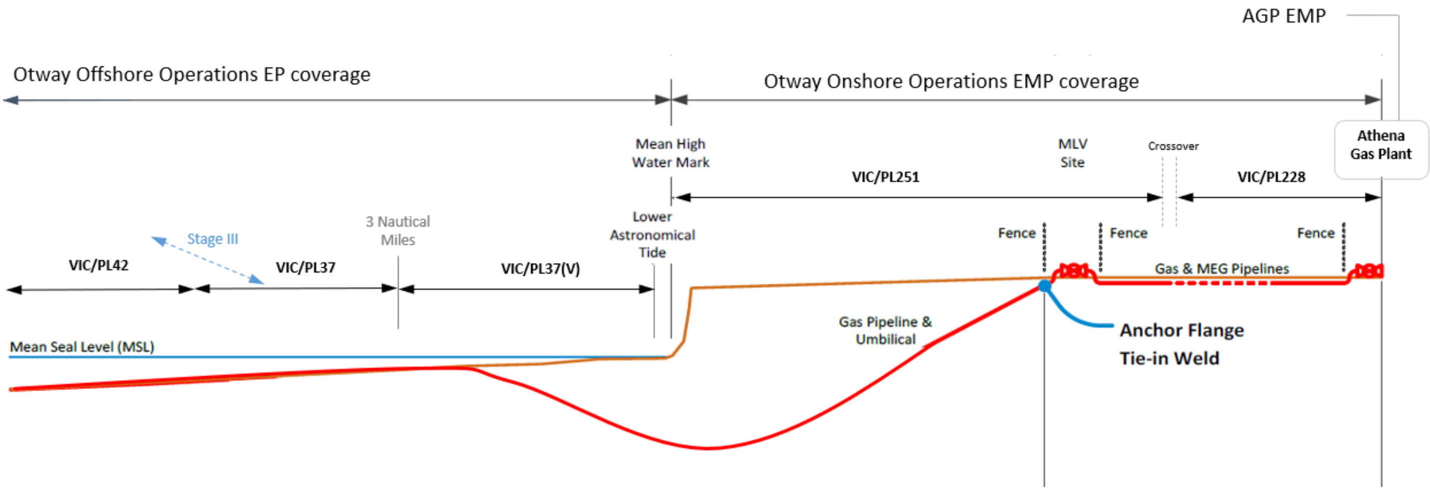


Figure 1-2: Otway offshore and onshore activities and associated environment (management) plans

1.4. Titleholder Details

In accordance with the OPGGS(E)R Regulation 18(2) and Regulation 15 of the OPGGSR Regulation 15, details of the titleholder and liaison person for this EP are provided in Table 1-1. Further information about Cooper Energy is available at: www.cooperenergy.com.au.

Table 1-1: Titleholder and Liaison Person

Title Details	Titleholder Details	Liaison Person
Exploration Permit VIC/P44 (Annie) Production Licence VIC/L24 (Casino, Juliet) Production Licence VIC/L30 (Henry & Netherby) Pipeline Licence VIC/PL37 Pipeline Licence VIC/PL42 Pipeline Licence VIC/PL37(v)	Name: Cooper Energy (CH) Pty Ltd ABN: 70 615 355 023 Address: Level 8, 70 Franklin Street, Adelaide, 5000 Telephone Number: (08) 8100 4900 Name: Mitsui E&P Australia Pty Ltd ACN: 108 437 529 Name: Peedamullah Petroleum Pty Ltd ACN: 009 363 820	Titleholder's nominated liaison person: Mike Jacobsen General Manager Projects and Operations Cooper Energy Limited Level 8, 70 Franklin Street, Adelaide, SA, 5000 Phone: (08) 8100 4900 Email: mike.jacobsen@cooperenergy.com.au

2. Requirements

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

The activity is located within Commonwealth and Victorian waters. Table 2-2 and Table 2-3 detail the Victorian and Commonwealth requirements (respectively) and any codes or guidelines applicable to the activity. Petroleum Environment Regulations.

This 5-year revision of the EP has been prepared to meet the requirements of both Victorian and Commonwealth legislation namely:

- The OPGGS Regulations (Vic), administered by DJPR; and
- The OPGGS(E) Regulations (Cwlth) administered by NOPSEMA.

The revision is a submission under Regulation 22 of the Vic OPGGS Regulations 2021, Regulation 19 and Regulation 17(5) of the Cwth OPGGS (Environment) Regulations 2009.

Table 2-1 provides details of where the requirements of the Regulations have been addressed within this EP.

2.1. EPBC Act Requirements

This EP considers the impacts to matters of national environmental significance (MNES) protected under Part 3 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Relevant requirements associated with the EBPC Act, related policies, guidelines, plans of management, recovery plans, threat abatement plans, and other relevant advice issued by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) are detailed in the applicable sections within Section 4 as part of the description of the existing environment.

Threatened species recovery plans, threat abatement plans and species conservation advices relevant to the receptors identified in Section 4 and are detailed in *Table 2-4*.

2.2. Otway Development Approvals

The Greater Casino Development, including the Otway offshore operations and associated activities described in this EP, has received EPBC Act Approval. Stage I, involving onshore, coastal and offshore construction and operations was approved as a controlled action (EPBC 2003/1295). Stage II, involving the drilling and tie-back of gas/condensate resources to the Casino infrastructure was assessed as not-controlled action (EPBC Ref 2006/2635 and EPBC Ref 2007/3767). EPBC 2007/3767 also included provision for four (4) exploration wells within VIC/P44 (one of which has been drilled). The approvals, and installed infrastructure provide for the integration of infill gas/condensate resources; there are multiple existing tie-in points within the installed pipelines.

Stage III involves two infill production wells (Annie-2 and Juliet-1) that will tie back to existing subsea facilities in Commonwealth waters. Stage III is analogous in nature and scale to the existing Otway infill developments approved as not controlled actions: 2006/2635 and 2007/3767. Stage III, being a modest extension of production through the existing Casino facility, is considered a new stage of the existing activity (OPGGS (E) Reg 17(5)).

Table 2-1: Requirements of the Regulations

OPGGS(E) Regulations (Cwlth)	OPGGS Regulation (Vic)	Description	Document section
13 (1)	15 (1)	A description of proposed activities.	Section 3
13 (2) and (3)	15 (2)	A description of the existing environment that may be affected by the activity including details of matters of National Ecological Significance (NES) as outlined under Part 3 of the EPBC Act.	Section 0
13 (4), 14 (10)	15 (3)(a) and 15 (3)(b)	An overview of the environment legislation applicable to the proposed activities and a demonstration of how they are met.	Section 0 (this section)

OPGGS(E) Regulations (Cwlth)	OPGGS Regulation (Vic)	Description	Document section
13 (5) and (6)	15 (3)(c) and 15 (3)(d) and 15 (3)(e) 15 (4)	An identification and evaluation of environmental risks of described activities and details of control measures that will be used to reduce impacts and risks to ALARP and an acceptable level, for both planned and unplanned activities.	Section 6 and 7
13 (7)	15 (5)	The environmental performance outcomes, standards and measurement criteria that apply to both planned and unplanned activities.	Section 8
14 (1) and (2)	16(1) and (2)	An appropriate implementation strategy including reporting arrangements to the Regulator in relation to environmental performance.	Section 9
14 (3)	16 (3)	A description of the environmental management system and measures to ensure that impacts and risks are continually identified and reduced, control measures are effective in reducing impacts and risks, and that performance outcomes and standards are being met.	Section 9
14 (4) and (5)	16(4) and (5)	Details of role and responsibilities of personnel in relation to implementation, management and review of this Plan, including measures to ensure personnel are aware of their responsibilities.	Section 9
14 (6), 26C	16 (6)	Details of monitoring, recording, auditing, management of con-conformance and review of environmental performance.	Section 9
14 (7)	16 (7)	Details of monitoring and maintenance of quantitative records for emissions and discharges.	Section 9
14 (8)	NA	Details of the Oil Pollution Emergency Plan (OPEP), provision for its updating, inclusion of arrangements for monitoring and responding to oil pollution and details of testing of the plan.	Section 7 and Section 9
NA	17 (1) and (2) and (3)	An environmental emergency response manual that describes emergency response arrangements, is maintained, kept up to date, and tested	Cooper Energy Offshore Victorian OPEP (VIC-ER-EMP-0001)
16(c), 26A and B	19 (c)	Details of reportable incidents in relation to the activity, procedures for reporting and notifying reportable and recordable incidents.	Section 9
11A, 14 (9) and 16 (b)	16 (8) and 19 (b)	Details of stakeholder consultation that has been undertaken prior to, and during preparation of the EP, including all correspondence.	Section 10
15 (1), (2) and (3)	18 (1) and (2)	Details of the titleholder and an appropriate nominated liaison person, including arrangements for notifying the Regulator should this change.	Section 0 and Section 9
16 (a)	19 (a)	Details of the titleholders' environmental policy.	Section 9

Table 2-2: Summary of Victorian environmental legislation relevant to Otway Offshore Operations

Legislation / Regulation	Scope	Application to Activity	Administering Authority
Emergency Management Act 2013	Provides for the establishment of governance arrangements for emergency management in Victoria, including the Office of the Emergency Management Commissioner and an Inspector-General for Emergency Management. Provides for integrated and comprehensive prevention, response and recovery planning, involving preparedness, operational co-ordination and community participation, in relation to all hazards. These arrangements are outlined in the Emergency Management Manual Victoria.	Emergency response structure for managing emergency incidents within Victorian waters. Emergency management structure will be triggered in the event of a diesel spill originating from or entering state waters. *Emergency response arrangements are detailed in the OPEP.*	Department of Justice and Regulation (Inspector General for Emergency Management)
Environment Protection Act 1970 & amendments *(& various regulations)* *[REPEALED]*	This Act was repealed on 1 July 2021 by section 63 of the Environment Protection Amendment Act 2018, No. 39/2018 (as amended by No. 11/2020).	None. Applicable to previous versions of this EP and historical activities.	EPA
Environment Protection Act 2017 (the 2017 Act)	This Act: came into effect on 1 July 2021 and is aimed at preventing harm to public health and the environment from pollution and waste. It: - provides for General Environmental Duty within Victorian jurisdiction to minimise risks of harm to human health and the environment from pollution or waste. - establishes a permissions scheme that enables EPA to issue or grant development licences, operating licences etc. - deals with the management of waste, pollution events, potential contamination (e.g., contaminated soils) - enables the EPA and authorised officers to ensure compliance with the Act - provides for a system of criminal and civil penalties	GED within Victorian jurisdiction. Athena gas plant operations. Activities, including management of emissions to air and discharges are subject to an operating licence issued by the EPA. Management of all wastes in Victoria will comply with these requirements.	EPA
Flora and Fauna Guarantee Act 1988 (FFG Act) (& Regulations 2011)	The purpose of this Act is to protect rare and threatened species; and enable and promote the conservation of Victoria's native flora and fauna and to provide for a choice of procedures that can be used for the	The EP must assess any actual or potential impacts or risks to rare and threatened species and apply controls in line with any Action Statements.	Department of Environment, Land, Water and Planning (DELWP)

Legislation / Regulation	Scope	Application to Activity	Administering Authority
	conservation, management or control of flora and fauna and the management of potentially threatening processes. Where a species has been listed as threatened an Action statement is prepared setting out the actions that have or need to be taken to conserve and manage the species and community.	*Section 4.4.2 identifies any rare or threatened species that maybe impacted by the activity.* *Section* 6 *and 7 assess potential impacts and risks to rare and threatened species and applies applicable Action Statement controls.*	
Heritage Act 1995 *(& Heritage (Historical Shipwrecks) Regulations 2007)*	The purpose of the Act is to provide for the protection and conservation of historic places, objects, shipwrecks and archaeological sites in state areas and waters (complementary legislation to Commonwealth legislation). Part 5 of the Act is focused on historic shipwrecks, which are defined as the remains of all ships that have been situated in Victorian waters for 75 years or more. The Act addresses, among other things, the registration of wrecks, establishment of protected zones, and the prohibition of certain activities in relation to historic shipwrecks.	Identification of historic places, objects, shipwrecks and archaeological sites in State waters that may be impacted by the activity and reporting of any identified historic places, objects, shipwrecks and archaeological sites or impacts to them. *Section 4.4.3 identifies known historic places, objects, shipwrecks and archaeological sites.* *Section* 6 *and 7 assess potential impacts and risks to historic places, objects, shipwrecks and archaeological sites from the activity.* *Section 9.13 details reporting requirements.*	Heritage Victoria (DELWP)
Marine and Coastal Act 2018	Consent for use and development of coastal crown land within Victorian Waters and within 200 metres inland of the highwater mark. This consent usually takes place prior to construction activities. A person may apply for a consent to use or develop, or undertake works on, marine and coastal Crown land.	Activities (e.g. modification) to the shore crossing (HDD) may require consent.	DELWP and Parks Victoria
Marine (Drug, Alcohol and Pollution Control) Act 1988 *(& Regulations 2012)*	This Act provides for the prohibition of masters and other persons involved in vessel operations from being under the influence of prescribed drugs or alcohol; defines prohibited discharges (refer to Pollution of Waters by Oil and Noxious Substances Act 1986); and allocates roles, responsibilities and liabilities to ensure there us a capacity and obligation (i.e. Director – Transport Safety, public statutory body) to respond to marine incidents which have the potential, or do, result in pollution.	Applies to vessel masters, owners, crew operating vessels in Victorian State waters. Provides the Victorian Government response structure and contingency planning arrangements for marine pollution incidents in Victorian waters (i.e. Victorian Marine Pollution Contingency Plan aka State Maritime Emergencies (non-search and rescue) Plan) that Cooper must observe for vessel incidents.	DJPR

Legislation / Regulation	Scope	Application to Activity	Administering Authority
Marine Safety Act 2010 (& Regulations 2012)	Act provides for safe marine operations in Victoria of including imposing safety duties on owners, managers and designers of vessels, marine infrastructure and marine safety equipment; marine safety workers, masters and passengers on vessels; regulation and management of vessel use and navigation in State waters; and enforcement provisions of Police Officers and the Victorian Director of Transport Safety. This Act reflects the requirements of international conventions - Convention on the International Regulations for Preventing Collisions at Sea & International Convention for the Safety of Life at Sea (SOLAS). The Act also defines marine incidents and the reporting of such incidents to the Victorian Director of Transport Safety.	Applies to vessel masters, owners, crew operating vessels in Victorian State waters. *Section 6 details the requirements applicable to vessel activities.*	Maritime Safety Victoria
Offshore Petroleum and Greenhouse Gas Storage Act 2010 (OPGGSA) *(& Regulations 2021)*	Addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations in Victorian coastal waters (between the low water mark and the 3 nm limit). This Act and its Regulations (Section 2 – Environment) are similar to the Commonwealth Act and Regulations of the same name, however, have not been modified to align with most recent revisions of the Commonwealth Act and regulations and hence variations between jurisdictions exist. The preparation of this EP satisfies the requirement of Section 2 of the OPGGS Regulations. Section 61 of the Act (Principles of sustainable development) states that the administration of the Act should consider the principles of sustainable development. These principles include involving the community in issues that affect them. To this extent, the stakeholder consultation undertaken due to the change of titleholder (described in Section 4), satisfies this requirement.	Triggered for petroleum activities within State waters. *Demonstration that the activity will be undertaken in line with the principles of ecologically sustainable development and in accordance with an EP with appropriate performance objectives and standards is provided in Sections 8.* *Cooper Energy's implementation strategy is detailed in Section 9.* *Stakeholder consultation undertaken is detailed in Section 10.*	DJPR
Pollution of Waters by Oil and Noxious Substances Act 1986 (POWBONS) *(& Regulations 2012)*	The purpose of the Act is to protect the sea and other waters from pollution by oil and noxious substances. This Act also implements the International Convention for the Prevention of Pollution from Ships (MARPOL) 1973 in State waters (see Table 3 3).	Triggered in the event of a diesel spill originating from or entering Victorian state waters. *Section 6 details the requirements applicable to vessel activities.* *Section 9 details reporting requirements.*	Jointly administered by DJPR and EPA

Legislation / Regulation	Scope	Application to Activity	Administering Authority
	The Act requires the mandatory reporting of marine pollution incidents and restricts various discharges within State waters (see Table 3 3).		
Wildlife Act 1975 *(& Regulations 2013)*	The purpose of this Act is to promote the protection and conservation of wildlife, prevent wildlife from becoming extinct and prohibit and regulate persons authorised to engage in activities relating to wildlife (including incidents). The Wildlife (Marine Mammal) Regulations 2009 prescribe minimum distances to whales and seals/seal colonies, restrictions on feeding/touching and restriction of noise within a caution zone of a marine mammal (dolphins (150m), whales (300m) and seals (50m)).	Prescribed minimum proximity distances to whales, dolphins and seals by vessels are included in this EP. Triggered if an incident results in the injury or death of whales, dolphins or seals. *Sections 8 details proximity requirements in relation to vessel operations.* *Section 9 details reporting requirements.*	DELWP

Table 2-3: Summary of Commonwealth Environmental Legislation relevant to Otway Offshore Operations

Legislation / Regulation	Scope	Application to Activity	Administering Authority
Australian Ballast Water Management Requirements (CoA 2020)	The Australian Ballast Water Management Requirements set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas.	Provides requirements on how vessel operators should manage ballast water when operating within Australian seas to comply with the Biosecurity Act. *Section 6.6 details these requirements in relation to the management of ballast water.*	Department of Agriculture, Water and the Environment (DAFF)
Australia Biofouling Management Requirements (DAFF 2022)	The Australian biofouling management requirements set out vessel operator obligations for the management of biofouling when operating vessels under biosecurity control within Australian territorial seas.	Provides requirements on how vessel operators should manage biofouling when operating within Australian seas to comply with the Biosecurity Act. *Section 6.6 details these requirements in relation to the management of biofouling water.*	Department of Agriculture, Water and the Environment (DAFF)
Australian Maritime Safety Authority Act 1990	Facilitates international cooperation and mutual assistance in preparing and responding to major oil spill incidents and encourages countries to develop and maintain an adequate capability to deal with oil pollution emergencies.	In Commonwealth waters AMSA is the Statutory Agency for vessels and must be notified of all incidents involving a vessel. In Commonwealth waters AMSA is the Control Agency for all ship-sourced marine pollution incidents and will respond in accordance with the National Plan for Maritime Environmental Emergencies. Under the National Plan AMSA support oil spill response for non-ship sourced pollution incidents on the formal request of the respective incident controller. *These arrangements are detailed in Cooper Victorian Oil Pollution Emergency Plan (OPEP) (VIC-EPER-EMP-0001).*	Australian Maritime Safety Authority (AMSA)
Biosecurity Act 2015 *(& Regulations 2016)*	The objects of this Act are: (a) to provide for managing the following:	The Biosecurity Act and regulations apply to ‘Australian territory’ which is the airspace over	DAFF

Legislation / Regulation	Scope	Application to Activity	Administering Authority
	(i) biosecurity risks; (ii) the risk of contagion of a listed human disease; (iii) the risk of listed human diseases entering Australian territory or a part of Australian territory, or emerging, establishing themselves or spreading in Australian territory or a part of Australian territory; (iv) risks related to ballast water; (v) biosecurity emergencies and human biosecurity emergencies; (b) to give effect to Australia's international rights and obligations, including under the International Health Regulations, the SPS Agreement and the Biodiversity Convention.	and the coastal seas out to 12 nm from the coast line. For the activity it regulates vessels entering Australian territory regarding ballast water and hull fouling. *Biosecurity risks associated with the activity are detailed in Section 6.6.*	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The Act aims to: Protect matters of national environmental significance (MNES); Provides for Commonwealth environmental assessment and approval processes; and Provides an integrated system for biodiversity conservation and management of protected areas. MNES are: World heritage properties; RAMSAR wetlands; Listed threatened species and communities; Migratory species under international agreements; Nuclear actions, Commonwealth marine environment; Great Barrier Reef Marine Park; and Water trigger for coal seam gas and coal mining developments. The assessment process is overseen by NOPSEMA as the delegated authority under the EPBC Act.	Petroleum activities are excluded from within the boundaries of a World Heritage Area (Sub regulation 10A(f). *The activity is not within a World Heritage Area.* The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these. *Section 4 describes matters protected under Part 3 of the EPBC Act.* The EP must assess any actual or potential impacts or risks to MNES from the activity. *Section 6 and Section 7 provides an assessment of any impacts and risks to matters protected under Part 3 of the EPBC Act.*	DCCEEW

Legislation / Regulation	Scope	Application to Activity	Administering Authority
Environment Protection and Biodiversity Conservation Regulations 2000	Part 8 of the regulations provide distances and actions to be taken when interacting with cetaceans.	-	DCCEEW
Environment Protection (Sea Dumping) Act 1981	Aims to prevent the deliberate disposal of wastes (loading, dumping, and incineration) at sea from vessels, aircraft, and platforms.	May be triggered in the event equipment is decommissioned on the seabed. This is not the base case for planning purposes.	DCCEEW
Marine Pest Plan 2018 – 2023: National Strategic Plan for Marine Pest Biosecurity	Australia's national strategic plan for marine pest biosecurity. It outlines a coordinated approach to building Australia's capabilities to manage the threat of marine pests over the next five years. It represents agreed priorities and actions of governments, marine industries, and other stakeholders to achieve a common purpose: to manage the risks posed by marine pests and minimise their potential harm to marine industries, communities and the environment.	Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species.	DAFF
National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (CoA 2009)	The guidance document provides recommendations for the management of biofouling hazards by the petroleum industry. Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species. Project trigger: Applies to commercial vessels utilised for inspection and maintenance activities.	Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species. *Section 6.6 details the requirements applicable to vessel activities.*	DAFF
National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds (CoA 2020a)	The Guidelines outline the process to be followed where there is the potential for artificial lighting to affect wildlife. Applying the recommendations within this document and implementing effective controls can reduce the impact of light to sensitive receptors. Project trigger: Applies to commercial vessels utilised for inspection and maintenance activities.	Applying the recommendations within this document and implementing effective controls can reduce the impact of light to sensitive receptors. *Section 6.2 details the requirements applicable to vessel activities.*	DCCEEW
National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (COA, 2017a)	The overarching goal of the strategy is to provide guidance on understanding and reducing the risk of vessel collisions and the impacts they may have on marine megafauna.	Applying the recommendations within this document and implementing effective controls can reduce the risk of the vessel collisions with megafauna.	DCCEEW

Legislation / Regulation	Scope	Application to Activity	Administering Authority
	Project trigger: Applies to commercial vessels utilised for inspection and maintenance activities.		
Navigation Act 2012	Regulates international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters. It gives effect to the relevant international conventions (MARPOL 73/78, COLREGS 1972) relating to maritime issues to which Australia is a signatory. The Act also has subordinate legislation contained in Regulations and Marine Orders.	All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act. Several Marine Orders (MO) are enacted under this Act which relate to offshore petroleum activities, including: MO 21: Safety and emergency arrangements MO 30: Prevention of collisions MO 31: SOLAS and non-SOLAS certification *Section* 6 *and Section* 7 *details the requirements applicable to vessel activities.*	AMSA
Offshore Petroleum and Greenhouse Gas Storage (OPGGS) Act 2006 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (OPGGS(E)R 2009	The Act addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the three-nautical mile limit. Part 2 of the OPGGS(E) Regulations specifies that an EP must be prepared for any petroleum activity and that activities are undertaken in an ecologically sustainable manner and in accordance with an accepted EP.	The OPGGS Act provides the regulatory framework for all offshore petroleum exploration and production activities in Commonwealth waters, to ensure that these activities are carried out: Consistent with the principles of ecologically sustainable development as set out in section 3A of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). So that environmental impacts and risks of the activity are reduced to ALARP. So that environmental impacts and risks of the activity are of an acceptable level. *Demonstration that the activity will be undertaken in line with the principles of ecologically sustainable development, and that impacts and risks resulting from these*	NOPSEMA

Legislation / Regulation	Scope	Application to Activity	Administering Authority
		activities are ALARP and acceptable is provided in Section 6 *and Section 7.*	
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	The Act aims to protect the marine environment from pollution by oil and other harmful substances discharged from ships in Australian waters. It also invokes certain requirements of the MARPOL Convention such as those relating to discharge of noxious liquid substances, sewage, garbage and air pollution. Requires ships greater than 400 gross tonnes to have pollution emergency plans in place and provides for emergency discharges from ships.	All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act. Several MOs are enacted under this Act relating to offshore petroleum activities, including: MO Part 91: Marine Pollution Prevention – Oil MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances MO Part 94: Marine Pollution Prevention – Packaged Harmful Substances in Packaged Forms MO Part 95: Marine Pollution Prevention – Garbage MO Part 96: Marine Pollution Prevention – Sewage MO Part 97: Marine Pollution Prevention – Air Pollution MO Part 98: Marine Pollution Prevention – Anti-fouling Systems. *Section* 6 *details the requirements applicable to vessel activities.*	AMSA
Protection of the Sea (Harmful Antifouling Systems) Act 2006	The Act aims to protect the marine environment from the effects of harmful anti-fouling systems. Under this Act, it is an offence to engage in negligent conduct that results in a harmful anti-fouling compound being applied to a ship. This Act also requires that Australian ships must hold ‘anti-fouling certificates’, provided they meet certain criteria.	All ships involved in offshore petroleum activities in Australian waters are required to abide to the requirements under this Act. The Marine Order MO 98: Marine Pollution Prevention – Anti-fouling Systems is enacted under this Act.	AMSA

Legislation / Regulation	Scope	Application to Activity	Administering Authority
		Section 6 *details the requirements applicable to vessel activities.*	
Underwater Cultural Heritage Act 2018	Protects the heritage values of shipwrecks, sunken aircraft and other underwater cultural heritage (older than 75 years) below the low water mark.	Anyone who finds the remains of a ship, sunken aircraft or other underwater cultural heritage article needs to notify the relevant authorities, as soon as possible but ideally no later than after one week, and to give them information about what has been found and its location. *Section 5 details that there are no historic wrecks near or within the operational area.*	DCCEEW

Table 2-4 Recovery plans, threat abatement plans and species conservation advices

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
Fish					
Whale Shark	Approved Conservation Advice for *Rhincodon typus* (Whale Shark)	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.	Vessel disturbance	Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations (Ningaloo Reef, Christmas Island and the Coral Sea) and 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, DotE, 2014).	Section 6.2.2
			Marine debris	No explicit relevant management actions: marine debris identified as a threat.	Section 6.2.2
			Climate Change	No explicit relevant management actions; climate change identified as threat.	Section 0
			Habitat disruption from mineral exploration, production and transportation	Implement measures to reduce adverse impacts of habitat degradation and / or modification.	Section 6.6.5
Australian Grayling	National Recovery Plan for Australian Grayling	The overall objective of recovery is to minimise the probability of extinction of the Australian Grayling in the wild, and to increase the probability of important populations becoming self-sustaining in the long term. Relevant specific objectives within the lifespan of the recovery plan are: • Protect and restore habitat for Australian Grayling	Climate Change	No explicit relevant management actions; climate change identified as a threat.	Section 0

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
		• Investigate and manage threats to populations and habitats			
	Conservation Advice *Prototroctes maraena* Australian Grayling	No explicit relevant objectives	Climate Change	No explicit relevant management actions; climate change identified as a threat.	Section 0
White Shark	Recovery Plan for the White Shark (*Carcharodon carcharias*)	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 identified as a threat.	Section 6.6.5
			Climate Change	No explicit relevant management actions; climate change identified as a threat.	Section 0

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
Yarra Pygmy Perch	National recovery plan for the Yarry Pygmy Perch (*Nannoperca obscura*)	The long-term objective of recovery is to minimise the probability of extinction and ensure long-term survival of Yarra Pygmy Perch in the wild and to increase the probability of important populations becoming self-sustaining in the long term.	Climate Change	No explicit relevant management actions; climate change identified as a threat.	Section 0
Variegated Pygmy Perch	National recovery plan for the Variegated Pygmy Perch *Nannoperca variegata*	The long-term objective of recovery is to minimise the probability of extinction and ensure long-term survival of Variegated Pygmy Perch in the wild and to increase the probability of important populations becoming self-sustaining in the long term.	Climate Change	No explicit relevant management actions; climate change identified as a threat.	Section 0
Marine Turtles					
All Marine Turtles including: • Loggerhead Turtles • Green Turtles • Leatherback Turtles	Recovery Plan for Marine Turtles in Australia, 2017 – 2027	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.	Chemical and Terrestrial Discharge	Minimise chemical and terrestrial discharge.	Section 6.2.1
			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.	Section 6.2.2
			Noise interference	Assess and address anthropogenic noise: • Understand the impacts of anthropogenic noise on marine turtle behaviour and biology.	Section 0
			Light interference	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.	Section 6.2.1

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
				• 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.	
			Vessel disturbance	Vessel interactions identified as a threat; no specific management actions in relation to vessels prescribed in the plan.	Section 6.2.2
			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.	Section 6.6.5
			Disease and pathogens	No explicit management actions; disease and pathogens recognised as a threat.	Section 6.7
			Climate Change and variability	Adaptively manage turtle stocks to reduce risk and build resilience to climate change and variability: • Continue to meet Australia's international commitments to address the causes of climate change. • Identify, test and implement climate-based adaptation measures.	Section 0
	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and	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	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.	Section 6.2.1

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
	Migratory Shorebirds	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 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.	
Leatherback Turtle	Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle)	No explicit relevant objectives	Boat strike	No explicit relevant management actions; vessel strikes identified as a threat.	Section 6.2.2
			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.	Section 6.6.5
			Marine debris	No explicit relevant management actions; marine debris identified as a threat.	Section 6.2.2
			Climate Change	No explicit relevant management actions; climate change identified as a threat.	Section 0
Migratory shorebirds and seabirds					
All Threatened Albatross and	Draft National Recovery Plan for	Overall objective: • To ensure the long-term survival and recovery of	Marine pollution	Where feasible, population monitoring programs also monitor, in a standardised manner, the incidence of oiled birds at the nest.	Section 6.6.5

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
Petrels including: • Shy Albatross • Northern Royal Albatross • Southern Giant Petrel • Grey-headed Albatross • Southern Royal Albatross • Wandering Albatross • Gibson's Albatross • Northern Buller's Albatross • Buller's Albatross • Indian Yellow-nosed Albatross • White-capped Albatross • Antipodean Albatross • White-bellied	Albatrosses and Petrels, 2021	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.	Parasites and Disease	No explicit management actions; parasites and disease recognised as a threat.	Section 6.6
			Climate Change	Where climate change is identified as having the potential for significant negative impacts on Australian populations of seabirds: • Appropriate monitoring strategies are implemented to fill information gaps • Mitigation actions are identified and adopted where feasible and appropriate.	Section 0

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
Storm Petrel • Soft-plumaged Petrel • Blue Petrel • Sooty Albatross • Salvin's Albatross • Campbell Albatross • Northern Giant Petrel • Black-browed Albatross					
All Migratory Shorebirds	Wildlife Conservation Plan for Migratory Shorebirds – 2015	Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.	Habitat degradation / modification (oil pollution)	No explicit relevant management actions; identified as a threat.	Section 6.6.5
			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).	Section 6.2.1
			Climate Change	Investigate the impacts of climate change on migratory shorebird habitat and populations in Australia.	Section 0
All Seabirds	Draft Wildlife Conservation Plan for Seabirds	Seabirds and their habitats are protected and managed in Australia.	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.	Section 6.2.1 and Section 6.2.2
			Habitat loss and degradation from pollution	No explicit relevant management actions; identified as a threat.	Section 6.6.5

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
			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.	Section 6.2.1
			Invasive species	Ensure seabirds are protected from the adverse effects of invasive species.	Section 6.6
			Climate Change	No explicit relevant management actions; identified as a threat.	Section 0
All Seabirds and Migratory Shorebirds	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds	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	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.	Section 6.2.1

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
		clearly, easily, safely and without discomfort.			
Australasian Bittern	Approved Conservation Advice for Botaurus poiciloptilus (Australasian bittern)	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 and degradation	No explicit relevant management actions; habitat loss and degradation recognised as a threat.	Section 6.6.5
			Climate Change	No explicit relevant management actions; climate change recognised as a threat.	Section 0
Red Knot	Approved Conservation Advice for *Calidris canutus* (Red Knot)	No explicit relevant objectives	Pollution/contamination impacts	No explicit relevant management actions; pollution / contamination recognised as a threat.	Section 6.2.1 and Section 6.6.5
			Habitat loss and degradation	Protect important habitat in Australia. Maintain and improve protection of roosting and feeding sites in Australia	Section 6.6.5
			Anthropogenic disturbance	Manage disturbance at important sites which are subject to anthropogenic disturbance when red knot are present.	Section 6.2.1
			Climate Change	No explicit relevant management actions; climate change recognised as a threat.	Section 0
Curlew Sandpiper	Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper)	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.	Section 6.6.5
Great Knot	Approved Conservation Advice for *Calidris tenuirostriss* (Great Knot)	No explicit relevant objectives	Habitat degradation	Identifies research priorities and the need for actions to prevent destruction of key breeding and migratory staging sites.	Section 6.6.5
			Pollution and contaminants	No explicit relevant management actions; pollution / contamination recognised as a threat.	Section 6.2.1 and Section 6.6.5

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
			Disease	No explicit relevant management actions; disease recognised as a threat.	Section 6.6
			Climate Change	No explicit relevant management actions; climate change recognised as a threat.	Section 0
Greater Sand Plover	Approved Conservation Advice for *Charadrius leschenaultia* (Greater Sand Plover)	No explicit relevant objectives	Habitat loss and degradation	Identifies research priorities and the need for actions to prevent destruction of key breeding and migratory staging sites. Protect important habitat in Australia.	Section 6.6.5
			Pollution and contamination	No explicit relevant management actions; pollution / contaminants recognised as a threat.	Section 6.2.1 and Section 6.6.5
			Introduced Species	No explicit relevant management actions; introduced species recognised as a threat.	Section 6.6
			Disease	No explicit relevant management actions; disease recognised as a threat.	Section 6.6
			Climate Change	No explicit relevant management actions; climate change recognised as a threat.	Section 0
Lesser Sand Plover	Approved Conservation Advice for *Charadrius mongolus* (Lesser Sand Plover)	No explicit relevant objectives	Habitat loss and degradation	Outlines research and survey priorities and recommends habitat restoration/ maintenance.	Section 6.6.5
			Pollution and contamination	No explicit relevant management actions; pollution / contaminants recognised as a threat.	Section 6.2.1 and Section 6.6.5
			Introduced Species	No explicit relevant management actions; introduced species recognised as a threat.	Section 6.6
			Disease	No explicit relevant management actions; disease recognised as a threat.	Section 6.6
			Climate Change	No explicit relevant management actions; climate change recognised as a threat.	Section 0

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
Blue Petrel	Approved Conservation Advice for *Halobaena caerulea* (Blue Petrel)	No explicit relevant objectives	Habitat Loss, Disturbance and Modification	No explicit relevant management actions; habitat loss, disturbance and modification recognised as a threat.	Section 6.6.5
Bar-tailed Godwit	Approved Conservation Advice for *Limosa lapponica bauera* (Bar-tailed Godwit (western Alaskan)	No explicit relevant objectives	Habitat loss and degradation from pollution	Protect important habitat in Australia.	Section 6.6.5
			Pollution and contamination	No explicit relevant management actions; pollution / contaminants recognised as a threat.	Section 6.2.1 and Section 6.6.5
			Climate Change	No explicit relevant management actions; climate change recognised as a threat.	Section 0
Eastern Curlew	Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew)	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.	Section 6.6.5
Fairy Prion (southern)	Approved Conservation Advice for *Pachyptila subantarctica* (Fairy Prion (southern))	No explicit relevant objectives	Habitat Loss, Disturbance and Modification	No explicit management actions; habitat loss, disturbance and modification recognised as a threat.	Section 6.6.5
Australian Painted Snipe	Approved Conservation Advice for *Rostratula australis*	No explicit relevant objectives	Habitat loss disturbance and modifications	Habitat recovery actions are a priority.	Section 6.6.5

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
	(Australian painted snipe)				
Australian Fairy Tern	Approved Conservation Advice for *Sternula nereis* (Australian Fairy Tern)	No explicit relevant objectives	Oil spills, particularly in Victoria	Ensure appropriate oil spill contingency plans are in place for the subspecies' breeding sites that are vulnerable to oil spills.	Section 6.6.5
	National Recovery Plan for *(Sternula nereis nereis)* (Australian Fairy Tern)	Long-term Vision: • The Australian Fairy Tern population has increased in size to such an extent that the species no longer qualifies for listing as threatened under any of the Environment Protection and Biodiversity Conservation Act 1999 listing criteria.	Habitat degradation and loss of breeding habitat	No explicit management actions; habitat degradation and loss of breeding habitat recognised as a threat.	Section 6.6.5
			Pollution	No explicit management actions; pollution recognised as a threat.	Section 6.6.5
			Climate variability and change	No explicit management actions; climate change recognised as a threat.	Section 0
Grey-headed Albatross	Approved Conservation Advice for *Thalassarche Chrysostoma,* Greyheaded Albatross)	No explicit relevant objectives	Parasites and Disease	Continue to implement suitable hygiene and biosecurity protocols to protect Macquarie Island from outbreaks of disease/fungus/parasites which could potentially be introduced to the island by humans.	Section 6.6
			Pollution	No explicit management actions; pollution recognised as a threat.	Section 6.6.5
			Entanglement in Marine Debris	No explicit management actions; marine debris recognised as a threat.	Section 6.2.2
			Climate Change	No explicit management actions; climate change recognised as a threat.	Section 0
Shy Albatross	Conservation Advice	Refer to objectives in the National Recovery Plan for	Marine Pollution	No explicit management actions; marine pollution recognised as a threat.	Section 6.6.5

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
	Thalassarche cauta Shy Albatross	Threatened Albatrosses and Giant Petrels 2011-2016	Disease	No explicit relevant management actions; disease recognised as a threat.	Section 6.6
			Climate Change	No explicit relevant management actions; climate change recognised as a threat.	Section 0
Hooded Plover (eastern)	Approved Conservation Advice for *Thinornis rubricollis* (Hooded Plover, Eastern)	Primary Conservation Objectives: • Achieve stable numbers of adults in the population, and maintain a stable number of occupied and active breeding territories • 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.	Section 6.6.5
			Entanglement and Ingestion of Marine Debris	Reduce in-shore marine debris	Section 6.2.2
			Invasive Species	No explicit management actions; invasive species recognised as a threat.	Section 6.6
			Climate Change	No explicit management actions; climate change recognised as a threat.	Section 0
Gould's Petrel	Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan	The overall objective of the Gould's Petrel recovery effort is for Gould's Petrel to be down listed from endangered to vulnerable by 2011. Specific recovery objectives are: • To identify and manage the threats operating at sites where the subspecies occurs	None identified	NA	NA
Swift Parrot	National Recovery Plan for the *Lathamus discolour* (swift parrot)	Overall objectives: • To prevent further decline of the Swift Parrot population. • To achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat to increase carrying capacity.	Climate Change	Monitor and manage for climate change: Investigate the potential impact of climate change on the Swift Parrot and its habitat.	Section 0

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
	Conservation Advice *Lathamus discolor* Swift Parrot	No explicit relevant objectives	None identified	NA	NA
Orange-bellied Parrot	National Recovery Plan for the Orange-bellied Parrot (*Neophema chrysogaster*)	The three primary objectives of this Recovery Plan are based on the recovery strategy outlined above, while the fourth, supporting objective is essential in order to achieve the three primary objectives: • Objective 1. To achieve a stable or increasing population in the wild within five years. • Objective 2. To increase the capacity of the captive population, both to support future releases of captive-bred birds to the wild and to provide a secure long term insurance population. • Objective 3. To protect and enhance habitat to maintain, and support growth of, the wild population. • Objective 4. To ensure effective adaptive implementation of the plan.	Habitat degradation and modification	Retain habitat Manage threats to habitat quality Monitor the wild population and habitat	Section 6.6.5
			Barriers to migration and movement	No explicit relevant management actions; barriers to migration recognised as a threat.	Section 6.2.1
			Disease	No explicit relevant management actions; disease recognised as a threat.	Section 6.6
			Climate Change	No explicit relevant management actions; climate change impacts recognised as a threat.	Section 0
Grey Falcon	Conservation Advice *Falco hypoleucos* Grey Falcon	No explicit relevant objectives	Climate Change	No explicit relevant management actions; climate change impacts recognised as a threat.	Section 0

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
White-throated Needletail	Conservation Advice *Hirundapus caudacutus* White-throated Needletail	No explicit relevant objectives	NA	NA	NA
Tasmanian Wedge-tailed Eagle	Threatened Tasmanian Eagles recovery plan: 2006-2010	The objectives of this recovery plan are to increase the breeding success and security of both eagle populations by protecting nesting habitat from destruction and disturbance, minimising the modification of foraging habitat and by minimising the occurrence of human-related mortality.	Loss of habitat, specifically nesting habitat	No explicit relevant management actions; habitat loss recognised as a threat.	Section 6.6.5
			Oiling	No explicit relevant management actions; oiling recognised as a threat.	Section 6.6.5
			Entanglement (marine debris)	No explicit relevant management actions; entanglement recognised as a threat.	Section 6.2.2
			Pollution	No explicit relevant management actions; pollution recognised as a threat.	Section 6.6.5
Cetaceans					
Sei Whale	Approved Conservation Advice for *Balaenoptera borealis* (Sei Whale)	Determine population abundance, trends and population structure for sei whales, and establish a long-term monitoring program in Australian waters.	Vessel disturbance	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.	Section 6.2.2
			Noise interference	Once the spatial and temporal distribution (including biologically important areas) of Sei Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).	Section 0
			Habitat degradation	No explicit relevant management actions; habitat degradation identified as a threat.	Section 6.6.5

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
			Pollution (persistent toxic pollutants)	No explicit relevant management actions; pollution identified as a threat.	Section 6.6.5
			Climate and Oceanographic Variability and Change	Understanding impacts of climate variability and change: • Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica.	Section 0
Fin Whale	Approved Conservation Advice for *Balaenoptera physalus* (Fin Whale)	Determine population abundance, trends and population structure for fin whales, and establish a long-term monitoring program in Australian waters.	Vessel disturbance	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.	Section 6.2.2
			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).	Section 0
			Habitat degradation	No explicit relevant management actions; habitat degradation identified as a threat.	Section 6.6.5
			Pollution (persistent toxic pollutants)	No explicit relevant management actions; pollution identified as a threat.	Section 6.6.5
			Climate and Oceanographic Variability and Change	Understanding impacts of climate variability and change: • Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica	Section 0
Blue Whale	Conservation Management Plan for the Blue	The long-term recovery objective is to minimise anthropogenic threats to allow the conservation	Noise interference	Assess and address anthropogenic noise: shipping, industrial and seismic noise.	Section 0
			Vessel disturbance	Minimise vessel collisions:	Section 6.2.2

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
	Whale, 2015-2025	status of the Blue Whale to improve so that it can be removed from the threatened species list under the EPBC Act. Key terms of the Conservation Management Plan (CMP) and how they have been considered in this EP are provided in Table 2-5.		• 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.	
			Habitat modification	No explicit relevant management actions; habitat modification identified as a threat.	Section 6.6.5
			Climate Change	Understanding impacts of climate variability and change: Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica.	Section 0
			Marine Debris	No explicit relevant management actions; marine debris identified as a threat.	Section 6.2.2
Southern Right Whale	Conservation Management Plan for the Southern Right Whale, 2011 – 2021	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	Vessel disturbance	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.	Section 6.2.2
			Noise interference	Assess and address anthropogenic noise: shipping, industrial and seismic noise.	Section 0
			Habitat modification	No explicit relevant management actions; habitat modification identified as a threat.	Section 6.6.5
			Entanglement (marine debris)	No explicit relevant management actions; entanglement in marine debris identified as a threat.	Section 6.2.2
			Climate Change	Assess impacts of climate variability and change.	Section 0

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
				Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica.	
Pinnipeds					
Australian Sea Lion	Conservation Advice for the *Neophoca cinerea* (Australian sea lion)	Primary conservation actions: • Mitigate the impacts of marine debris on Australian Sea Lions	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.	Section 0
			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.	Section 6.2.2
			Disease and parasites	Improve human wastewater management to minimise dispersal of bacteria, parasites and pollutants into the marine environment.	Section 6.6
			Habitat degradation and pollution (oil spills)	Require all vessels to have oil spill mitigation measures in place and implement jurisdictional oil spill response strategies as required.	Section 6.6.5
			Climate Change	Review and adjust management measures to address the threats from disease/parasites and prey depletion, if it is demonstrated that increased temperatures compound these threats.	Section 0

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
	Recovery Plan for the Australian Sealion	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.	Vessel strike	Collect data on direct killings and confirmed vessel strikes.	Section 6.2.2
			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.	Section 6.2.2
			Pollution and oil spills	Implement jurisdictional oil spill response strategies as required.	Section 6.6.5
			Habitat degradation	No explicit management actions; habitat degradation recognised as a threat.	Section 6.6.5
			Disease	No explicit management actions; disease and pathogens recognised as a threat.	Section 6.6
			Climate Change	No explicit management actions; climate change recognised as a threat.	Section 0
Marine habitat					
Cauliflower Soft Coral	Conservation Advice for *Dendronephthya australis* Cauliflower Soft Coral	No explicit relevant objectives	Damage from boat anchoring and moorings	No explicit management actions for Victorian waters; damage from boat anchoring and moorings recognised as a threat.	Section 6.3
Threatened Ecological Communities					

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
Giant Kelp Marine Forests of Southeast Australia	Approved Conservation Advice for Giant Kelp Marine Forests of Southeast Australia	No explicit relevant objectives	Invasive species	No explicit management actions; invasive species recognised as a threat.	Section 6.6
			Climate Change	No explicit management actions; climate change recognised as a threat.	Section 0
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Approved Conservation Advice for the Littoral Rainforest and Coastal Vine Thickets of Eastern Australia ecological community	No explicit relevant objectives	None identified	NA	NA
Subtropical and Temperate Coastal Saltmarsh	Conservation Advice for Subtropical and Temperate Coastal Saltmarsh	No explicit relevant objectives	Pollution (oil spills)	Identify Coastal Saltmarsh as important habitat in all oil spill contingency planning at national and State levels and monitor the application of protocols on the management of spills involving saltmarshes.	Section 6.6.5
			Invasive Species	No explicit management actions; invasive species recognised as a threat.	Section 6.6
			Climate Change	No explicit management actions; climate change recognised as a threat.	Section 0
Other relevant					
Vertebrate Species	The Threat Abatement Plan for the impacts of Marine Debris on Vertebrate	There are four main objectives: • Contribute to the long-term prevention of the incidence of harmful marine debris	Marine debris	No explicit management actions for non-fisheries related industries (note that management actions in the plan relate largely to management of fishing waste (for example ‘ghost’ gear), and State and Commonwealth management through regulation.	Section 6.2.2

Species Name	Relevant Plan / Advice	Relevant Objectives	Threats identified relevant to the Activity	Relevant Conservation Actions	Address (where relevant) in the EP
	Wildlife of Australia's Coasts and Ocean	• 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.			

Table 2-5: Key terms of the Blue Whale Conservation Management Plan (September 2022) and how they are connected to this EP

Relevant Plan/Advice	Description
Recovery Plans	The Conservation Management Plan for the Blue Whale (Commonwealth of Australia, 2015), 2015-2025 has been treated as a recovery plan (under the EPBC Act) throughout the EP.
Recovery plan actions	Actions identified in the Conservation Management Plan for the Blue Whale, 2015-2025 have been considered in the assessment of impacts and determination of acceptability of impacts to blue whale, specifically in Section 0 underwater sound emissions).
Biologically important areas (BIA)	BIAs for blue whale, as provided in the Conservation Management Plan for the Blue Whale, 2015-2025, are described in Appendix 3 and Section 4.4.
Legal requirement - Action A.2.3. from the Blue Whale CMP: *"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"* Further, the DAWE key terms state: *'The recovery plan requirement, Action A.2.3, applies in relation to BIAs. A whale could be displaced from a Foraging Area if impact mitigation is not implemented. This means that underwater anthropogenic noise should not:* *stop or prevent any blue whale from foraging* *cause any blue whale to move on when foraging* *stop or prevent any blue whale from entering a Foraging Area* *It is considered that a whale is displaced from a Foraging Area if foraging behaviour is disrupted, regardless of whether the whale can continue to forage elsewhere within that Foraging Area. 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'*	Action A.2.3 and the DAWE key terms (September 2021) have informed the assessment of acceptability of underwater sound emissions, described in Section 0. In the assessment of underwater sound emissions, Cooper Energy has taken a precautionary approach. This is presented through the application of conservative impact thresholds for potential disturbance and injury, the application of ALARP Decision Context B, and the adoption of additional control measures to achieve ALARP and acceptability. Adaptive management approaches have been investigated and the selected measures adopted reflect a precautionary approach; they are designed such that the risk of injury and displacement are reduced so that the foraging behaviour of any blue whale should not be impacted. Cooper Energy has considered the seasonal presence of species in defining the schedule and limitations for this activity. The residual risks to the species are considered low (Section 0) and the duration of activities (which could cause disturbance) are limited. As sound emissions are not expected to be significantly higher than existing shipping noise, the level of risk reduction achieved by locking the activity into a specific activity window is grossly disproportionate to the level of risk reduction achieved. Temporal restrictions, if applied consistently within blue whale foraging areas, would prevent the use of vessels for a range of offshore activities for large periods of the year across the entire south-eastern bioregion, with significant impacts to shipping, fishing, existing and transitional offshore projects.
Definition of 'a foraging area'	The activity operational area is located within a foraging BIA.

Relevant Plan/Advice	Description
	Blue whale foraging is considered throughout the assessment of potential impacts and risks to blue whales. Timeframes when blue whale foraging is more likely to occur has been defined based on contemporary literature.
Definition of 'displaced from a foraging area'	The definition of 'displacement from a foraging area' has been adopted throughout the assessment of underwater sound emissions (Section 0).
Definition of 'injury to Blue Whales'	Injury has been defined as permanent threshold shift (PTS) and temporary threshold shift (TTS) throughout the assessment of underwater sound emissions (Section 0).

2.3. Government Policy and Administrative Guidelines

This EP has been developed in accordance with the NOPSEMA Guidance Note for Environment Plan Content Requirements (N04750-GN1344, September 2020). This guidance has been applied to the portion of the Otway assets within Victorian state waters where appropriate. The guidance note provides guidance to the petroleum industry on NOPSEMA's interpretation of the OPGGS(E)R to assist operators in preparing EPs.

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

- Oil Pollution Risk Management (NOPSEMA Guidance Note, N-04750-GN1488, 7/7/21)
- Operational and scientific monitoring programs (NOPSEMA Information Paper, N-04700-IP1349, October 2020)
- Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA, 2015a)
- EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – MNES (DoE, 2013)
- National Plan for Maritime Environmental Emergencies (NATPLAN) (AMSA,2020)
- State Maritime Emergencies (non-search and rescue) Plans and Sub-Plans (EMV, 2021)

3. Activity Description

This section provides a description of the petroleum activity, including:

- Location;
- General details of the layout of facilities / structures;
- An outline of the field characteristics; and
- A description of the activities which will occur and their timing.

For the purposes of this EP, activities performed by vessel(s) when outside the operational area (refer to Section 3.1.1) are not covered by the OPGGS(E) Regulations (Cwlth) and OPGGS Regulations (Vic) 2021 and are therefore not addressed within this EP.

3.1. Activity Location

The Otway offshore facilities are located in Victorian and Commonwealth waters off Victoria's southwest coast in the Bass Strait. The Licence Areas are located southwest of Port Campbell in Commonwealth waters.

The facilities are located in water depths ranging from 55 to 70 m deep. The coordinates of the subsea wells and pipelines are provided in Table 3-1 and Table 3-2 (respectively). The subsea umbilicals are offset from the pipelines within approximately 100 m.

Table 3-1: Coordinates of the Subsea Well Locations

Well Name	Latitude	Longitude
Stage I (VIC/L24)		
Casino-4	38° 47' 13.03"	142° 41' 54.48"
Casino-5	38° 47' 43.68"	142° 44' 44.59"
Stage II (VIC/L30)		
Henry-2	38° 42' 14.55"	142° 37' 13.05"
Netherby-1	38° 40' 48.58"	142° 38' 25.74"
Stage III (planned)		
Annie-2 (VIC/P44)	38° 41' 01.51''	142° 49' 28.47''
Juliet-1 (VIC/L24)	38° 46' 16.73"	142° 48' 46.72"

Table 3-2: Coordinates of the Offshore Otway Pipelines

Location Point	Latitude	Longitude
Stage I (VIC/PL37)		
HDD Entry	38° 36' 55.88''	142° 57' 49.43''
HDD Exit	38° 37' 46.54''	142° 57' 46.02''
Tangent Point 1	38° 39' 59.26''	142° 57' 37.11''
Tangent Point 2	38° 40' 45.83''	142° 57' 7.22''
Tangent Point 3	38° 47' 37.48''	142° 46' 29.83''
Tangent Point 4	38° 47' 50.63''	142° 45' 18.61''
Pipeline End	38° 47' 13.81''	142° 41' 54.08''
Stage II (VIC/PL42)		
Pecten East Lay down flange	38° 38' 10.83"	142° 41' 8.71"
Tangent Point 1	38° 41' 29.18"	142° 37' 43.01"
Tangent Point 2	38° 41' 36.04 "	142° 37' 37.33"

Tangent Point 3	38° 42' 35.28"	142° 36' 58.86"
Tangent Point 4	38° 43' 19.76"	142° 37' 7.14"
Casino tie-in initiation flange	38° 47' 4.77"	142° 41' 52.36"
Stage III (connected to VIC/PL37)		
Planned Annie and Juliet flowline / jumper offshore tie-ins (Blackwatch tee)	38° 46' 15.14"	142° 48' 37.62"

Geocentric Datum Of Australia 1994 (GDA 94), Geodetic Reference System 1980 (GRS80), Universal Transverse Mercator (UTM) Zone 55

3.1.1. Operational Area

The operational area for the activity is the area where activities will take place and will be managed under this EP. The operational area around the subsea infrastructure is shown in Figure 3-1. The operational areas include:

- 500 m around existing wells and on either side of linear infrastructure: the Stage I and II pipelines and proposed EHUs and flowlines; and
- 2 km radius around wells during well work (e.g. drilling).
- 500 m around survey vessel within the Otway Title Areas.

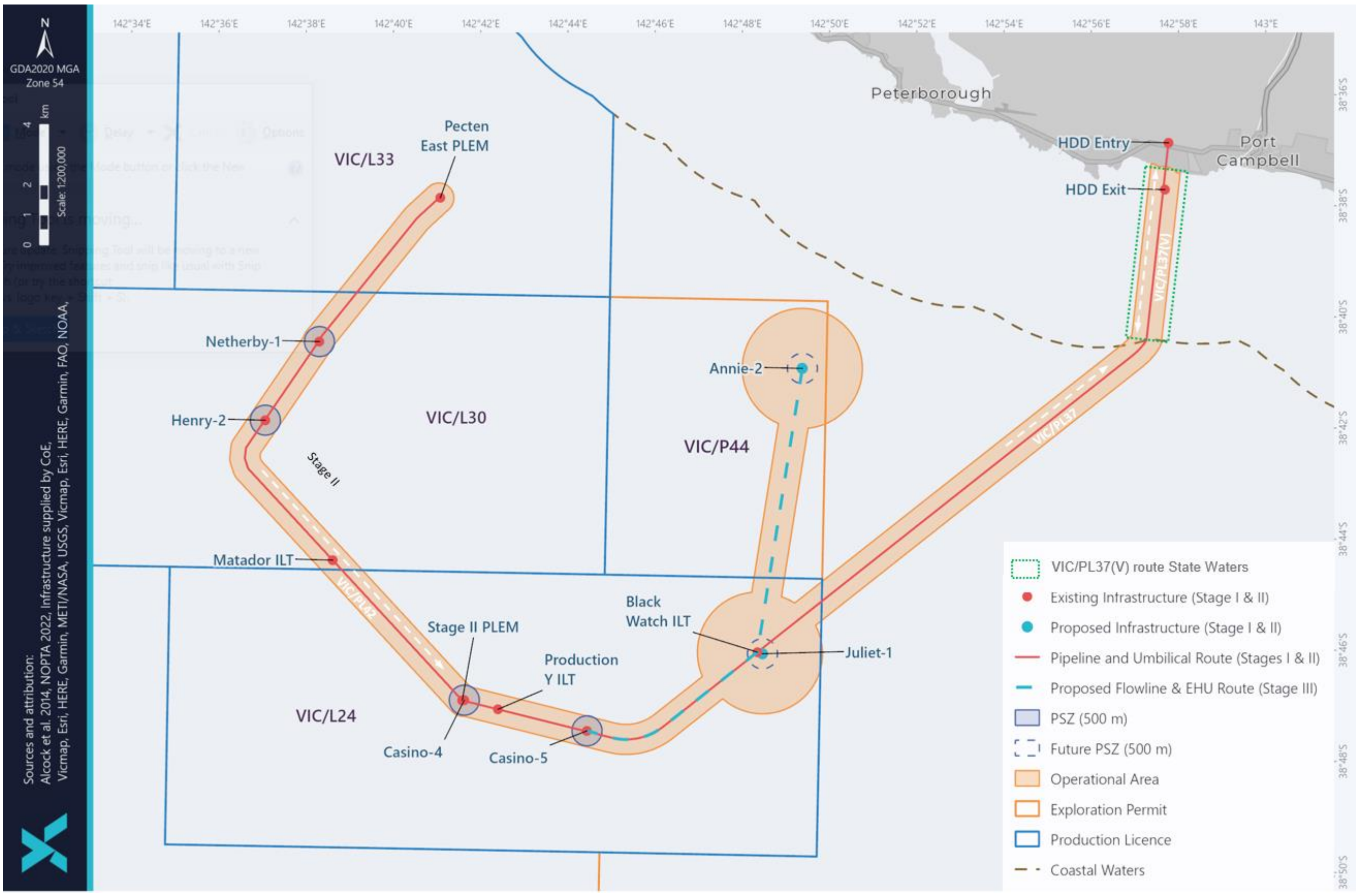


Figure 3-1: Operational Area

3.2. Activity timing

The EP covers a period of 5-years from acceptance. Within this period a number of activities are expected to take place. These activities, including contingency activities such as repair works, and their approximate durations are described in the respective sections below. Table 3-3 shows the activity schedule; some of these timings are as planned, and some are nominal timings.

Table 3-3: Indicative activity timings

Year	2022				2023				2024				2025				2026				2027			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
EP				a																				s
Operations															S3									
IMR					n								n								n			
Survey								n																
Stage III drilling										◄	—	—	—	—	►									
Stage III tie-in												◄	—	—	—	►								

a = acceptance (assumed), s = submission (dependent on acceptance timing), n = nominal timing, S3 = Stage III online (planned), arrows = activity window.

3.3. Asset Description

The Otway offshore facilities (Figure 3-1) consist of:

- Stage I (installed and operational):
  - Casino-4 and Casino-5 (located in Production Licence VIC/L24) complete with wellheads and trees at the seabed in 70 m water depth.
  - A 32.6 km long, 300 mm nominal diameter pipeline (VIC/PL37 and VIC/PL37(V), connecting the Casino wells to shoreline infrastructure and processing facilities at the Athena Gas Plant. The Stage I offshore pipeline is not trenched but laid directly onto the seabed. It is stabilised with 271 concrete articulated mattresses to prevent movements induced by ocean currents at the seabed.
  - The 120 mm diameter EHU cable, 31.2 km long, which connects Casino-4 and Casino-5 to the MLV onshore; the MLV is connected to the Athena Gas Plant. The umbilical contains electrical lines and multiple cores which convey chemicals and hydraulic fluids. The umbilical is stabilised by 84 mattresses.

Five and a half km (5.5 km, 3 NM) of the Stage I pipeline (VIC/PL37(V)) and associated EHU cable are located in Victorian state waters. The VIC/PL37(V) pipeline extends from the Horizontal Directional Drill (HDD) shoreline crossing, within the HDD section of pipeline, to 5.5 km from the shoreline. The HDD exit is located approximately 800m from the shore in 18 m water depth. The Stage I pipeline then runs south through State waters into Cwth waters where it passes south of the Casino-5 and Casino-4 wells by an offset of approximately 30 m from the wells and terminates at the Casino pipeline end manifold (PLEM).

- Stage II (installed and operational):
  - Henry-2 and Netherby-1 (located in Production Licence VIC/L30) complete with wellheads and trees at the seabed in 67 m and 63 m water depth respectively, with rigid spools to connect the subsea trees (SST) to the Casino pipeline.
  - A 22 km long, 300 mm nominal diameter (Licenced Pipeline VIC/PL42) Casino to Pecten East pipeline (Casino Stage II pipeline), which connects the Henry-2 and Netherby-1 wells to the Casino Stage I Pipeline. The Stage II pipeline was also not trenched and was laid directly onto the seabed. It is stabilised with 390 concrete mattresses to prevent movements induced by ocean currents at the seabed.
  - The 135 mm diameter EHU cable (extension of the Stage I umbilical), 22 km long, connecting the Henry-2 and Netherby-1 wells to the electrically and hydraulically to the MLV and AGP. The umbilical is stabilised by 240 concrete mattresses.
  - Subsequent installation of a 4.4 km EU from Casino 5 to Casino 4, 6.6 km EU from Casino 4 to Matador, 6.2 km EU from Matador to Henry, 3.5km EU from Henry to Netherby. These sections of EU replaced and repaired the electrical component of the in-field EHU which had been experiencing communication issues.

The Stage II pipeline, installed in 2009, ties into the Casino PLEM via a tie-in spool and a separate downstream PLEM. The pipeline runs in a north-westerly direction towards Henry-2. Prior to reaching Henry-2, the pipeline turns north-east where it runs past Henry-2 and Netherby-1 to the Netherby PLEM. The pipeline then further extends from the Netherby PLEM to the Pecten East PLEM. This pipeline section is isolated by double block and bleed valving and was filled within inhibited water[2] (440 m^3) in 2009. The end point of this pipeline is the Pecten East prospect. Development of Pecten East is a potential future activity; it is not currently within the scope of this EP.

- Stage III (planned install 2024/25, operational from 2025):

Cooper Energy plans to integrate Stage III into the existing facilities, as shown in Figure 3-1. Stage III targets modest size gas reservoirs in the Annie and Juliet fields, situated near to the existing offshore infrastructure. These infill tiebacks are proposed to involve:

- a diverless manifold near, and tied back to, the Black Watch ILT with an 8" flexible jumper.
- a single subsea well at Annie-2 (located in VIC/P44, water depth ~60m). A 10.1 km 8" flexible flowline (laid on the seafloor) will tie-in to the new manifold as detailed above.
- a single subsea well at Juliet-1 (located in VIC/L24, water depth). A short (<1 km) 8" flexible flowline will tie-in to the new manifold (noted above).
- EHUs for both Annie and Juliet will be integrated into the existing controls, providing the same hydraulic and chemical injection capability. A primary umbilical will be laid from C5 to a new SUDU at Black Watch and additional umbilicals will run from the new SUDU out to the Stage III wells. Umbilical routes are generally aligned with the facility pipelines.

3.3.1. Equipment Status

A range of infrastructure currently exists within the operational area. An infrastructure register is maintained within the Asset Integrity Management Plan (IMP) document (CHN-IR-IMP-0001). Table 3-4 provides summary of the main infrastructure components for Stages I and II and their status; minor and auxiliary pieces of equipment (e.g. flowline jumpers, flying leads) are not described here but are tracked via the IMP.

Table 3-4 Equipment Status

Infrastructure	Associated Licence	Status
Wells and Subsea Trees		
Casino-4	VIC/L24	Operational
Casino-5	VIC/L24	Operational
Henry-2	VIC/L30	Operational
Netherby-1	VIC/L30	Operational
Pecten East Well	VIC/L33	Not installed
Annie-2	VIC/P44[3]	To be installed, subject to planning approvals
Juliet-1	VIC/L24	To be installed, subject to planning approvals
Manifolds and Tie-ins		
Pecten East Tee & PLEM	VIC/PL42	Installed for future tie-ins
Netherby Tee & PLEM	VIC/PL42	Operational
Henry 2 ILT	VIC/PL42	Operational
Matador ILT	VIC/PL42	Installed for future tie-ins
Casino 2009 PLEM	VIC/PL37	Operational

[2] *Water inhibited with Oxygen Scavenger Champion OS2 (@ 150 ppm), Biocide 1710 Champion (@700 ppm), Florescent Dye (@ 100 ppm concentration).*

[3] *Annie Field will be excised into a production licence prior to production*

Infrastructure	Associated Licence	Status
Casino 4 Tee & PLEM	VIC/PL37	Operational
Production Y Tie-in ILT	VIC/PL37	Installed for future tie-ins
Casino 5 ILT	VIC/PL37	Operational
Blackwatch ILT	VIC/PL37	Installed for future tie-ins
Blackwatch Manifold	VIC/L24	To be installed
Flowlines		
Pecten East to Netherby Rigid Pipeline	VIC/PL42	Installed for future tie-ins
Netherby to Henry 2 Rigid Pipeline	VIC/PL42	Operational
Henry 2 to Matador Rigid Pipeline	VIC/PL42	Operational
Matador to Casino Tie-in Rigid Pipeline	VIC/PL42	Operational
Casino 5 to KP13.7 Rigid Pipeline	VIC/PL37	Operational
KP13.7 to HDD Exit Rigid Pipeline	VIC/PL37 / VIC/PL37(V)	Operational
HDD Exit to HDD Entrance Rigid Pipeline	Crossover between VIC/PL37(v) / VIC/PL251	Operational (VIC/PL251 is not in scope)
HDD Entrance to Mainline Valve (LV) Rigid Pipeline	VIC/PL251	Operational (not in scope)
Annie-2 to Blackwatch Manifold Flexible Flowline	VIC/PL37[4]	To be installed
Juliet-1 to Blackwatch Manifold Flexible Flowline	VIC/PL37	To be installed
Umbilicals and Termination / Distribution Units		
Pecten East Umbilical Terminal Assembly (UTA)	-	Installed for future use
Pecten East to Netherby Umbilical	-	Installed for future use
Netherby to Henry 2 Umbilical	-	Operational
Henry – Netherby (HN) EU	-	Operational
Matador – Henry (Matador – Henry (MH)) EU	-	Operational
Henry 2 to Matador UTA-2 Umbilical	-	Operational
Matador UTA-2 to UTA-1 Umbilical	-	Operational
Casino – Matador (CM) EU	-	Operational
Casino 4 to Casino 5 Infield Umbilical	-	Operational
Casino 5 – Casino 4 (5/4) EU	-	Operational
Casino 5 to MLV Main Umbilical	-	Operational
Netherby UTA	-	Operational
Henry 2 EDU	-	Operational
Henry 2 UTA (x2)	-	Operational
Matador UTA-2 (at Matador)	-	Operational

[4] *May require separate pipeline licence*

Infrastructure	Associated Licence	Status
Matador UTA-1 (at Casino 4)	-	Operational
Casino 4 EDU	-	Operational
Casino 4 MUTA	-	Operational
Casino 4 UTA (x2)	-	Operational
Casino 5 EDU	-	Operational
Casino 5 UTA	-	Operational
Blackwatch subsea umbilical distribution unit (SUDU)	-	To be installed

3.4. Asset Decommissioning

Cooper Energy's strategy in the Otway is to extend the life of and utilise existing infrastructure where practical. This has the dual benefit of reducing the economic threshold for bringing gas to market and reducing the environmental footprint. At this time, the Otway offshore facilities are operational and are maintained in accordance with the facility IMP (CHN-PI-IMP-0001).

Cooper Energy acknowledges the requirement through Section 572 of the OPGGSA and NOPSEMA Policy Section 572 Maintenance and Removal of Property (N-00500-PL1903, A720369, November 2020) for removal of all property when it is no longer in use and that any deviations from this position will need to be evaluated and accepted by NOPSEMA. These requirements are integrated into the Cooper Energy Decommissioning Protocol (see Section 9.3.1).

Table 3-5 outlines the expected abandonment and decommissioning timelines for Cooper Energy's wells and subsea infrastructure in the Otway Basin. Decommissioning timings are indicative and are dependent on several factors, including:

- Production duration from producing assets;
- Rig / vessel availability;
- Potential to extend life for adjacent projects; and
- Ability to combine decommissioning operations with other projects and / or operators to carry out works efficiently, and in a cost-effective manner.

Table 3-5 Indicative Decommissioning Plan

Asset	Scope	Indicative Timing	Notes
Offshore Wells	Plug and Abandon Wells	Within 3-years of cessation of production from all assets.	Well abandonment to be carried out within 3 years of cessation of production. If production ceases from wells incrementally, wells which are no longer producing will be monitored in accordance with the WOMP, until the full field well abandonment campaign.
Offshore facilities	Prepare Offshore Facilities for decommissioning (flushing / cleaning)	Following cessation of production	Undertaken as part of preparations for full field decommissioning.
	Decommissioning of offshore facilities	Within 5-years of cessation of production.	The final end state is expected to involve removal of all surface facilities; any alternative arrangements would be sought through the submission of a separate EP. Where IMR involves the replacement of equipment; redundant equipment shall be removed subject to an assessment considering aspects including stability,

Asset	Scope	Indicative Timing	Notes
			integrity, and interaction with live equipment, which may preclude interim removal.
Title Area	Making good seabed	Prior to Title relinquishment	Making good the seabed may involve offshore survey for debris and seabed condition.

3.5. Production and Field Characteristics

3.5.1. Production & Emissions Profile

The Otway offshore reservoirs produce gas with minor quantities of condensate. Production from the Casino field commenced in 2005 and production from Henry-2 and Netherby-1 commenced in 2010. Production from Annie-2 and Juliet-1 is planned from 2025.

Figure 3-2Figure 3-2: shows a raw gas production profile forecast for the Offshore Otway Asset. It comprises a number of components:

- Remaining Base 2P production from existing producing fields (no further activity) (dark grey)
- Remaining 2P production including a minor pressure reduction project at Athena (light grey)
- Addition of the Annie 2P production forecast (dark pink)
- Addition of the unrisked Juliet P50 forecast (light pink)

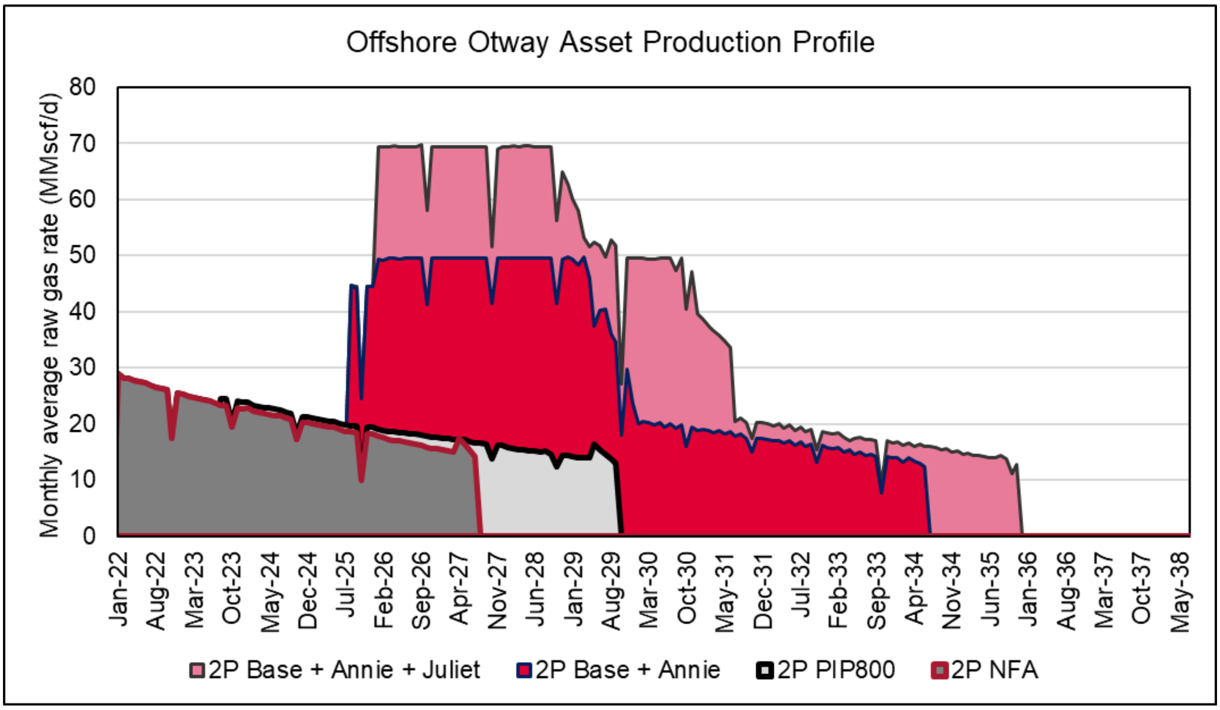


Figure 3-2: Indicative production forecasts for the Otway offshore reservoirs

Table 3-6 shows the estimated resources within the fields described. Production varies day-to-day to meet monthly/daily nominations by customers. Gas production from the fields has historically exceeded 100 TJ/d, though is now at around 25 TJ / day and 3 m^3 / day condensate.

Table 3-7 identifies total Scope 1, 2 and 3 emissions associated with the production activities, shown for both the current stage (Stage 1 & 2 only) and with the inclusion of Stage 3.

Table 3-6: Otway offshore reservoirs - estimated resource

	Field	Estimated resource (EUR, raw Bcf)	Production rates	Production cessation cases
Stage I	Casino	299	Historical >100 TJ/d 2022: 25 TJ/d	Circa 2027 (no AGP inlet modification) Circa 2029 (with AGP inlet modification) Circa 2034/5 (with AGP inlet modification and Stage III as Annie-2 and Juliet-1)
Stage II	Henry	51		
	Netherby	97		
Stage III	Annie	68	Up to approx. 70TJ/d	
	Juliet	49		
Total	-	564	-	

Table 3-7 Total emissions (remaining as of 2022) estimates for Base, Annie and Juliet

Total Emissions Estimates ($ktCO_2$-e)	Base (Stage I & 2 remaining)		Base plus Annie and Juliet (Stage I & II remaining and Stage III)	
	Annual Ave	Cumulative	Annual Ave	Cumulative
Scope 1	82	571	66	919
Scope 2	2	14	8	110
Scope 3	397	2,776	677	9,479

3.5.2.Reservoir and Hydrocarbon properties

All wells in the development area access hydrocarbons from the Waarre A or Waarre C Formation reservoirs. Reservoir conditions and gas and condensate compositions across the wells do not vary materially.

Table 3-8 provides a breakdown of the known and expected reservoir and hydrocarbon properties from the fields. The condensate of the Otway offshore reservoirs is classified as a Group 1 (non-persistent) oil. The Netherby condensate is considered representative of all reservoirs (refer to Table 3-10), which are ultimately comingled within the Casino pipeline during transport to shore. Netherby condensate is highly evaporative under ambient atmospheric conditions, with zero estimated residual (persistent) components (Table 3-9). It has a pour point of -54°C (when fresh).

Table 3-8: Otway Field Reservoir Conditions

Parameter	Casino Waarre C	Casino Waarre A	Henry	Netherby	Annie	Juliet
Pressure at Reservoir Depth (psia)	Undepleted: 2850 Current: 515	Undepleted: 2830 Current: 880	Undepleted: 2670 Current: 880	Undepleted: 2550 Current: 505	Undepleted: 3280	Undepleted: 3150-3350
Temperature (°C)	80	87	80	76	100	101-106
Gas Specific Gravity	0.595-0.65	0.595-0.65	0.59	0.584	0.66	0.6
Condensate to Gas Ratio	Undepleted: 1.1 bbls/MMscf Current: 0.3 bbls/MMscf				1bbl/MMscf	1bbl/MMscf

Table 3-9: Otway Field Gas Compositions[5]

Component	Casino		Henry	Netherby	Annie	Juliet
	Casino 4 (Waarre A)	Casino 5 (Waarre C)	Henry 2 (Waarre A)	Netherby 1 (Waarre A)	(Waarre C) also base case for Annie-2	Juliet base case (Waarre C)[6]
	mole%					
Hydrogen sulphide	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen	0.66	0.74	0.07	0.06	0.88	1.60
Carbon Dioxide	3.15	2.18	1.59	1.16	7.60	1.63
Methane	93.67	94.50	94.82	95.66	88.29	94.79
Ethane	1.50	1.80	2.26	1.99	2.11	1.22
Propane	0.43	0.44	0.60	0.55	0.64	0.34
i-Butane	0.13	0.07	0.12	0.10	0.03	0.08
n-Butane	0.13	0.07	0.18	0.12	0.07	0.09
i-Pentane	0.04	0.02	0.04	0.04	0.04	0.03
n-Pentane	0.03	0.02	0.04	0.04	0.04	0.02
Hexane	0.05	0.02	0.07	0.05	0.11	0.03
Heptane	0.09	0.06	0.10	0.08	0.08	0.03
Octane	0.03	0.03	0.04	0.04	0.03	0.01
Nonane	0.03	0.01	0.02	0.03	0.02	0.01
Decane	0.02	0.01	0.02	0.02	0.01	0.01
Undecane	0.03	0.01	0.01	0.02	0.01	0.02
Dodecane+	0.01	0.02	0.02	0.04	0.03	0.09
TOTAL	100	100	100	100	100	100
Mercury	11-15 ng/m^3				1-4 µg/m^3	-
NORMS	240 Bq/m^3 (Radon-222)				-	-

Table 3-10: Physical Characteristics of the Netherby Condensate

Characteristic	Volatiles (%)	Semi-volatiles (%)	Low Volatiles (%)	Residuals (%)	Density (kg/m^3)	Dynamic Viscosity (%)
Boiling point (°C)	<180	180-265	265-380	>380		
Aromatics	MAHs	2-ring PAHs	3-ring PAHs	≥4 rings		
Aliphatic	C4 – C10	C10 – C15	C15 – C20	>C20		
Netherby condensate	84	14	2	0	774 @ 16 °C	0.14 @ 25 °C
	Non-persistent			Persistent		

3.6. Activities that have the potential to impact the environment

The scope of this EP covers the operations, maintenance and support activities associated with Stages I and II. The EP also covers the integration of Stage III, comprising the construction, tie-in, testing and operation of infill gas wells and associated equipment. Activity types in scope of the ongoing operations include:

- Subsea Operations
  - Operation of subsea infrastructure (wells and other infrastructure)
  - Operation of subsea pipelines
  - Inspection, maintenance and repair (IMR)
- Activity types in scope to support Stage III include:

[5] *Gas is treated at AGP to meet sales specification*
[6] *Based on Otway field analogues*

- Drilling
  - MODU Positioning
  - Pre-lay moorings
  - Drilling and Completions operations
  - BOP installation and testing
  - BOP fatigue clump weights
  - Cementing operations
  - Well clean up and flowback
- Installation and commissioning
  - Pre-lay , crossings and stabilisation
  - Installation – Infield flowlines and umbilicals
  - Termination structures and manifolds
  - Subsea equipment preservation and start up

Both operations and new stage activities will also involve:

- Support operations
  - Vessel operations
  - MODU operations (new stage)
  - ROV operations
  - Helicopter operations
  - Diver operations
- Site Surveying
  - Geophysical
  - Geotechnical

All activities are all described in detail in the sections to follow, with inputs provided that relate to the environmental aspects that the activity triggers.

3.6.1. Subsea Operations

The operation, monitoring and control of the Otway wells are conducted remotely from the Athena Gas Plant through control via the EHU. All well functions are monitored and controlled from the gas plant control room through a Master Control System (MCS) via a Subsea Control Module (SCM) integrated into the subsea tree at each well. All subsea control systems are electro-hydraulic.

Isolation of the pipeline occurs at the offshore wells, the onshore MLV site and at the inlet to the Athena Gas Plant upstream of the Athena Gas Plant Slug Catcher. Isolation valves, sub-surface safety and wellhead isolation valves are tested in accordance with the WOMP and IMP.

The hydraulic component of the EHU is open loop, with discharges of water-based control fluids at the wells during valve functioning. These hydraulic cores currently carry two control fluids which are common within offshore production facilities in Bass Strait:

- Castrol Transaqua HT2. This product has been in use for > 5 years and comprises the majority of the control fluid within the system.
- Macdermid HW525. This product was in use for a period until it was substituted for HT2. There remains some residual HW525 within the system (HP lines) which is gradually displaced by the HT2.

Hydrate, scale and corrosion is managed with the assistance of chemical injection at the wells via chemical cores within the EHU. These cores are closed loop with no planned discharges during normal operations. Chemicals within the EHU include hydrate inhibitors (Methanol, MEG) treated with an acidity regulator (e.g.

sodium hydroxide, potassium carbonate) and scale inhibitor (e.g. Gyptron SA-3220, Dissolvine Stimwell HTF).

Fluids within the EHUs may be discharged during maintenance and repair activities, for example during umbilical jumper replacement, or intervention and re-termination of umbilicals in the event of a fault. Details regarding the functioning of the EHU and planned discharges are described below.

<table>
<tr><th>Requirements for Impact Assessment</th><th>Technical Input</th></tr>
<tr><td>What volume of hydraulic fluid will be discharged to the marine environment in normal operations?</td><td>
<table>
<tr><th>Valve Action</th><th>Approximate control fluid release volume</th></tr>
<tr><td>Emergency shutdown (ESD)</td><td>10 L</td></tr>
<tr><td>Controlled well shutdown</td><td>10 L</td></tr>
<tr><td>Well Integrity Test (over 4-6 hours)</td><td>30 L</td></tr>
<tr><td>Total annual</td><td>2 – 3 m^3</td></tr>
</table>
</td></tr>
</table>

3.6.2. Inspection, Maintenance and Repair Activities

3.6.2.1. Inspections

Inspection of wells, pipelines, umbilicals and subsea structures will be undertaken by an ROV from a vessel. In some cases, this may involve divers and a dive support vessel.

Inspections typically monitor:

- Anode wastage;
- Coating damage;
- Cathodic protection (CP) measurements;
- External corrosion;
- Lack of integrity (missing components, broken loose or damaged appurtenances);
- Pipeline spans, support and stabilisation
- Structures integrity
- Marine growth;
- Damage (impact, environment or third party);
- Scour;
- Variation of inspected components or operating conditions; and
- Leaks (gas or liquid).

Inline inspections/pigging (ILI) of the offshore pipelines may occur with pigs received at the Athena Gas Plant along with any pipeline gas, fluids, debris and chemicals.

<table>
<tr><th>Requirements for the Impact Assessment</th><th>Technical Input</th></tr>
<tr><td>Describe the potential discharges resulting from inspection activities</td><td>ILI scenario #1: Discharge of treated water associated with installation/removal of pig launcher offshore (Commonwealth waters). Nominal discharge of chemically treated water. Treatment chemicals may include: Corrosion inhibitor, Oxygen scavenger, Biocide and Dye.

ILI scenario #2: Displacement of 400 m^3 previously treated water from the Pecten-east to Netherby section of pipeline when PIG is propelled from PE. Discharge at Netherby at a rate of 0.5 to 1 m/s.

External integrity checks: targeted use of marine scale dissolver to remove calcareous deposits and from subsea infrastructure, allowing access for CP and wall thickness checks. Nominal discharge volume of 2 m^3 in 100 L batches.</td></tr>
</table>

What is the planned inspection schedule/frequency?	Inspections are undertaken in accordance with the schedule outlined in the asset IMP and vary based on the outcomes of the previous inspection and ongoing integrity monitoring. Inspections can also occur in response to incidents.
What is the planned inspection duration	Inspections typically take 4 – 6 hrs per structure and 1 – 2 days for pipelines, totalling 2 – 4 weeks at sea for an entire inspection program including mobilisation and demobilisation.

3.6.2.2. Maintenance and Repair

Maintenance and repair activities may need to occur during the operational life of the field to:

- Prevent deterioration and/or failure of infrastructure; and
- Maintain reliability and performance of infrastructure.

Maintenance and repair activities are typically conducted in response to inspection findings, engineering analyses, and/or external events. The activities are typically performed by ROV from a vessel or by divers from a dive support vessel.

Table 3-11 summarises the typical maintenance and repair activities that may be undertaken but this list is not exhaustive. The table also includes details of the initiation criteria for the various maintenance programs.

Table 3-11: Summary of Typical Maintenance and Repair Activities

Maintenance and Repair Type	Description	Initiation Criteria
Cathodic protection system maintenance	Replacement of anodes and continuity straps. Installation of cathodic skids.	Anodes are retrofitted when the existing anodes have depleted.
Leak testing	Leak testing is undertaken as required to verify the pressure integrity of components. Leak testing involves filling the component with water dosed with inhibitor, biocide and dye (normally fluorescent) and pressurising the pipeline to an appropriate test pressure.	Where the integrity of the pipeline system must be re-confirmed.
Excavation for intervention	To undertake subsea IMR, localised excavation may be required directly adjacent to the subsea system, allowing access to infrastructure that may have become buried. Typically, this is conducted by jetting, equipment from an ROV, vessel, or by using divers, depending on the location, depth, and seabed characteristics. Significant burial (or deburial works) is not expected noting the sand layer in the area is generally thin or non-existent.	Access required to subsea infrastructure that may have become buried, for inspection, maintenance or repair.
Marine growth and hard deposit removal	Marine growth and deposits may be removed by water jetting or manual cleaning from an ROV or by divers to access equipment. Water jetting may use potable or sea water. Chemicals, typically sulfamic acid (or equivalent such as citric acid), may be used to assist clean-up for removing limescale.	Access required to subsea infrastructure for inspection, maintenance or repair.
Removal of debris or fishing net	Removal of debris such as ropes and fishing nets that may become entangled on infrastructure.	Inspection identifies hazardous debris on infrastructure.

Maintenance and Repair Type	Description	Initiation Criteria
Rectification of electrical or hydraulic fault	Rectification of an electrical or hydraulic fault associated with an umbilical and associated connected equipment. Replacement of electrical/hydraulic/chemical umbilical or jumper, cleaning of connectors, testing of connectors.	Electrical or hydraulic fault.
Pipeline repair	Pipeline repair which may, depending upon the damage the pipeline has sustained, include composite wrap application, mechanical clamp installation, anode retrofit, pipeline cut-out and section replacement.	Inspection identifies significant corrosion or damage to pipeline or a LOC from the pipeline.
Pipeline Gauging	Gauging involves the use of a series of pipeline inspection gauges (pigs) which clean and inspect the line. A pig launcher and receiver are typically installed at either end of the flowline for this activity. The pigs are pumped from a temporary launcher offshore, through the flowline, to the receiver onshore, where gauging products and associated fluids are collected for processing. Prior to re-instatement of operations the pipeline is displaced to nitrogen.	Gauging may be completed for the existing rigid sections of pipeline to inspect pipe condition as part of the broader integrity management program and depending on future re-life opportunities.
Flowline jumper replacement	Replacement of flowline jumper with either rigid or flexible flowline between existing flange connections.	Flowline jumper significantly damaged or not functioning.
Service line/hydraulic capping plate removal and reinstallation	Replacement or institute servicing of hydraulic multi quick connect plate including cleaning of interface (ROV and hydraulic) and testing of connections.	Testing / inspection indicates an issue, or local control / intervention required.
Subsea control unit change out	Replacement or institute servicing of SCM including cleaning of interface (ROV, hydraulic and electrical) and testing of connections.	SCM significantly damaged or not functioning:
Replacement of equipment on the seafloor	Where subsea equipment cannot be repaired it may be replaced. This would typically occur in the same location or near to the previous location.	Subsea equipment significantly damaged or not functioning:
Stabilisation deployment	Mattresses and grout bags maybe used where electrical or hydraulic leads are observed to be “floating” or where further support is required beneath the umbilicals and pipelines.	Inspection identified electrical or hydraulic leads “floating” or other infrastructure requires physical protection.
SSTs, flowlines, well bore penetrations, flanges and mechanical connections servicing	Tensioning, blanking or polymer sealant intervention to restore or preserve integrity to subsea conduits.	Subsea equipment significantly damaged or not functioning.

<table>
<tr><th>Requirements for Impact Assessment</th><th>Technical Input</th></tr>
<tr><td>Describe planned chemical / additive discharges</td><td>Occasional subsea discharge of fluids typically treated water, hydraulic fluids and grout.
Marine growth removal
<table>
<tr><th>Fluid Type</th><th>Approximate release volume</th></tr>
<tr><td>Scale dissolver</td><td>3 m³ in (500 L batch applications)</td></tr>
</table>
Control System Repair (subsea discharge):
<table>
<tr><th>Fluid Type</th><th>Approximate release volume</th></tr>
<tr><td>Control Fluid</td><td>Jumper replacement: 30 L
Umbilical re-termination: 10 m³</td></tr>
<tr><td>Treated MEG / Methanol</td><td>Jumper replacement: 30 L
Umbilical re-termination: 10 m³</td></tr>
</table>
Pipeline Repair (subsea discharge):
<table>
<tr><th>Fluid Type</th><th>Approximate release volume</th></tr>
<tr><td>Treated Water</td><td>100 m³</td></tr>
</table>
Stabilisation deployment (subsea discharge):
<table>
<tr><th>Material</th><th>Approximate release volume</th></tr>
<tr><td>Grout and washings</td><td>3 m³ (grout pumped from surface to expandable grout bags at seabed).</td></tr>
</table>
</td></tr>
<tr><td>What is the area and nature of any seabed disturbance?</td><td>Placement of some tools or equipment on the sea floor for ROV activities (~ 5 m²). Replacement of like for like equipment (~25 m²), installation of anode skids (~ 5 m²). Any coatings, marine growth or sand removed from around structures is left in-situ. Grout bags/span rectification materials typically cover an area of 2 m²</td></tr>
<tr><td>What is the planned maintenance and repair schedule/frequency</td><td>Maintenance and repair activities are expected to be rare and infrequent, with activities anticipated to occur on a 5-yearly frequency, however the exact frequency of maintenance activities will depend on the results of inspections.</td></tr>
<tr><td>What is the planned maintenance and repair duration</td><td>If a repair is required, a vessel may remain on site for approximately 7 – 30 days at a time, depending on the repair.</td></tr>
</table>

3.6.3. Site Surveying

3.6.3.1. Geophysical Survey

Geophysical surveying is planned to occur within the Otway offshore titles. These types of surveys are required to understand seabed relief, substrate and hazards on or below the seabed, to inform the planning of activities such as installation and drilling. The geophysical survey techniques are described in Table 3-12.

Table 3-12: Geophysical Survey Equipment

Survey Equipment	Description
Multi-beam echo sounder (MBES)	The purpose of the MBES investigation is to undertake detailed measurements of bathymetry in the operational area. A MBES mounted on the vessel hull is likely to be used. A MBES acquires a wide swath (strip) of bathymetry data perpendicular to the vessel track and

Survey Equipment	Description
	provides total seabed coverage with no gaps between vessel tracks. MBES systems are available for all water depths between 1 m and 12,000 m. A MBES transmits a broad acoustic pulse from a transducer over a swath across track. The MBES then forms a series of received beams that are each much narrower and form a ‘fan’ (with a half-angle of 30-60°) across the seabed, perpendicular to the vessel track. The transducer(s) then ‘listen’ for the reflected energy from the seabed. The fans of seabed coverage produce a series of strips along each track, which are lined up side-by-side to generate two dimensional georeferenced bathymetric maps of the seabed.
Side Scan Sonar (SSS)	An SSS detects hazards such as existing pipelines, lost shipping containers, boulders, debris, unmarked wrecks, reefs and craters. The SSS method of surveying generates oblique acoustic images of the seabed by towing a sonar ‘towfish.’ The towfish is provided with power and digital telemetry services and towed from the vessel using a reinforced or armoured tow cable. The towfish is equipped with a linear array of transducers that emit, and later receive, an acoustic energy pulse in a specific frequency range. Typically, a dual-channel, dual-frequency SSS is used. SSS is similar to MBES but operates at a wider fan angle. The SSS towfish is constructed of stainless steel and is a cylindrical torpedo-like device and is typically towed 10-15 m above the seabed depending on water depth and the frequency range. The SSS is towed and operated at the same time as the MBES.
Sub-bottom Profiler (SBP)	An SBP is used to investigate the layering and thickness of the uppermost seabed sediments. The SBP must be able to provide imagery that penetrates to a minimum depth of at least 30 m below the seabed. **Compressed High-Intensity Radar Pulse (CHIRP)** Very high frequency systems including pingers, parametric echo sounding and CHIRP – produce a swept-frequency signal. CHIRP systems usually employ various types of transducers as the source. The transducer that emits the acoustic energy also receives the reflected signal. CHIRP signals typically penetrate only about 5-10 m into the seabed and provide the best resolution, but lowest penetration. A CHIRP is normally hull mounted when used for shallow water operations but may also be towed in a similar fashion to the SSS. **High frequency Boomers** High-frequency boomers consist of a circular piston moved by electro-magnetic force (comprising an insulated electrical coil adjacent to a metal plate). The high voltage energy that excites the boomer plate is stored in a capacitor bank. A shipboard power supply generates an electrical pulse that is discharged to the electrical coil causing a magnetic field to repel a metal plate. This energetic motion generates a broadband, high amplitude impulsive acoustic signal in the water column that is directed vertically downward. A boomer system offers a penetration depth of up to 100 m below the seabed. Boomers are mostly surface towed but may also be towed below the surface to avoid sea surface wave noise and movement. The receiver for the boomer system is usually a hydrophone or hydrophone array consisting of a string of individual hydrophone elements located within a neutrally buoyant synthetic hydrocarbon filled tubing. They typically contain eight to 12 hydrophone elements evenly spaced in a tube that is 2.5 to 4.5 m in length and 25 mm in diameter. The SBP system is towed and operated at the same time as the MBES and SSS. The survey is likely to be undertaken in two passes in conjunction with the MBES and SSS.
Magnetometer	This equipment detects large and small metallic objects on or below the seabed (e.g. buried pipelines, petroleum wellheads, shipwreck debris and dropped objects such as un-exploded ordinance, cables, anchors, chains) that may not be identified by acoustic means. A magnetometer sensor is housed in a towfish and is towed as close to the seabed as possible and sufficiently far away from the vessel to isolate the sensor from the magnetic field of the vessel.

Survey Equipment	Description
	A magnetometer measures the ambient magnetic field using nuclear magnetic resonance technology, applied specifically to hydrogen nuclei. The magnetometer survey will be conducted simultaneously with the MBES, SSS and SBP, as it can be powered using the same tow cable and power supply.
Ultra-Short Baseline (USBL) Positioning System	A complete USBL system consists of a transceiver, which is mounted on a pole under a vessel, and a transponder or responder on a towfish. A computer, or "topside unit", is used to calculate a position from the ranges and bearings measured by the transceiver. An acoustic pulse is transmitted by the transceiver and detected by the subsea transponder, which replies with its own acoustic pulse. This return pulse is detected by the shipboard transceiver. The time from the transmission of the initial acoustic pulse until the reply is detected is measured by the USBL system and is converted into a range. This equipment is designed for positioning towfish in water depths up to 3,000 m.
Sound Velocity Profiler (SVP) and Conductivity, Temperature and Depth (CTD)	This equipment is used to determine the speed of sound in water; in addition to CTD data. The probe is fitted with a digital time of flight sound velocity sensor, conductivity sensor, a temperature compensated piezo-resistive pressure transducer, and a temperature sensor.

Requirements for Impact Assessment	Technical Input
Typical noise emission from survey techniques	MBES R2Sonic 2024 Reson SeaBat 8101 200–400 kHz Sidescan sonar EdgeTech 4200 70–400 kHz Sub-bottom profiler • CHIRP, Applied Acoustics AA301 2–16 kHz • Boomer, Applied Acoustics AP3000 100-1,000 Hz • USBL Sonardyne Ranger 18–36 kHz

3.6.3.2. Geotechnical Survey

Geotechnical surveying will be required and will occur within the operational area. The geotechnical survey techniques are described in Table 3-13. Sampling locations will be decided following assessment of geophysical survey results.

Table 3-13: Geotechnical Survey Equipment

Survey Equipment	Description
Penetration testing	Penetration testing involves pushing a probe into the seabed at a constant rate of penetration and continuously measuring resistance, friction, and water pressure. The method can detect fine changes in stratigraphy.
Coring	Coring involves inserting equipment into the seabed, either via gravity, or rotating equipment to retrieve samples for geotechnical analysis.
Grab sampling	Grabs may be used to retrieve surface sediments along flowline and umbilical routes, and at well sites.
Deployment skids	Geotechnical survey equipment is deployed from a vessel to the seabed within a frame, or skid. The skid provides allowed the equipment to be landed on the seabed in the correct orientation and provides a stable structure through with samples can be taken. Skid sizes vary. A nominal 1 m^2 footprint has been used for assessment purposes.

Requirements for Impact Assessment	Technical Input
Typical seabed disturbance based on number of samples and sample size from survey techniques	Penetration Testing – 12 samples per well site. 0.1 m diameter sample size. Coring – 12 samples per well site. 0.5 m diameter sample size. Grabs – 2 x samples per km along flowline or umbilical route. Nominal 2 x samples per mooring. 0.1 m^3 sample size. Number of samples required is optimised alongside the collection of geophysical data.

3.6.4. Well Construction

Drilling of Annie-2 and Juliet-1 wells is proposed as a part of Stage III. The activities associated with the construction of these wells is discussed below. Each well is expected to take around 45 days to drill and complete. Petroleum Safety Zones, once gazetted over the wells, remain in force for the duration of the subsequent activities, through production and abandonment, until revoked.

3.6.4.1. MODU Positioning

The relatively shallow water depths, metocean conditions and unique seabed in the Otway, in most circumstances, necessitates the use of a moored semi-submersible mobile offshore drilling unit (MODU).

The MODU will typically require a between eight and 12 anchors to maintain position during drilling. These anchors, associated chain is deployed to the seabed by the AHSVs.

A moored MODU may move into position under its own propulsion or be towed via anchor handling support vessels (AHSVs). Once the MODU is in position, the AHSV will connect the mooring lines to the MODU, and the lines are tensioned by winches to a pre-determined tension value. Anchors are spread in a radial pattern extending from the MODU. The size of the anchor spread will be dependent on the MODU and the MODU specific mooring analysis conducted during the well planning stage. Typically, mooring lines extend approximately 2,000 m from the MODU with approximately 1,000 m of grounded chain. Each anchor typically occupies a total seabed area of approximately 30 m^2 – 60 m^2. The method for retrieval of anchors is the reverse of the deployment procedures.

Anchors may be pre-laid a number of weeks in advance of the MODU arriving at each well location. This reduces the overall time the MODU is on location. Anchor pre-lays will be located within the near vicinity of the well.

3.6.4.2. Drilling Operations

The tophole sections of the wells (conductor and surface hole) are drilled without a riser; this is standard practice prior to blowout preventer (BOP) installation. The cuttings (rock chips) from the wellbore and drilling fluids from this section are released at seabed in the process of drilling.

For Annie-2 and Juliet-1, once the conductor (with the low-pressure wellhead housing) and surface casing (with high-pressure wellhead housing) are installed, a drill-through subsea christmas tree (XT) will be installed and tested on the well (required for development well production and regulation of flow).

Following this, a riser and blowout preventer (BOP) will be installed to facilitate the drilling of the deeper well sections once the surface casing is cemented in place and the XT is installed. Once the riser and BOP are installed, drilling fluids and cuttings will be returned to the MODU, via the marine riser, where the drilling fluids will be separated using solids control equipment.

The solids control equipment comprises of shale shakers that remove coarse cuttings from drilling fluids. The recovered fluids that have been separated from the cuttings may be directed to centrifuges to remove the finer solids. The cuttings are usually discharged below the water line and the reconditioned fluids are recirculated into the fluid system. The drilling fluids are ultimately discharged once they have reached the end of their usable life.

Drilling Fluids

Drilling fluid, sometimes called drilling muds, are a specialist mix of seawater, clay (or gel) and weighting additives such as barite, salt and chalk. Standard additives to the drilling fluids include polymer and polyamine to control fluid loss, viscosity and provide further formation inhibition. Drilling fluids perform several functions, including cooling and lubricating the drill bit; transporting drill cuttings to the surface; and, maintaining hydrostatic pressure greater than formation pressure, thereby preventing the influx of hydrocarbons from the formation into the wellbore. The drilling fluid system is the primary well control barrier.

During drilling of the conductor and surface hole sections, a combination of seawater and high-viscosity gel sweeps are typically used as drilling fluid. Subsequent intermediate and reservoir hole sections will be drilled with water-based drilling fluids (WBDF), with specific formulations dependent on the technical requirements of the well.

Drilling fluids, bulk dry products, brine and drill water are transferred to the MODU from supply vessels and stored in tanks and pits. Dry and liquid additives are mixed into the fluid system from sacks or containers.

Requirements for Impact Assessment	Technical Input (per well)
Volumes of drill cuttings and fluids discharged at seabed.	150 m^3 of drill cuttings and 1,500 m^3 of associated drill fluids, typical discharges in batches of between 10-100 m^3.
Volumes of drill cuttings and fluids discharged at surface.	180 m^3 of drill cuttings and 2,000 m^3 of associated drill fluids, typical discharges in batches of between 10-100 m^3.

3.6.4.3. BOP Installation and Testing

A BOP will be available to use in the event that primary well control hydrostatic overbalance to formation pressure is compromised or lost.

The BOP will be installed onto the wellhead after completion of the top-hole sections. The BOP consists of a series of hydraulically operated valves and sealing mechanisms (annular preventers, pipe rams and blind shear rams) that are normally open to allow the drill fluid to circulate up the marine riser to the MODU during drilling. The BOP is used to “close in the well” in the event that primary well control is lost resulting in an unwanted influx into the wellbore. Once closed, the MODU’s high-pressure circulating system will be used to remove the influx from the well and regain hydrostatic overbalance. The annular and ram preventers are used to shut in around various tubulars in the well, while the blind shear rams are designed to shear the pipe and seal the well. Clump weights may be used for BOP tethering, to improve fatigue performance.

Once the BOP is installed, regular function and pressure tests are undertaken to relevant standards, described in the WOMP. Function testing is undertaken by activating the hydraulic control system onboard the MODU to confirm functionality of the BOP systems, whilst a pressure test is undertaken to verify seals on the BOP stack. Both tests result in the discharge of control / test fluid.

Requirements for Impact Assessment	Technical Input
Frequency of BOP function testing	Function tests are generally undertaken every 7 days, and pressure tests every 21 days.
Details of the discharges from function testing	Total 25 m^3 control fluid and test fluid per well.

3.6.4.4. Cementing Operations

When drilling a well, cement is used to seal the casing following drilling of each section or to provide a permanent or temporary well barrier.

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

The cementing unit is tested prior to the commencement of cementing operations, resulting in a discharge of cement slurry to sea.

After a string of casing or liner has been installed into the well, a cementing spacer is pumped to flush drilling fluids and filter cake from the well to allow a good cement bond to be formed with the formation. Cement slurry is pumped down the inside of the landing string, followed by casing (or liner). A displacement fluid is then pumped into the casing with a wiper plug to displace the cement out of the bottom of the casing and up, into the annular space, between the pipe and the borehole wall. Cement volume excesses depend on the cement job design requirements, drilled hole size and size of casing; typically for the conductor and surface casing strings the bulk of the excess will be discharged to the seabed.

For all other casing and liner cementing operations, the cement will predominantly remain downhole. In the case of a liner cement job, some excess cement will be circulated back to surface and discharged into the sea. When the wiper plug is pumped and reaches the bottom of the casing string, it stops and allows the casing to be pressure tested.

During cementing operations, to ensure adequate isolation, excess on the required job volume is pumped; for the conductor and surface casing strings, this (majority) of this excess is discharged to sea.

If there are mixed batches of cement spoil within the cementing unit, or if there is a problem during the cementing operation, cement slurry will be either flushed from the cement unit or circulated out of the well and discharged to sea.

Upon completion of each cementing activity, the cementing head and blending tanks are cleaned which also results in a release of cement washings to sea.

Requirements for Impact Assessment	Technical Input
Discharge volumes of cement on testing	2.4 to 8 m^3

Discharge volumes of cement due to job excess (excess pumped to seabed)	Up to 50 m^3
Spacer displaced to seabed	8 m^3
Discharge volumes of cement on disposal of slurry	up to 40 m^3
Discharge volumes of cement during cleaning	< 1 m^3 per cement job

3.6.4.5. Well Completions

Completions involve running production components into the well, optimising the flowpath and minimising the ingress of sand from the reservoir. Displacing spent drilling fluids to filtered brine is also necessary as part of the completions installation.

Components of the lower well completion may include perforating the casing/tubing across the reservoir section and running sand management technology (typically screens) across the production interval. Upper well completions involve running elements such as production tubing, production packer, permanent downhole gauges and downhole safety valves.

The well bore will be cleaned and displaced to filtered brine multiple times when running completions to minimise solids within the wellbore which could affect installation and subsequent performance. Returned fluids will be re-used where they are assessed as suitable for future use. Fluids that are not suitable for reuse are directed to sea at surface.

Prior to setting the production packer, the tubing annulus is displaced to corrosion inhibited completion brine (e.g. sodium chloride) which will remain in the well. At the same time, the tubing is displaced to a base oil underbalance (~40 m^3).

Cleaning and displacement fluids indicative use/discharge volumes are described below.

Requirements for Impact Assessment	Technical Input
Solids free drilling fluids (water based)	120 m^3
Viscous cleaning fluids (water-based)	10 m^3
Filtered inhibited completion brine (e.g. sodium chloride)	220 m^3
Base oil (e.g. Saraline 185V). Displaced to and burned at the flare during well clean-up.	40 m^3
Note: inhibitors typically include: biocide, oxygen scavenger, corrosion inhibitor. Fluid displacements are in the order of 10-50 m^3 per batch.	

3.6.4.6. Well Clean-up / Flow-back

The base oil within the production tubing creates an under-balance to the reservoir allowing reservoir fluids to be produced in a controlled manner to surface. Produced reservoir fluids, underbalance cushion (base oil) and any completion fluid are directed to a flare boom via the test separator or surge tank. Hydrate inhibitors may be injected for flow assurance. Flow from the well will continue until the completion fluids have been removed and the flowing gas has reached acceptable levels of residual solids and fluids (nominally < 2%).

Industry flares are designed to maximise burn efficiency, limiting smoke and liquid dropout. Whilst the well is flowing through the separator, samples of gas and /or liquid will be captured for onsite analysis (critical for time dependent components such as H_2S, Radon or Mercury).

Requirements for Impact Assessment	Technical Input (per well)
Duration of flaring	12 – 24 hours
Gas flared	60 MMscf
Base oil flared	40 m^3

Completion brine / liquids in test separator	1 m^3
Methanol injection / flared for hydrate inhibition	3 L / min
Viscous cleaning fluids (water-based)	10 m^3
Gas vented (during sampling)	20 L per sample.
Approx. CO_2e emissions (from flaring)	4.7 kt

3.6.4.7. Well Suspension

Following completion and well-test activities, Stage III wells will be left with the subsea trees installed and the wells shut-in, awaiting connection to the Casino pipeline. As part of suspension, well and subsea tree barriers will be tested. Preparation of the XT for suspension will involve displacing the contents of the XT with treated MEG (or similar), and running an internal tree cap, crown plugs and debris cap. A small volume of treated fluid (e.g. MEG treated with corrosion inhibitor) is typically pumped beneath the debris cap.

Installation and commissioning of the Stage III is anticipated within approximately 12 months of the completion of the drilling program. During this time the wells will remain in a suspended state. Offshore inspection of the wells during the suspension phase may be undertaken periodically in accordance with the WOMP. Inspection intervals and activities are informed by review of well data captured during the drilling program; typically, inspection involves a single vessel and deployment of an ROV for visual and sonar survey.

3.6.4.8. Logging

During drilling, it is necessary to gather formation information for ongoing drilling operations or to influence the effective recovery of hydrocarbons from the reservoir. This information is gathered real-time from Logging Whilst Drilling (LWD) tools, or by wireline.

Vertical Seismic Profiling (VSP) will not be progressed as an option, avoiding introduction of associated impulsive noise.

3.6.4.9. Contingencies

The following scenarios are also provided for within the EP:

- Well re-spud: Additional 150 m^3 of drill cuttings and 1,500 m^3 of associated drill fluids, typical discharges in batches of between 10 - 100 m^3, up to 50 m^3 discharge volumes of cement due to job excess (excess pumped to seabed) and 8 m^3 spacer, plus testing (up to 8m^3) and cleaning (< 1m^3) volumes.
- Side-track: Additional 180 m^3 of drill cuttings and 2,000 m^3 of associated drill fluids, typical discharges in batches of between 10 - 100 m^3, along with cement testing (up to 8m^3) and cleaning (< 1m^3) volumes.
- Abandonment: Minimal change to expected discharge volumes; additional discharge volumes of cement on testing (up to 8 m^3) cleaning (< 1 m^3) volumes.

3.6.5. Installation and Commissioning

Installation will involve the placement of subsea infrastructure. To transition from construction to operation, these facilities will go through a process of commissioning prior to start-up. The commissioning process assures all infrastructure and systems are working according to the design and operational requirements.

3.6.5.1. Pre-lay , crossings and stabilisation

Pipeline and umbilical crossings are planned based on the current Stage III concept. Crossings will be managed via the placement of stabilisation material on the seabed.

Stabilisation pre-lay works within the operational area involve the installation of a combination of concrete mattresses and grout bags. The hard, irregular seabed precludes trenching as a stabilisation method. Stages I and II involved the installation of around 1000 mattresses for stabilisation. Stage III, being comparably small, may require in the order of 350 mattresses inside the flowline and umbilical corridor described in Section 3.6.5.2.

Requirements for Impact Assessment	Technical Input

Area of seabed disturbance	350 mattresses approx. dimensions 6.75m (l) x 2.5m (w) x 0.5m (h). Disturbance is expected to be limited to within the pipeline and umbilical corridor.

3.6.5.2. Installation – Infield Flowlines and Umbilicals

The infrastructure to be installed includes:

- 10.1 km of 8” (internal diameter) flexible flowline connecting Annie-2 to the new Black Watch manifold
- 150m of 8” (internal diameter) flexible jumper connecting the Black Watch Manifold to the Black Watch In-line Tee
- 275m of 8” (internal diameter) flexible jumper connecting the Black Watch Manifold to Juliet 1
- 10.1 km of 111 mm diameter EHU connecting Annie-2 to new Subsea Umbilical Distribution Unit (SUDU)
- 7 km of 111 mm diameter EHU connecting Casino 5 to new SUDU
- <1 km of 111 mm diameter EHU connecting Juliet-1 to new SUDU

Flowlines will be typical, flexible lines, constructed of an inner corrosion-resistant alloy centre carcass, with concentric layers of polymer tape, polymer pressure layers, steel wire strength members and an outer polymer sheath.

The EHUs are also considered standard construction, designed to integrate with the incumbent Stage I and II controls system. The EHUs are made up of a combination of copper electrical lines, fibre optics, thermoplastic or high alloy steel tubing, steel strength/protection wires and a heavy-duty plastic outer sheath.

Subsea infrastructure including a manifold, tees, spools, controls distribution unit, flying leads and stabilisation will be installed to connect Stage III to the Casino pipeline and controls. Internal cavities within the structures may be flooded with inhibited water or solid inhibitor sticks placed inside before or after deployment to prevent corrosion and fouling. These fluids and inhibitors are displaced to sea during subsequent activities (see Section 3.6.5.3). Equipment to support accurate positioning, including ROVs, deployment skids and frames, will also be required.

Flowlines and umbilicals will be installed on the seabed via reeling from a DP installation support vessel (ISV) or similar. Vessel presence in the operational area for flowline installation will be around 15 days at average line installation speeds. Sequentially, an ISV or dive support vessel (DSV) and hyperbaric support vessel (HSV) will install the structures, test, tie-in and preserve (see Section 3.6.5.3) the lines over a period of around 20 days. Installation timeframes often extend in this region due to weather constraints.

A temporary exclusion area (500 m around the installation vessels) will be in place and standard marine notices provided to other sea users during installation of flowlines and umbilicals.

Seabed disturbance is expected during the installation of umbilicals and flowlines. The area of seabed which may be disturbed during installation works is estimated in Table 3-14. This footprint is considered to be conservative as it assumes a 100 m disturbance corridor either side of the flowlines and umbilicals from wells to infrastructure and allows for tie-in loops on approach to the connection points. The direct footprint of the Stage III equipment and stabilisation will be significantly smaller; contact between the seabed and flowlines and umbilical will be <1 m width and typically <10 m width for stabilised sections.

Table 3-14: Seabed Disturbance for Flowline, Umbilical and Structures Installation

Infrastructure	Km	Disturbance Corridor (km)	Area of Disturbance (km^2)
Annie-2 flowline length	10.1	0.2	2.02
Annie-2 EHU length	10.1	0.2	2.02
Casino 5 to new SUDU EHU length	7	0.2	1.4
Juliet-1 flowline length	0.3	0.2	0.06

Infrastructure	Km	Disturbance Corridor (km)	Area of Disturbance (km^2)
Juliet-1 to new SUDU EHU length	0.3	0.2	0.06
Stabilisation (mattresses)	350 mattresses approx. dimensions (m): 6.75 (l) x 2.5m (w) x 0.5m (h).		0.006
Manifold	Nominal dimensions (m): 5 (l) x 5 (w) x 3 (h)		0.00003
Distribution unit and ancillary structures	Nominal dimensions (m): 3 (l) x 3 (w) x 3 (h)		0.00001
Estimated total disturbance corridor			5.6
Estimated total direct footprint			0.3

3.6.5.3. Testing, Preservation and Start up

Following subsea infrastructure installation, equipment is inspected and tested via a number of activities:

- Flooding. Seawater within the flowlines is displaced to fresh or inhibited seawater to prevent corrosion and marine growth within the line. The inhibited water is pumped into the subsea system via a downline from the surface vessel.
- Cleaning. This involves the use of a series of gel pils which sweep the lines. Fluids, pumped from a surface vessel via a downline, are used to buffer and push the gel and are displaced to sea along with the gel at the receiver end during the cleaning operation. The pumped fluids may include MEG, water-based gel and inhibited water.
- Hydrotest. Inhibited water within the flowline is topped up to test pressure via a downline from the surface vessel. Test pressure is held for 24 hours and monitored from the vessel. Where anomalies in pressure readings indicate a leak, this is investigated. Dye is incorporated into the flowline flooding medium to enable identification of leak points.

One or more of these activities will be repeated. Once tested, depending on timing to start-up, the subsea system may be left flooded.

- Dewatering. Once testing is complete, the flowlines will be in a flooded state. Prior to start-up of production from the wells, the subsea system is dewatered by displacing the lines with nitrogen. Nitrogen will be pumped from a surface vessel via a downline into the subsea system. Downstream, the inhibited water is displaced to sea (at manifold) until the system is entirely filled with nitrogen. Nitrogen is used because it is an inert gas with no risk of ignition and is non-corrosive.

At this stage the system is entirely connected, tested and ready to operate. The subsea equipment is operated by the onshore gas plant via the controls system. Once the gas plant is ready to receive hydrocarbons from Annie-2 and Juliet-1, the wells can be opened, and gas will flow through the flowlines per normal operations described in Section 3.6.1.

Table 3-15: Fluid use and discharge from Stage III subsea system before start-up

Requirements for Impact Assessment	Technical Input
Flooding fluids	350 m^3
Cleaning / Gauging fluids	5 x 1 m^3 MEG and gel slugs
Hydrotesting	400 m^3
Pigging speed	0.5 m/s
Dewatering rate	2 m^3 / min
Inhibitor and test chemicals (liquid and solid (stick) form)	Oxygen Scavenger, corrosion inhibitor, biocide, dye.

3.6.6. Support Operations

3.6.6.1. Vessel Operations

Activities associated with the ongoing operations of the Otway offshore assets, as well as the new stage activities will be supported by vessels. Vessels may be contracted from international or Australian suppliers and will vary depending on the proposed activity and vessel availability. Vessels will be used for:

- IMR. Typically one vessel is hired for IMR activities. The type of vessel depends on the work scope. Minor inspection works may be undertaken using inspection class ROV from a small vessel. Maintenance and Repair works may require an ISV or DSV as shown in Figure 3-3.
- Drilling support. Two or 3 anchor handler and tow support vessels (AHTS) may be used to support the MODU (Section 3.6.6.2). The AHTSs are involved in towing the MODU, moorings, material transfers and emergency standby and support.
- Subsea installation. Similar to IMR, installation works require an ISV or DSV. DSVs may be supported by a HSV if divers are mobilised for the activity.

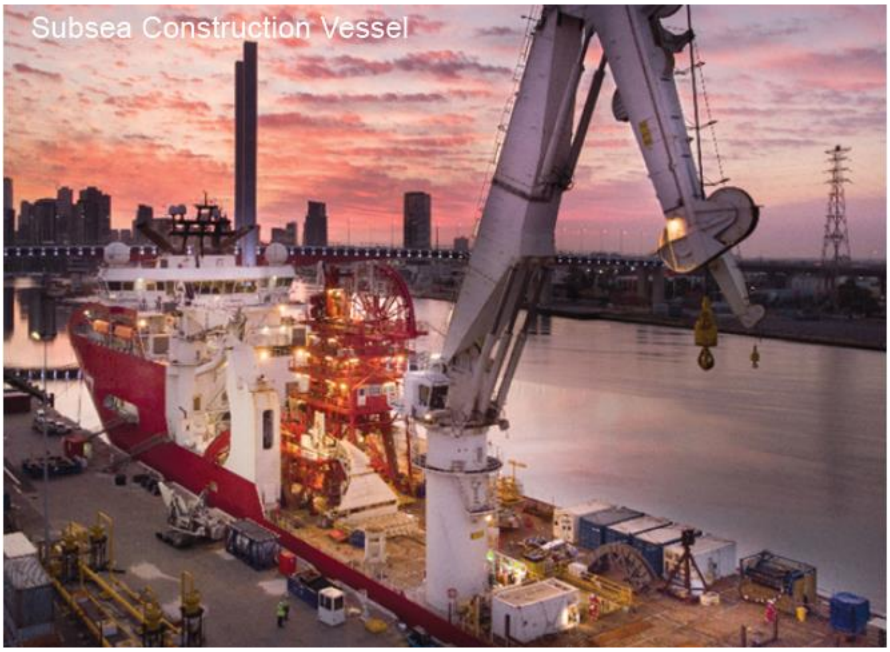


Figure 3-3: Indicative ISV

Requirements for Impact Assessment	Technical Input
Persons on Board (POB)	Small vessel: 15 AHTS: 20-40 DSV, ISV: 70-100
Will vessels be moving within the operational area?	Yes
Will anchoring be required?	Anchoring may be required where it is too shallow to use vessel's dynamic positioning mode (e.g. small vessel close to shore in state waters)
Lighting requirements	Standard navigation lighting
Bilge requirements	Standard bilge requirements
Cooling water and brine requirements	Standard cooling water and brine requirements
Sewage requirements	MARPOL compliant sewage treatment system
Hazardous waste	Yes

Requirements for Impact Assessment	Technical Input
Ballast water discharge or exchange within territorial sea boundary?	Yes
Estimated fuel consumption (daily)	0.2 m^3 (small vessel) to >20 m^3 (large vessel)
Is refuelling at sea planned?	No
What is the largest expected MDO tank size?	250 m^3
Ancillary equipment may include	Cranes, ROVs

Requirements for Impact Assessment		Technical Input
Vessel Operations	Planned marine discharges from the vessels.	For the duration of the activities, in accordance with Marpol and AMSA discharge standards. Discharges will include: sewage and grey water, putrescible waste, cooling water, brine and treated ballast, deck drainage and bilge.
	Underwater Sound emissions from dynamic positioning system / thrusters	Continuous; noise levels may vary with environmental conditions and operating requirements, within defined safety parameters.
	Approximate atmospheric emissions (CO_2e) from: • Fuel use / power generation • Embedded materials (steel / concrete)	Scenarios: • 5-day inspection with small vessel: 3 t • 30-day IMR with ISV: 2.3 kt • 15-day pipelay (reel) with ISV: 1.65 kt • 20-day installation with DSV and HSV: 2.2 kt • Subsea equipment / materials: 8 kt

3.6.6.2. MODU Operations

A MODU will be used to support drilling operations. The MODU may be self-propelled or will otherwise be towed into position at the well location by one or more support vessels. The MODU is fitted with various equipment to support operations including:

- Pressure control equipment capable of sealing the well such as a BOP.
- Derrick with rotating equipment and drill pipe.
- Wireline unit for well logging.
- Flowback package providing flaring capability.
- Cement unit.
- Work Class ROV.
- Mooring system (possible DP assist).
- Power generation systems.
- Cooling water and freshwater systems.
- Drainage, effluent and waste systems.
- Bulk storage tanks for cement and weighting agents.
- Sack room for storage of drilling fluid additives.
- Mud pits (tanks to store and maintain drilling fluids) – in the order of 1000 m^3 combined capacity.
- Solids control equipment used in drilling to separate the solids and drilling fluids (this may include shale shakers, centrifuging systems and cuttings driers).

Refuelling of the MODU and bunkering will be required during the activity. Bunkering and bulk transfer will be managed by the MODU.

Figure 3-4: Indicative MODU and support vessels (Image showing MODU at Annie-1, 2019)

Table 3-16 MODU Specifications and Capacities

Technical specification	
Vessel type	Typically semi-submersible
Size	Length 120 m, Width 120 m
Deck height above sea level	Similar
MPT / Derrick height above main deck	Similar
Weight	50,000 T
Maximum persons on board	150 to 200
Station keeping	Moored (8-12 anchors), DP assist (transit, emergency)
Helideck	Yes
Crane / Lifting capacity	150 T
Flare Boom	Height 11-15 m above sea level
Fuel type	MDO / MGO
Bunkering	Offshore
Fuel storage capacity	1,100 m^3
Bilge Discharge OIW limit	15 ppm
Ballast Water Management	Per IMO and Australian requirements as applicable to age and class

Requirements for Impact Assessment		Technical Input
MODU Operations	Planned marine discharges from the vessels.	For the duration of the activities, in accordance with Marpol and AMSA discharge standards. Discharges will include: sewage and grey water, putrescible waste, cooling water, brine and treated ballast, deck drainage and bilge.
	Underwater Sound emissions from rotating pipe.	Continuous; relatively low noise levels which may vary with environmental conditions, drilling depth, and operating requirements.
	Approximate atmospheric emissions (CO_2e) from: • Fuel use / power generation • Embedded materials (steel / concrete)	Scenario: • Annie-2 and Juliet-1 drilling and completion with moored MODU, supported by three AHTS: 15 kt • XTs and downhole materials: 2.5 kt

3.6.6.3. ROV Operations

Inspection and / or work-class ROVs are required for inspection, maintenance or repair activities.

A ROV is a tethered underwater vehicle operated by a crew aboard the vessel or MODU. They are linked by either a neutrally buoyant tether or often when working in rough conditions, deeper water or with large payloads, a load carrying umbilical cable is used along with a tether management system.

ROVs are equipped with a video camera and lights. Additional equipment may include positioning and survey equipment, and various apparatus to support installation and IMR activities. ROVs may utilise electric control system or a closed loop hydraulic control system.

Requirements for Impact Assessment	Technical Input
Describe planned discharges	No planned discharges. Hydraulic fluid is within a closed system.
Provide sonar details, if applicable	Outlined under survey section
Will seabed mooring of ROV occur?	Not planned

3.6.6.4. Helicopter Operations

Helicopters will be used during the drilling and installation activities, primarily for crew change and medevac, and occasionally equipment and material transfers.

Requirements for Impact Assessment	Technical Input
Frequency of flights	Helicopter flights will occur a minimum of three times a week, dependent on the progress of the drilling program and logistical constraints.
Underwater sound emissions	Helicopter will result in some level of underwater noise, particularly when at lower altitudes for landing/take-off at the MOU (Richardson *et al*. 1995). Continuous noise level, limited to tens of metres from the source. Typical helicopter acoustic emissions • 162 dB re 1 µPa 108 dB re 1 µPa at 305 • <500 Hz Continuous
Approximate atmospheric emissions (CO_2e) from: • Fuel use	Scenario: • Offshore Crew changes through drilling and install activities: 0.4 kt

4. Description of the Environment

A detailed description of the environment is provided in the appendices for all physical, ecological and social receptors. This section provides regulatory context, description of the environment that may be affected (EMBA), regional setting and a summary of the key ecological and social receptors.

4.1. Regulatory Context

The OPGGS(E) Regulations 2009 define 'environment' as the ecosystems and their constituent parts, natural and physical resources, qualities and characteristics of areas, the heritage value of places and includes the social, economic and cultural features of those matters.

In accordance with Regulation 13(2) of the OPGGS(E), this section (and associated appendices) describes the physical setting, ecological receptors, and social receptors, of the receiving environment relevant to the described activity.

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

- The world heritage values of a declared World Heritage property within the meaning of the EPBC Act;
- The national heritage values of a National Heritage place within the meaning of that Act;
- The ecological character of a declared Ramsar wetland within the meaning of that Act;
- The presence of a listed threatened species or listed threatened ecological community (TEC) within the meaning of that Act;
- The presence of a listed migratory species within the meaning of that Act;
- Any values and sensitivities that exist in, or in relation to, part or all of:
  - A Commonwealth marine area within the meaning of that Act; or
  - A Commonwealth land within the meaning of that Act.

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

With regards to 13(3)(f) more detail has been provided for:

- Key Ecological Features (KEFs) as they are considered a conservation value under a Commonwealth Marine Area (CMA), and
- Australian Marine Parks (AMPs) as they are enacted under the EPBC Act.

4.2. Environment that May Be Affected

The EMBA by the activity has been defined as an area where a change to ambient environmental conditions may potentially occur as a result of planned activities or unplanned events. It is noted that a change does not always imply that an adverse impact will occur; for example, a change may be required over a particular exposure value or over a consistent period of time for a subsequent impact to occur. Table 4-1 and Figure 4-1 detail the Project Areas associated with the activity that are used to describe the environmental context relevant to the activity and to support the impact and risk assessments.

Table 4-1: Otway Offshore Operations Project Area descriptions

Project Area	Description
Operational Area	The operational area includes: 500 m around existing wells and on either side of linear infrastructure: Casino pipeline, the Casino-Pecten East Pipeline and proposed EHUs and flowlines. 2 km radius around wells during well work (e.g. drilling). 500 m around survey vessel within the Otway Title Areas. Planned operational discharges, physical presence and seabed disturbance that occur during the activity will be within the operational area. The EPBC Protected Matters Report for the operational area is in Appendix 2.
Spill EMBA	The boundary of the EMBA is defined using the hydrocarbon exposure (low) thresholds (Table 6-21) for an accidental hydrocarbon release from a loss of well control (LOWC) event (Section 0). Based on stochastic modelling results (Appendix 6), the EMBA overlaps five IMCRA areas (Central Bass Strait, Central Victoria, Flinders, Otway and Victorian Embayment's), which are described further in Appendix 3. The EPBC Protected Matters Report for the EMBA is in Appendix 2.
Aspect potential impact radii	Other aspects of the activity which may impact on the environment, including subsea noise, involve discrete areas that may be affected. These areas are delineated in terms of a contour or potential impact radii around a source and are described in Section 6.

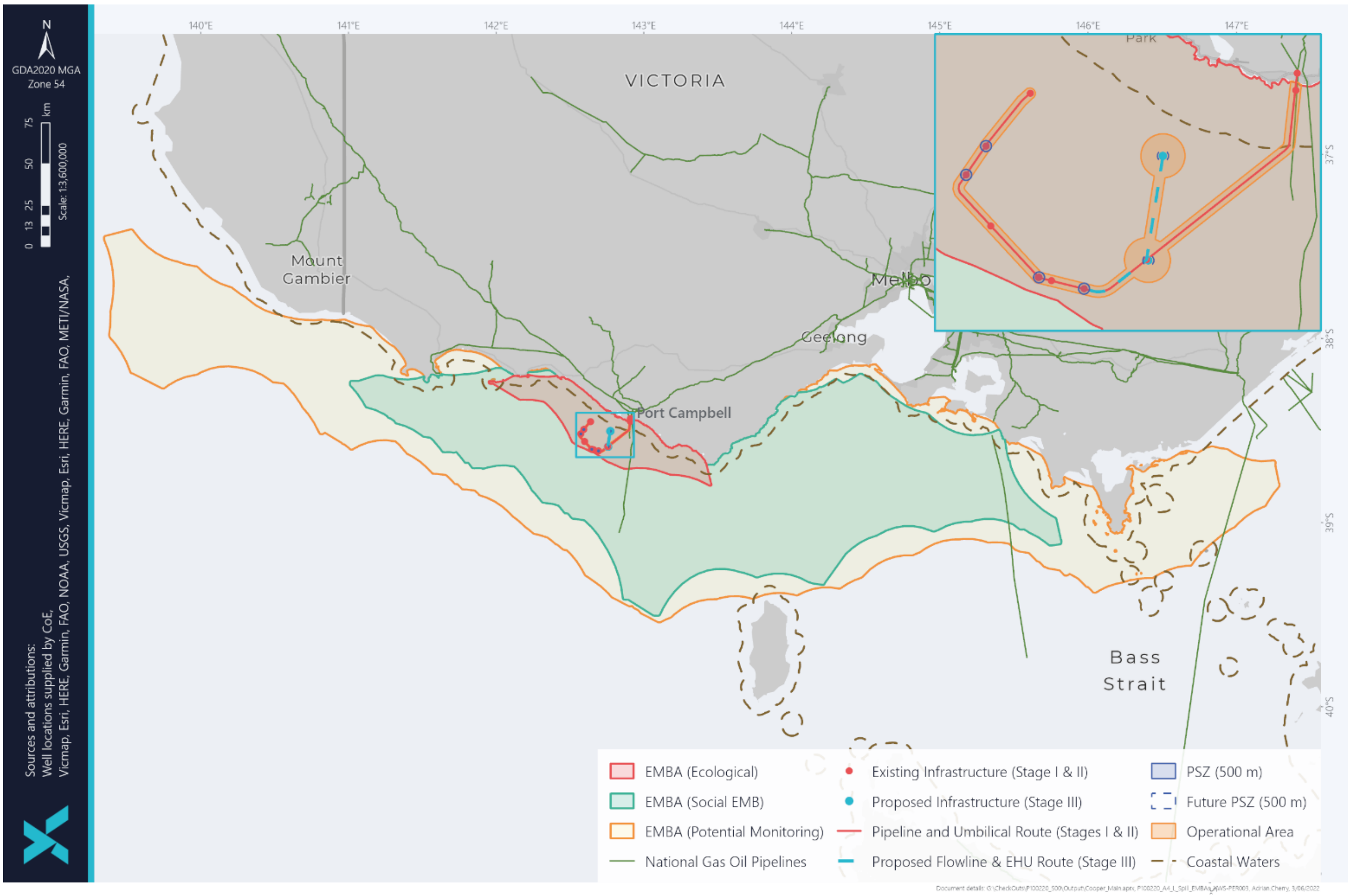


Figure 4-1: Otway Offshore Operations EMBA and Operational Area

4.3. Regional Setting

The offshore facilities are located in the Otway marine bioregion (National Oceans Office (NOO), 2002) as classified by the Interim Marine and Coastal Regionalisation for Australia (IMCRA). This bioregion extends from Cape Otway (Vic) to Cape Jaffa (South Australia) and includes the western islands of Bass Strait such as King Island.

The characteristics of the Otway coastline and marine environment include very steep to moderate offshore gradients, high wave energy and cold temperate waters subject to upwelling events (i.e., the Bonney Upwelling) (IMCRA, 1998). Upwelling water is nutrient rich and corresponds with increases in the abundance of zooplankton, which attracts baleen whales and other species (including EPBC-listed species) that feed on the plankton swarms (krill). The Bonney upwelling is seasonal, occurring west of Portland, >100km west of the Otway offshore operations. Upwelling around the operational area is unlikely or occasional (Huang and Wang, 2019).

The Otway basin is well mixed given it is a higher-energy environment exposed to frequent storms and significant waves. Water quality is expected to be good and typical of the offshore marine environment. Average current speeds in the area range between 0.15 m/s to 0.25 m/s, with maximum current speeds 0.61 m/s (Dec) to 1.22 m/s (Mar). Monthly average sea surface temp 13.6°C (Aug) to 17.6°C (Jan/Mar). Salinity is expected to be relatively consistent throughout the year ranging at 35.2-35.6 psu (RPS, 2019a).

The seabed on the Otway shelf is comprised exhumed limestone, is generally rocky with relief that varies substantially including some areas of flat limestone and some of crevices, gutters, pillars and overhanging shelves. Whilst there are some areas of thin overlying sediment (comprising fine-coarse grained sand and calcarenite fragments), the region is starved of terrigenous sediment (Santos 2004, Fugro 2020).

The coastline is generally rocky, with tall cliffs and rock outcrops, some sandy beaches, inlets and settlements. Shoreline habitats of the Otway coastline provide for a range of fauna including penguin colonies, fur seal colonies and bird nesting sites.

4.4. Physical, Biological and Social Receptors

The following tables show the presence of physical (Table 4-2), biological (Table 4-3) and socio-economic (Table 4-4) receptors that may occur within the operational area and spill EMBA. Further descriptions and maps of these physical, biological, ecological and socio-economic receptors are provided in the Description of the Environment Appendix 3.

Examples of values and sensitivities associated with each of the physical, biological or social-economic receptors have been included in the tables. These values and sensitivities have been identified based on:

- Presence of listed threatened or migratory species or threatened ecological communities identified in the EPBC Protected Matter searches (Appendix 2).
- Presence of BIAs and habitats critical to the survival of the species.
- Presence of important behaviours (e.g. foraging, roosting or breeding) by fauna, including those identified in the EPBC Protected Matter searches (Appendix 2).
- They provide an important link to other receptors (e.g. nursery habitat, food source).
- They provide an important human benefit (e.g. recreation and tourism, aesthetics, commercial species, economic benefit).

4.4.1.Physical Receptors

Table 4-2: Presence of Physical Receptors within the Operational Area and EMBA

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
Physical	Climate	Cool temperate region	N/A	✓	Present The operational area is typical of a cool temperate region with cold, wet winters and warm dry summers. 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.	✓	Present The regional climate is dominated by sub-tropical high-pressure systems in summer and sub-polar low-pressure systems in winter. The low-pressure systems are accompanied by strong westerly winds and rain-bearing cold fronts that move from south-west to north-east across the region, producing strong winds from the west, north-west and south-west.
	Winds	Strong westerly winds found in the Southern Hemisphere between latitudes of 40°S and 50°S	• Cold fronts • Sustained west to south-westerly winds	✓	Present The operational area is subject to wind conditions aligned with the Bass Strait with conditions likely to align with those listed within the spill EMBA	✓	Present The spill EMBA is located within 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. In summer, frontal systems are often shallower and occur between two ridges of high pressure (HP), bringing more variable winds and rainfall.
	Tides	Long, slow moving waves created by the gravitational pull of the moon	• Intertidal habitat • Fish aggregation • Fauna reproduction • Flora reproduction • Water quality • Maritime navigation	✓	Present The operational area has semi-diurnal tides with some diurnal inequities, generating tidal currents along a north-east/south-west axis, with speeds generally ranging from 0.1 to 2.5 m/s.	✓	Present The spill EMBA and wider Otway region experiences semi-diurnal tides. The maximum range of spring tides in western Bass Strait is approximately 1.2 m. Sea level variation in the area can arise from storm surges and wave set up.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
	Current	Directional movement of water driven by gravity, wind and water density	• Controlling climate • Food source • Flora reproduction • Water quality	✓	Present The operational area is subject to current conditions aligned with the Bass Strait with conditions likely to align with those listed within the spill EMBA.	✓	Present Average current speeds in the area range between 0.15 m/s to 0.25 m/s, with maximum current speeds 0.61 m/s (Dec) to 1.22 m/s (Mar) (RPS, 2019a). Bottom currents can exceed 0.5 m/s in nearshore areas during storms. In the Port Campbell area, the predominant south-westerly swell direction means that there are minimal longshore currents as most waves reach the shore parallel to the coast. Lateral flushing within Bass Strait results from inflows from the South Australian Current, East Australian Current (EAC) and sub-Antarctic surface waters. During winter, the South Australian current moves dense, salty warmer water eastward from the Great Australian Bight into the western margin of the 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 strait become stratified.
	Water Quality	Level of contaminants in water, sediments or biota or to changes in the physical or chemical properties of waters and sediments	• Ecosystem health • Fishing and aquaculture • Recreation and aesthetics • Industrial water supply • Cultural and spiritual	✓	Present The operational area is expected to have water quality typical of the offshore marine environment of the Otway Basin. This is characterised by high water quality with low background concentrations of trace metals and organic chemicals and an undisturbed mid-depth environment.	✓	Present The spill EMBA is expected to have the water quality typical of the Bass Strait and Otway Basin which are known for a complex, high energy wave climate and strong ocean currents. Water column turbidity on the Victorian coastline 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,

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
		relative to a natural state.					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.
	Sea Water Temperature	Heat present within ocean waters	• Fauna behaviour • Fauna reproduction • Fauna distribution and aggregation • Flora community maintenance	✓	Present Sea-surface water temperatures vary seasonally from 13.6°C (Aug) to 17.6°C (Jan/Mar) (RPS, 2019a).	✓	Present 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.
	Sediment Quality	Level and toxicity of contaminants within sediment	• Sink of dissolved contaminants • Source of bioavailable contaminants to benthic biota	✓	Present The operational area 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 seabed along the pipeline routes consists of large tracts exposed caprock (hard calcarenite), some fine to coarse grained sand with variable density and diversity of epifauna and infauna communities. The seabed at the exit point is classified as sand or fine gravel. Beyond 60 m water depth, out to the Casino well sites, the seabed comprises outcrops of hard substrate with very low relief and structural complexity separated by gullies of sand or fine gravel. The seabed along the Casino to Pecten East pipeline area typically consists of low relief rock outcrop with no significant sediment cover in water depths varying from 65 to 70 m. No significant items of debris or major sediment	✓	Present The spill EMBA is expected to have sediment quality typical of the surrounding area. Beach Energy conducted an environmental survey of a neighbouring title, located approximately 3 km from the Cooper Energy Otway offshore facilities, from November 2019 to January 2020. Six samples were taken with the sediment predominantly sand with a range of 95-97% as a proportion of each sample. There was also very little silt and a maximum of 4.7% for the clay fraction.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
					obstruction were identified during acoustic surveys. The seabed consists of medium to fine calcareous sand with fragments of calcarenite overlying siltstone / kalicinite. It is expected that sediment quality within the Otway offshore fields will be typical of the offshore marine environment of the Otway Basin.		
	Air Quality	The chemical, physical, biological and aesthetic characteristics of air.	• Ecosystem health • Human health • Fauna health	✓	Present The air quality within the operational area is expected to reflect the characteristics of the wider area. Due to local industry activity, there are expected localised and temporary decrease in air quality due to particulate matter from diesel combustion associated with emissions from vessel activities. These are rapidly dispersed around the discharge point due to the local wind regime.	✓	Present Historical air quality data from Cape Grim shows a continuous increase in most GHGs since the mid-to-late 1970s with carbon dioxide levels increasing by more than 15% since 1976, and concentrations of methane and nitrous oxide (N_2O) increasing by around 20% and 8% respectively since 1978. The increase in methane levels however has slowed recently and CFCs and halons are in decline. Increases have been attributed to anthropogenic causes, for example, fossil fuel consumption and agricultural practices.
	Ambient Light	Light present within an environment	• Fauna behaviour • Fauna breeding • Fauna hunting / predation • Circadian rhythms	✓	Present The ambient light within the operational area will be a reflection of Otway Basin with artificial emissions associated with Otway offshore activities including vessel activity.	✓	Present Ambient artificial light sources associated with offshore activities exist in the Otway region, including both permanent (e.g. onshore/offshore developments) and temporary (e.g. vessels, road traffic) light sources.
	Ambient noise	Level of background sound at a given location	• Fauna behaviour • Fauna breeding • Spatial distribution	✓	Present The operational area will be a reflection of Otway Basin with noise associated with Otway offshore activities including vessel activities.	✓	Present Natural sea sound sources are dominated by wind noise, but also include rain noise, biological noise and the sporadic noise of earthquakes. Man-made underwater sound sources in the region comprise shipping and small vessel traffic, petroleum-

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
							production and exploration-drilling activities and sporadic petroleum seismic surveys.

4.4.2. Biological Receptors

Table 4-3: Presence of Biological Receptors within the Operational Area and EMBA

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
Benthic Assemblages	Intertidal environment (0-2m)	Comprises rock platform, cliff face and sandy beach	• Foraging habitat • Nesting or Breeding habitat	-	Not present The operational area does not include the intertidal environment.	✓	Present Intertidal environment comprises a sandy cove and tidally submerged rock platforms with invertebrate colonisation.
	Shallow environments (2-8m)	Comprises kelp reef, patchy sandy reefs and sand	• Foraging habitat • Nesting or Breeding habitat	-	Not present The operational area does not include the shallow environments.	✓	Present Shallow environment comprises kelp reef with hard substrate with numerous epifauna and fish associated. Tracts of open shallow reef and give way to sand characteristically devoid of significant epifauna. But with significant infauna communities.
	Mid-depth environment (8–20m)	Comprises Eklonia-dominated reef and sand	Foraging habitat Nesting habitat	✓	Present Relatively uniform area dominated by sand. With intermittent patch reefs dominated by the brown alga, *Ecklonia sp*, with red algae and coralline algae, echinoderms, ascidians, bryozoans and sponges also present.	✓	Present Mid depth is relatively uniform through the region dominated by sand with intermittent reef patches.
	Deep environment (20-70m)	Comprises sponge-dominated reef and sand.	• Foraging habitat • Nesting or Breeding habitat	✓	Present Much of the deep environment is defined as hard platform substrates with some patches of thin overlying sand and	✓	Present Rocky reefs and hard grounds are located in all areas of the south-east marine region continental shelf including Bass Strait, from the sub-tidal zone shore to the

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
					rubble/calcarenite fragments. The patchy epifauna and presence of hard platform is consistent with the description of a KEF of the South-East bioregion, that is, shelf rocky reefs and hard substrates. Epifauna was also noted to occur on unconsolidated substrates (sand and gravel) and amongst biogenic rubble. While sponges were present, they were interspersed throughout the patchy epifaunal covering (Fugro, 2020). Notable sponge habitats were identified in association with the Casino pipeline route at location KP 19.5 at 59.3m depth during historical surveys.		continental shelf break. The continental shelf break generally occurs in 50 m to 150–220 m water depth. The shallowest depth at which the rocky reefs occur in Commonwealth waters is approximately 50 m. On the continental shelf, rocky reefs and hard grounds provide attachment sites for macroalgae and sessile invertebrates, increasing the structural diversity of shelf ecosystems. The reefs provide habitat and shelter for fish and are important for aggregations of biodiversity and enhanced productivity (DAWE, 2015).
Coastal Habitats	Rocky Shoreline	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.	-	Not present The operational area does not include rocky shorelines.	✓	Present The following areas along the Victorian coastline 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
	Sandy Beaches	Sandy beaches are dynamic environments, naturally fluctuating in response to external forcing factors (e.g.	Sandy beaches can support a variety of infauna and provide nesting habitat to birds and turtles.	-	Not present The operational area does not include sandy beaches.	✓	Present The following areas along the Victorian coastline 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

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
		waves, currents etc).					• Marengo east to Anglesea
	Mangroves	Mangroves grow in intertidal mud and sand, with specially adapted aerial roots.	• Provide for gas exchange during low tide • Important in helping stabilise coastal sediments • Providing a nursery ground for many species of fish and crustaceans • Providing shelter or nesting areas for seabirds	-	Not present The operational area does not include mangroves.	✓	Present 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 monitoring EMBA, but not within the ecological EMBA.
	Coastal 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,	• The vegetation in these environments is essential to the stability of the saltmarsh, as they trap and bind sediments. • Provide a habitat for a wide range of both marine and terrestrial fauna, including infauna and epifaunal invertebrates, fish and birds.	-	Not present The operational area does not include coastal saltmarsh.	✓	Present 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 which, and behind the sand dunes of Ninety Mile Beach in Gippsland. These areas do not fall within the ecological EMBA.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
		grasses and low shrubs.					
Marine Fauna	Plankton	Phytoplankton and zooplankton	Food Source	✓	Present Phytoplankton and zooplankton are widespread throughout oceanic environments and is expected to occur within the operational area. Populations near the Otway offshore assets are 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 populations.	✓	Present Phytoplankton and zooplankton are widespread throughout oceanic environments and is expected to occur within the EMBA with a high level of diversity. Coastal krill 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. Increased abundance and productivity can occur in areas of upwelling. The seasonal Bonney Coast upwelling contributes to locally productive pelagic habitats that exhibit a range of zooplankton. Plankton distribution is dependent upon prevailing ocean currents including the East Australia Current, flows into and from Bass Strait and Southern Ocean water masses.
	Marine Invertebrates	Benthic and pelagic invertebrate communities	• Food Source • Commercial Species	✓	Present Invertebrate species located in the vicinity of the Otway offshore pipeline alignment include sponges, annelids, ascidians, hydrozoans, bryozoans, molluscs, krill and crustaceans.	✓	Present A variety of marine invertebrate species may occur within the spill EMBA with high diversity with patchy distribution. Invertebrate diversity is high in southern Australian waters with distribution of species patchy, with little evidence of any distinct biogeographic regions.
	Fish	Fish	Commercial species	✓	Present	✓	Present Commercial fish species that may possibly occur within the spill EMBA include:

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
					Commonwealth commercial fish species that may possibly intersect Otway offshore assets include: • Elephantfish • Gummy shark • Sawshark State commercial fish species that do or are likely to intersect Otway offshore assets include: • Rock lobster • Eastern rock lobster • Blacklip abalone • Greenlip abalone • Southern rock lobster		• Southern Jig Squid • Elephantfish • Gummy shark • Sawshark State commercial fish species that intersect the EMBA include: • Rock lobster • Eastern rock lobster • Blacklip abalone • Greenlip abalone • Southern rock lobster
			EPBC Act protected species	✓	Present Thirty fish species are listed as having the potential to occur within the operational area on the EPBC Act PMST (26 of which are pipefish, pipehorses, seadragons, seahorses and mother of pearl). Threatened species that may be present within the operational area include: • Blue Warehou • Southern Bluefin Tuna • Australian Grayling • Great White Shark • Eastern School Shark Migratory species include species that may be present within the operational area include:	✓	Present Species present in the EMBA are largely cool temperate species, common within the South Eastern Marine Region. Forty-five fish species are listed as having the potential to occur within the EMBA on the EPBC Act PMST (32 of which are pipefish, pipehorses and seahorses). Vulnerable species identified within the spill EMBA include: • Eastern Dwarf Galaxias • Yarra Pygmy Perch • Australian Grayling • Great White Shark • Variegated Pygmy Perch • Whale Shark

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
					• Great White Shark • Shortfin Mako • Mackerel Porbeagle		Conservation Dependant species identified within the spill EMBA include: • Southern Dogfish • Orange Roughy • Eastern School Shark • Blue Warehou • Southern Bluefin Tuna BIA The Spill EMBA intersects the breeding (nursery area), distribution and foraging BIAs for the White Shark.
	Avifauna	Birds that live or frequent the coast or ocean	EPBC Act protected species	✓	Present There are 30 threatened, migratory and listed marine species that may occur within the operational area are protected under the EPBC Act. Critically Endangered • Eastern Curlew, Far Eastern Curlew • Orange-bellied Parrot • Curlew Sandpiper Endangered	✓	Present Ninety-three bird species (or species habitat) may occur within the spill EMBA. There are 40 threatened bird species that may occur within the spill EMBA. Critically endangered • Curlew Sandpiper • Great Knot • Swift Parrot • Orange-bellied Parrot

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
			Biologically Important Areas (BIAs)	✓	• Red Knot • Grey-headed Albatross • Southern Giant-Petrel • Northern Royal Albatross • Shy Albatross BIA The operational area intersects nine likely and known foraging BIAs • Wedge-tailed Shearwater • Wandering Albatross	✓	• Eastern Curlew, Far Eastern Curlew Endangered species • Northern Royal Albatross • Southern Giant Petrel • Gould's Petrel • Shy Albatross • Grey-headed Albatross • Red Knot • Lesser Sand Plover • Australian Painted Snipe
			FFG Act listed	✓	• Antipodean Albatross • Common Diving-petrel • Bullers Albatross • Shy Albatross • Indian Yellow-nosed Albatross • Black-browed Albatross • Campbell Albatross FFG Act There are 14 FFG protected species located within the operational area: • Buller's Albatross • Pacific Albatross • Common Sandpiper	✓	• Tasmanian Azure • Australasian Bittern • Wedge-tailed Eagle (Tasmanian) • Brown Thornbill • Gang-gang Cockatoo BIA The spill EMBA intersects nineteen seabird and shorebird BIAs. The identified BIAs within the spill EMBA are related to foraging, breeding and aggregation. FFG Act There are 39 FFG protected species located within the spill EMBA: • Australasian Bittern

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
			Iconic species	✓	• Curlew Sandpiper • Eastern Curlew, Far Eastern Curlew • Grey-headed Albatross • Indian Yellow-nosed Albatross • Northern Buller's Albatross, • Pacific Albatross • Orange-bellied Parrot • Red Knot, Knot • Sooty Albatross • Southern Giant Petrel • Southern Royal Albatross • Wandering Albatross	✓	• Australian Painted Snipe • Bar-tailed Godwit • Black-tailed Godwit • Buller's Albatross • Common Greenshank • Common Sandpiper • Curlew Sandpiper • Eastern Curlew • Fairy Tern • Great Knot • Greater Sand Plover • Grey Falcon • Grey Plover • Grey-headed Albatross • Grey-tailed Tattler • Eastern Hooded Plover • Indian Yellow-nosed Albatross • Lesser Sand Plover • Little Tern • Magpie Goose • Marsh Sandpiper • Northern Giant Petrel • Orange-bellied Parrot • Pacific Golden Plover • Red Knot • Ruddy Turnstone • Shy Albatross • Sooty Albatross • Southern Giant Petrel • Southern Royal Albatross • Swift Parrot

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
							• Terek Sandpiper • Wandering Albatross • Whimbrel • White-bellied Sea Eagle • White-faced Storm Petrel • White-throated Needletail • Wood Sandpiper Iconic species Several populations of the little penguin occur within Bass Strait, with nesting sites located on islands within Bass Strait and at various mainland shorelines. Penguin colonies known to occur in the southwest region of Victoria that are within the EMBA include Lady Julia Percy Island (2,000 breeding pairs), Twelve Apostles-London Arch (1,000 breeding pairs), Middle Island (200 breeding pairs) and Merri Island (200 breeding pairs).
	Marine Reptiles	Turtles	EPBC Act Protected Species	✓	Present Three marine turtle species are likely to occur within the operational area: Endangered • Leatherback Turtle • Loggerhead Turtle Vulnerable • Green Turtle This is considered vulnerable and migratory FFG Act The Leatherback Turtle is listed as Critically Endangered under the FFG Act and identified within the operational area	✓	Present Three species of marine turtle listed as endangered under the EPBC Act may occur within the EMBA Endangered • Leatherback Turtle • Loggerhead Turtle Vulnerable • Green Turtle FFG Act The Leatherback Turtle is listed as Critically Endangered under the FFG Act and identified within the EMBA. BIA There are no BIAs or Habitat Critical areas identified for EPBC Act listed turtles within the EMBA.
			FFG Act listed	-		-	
			BIAs	-		-	

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
					<u>BIA</u> No BIAs or Habitat Critical areas are within the operational area.		
	Marine Mammals	Seals and Sealions (Pinnipeds)	EPBC Act Protected Species	✓	Present Two pinniped Listed Marine Species may occur within the operational area: • Australian Fur-seal • Long-nosed Fur-seal <u>FFG Act</u> • Long-nosed Fur-seal	✓	Present Three pinniped species (or species habitat) may occur within the spill EMBA. <u>Threatened Species</u> Of the identified listed marine species, the pinniped species within the spill EMBA include: • One Endangered marine species (Australian sea-lion) • Two additional marine species (NZ fur seal and Australian fur seal). <u>FFG Act</u> • Long-nosed Fur-seal <u>BIA</u> A foraging (male) BIA has been identified for the Australian Sea-lion within the spill EMBA.
		Cetaceans	EPBC Act Protected Species	✓	Present Fourteen cetacean species (7 whales, 7 dolphins) are listed under the EPBC Act PMST as possibly occurring within the operational area. Two species are threatened under the FFG Act and there are 3 BIAs that intersect the operational area: <u>Endangered</u>	✓	Present Twenty-nine cetacean species are listed under the EPBC Act PMST as possibly occurring within the EMBA. Five whale species are threatened, and four whale species are also threatened under the FFG Act. <u>Endangered Species</u> • Blue whale • Southern right whale

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
			FFG Act	✓	• Southern right whale • Blue whale <u>Vulnerable</u> • Sei whale • Fin whale <u>Threatened under FFG Act</u> • Blue whale • Southern right whale <u>BIA</u>	✓	<u>Vulnerable Species</u> • Sei whale • Fin whale <u>Threatened under FFG Act</u> • Blue whale • Southern right whale • Humpback whale <u>BIA</u> The spill EMBA intersects a possible foraging and distribution BIA for the PBW and a migration and resting on migration, connecting habitat, known core range, and aggregation BIA for the Southern Right Whale.
			BIA	✓	• Pygmy blue whale distribution • Pygmy blue whale foraging • Southern right whale known core range	✓	
Invasive Species	Marine Pests	Established and Exotic	Introduced marine species	✓	Not identified Marine pests have not been identified within the operational area to date, though the potential exists for marine pests to establish through natural and anthropogenic influences.	✓	Present In the South-east Marine Region, 115 marine species are known to be introduced, and an additional 84 are considered to be possible introductions or 'cryptogenic' species. Eleven species are considered to be invasive marine species (IMS). Key known pest species in the South-East Marine Region include: • 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 *Pyromaiatuberculata*); • Macroalgae (*Undaria pinnatifida* (Japanese giant kelp) and *Codium fragile ssp.tormentosoides)*; and • The introduced NZ screw shell (*Maoricolpus roseus*), known to form extensive and dense beds on the sandy sea-floor in eastern Bass Strait

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area		Spill EMBA	
							spreading to the 80 m depth contour off eastern Victoria and NSW (Patil *et al*., 2004).
	Marine Viruses	Infection agent found in marine environments	Introduced virus species	✓	Present Marine viruses within the Operating Area are anticipated to reflect the conditions of the south-east marine region.	✓	Present Abalone Viral Ganglioneuritis (AVG), has been detected in southwest Victoria and was confirmed as far east as White Cliffs near Johanna, and west as far as Discovery Bay Marine Park (Department of Primary Industry (DPI), 2009). More recently in May 2021 wild abalone off the coast of Cape Nelson tested positive to AVG.

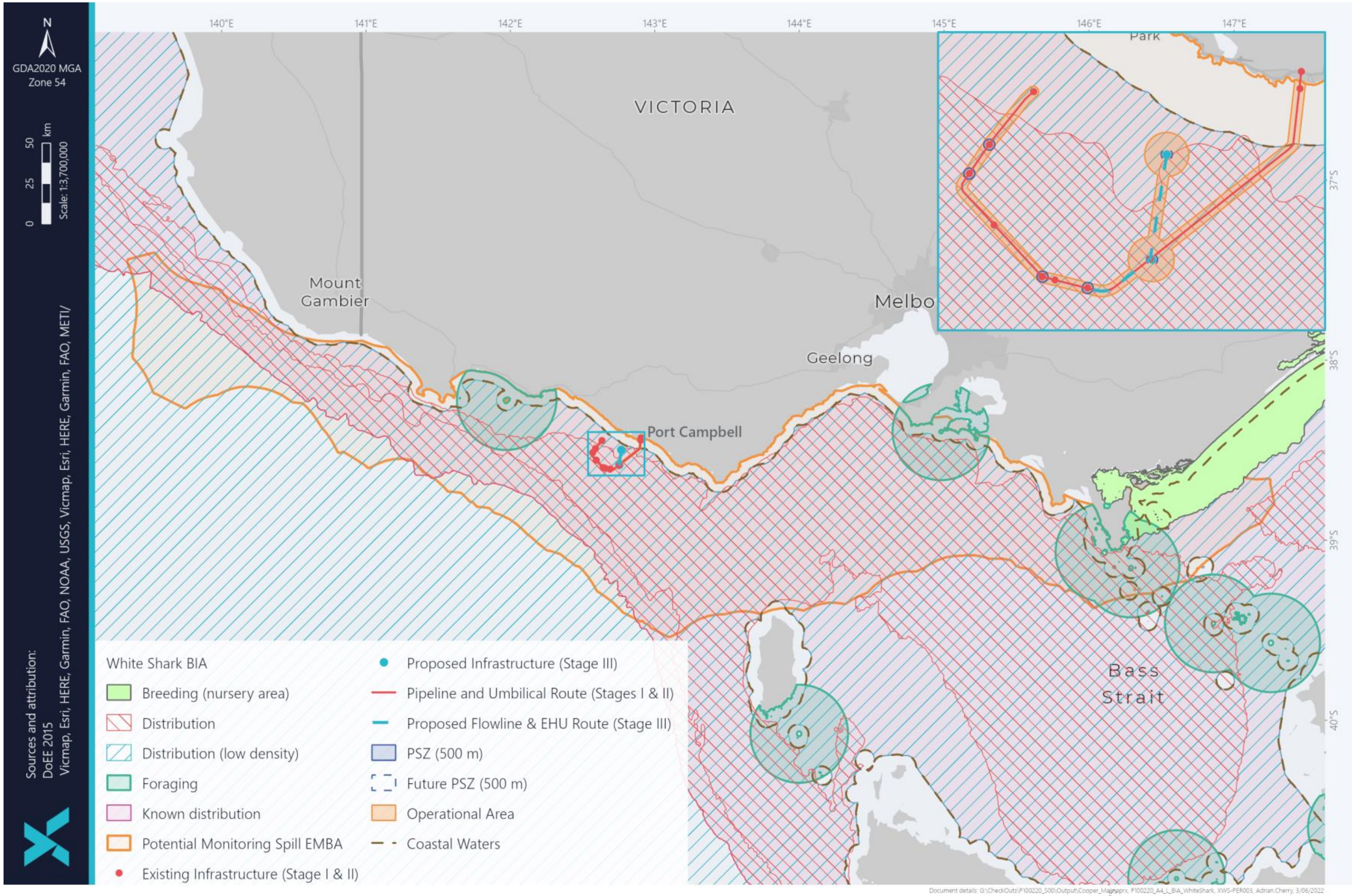


Figure 4-2: White Shark BIAs within the Operational Area and EMBA

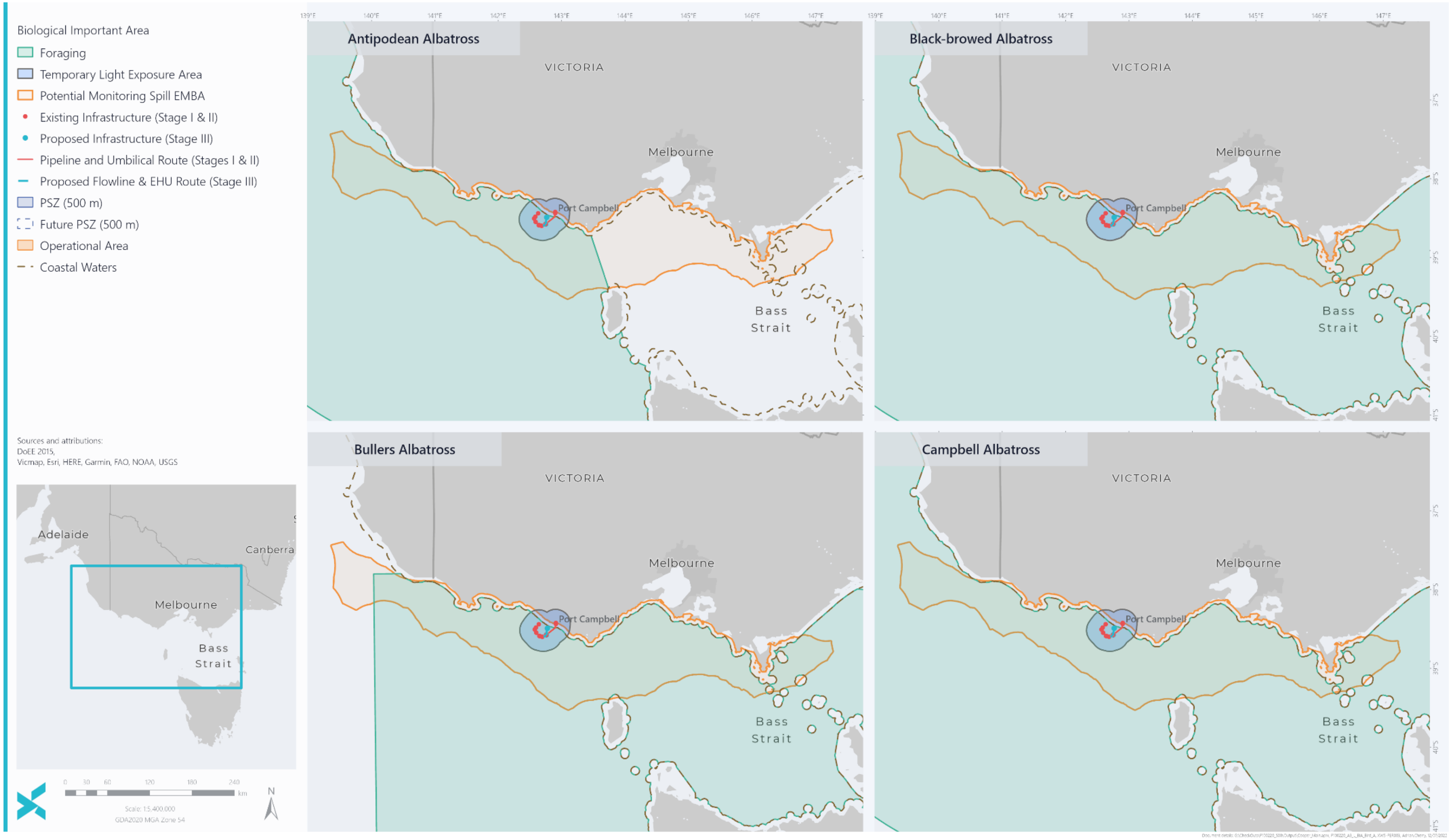


Figure 4-3: Albatross BIAs within the Operational Area

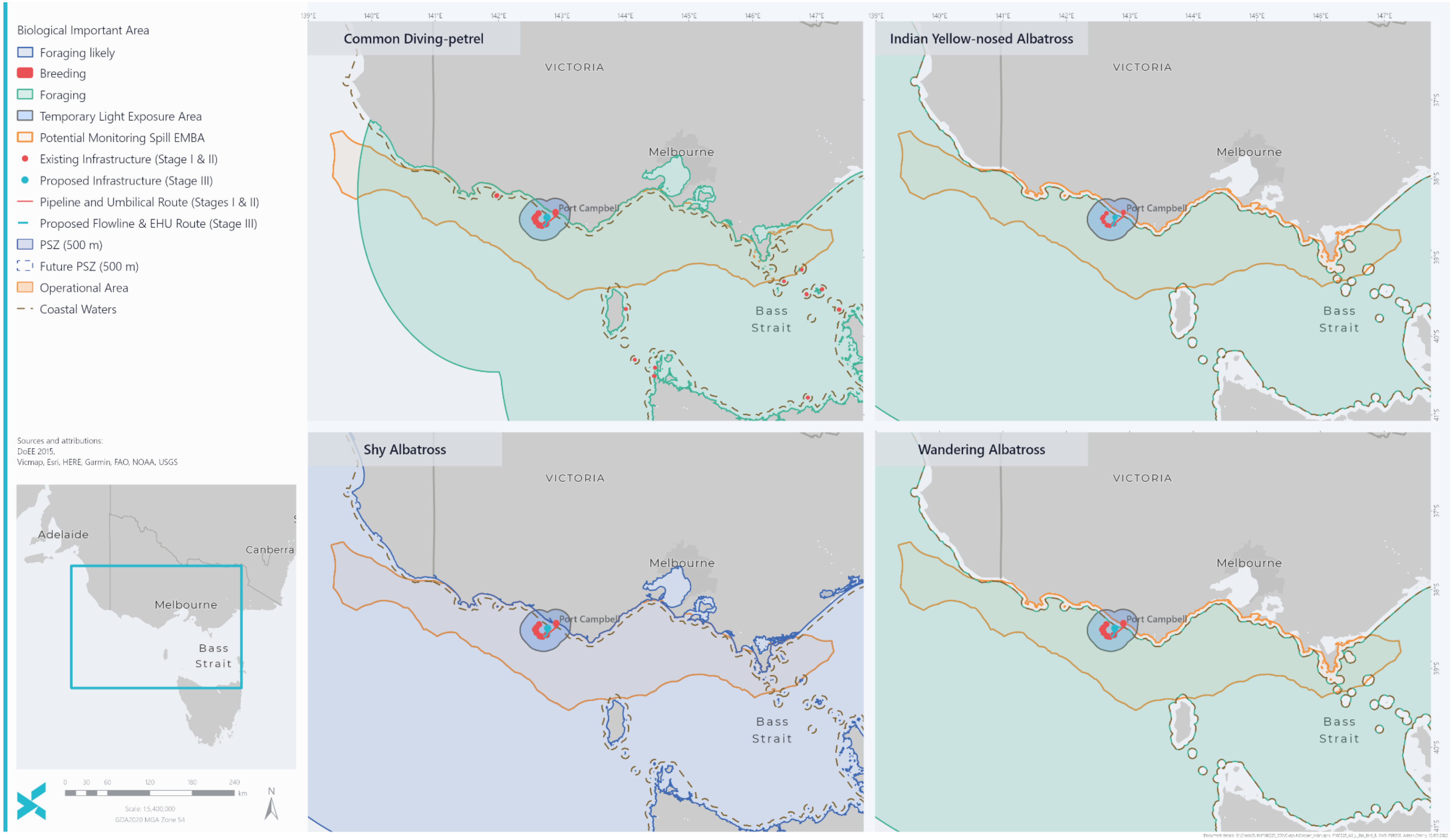


Figure 4-4: Petrel and Albatross BIAs within the Operational Area, Light Exposure Area and Potential Monitoring Spill EMBA

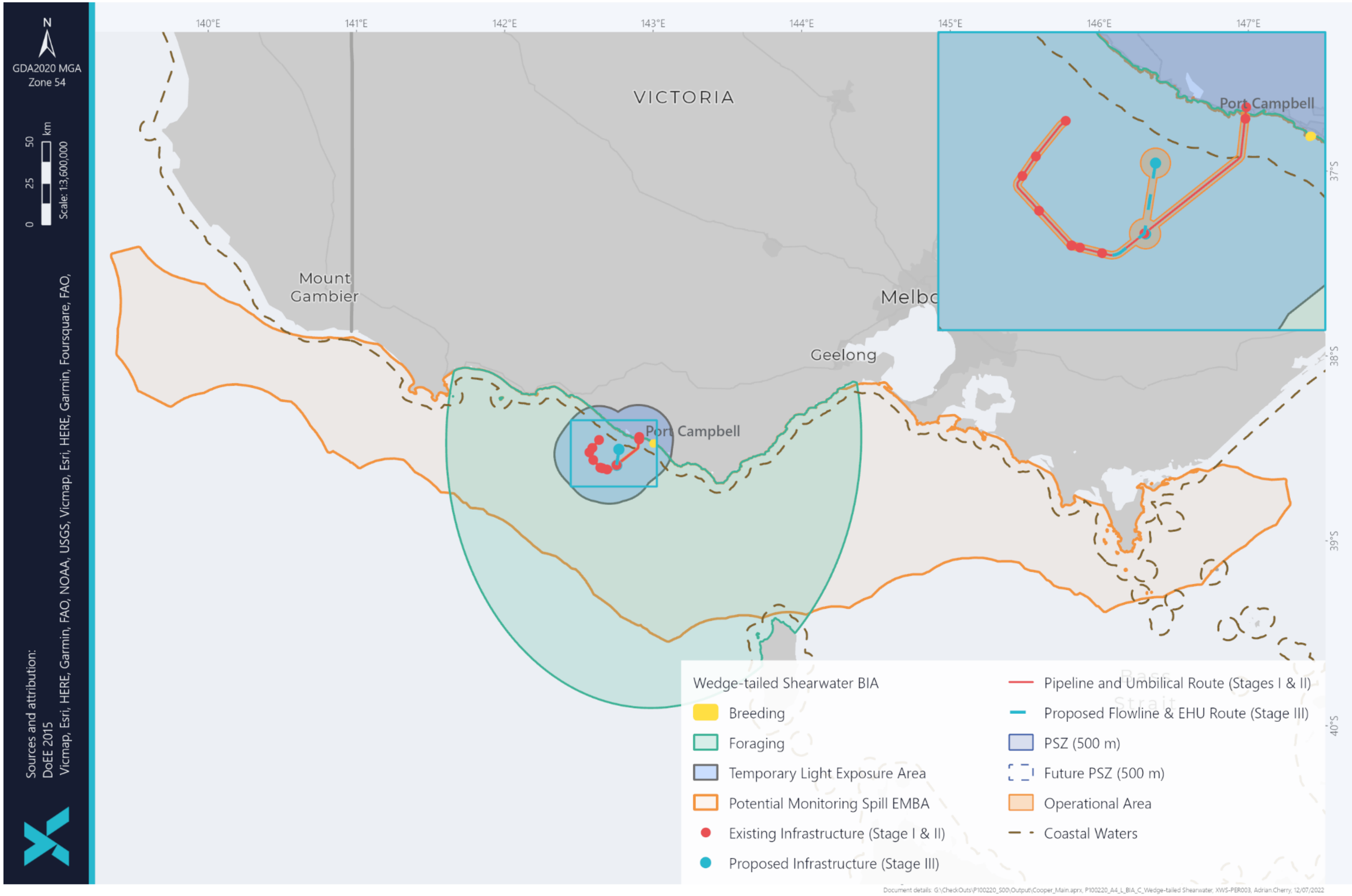


Figure 4-5: Wedge-tailed Shearwater BIA within the Operational Area, Light Exposure Area and Potential Monitoring Spill EMBA

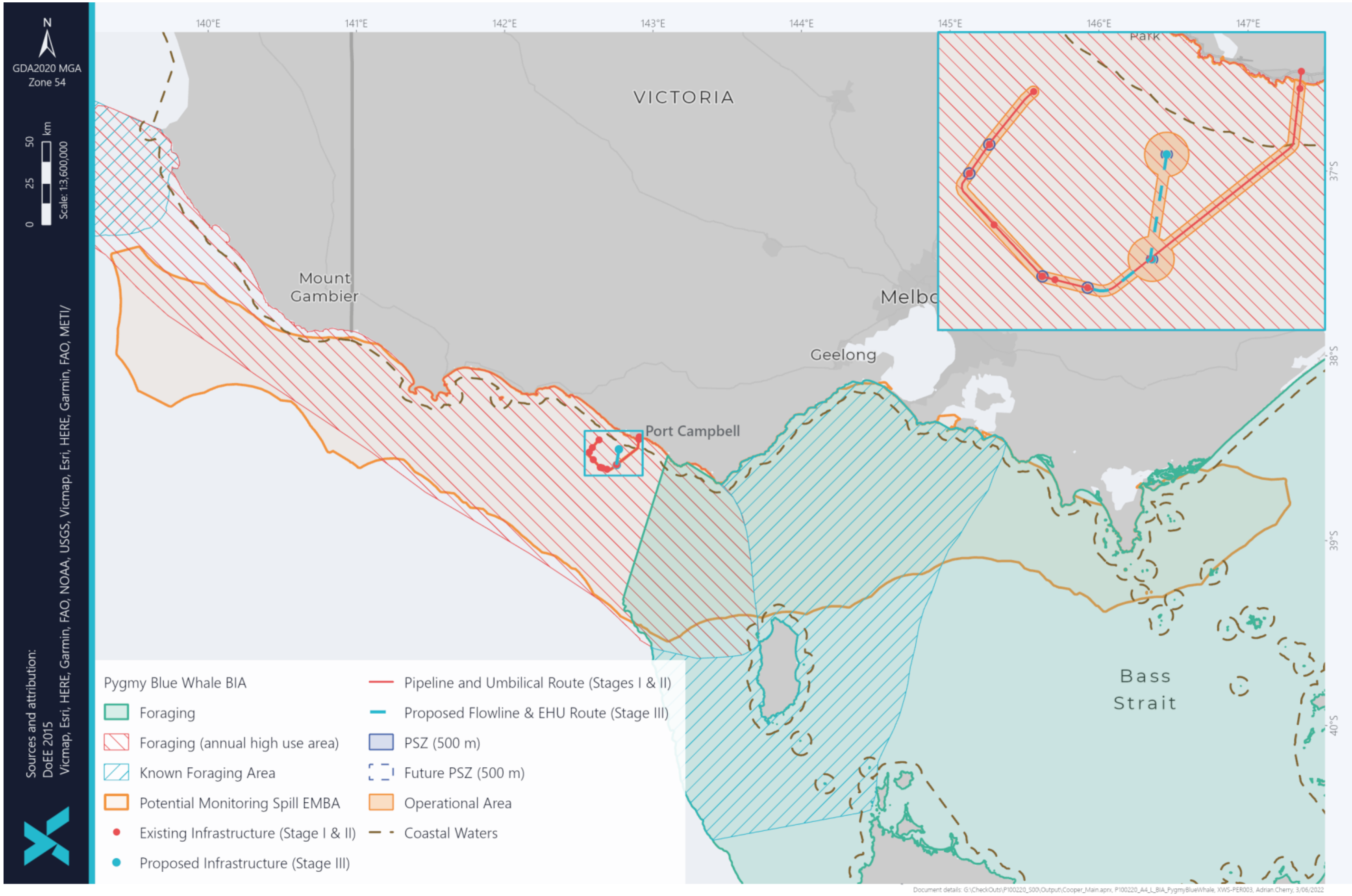


Figure 4-6: Pygmy Blue Whale BIAs within the Operational Area

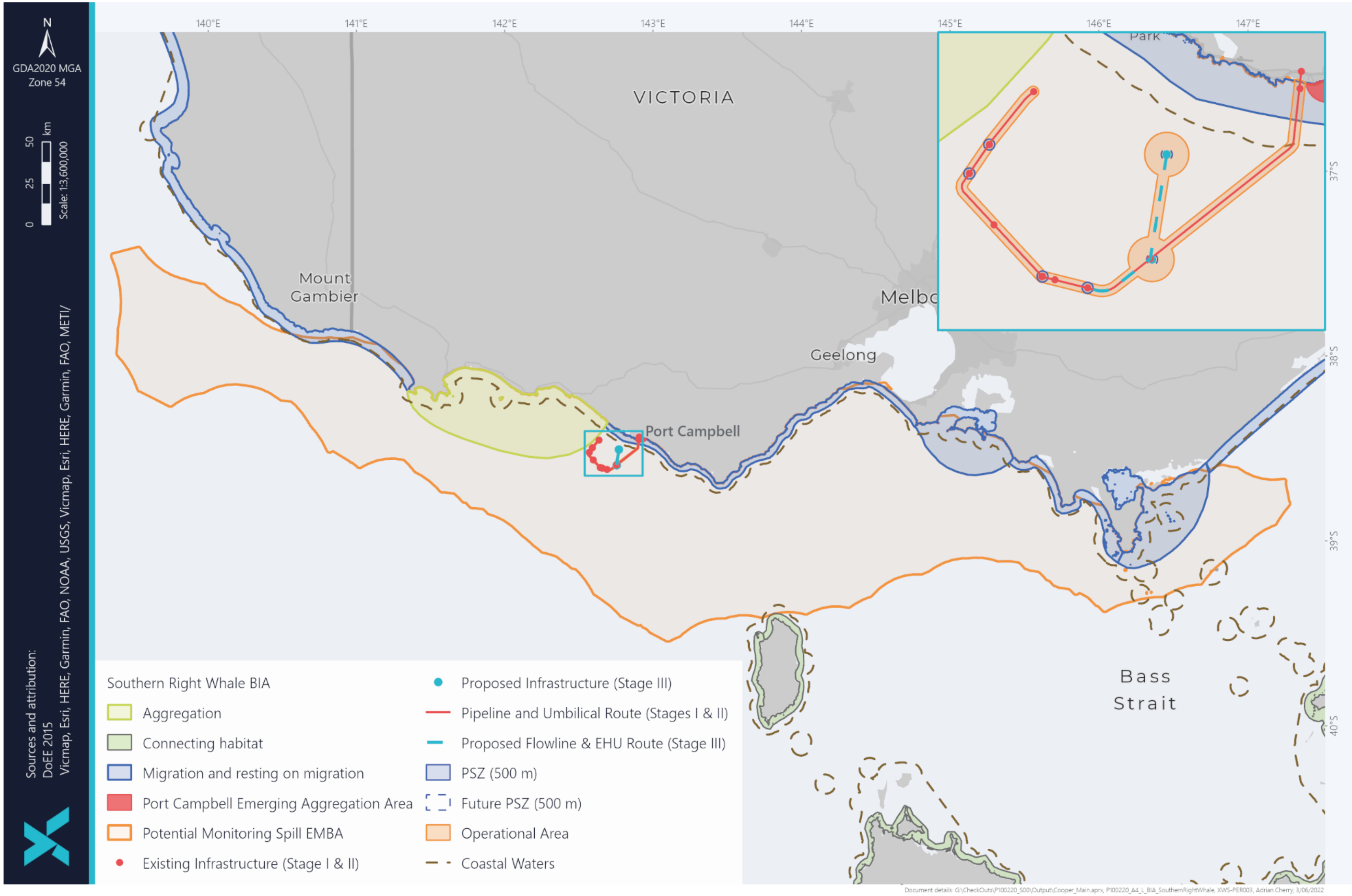


Figure 4-7: Southern Right Whale BIA proximity to Operational Area

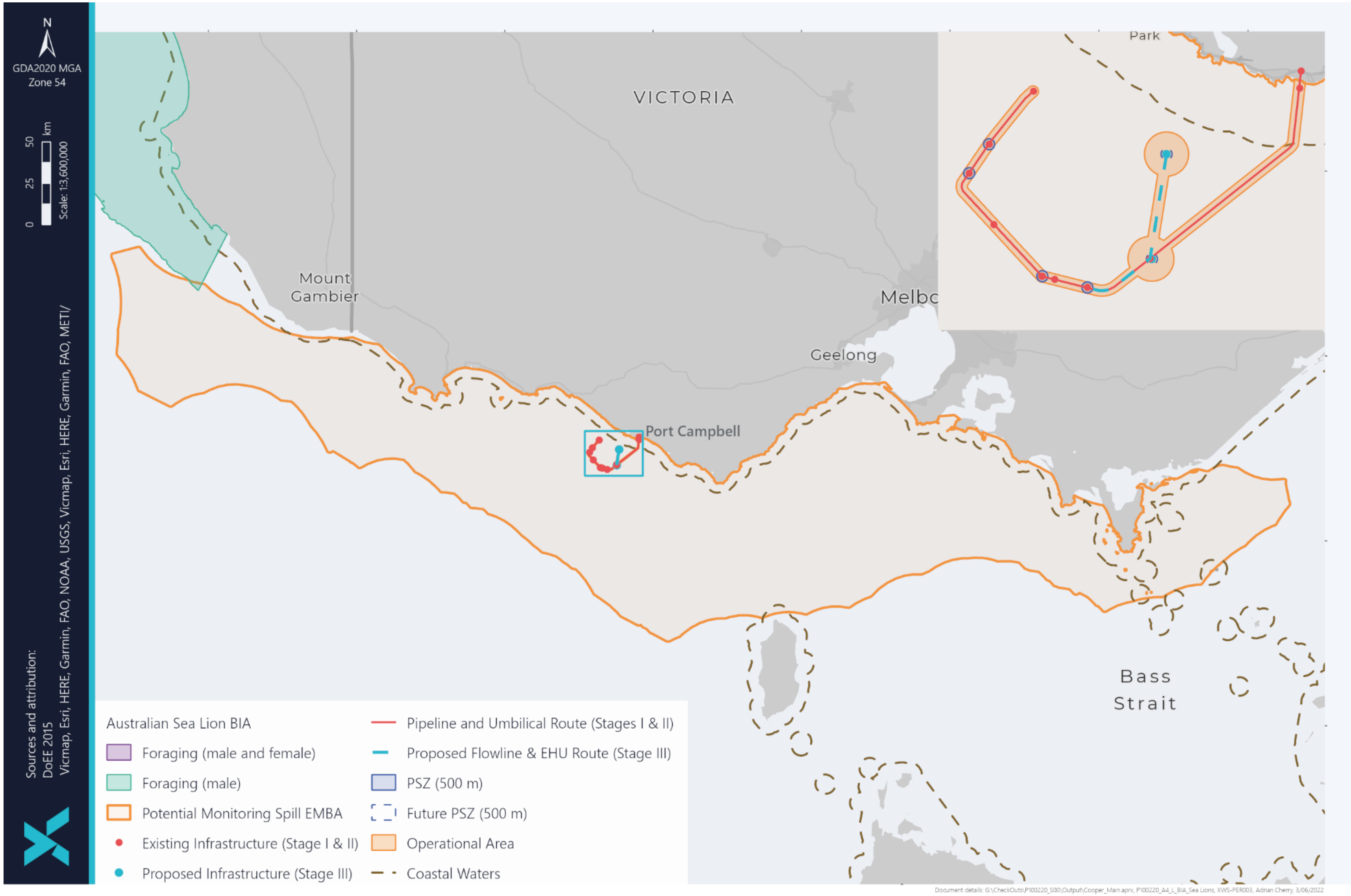


Figure 4-8 Sea Lion BIA proximity to Operational Area

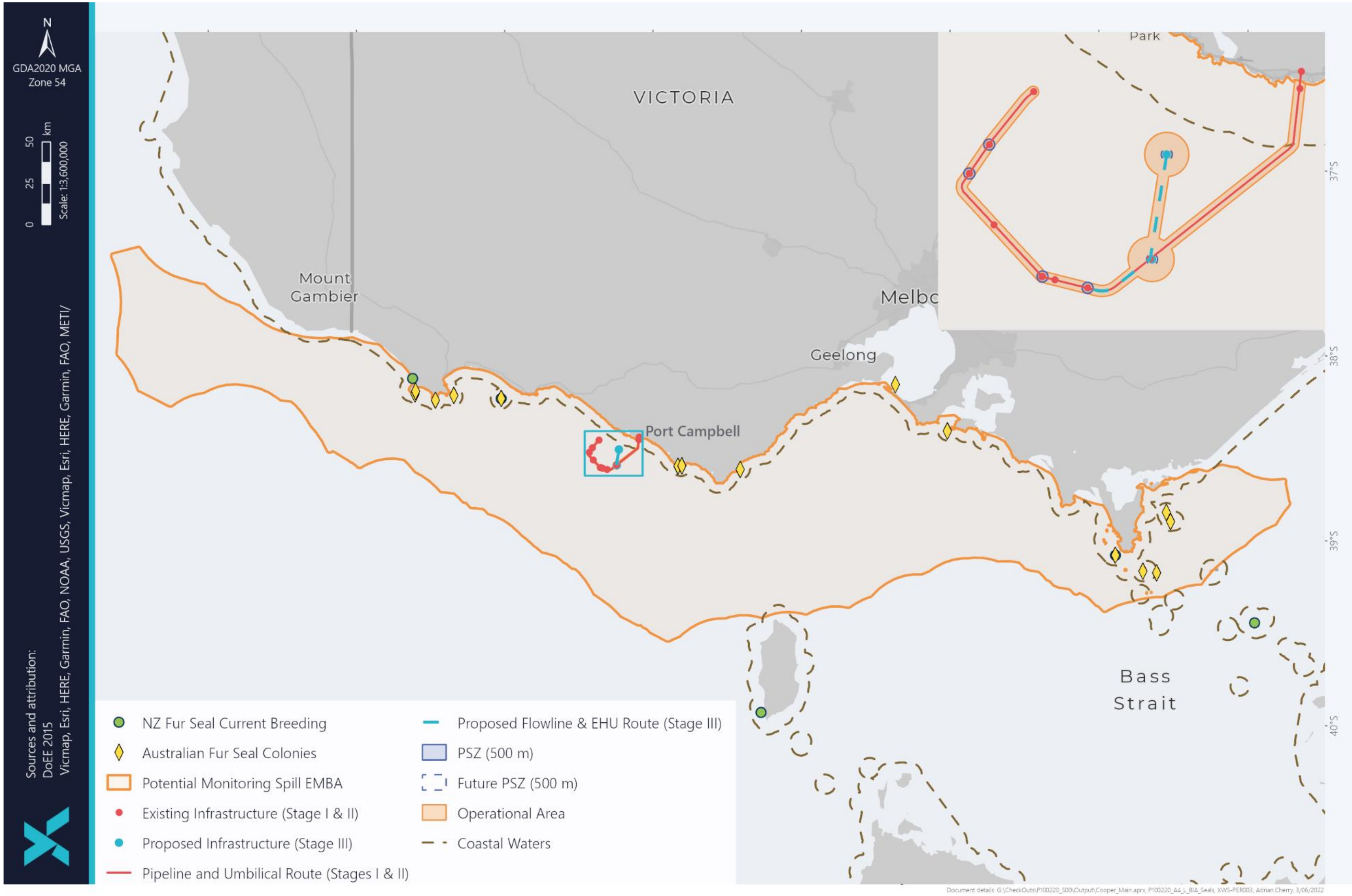


Figure 4-9 Seal BIA proximity to Operational Area

4.4.3. Social Receptors

Table 4-4: Presence of Social Receptors within the Operational Area and EMBA

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area[1]		Spill EMBA[2]	
Socio – ecological System	Commonwealth Marine Area	KEF	• High productivity (includes episodic productivity) • Aggregations of marine life • High biodiversity • High level of endemism • Unique Habitat	-	Not Present The operational area does not intersect with any delineated KEFs. There are areas of rocky reef and hard substrate within the operational area. Rocky reefs and hard grounds are located in all areas of the south-east marine region on the continental shelf.	✓	Present The EMBA intersects the Bonney Upwelling KEF (53 km) northwest of the Otway assets and the West Tasmania Canyons KEF 50km from Otway assets. Shelf Rocky reefs and hard substrates are also located in all areas of the south-east marine region on the continental shelf.
		Australian Marine Parks	• Aggregations of marine life • High productivity and biodiversity • Unique habitat	-	Not Present The operational area does not intersect any Australian Marine Parks.	✓	Present The following Australian Marine Parks are intersected by the EMBA: • Apollo AMP (Multiple Use Zone (IUCN VI) • Beagle AMP (Multiple Use Zone (IUCN VI)
	Commonwealth Area	Threatened Ecological Communities	• Support ecosystem services • Provide habitat • Community at risk of extinction	-	Not Present The operational area does not intersect any Threatened Ecological Communities.	✓	Present Eleven TEC are likely or may occur within the EMBA. Six have coastal areas: • Giant kelp marine forests of South East Australia (Endangered) • Subtropical and temperate coastal saltmarsh(vulnerable) • Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community (Endangered) • Karst Springs and associated alkaline fens of the Naracoote Coastal Plain Bioregion • Natural Damp Grassland of the Victorian Coastal Plains

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area[1]		Spill EMBA[2]	
							• Subtropical and Temperate Coastal Saltmarsh
	State Parks and Reserves	Marine Protected Areas	• Aggregations of marine life • High productivity • Biodiversity	-	Not Present The operational area does not intersect any State protected areas.	✓	Present • 22 State Marine Protected Areas located within the EMBA including: • 8 Victorian Marine National Parks • 7 Victorian Marine Sanctuaries • 1 SA Marine Park • 6 National Parks Act
		Terrestrial Protected Areas	• Aggregations of terrestrial life • High productivity • Biodiversity	-	Not present The operational area does not intersect any State protected areas.	✓	Present 74 State Terrestrial Protected Areas located within the EMBA including: • 7 Victorian Terrestrial National Parks
	Wetlands of International Importance	Ramsar wetlands (International Importance)	Aggregation, foraging and nursery habitat for marine life	-	Not present The operational area does not intersect any Wetlands of International Importance	-	Not Present Four Wetlands of International Importance are within the EMBA and include: • The Glenelg Estuary and Discovery Bay Wetlands • Corner Inlet • Port Phillip Bay (Western Shoreline) and Bellarine Peninsula • Western Port Two Wetlands of International Importance are located within 10 km of the EMBA but are outside of its range and include: • Piccaninnie Ponds Karst Wetlands • Lavinia

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area[1]		Spill EMBA[2]	
		National Importance Wetlands	Aggregation, foraging and nursery habitat for marine life	-	Not present The operational area does not intersect any Nationally Important Wetlands	✓	Present The spill EMBA intersects 14 Nationally Important Wetlands. However, 8 have a connection with the ocean and include: • Corner Inlet • Aire River • Western Port • Shallow Inlet Marine and Coastal Park • Swan Bay and Swan Island • Anderson Inlet • Long Swamp • Powlett River Mouth
	Heritage	Underwater Heritage (wrecks and aircraft)	Historic significance	-	Not present The operational area does not intersect any historic shipwrecks or aircraft.	✓	Present Wrecks closest to the Otway offshore assets include: • Napier • Nowra • Newfield • Young Australian • Schomberg • Falls of Halladale • Unnamed (located west of Peterborough in waters less than 10 m deep) • Loch Ard • Frankston • RAAF – B25 • USAF – B57 • Twin Engine – Lady Julia Percy Is
			World Heritage Properties	-	Not Present	-	Not Present

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area[1]		Spill EMBA[2]	
		Commonwealth Heritage	Commonwealth Heritage Places	-	There are no World Heritage Properties in the operational area. There are no marine or coastal places on the Commonwealth Heritage list in the operational area. There are no National Heritage Places in the operational area.	-	There are no World Heritage Properties in the EMBA. There are six Commonwealth Heritage Places within the EMBA, however only two have a connection with the ocean; Swan Island and Naval Waters, and Swan Island Defence. There are three National Heritage places within the EMBA with only one linked to the shoreline, Point Nepean Defence.
			National Heritage Places	-		-	
		Aboriginal	Indigenous use or connection	-	Not present The operational area does not intersect any areas of Aboriginal cultural heritage sensitivity.	✓	Present 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.
Socio-economic Systems	Commercial Fisheries	Commonwealth managed	Economic benefit	✓	Present The operational area intersects the management areas for seven Commonwealth-managed fisheries: • Bass Strait Central Zone Scallop • Eastern Tuna and Billfish • Skipjack (eastern) • Small Pelagic (western sub-area) • Southern and Eastern Scalefish and Shark (SESS) • Southern Bluefin Tuna However, possible activity around the Otway offshore assets is expected for the SESS – Shark Gillnet and Shark Hook	✓	Present The spill EMBA intersects the management areas for the seven Commonwealth-managed fisheries: • Bass Strait Central Zone Scallop • Eastern Tuna and Billfish • Skipjack (eastern) • Small Pelagic (western sub-area) • Southern and Eastern Scalefish and Shark (SESS) • Southern Bluefin Tuna • Southern Squid Jig However, possible activity within the spill EMBA is expected for the SESS – Shark Gillnet and Shark Hook sector and the Southern Jig Squid Fishery.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area[1]		Spill EMBA[2]	
					sector and the Southern Jig Squid Fishery.		
		State Managed – Vic	Economic benefit	✓	Present Victorian fisheries are managed by DJPR (Fisheries) and may overlap Commonwealth fisheries areas. The operational area is likely to intersect the management areas for the following six state-managed fisheries: • Rock Lobster Fishery • Giant Crab Fishery • Abalone Fishery • Scallop • Wrasse Fishery • Ocean General However, likely or definite activity around the Otway offshore assets is expected for the Rock Lobster, Giant Crab, Ocean General (octopus), Abalone and Wrasse fisheries.	✓	Present Victorian fisheries are managed by DJPR (Fisheries) and may overlap Commonwealth fisheries areas. The spill EMBA is likely to intersect the management areas for the following six state-managed fisheries: • Rock Lobster Fishery • Giant Crab Fishery • Abalone Fishery • Scallop • Wrasse Fishery • Ocean General However, likely or definite activity around the Otway offshore assets is expected for the Rock Lobster, Giant Crab, Ocean General (octopus), Abalone and Wrasse fisheries.
	Recreational Fisheries	State-managed	• Community • Recreation	✓	Present Recreational fishing includes rock, beach, boat and estuary fishing, using rod and line. Common inshore fish species caught by recreational fishers include: • Sand flathead • John dory • Jackass morwong	✓	Present Recreational fishing includes rock, beach, boat and estuary fishing, using rod and line. Fishing licences are required for inland and ocean fishing. Common inshore fish species caught by recreational fishers include: • Sand flathead • John dory • Jackass morwong

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area[1]		Spill EMBA[2]	
					• Silver trevally • Barracouta • Mullet • Common species caught at Curdies Inlet include: • Black bream • Estuary perch • Mullet • Australian salmon Most recreational fishing typically occurs in nearshore coastal waters (shore or inshore vessels) and within bays and estuaries. Recreational fishing activity is expected to be minimal in the operational area.		• Silver trevally • Barracouta • Mullet • Common species caught at Curdies Inlet include: • Black bream • Estuary perch • Mullet • Australian salmon Fishing charter operators provide deeper water recreational fishing opportunities (such as tuna fishing)
	Recreation and Tourism	Victoria	• Economic benefit • Community • Recreation	-	Not present Key activities include sight-seeing, surfing and fishing however, these are generally land-based or near-shore activities and are not impacted by the Otway offshore assets and operations.	✓	Present Key activities include sight-seeing, surfing, diving and snorkelling and fishing however, these are generally land-based or near-shore activities and are not impacted by the facilities and associated activities. The assets and Otway offshore activities are located in an area adjacent the Otway coastline, which is located on the Great Ocean Road, a popular tourist drive.
	Coastal Settlements	Victoria	• Economic benefit • Community engagement • Recreation	-	Not present The operational area does not include coastal and onshore environments.	✓	Present The communities of Apollo Bay, Princetown, Port Campbell, Peterborough, Warrnambool, Port Fairy and Portland all provide services to the commercial and recreational fishing industries in southwest Victoria. Port Campbell is the nearest town to the offshore facilities.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area[1]		Spill EMBA[2]	
	Native Title	Victoria	• Indigenous use or connection • Traditional land uses • Hunting, gathering and food supply sites • Custom and law activities		Not present A claim exists over the adjacent coastal shoreline by the Eastern Maar Traditional Owner Group that extends across much of Cape Otway and surrounding country, and into adjacent state waters; this is the negotiation area for a Recognition and Settlement Agreement under the Vic Traditional Owner Settlement Act 2010.		Present A claim exists over the adjacent coastal shoreline by the Eastern Maar people that extends across much of Cape Otway and surrounding country, and into adjacent state waters; this is the negotiation area for a Recognition and Settlement Agreement under the Vic Traditional Owner Settlement Act 2010. To the east and west are the registered aboriginal party boundaries for the Wadawurrung Traditional Owners Aboriginal Corporation and Guntitj Mirring Traditional owners aboriginal corporation (respectively).
	Industry	Shipping	• Community engagement • Economic benefit	✓	Present The offshore facilities are located at the northern extremity of areas with high traffic volumes. The highest density shipping occurs in the southern-most part of Vic/L30 and Vic/L24. There are no designated shipping lanes in the vicinity of the facilities, however local commercial fishing vessels utilise the area.	✓	Present 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.
		Petroleum Production	Economic benefit	✓	Present The operational area comprises Cooper Energy assets. The Minerva gas pipeline occurs immediately adjacent to the northern portion of the Casino gas pipeline. Minerva offshore facilities are currently suspended and decommissioning planning is underway.	✓	Present The Otway Gas Field Development consists of a remotely operated platform (at Thylacine) (~35 km south of the Casino wells), offshore and onshore pipelines and the Otway Gas Plant. The Halladale production well is located 13 km north of the Netherby production well.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area[1]		Spill EMBA[2]	
					The Thylacine/Geographe gas pipeline is located 1.8 km to the east of the northern (shallow water) portion of the Casino gas pipeline.		
		Petroleum Exploration	Economic benefit	-	Present Cooper Energy facilities and extend across existing Petroleum exploration Titles including VIC/P76 (Cooper Energy is Titleholder). VIC/P44 is the original Petroleum Exploration Title for the Otway offshore development from which the production licences have been excised.	✓	Present Numerous exploration wells have been drilled and seismic surveys have been undertaken in the permits of the Otway Basin, the most recent being the Beach Energy Artisan-1 exploration well (VIC/P43) in 2021 and Schlumberger Otway Basin 2D Marine Seismic Survey in 2020. Beach Energy production assets including subsea facilities at Geographe and Thylacene Platform are to the south east of the Cooper Energy facilities, with the Thylacene export pipeline to shore running parallel.
		Defence Activities	Protection and surveillance	-	Not present There are no military areas within the operational area.	✓	Present Five training areas are located more than 150 km east of the Otway offshore assets, in and around Port Phillip Bay and Western Port Bay. Detailed existing environment descriptions of defence areas within the spill EMBA is described Appendix 3.

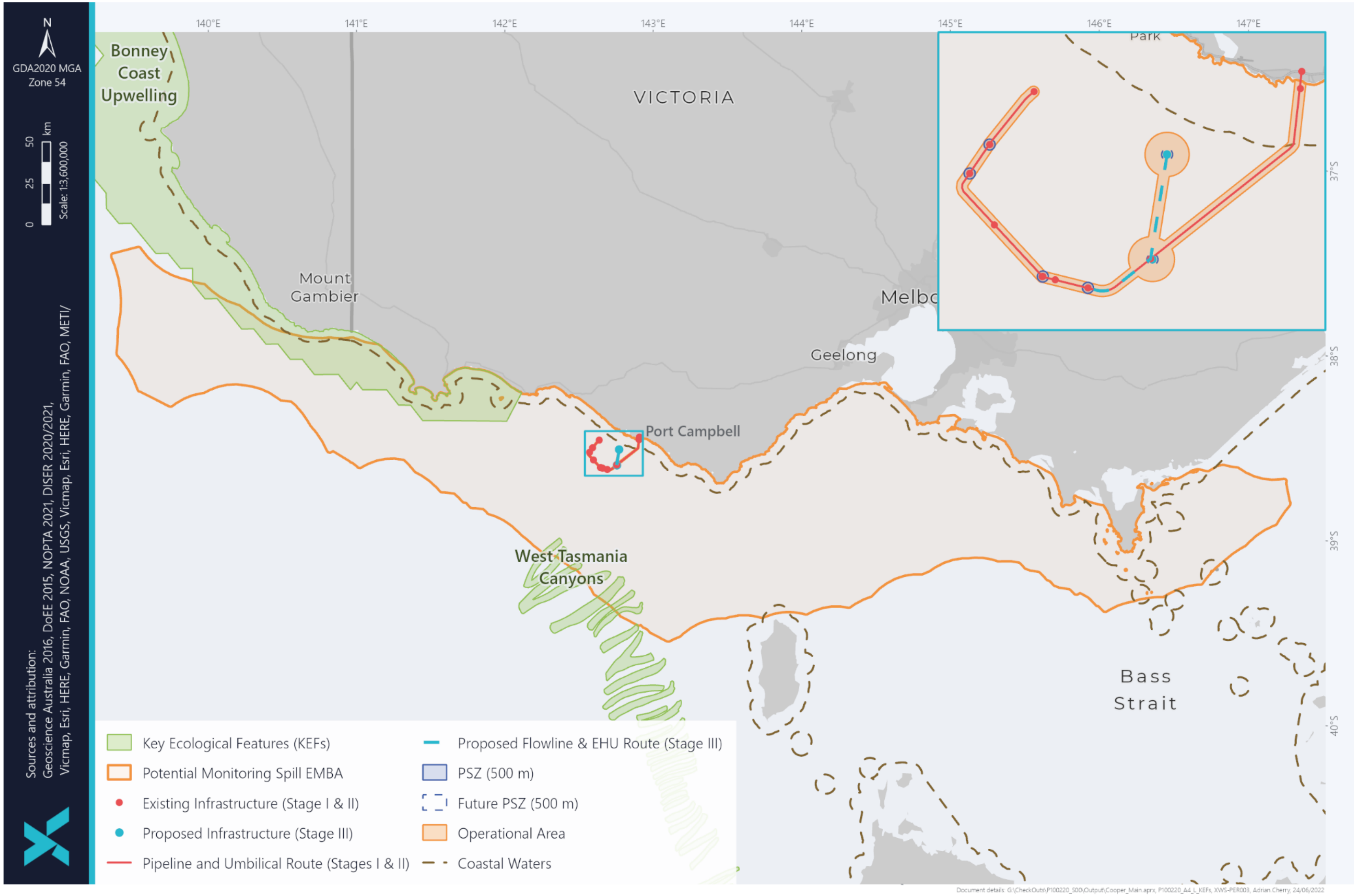


Figure 4-10: KEFs within the Operational Area and EMBA

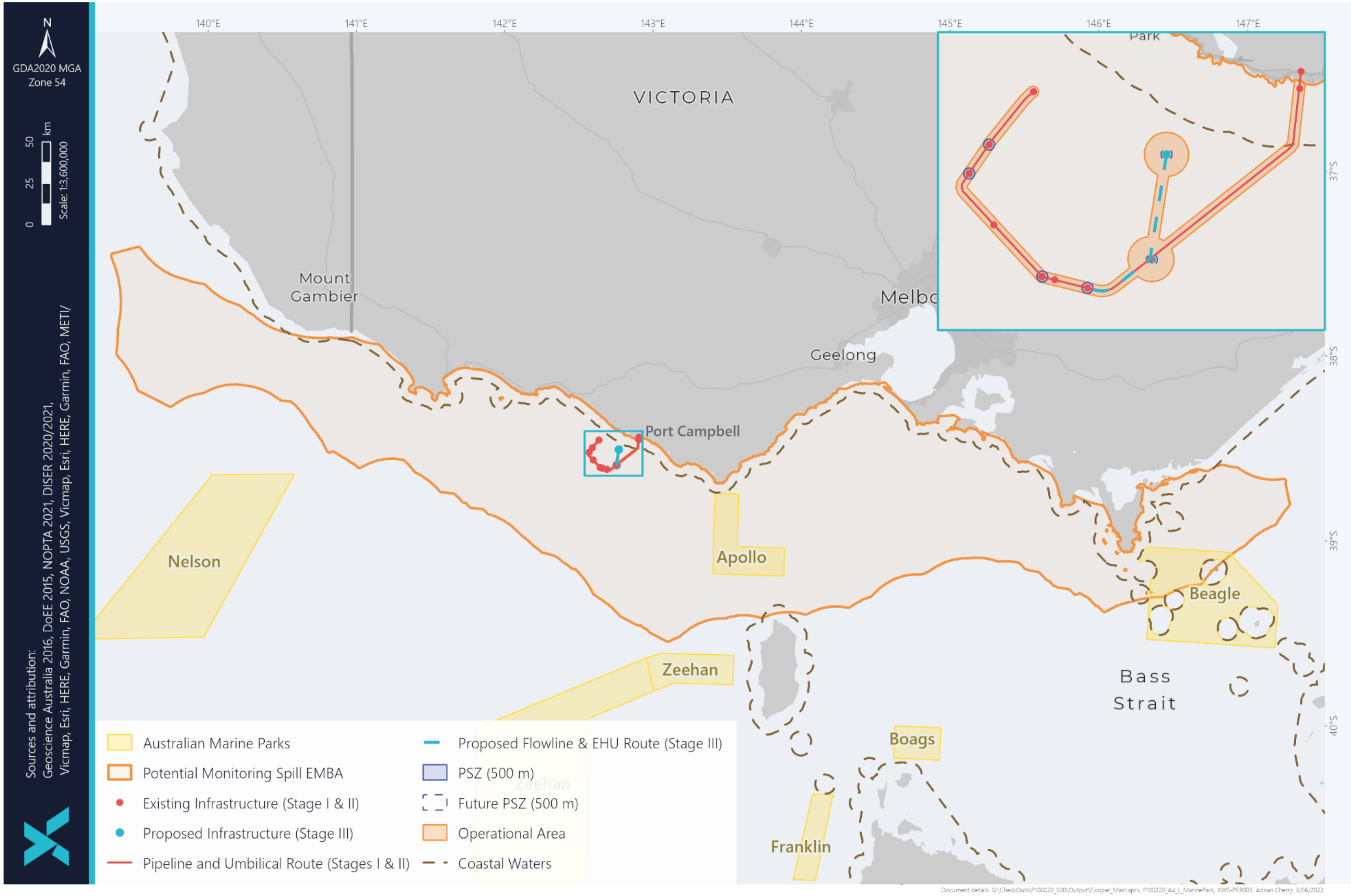


Figure 4-11: Australian Marine Parks within the Operational Area and EMBA

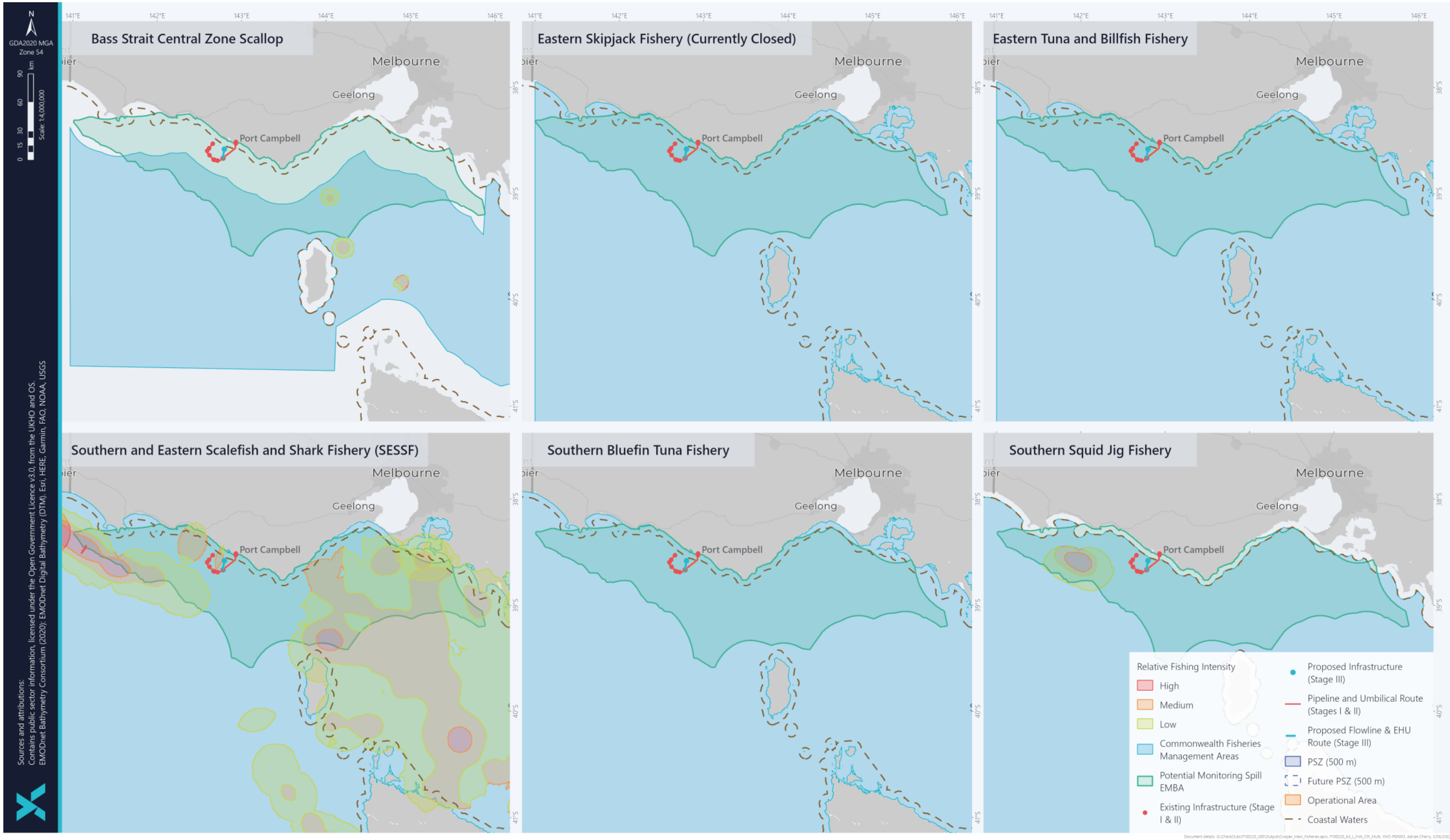


Figure 4-12: Management Areas of Commonwealth Fisheries within the Operational Area and EMBA

Figure 4-13: Abalone Victorian State-managed Commercial Fishery Management Area within the Operational Area and EMBA

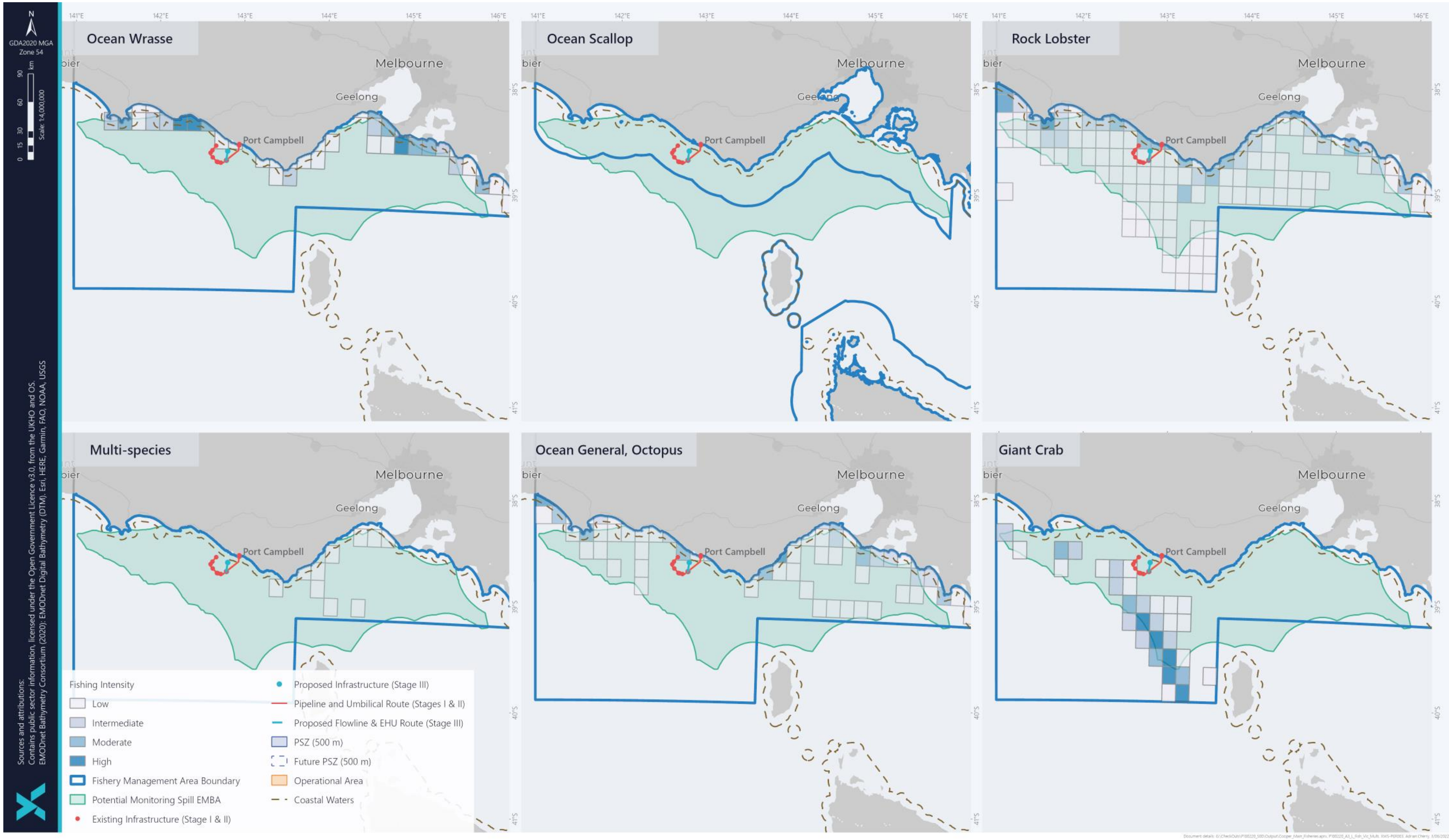


Figure 4-14: Victorian State-managed Commercial Fishery Management Areas within the Operational Area and EMB

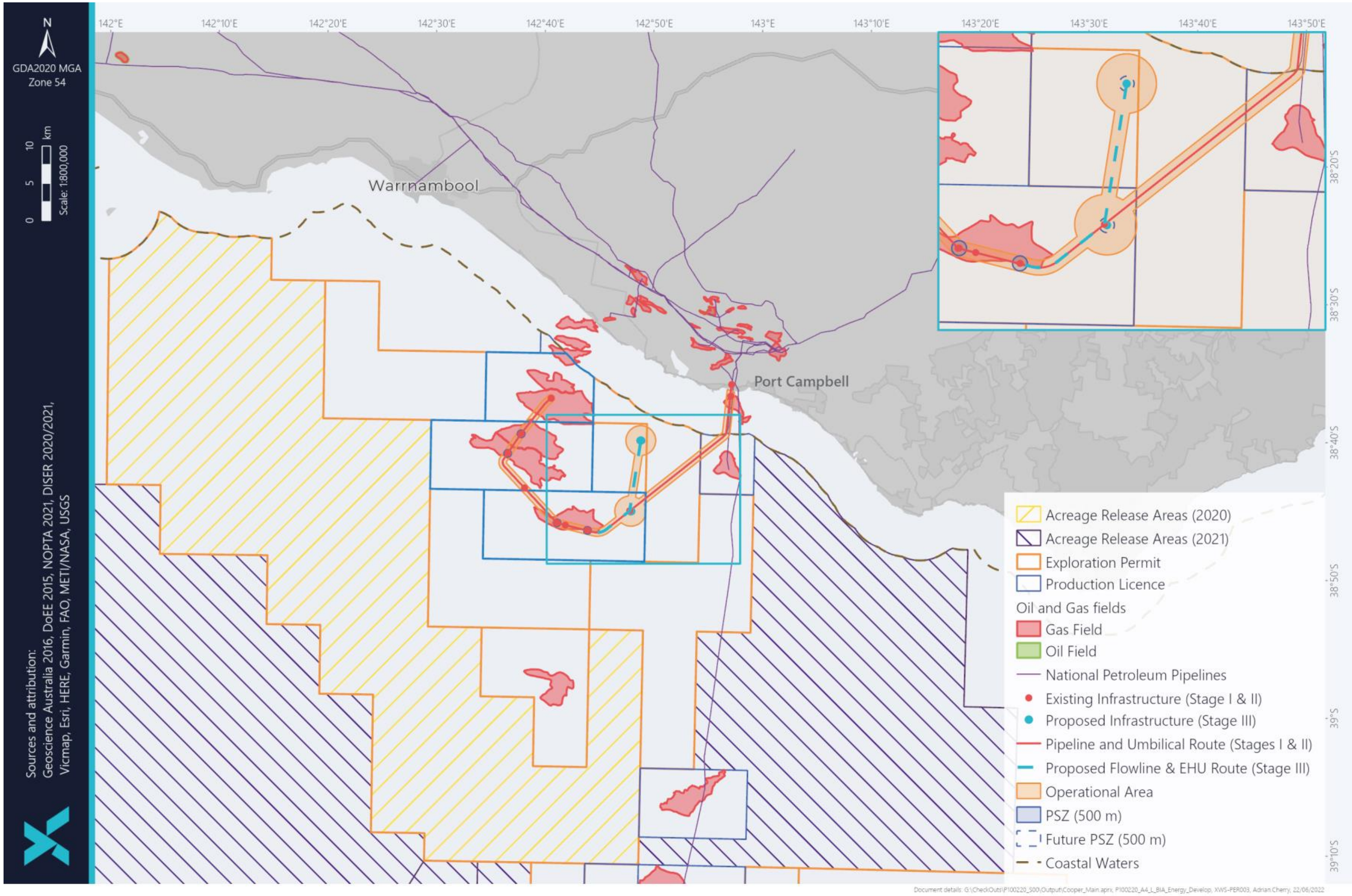


Figure 4-15: Energy Development Areas within the Operational Area

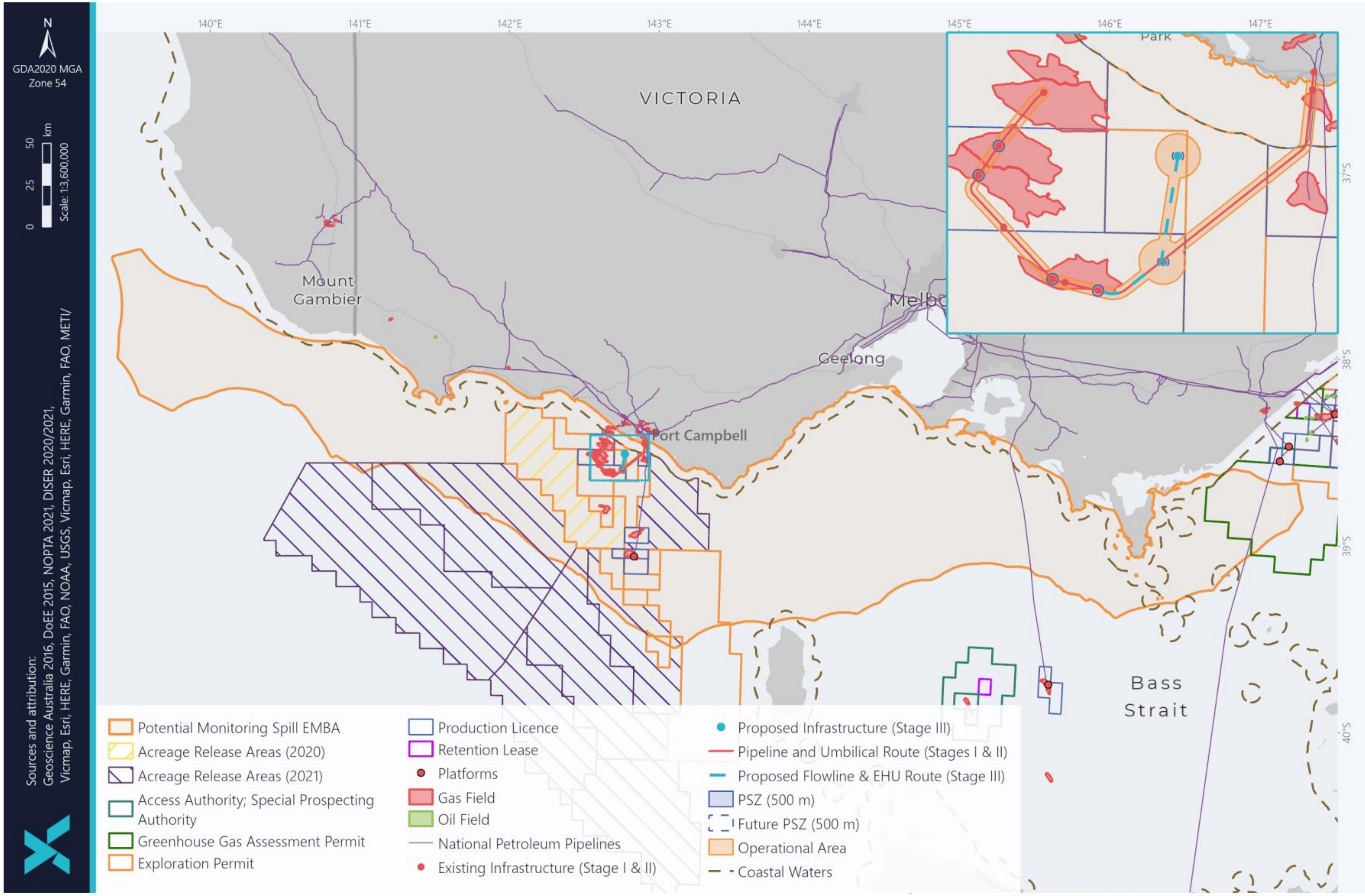


Figure 4-16: Existing Petroleum Infrastructure within the EMBA

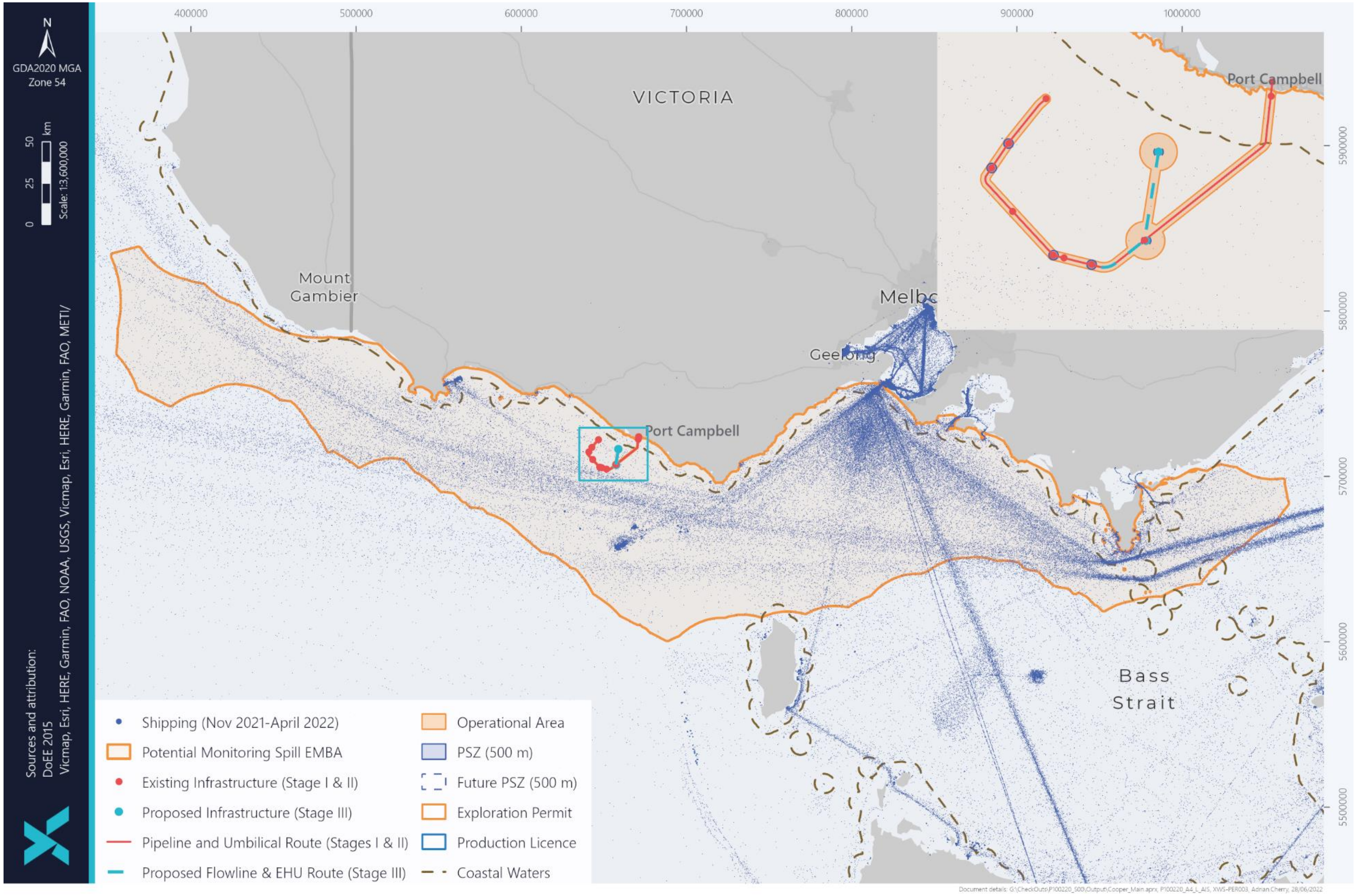


Figure 4-17: AMSA Ship Locations and Shipping Routes within the EMBA

Table 4-5: Seasonality of Key Sensitivities within the Otway Basin

Environmental Sensitivity	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marine Mammals												
Antarctic Minke Whale			Likely to occur in the austral summer									
Australian Sea Lion	Assumed present year-round – SEMR is a known range											
Pygmy Blue Whale		Foraging occurs during Bonney Upwelling – BIA										
Bryde's Whale	Prefers water depths ranging from 200 m – 1000 m											
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 – core coastal range												
Southern Right Whale – aggregation												
Sperm Whale	Prefer deep offshore environments >600 m											
Marine Reptiles												
Green turtle	Occurs in limited numbers in Vic and SA											

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						
Eastern Dwarf Galaxias	Occurs in freshwater habitats											
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											
Yarra Pygmy Perch	Occurs in freshwater habitats											
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											
Variegated Pygmy Perch	Occurs in freshwater habitats											
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.			

Environmental Sensitivity	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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)											
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), or otherwise as described above
	No occurrence

Source: DoE, 2015; DAWE, 2022; NCVA, 2020

5. Impact and Risk Assessment

The regulations require an EP be prepared which details the environmental impacts and risks associated with the activity; and that the EP comprises an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk.

This EP provides the environmental impact and risk evaluation for the Otway offshore activities, by adopting the Cooper Energy Risk Management Protocol (CMS-RM-PRO-0001). This Protocol is consistent with the approach outlined in ISO 14001 (Environmental Management Systems), ISO 31000:2009 (Risk Management) and HB 203:2012 (Environmental Risk Management – Principles and Process).

Figure 5-1 provides the six-step process adopted for the evaluation of impacts and risks associated with the activity, this process is integrated into the Cooper Energy risk assessment methodology.

Figure 5-1: CEMS Risk Management Protocol

Further details of the environmental impact and risk assessment methodology are provided in the following sections, including criteria for assessment and risk ratings.

A Risk Register is 'the managed repository of key risk information maintained by each Business Area'. It is a living part of risk management that is continually reviewed and updated. In accordance with the Cooper Energy Management System (CEMS) Risk Management Protocol, each Business Area must maintain a Risk Register and conduct risk management as an integral activity within all business processes to help manage uncertainty in achieving objectives and to aid in decision making. Section 6 expands on the project risk register, showing all identified risks, impacts, preventative and mitigative controls.

5.1. Definitions

In this section, Cooper Energy has provided a list of terminology and definitions that will be meet the requirements of Regulation 13(5) of the OPGGS(E)R:

- **Activity**: An activity refers to a component or task within a project which results in one or more environmental aspects.
- **Aspect**: An environmental aspect is an element or characteristic of an activity, product, or service that interacts or can interact with the environment. Environmental aspects can cause environmental impacts or may create a risk to one or more environmental receptors.
- **Consequence**: The consequence of an impact (or risk event) is the outcome of the event on affected receptors. Consequence can be positive or negative.
- **Impact**: An environmental impact is a change to one or more environmental receptors that is caused either partly or entirely by one or more environmental aspects. An impact is something which is certain to occur. An environmental aspect can have either a direct impact on the environment or contribute only partially or indirectly to a larger environmental change. An environmental aspect may result in a change

which puts one or more receptors at risk of being impacted. The relationship between environmental aspects and environmental impacts is one of cause and effect. The term 'impact' is associated with planned activities and known outcomes.

- **Likelihood**: The likelihood (or probability) of the consequence occurring. Likelihood only applies to risk and risk events.
- **Residual risk**: Residual risk is the risk remaining after additional control measures have been applied (i.e., after impact or risk treatment).
- **Risk:** An environmental risk (or risk event) is a change which could occur to one or more environmental receptors, caused either partly or entirely by one or more environmental aspects. A risk event has a degree of likelihood, it is not certain to occur. The term 'risk' is associated with planned and unplanned activities where the change elicited on or by a particular receptor is uncertain.
- **Risk severity**: The risk severity level is determined from the point on the risk matrix where the consequence intersects the likelihood.

5.2. Risk Management Process Steps

This section provides a detailed overview of the risk management process steps.

5.2.1. Establish the context

All components of the petroleum activity relevant to this scope were identified and described in Section 3 of this EP.

After understanding the petroleum activity, an assessment is carried out to identify aspects. The stakeholder consultation outcomes, undertaken over several years, also contribute to aspect identification. The environmental aspects identified for this petroleum activity are detailed in Section 3 and Table 6-1.

5.2.2. Risk identification

Risk identification involved the documentation of risks as they relate to the context established in step 1 (Section 5.2.1). An environmental risk assessment or review is to identify environmental impacts and risks associated with the petroleum activity. The assessment is attended by project personnel spanning operations, well engineering, subsea, HSEC disciplines and may be supported by other specialists.

5.2.3. Risk analysis

All impacts and risks identified during the assessment are analysed. Impact and risk analysis requires a level of consequence to be assessed for each impact or risk event. For each risk event, the likelihood of occurrence is determined.

Impacts and risks are evaluated using the Cooper Energy Risk Matrix, which includes:

- A six-level likelihood table to assess the probability of risk occurrence
- A five-level consequences table to assess the risk impact against business objectives
- A matrix of likelihood versus consequence that defines four levels of risk severity and allows a risk to be assessed and plotted
  - The outcome of the plotted risks is termed a 'Heat Map' and provides a graphic representation of the risks, their respective severities and likelihood
- A four-level risk severity table that defines the actions and escalation required for risks at different severity levels.

The Cooper Energy Risk Matrix is provided in Table 5-1 with definitions of the level of consequence.

Table 5-1 Consequence Assessment Criteria

Consequence level	Environmental Consequence Description
1	Minor local impacts or disturbances to flora/fauna, nil to negligible remedial/recovery works on land/ water systems.
2	Localized short-term impacts to species or habitats of recognized conservation value not affecting local ecosystem function; remedial/recovery work to land, or water systems over days/weeks.
3	Localized medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function; remedial/recovery work to land/water systems over months/year.
4	Extensive medium to long-term impact on highly valued ecosystems, species populations or habitats; remedial/recovery work to land/ water systems over 1 – 10 years.
5	Severe long-term impact on highly valued ecosystems, species, or habitats. Significant remedial/recovery work to land/water systems over decades.

The Risk Severity can be:

- **Extreme (red):** inherent risk at this level is not within the Company's risk appetite; the activity does not proceed until the Managing Director approves the treatment plans to bring the residual risk to an acceptable level. The Board must also be informed of the risk and its treatment.
- **High (orange):** inherent risk at this level requires involvement of the respective General Manager who will approve the treatment plans before the activity proceeds; the Board must also be informed of the risk and its treatment.
- **Moderate (yellow):** inherent risk at this level is tolerable if it is also ALARP. General Managers must approve treatment plans and risks should be reported to the Executive Leadership Team during regular reporting.
- **Low (green):** this level of risk is largely acceptable. Review of control procedures should occur, and the risk should be regularly monitored for deterioration.

Table 5-2 Cooper Energy qualitative risk matrix

LIKELIHOOD						CONSEQUENCE				
Qualitative										
Rating	Level	Probability	Time Period	Description	Quantitative	1	2	3	4	5
A	Almost certain	> 80%	More than once a year	Expected to occur in most circumstances and/or more than once a year, or repeatedly during the activity.	$>10^{-2}$	Moderate	Moderate	High	Extreme	Extreme
B	Likely	> 50%	Every 1 – 2 years	Not certain to happen but an additional factor may result in an occurrence. Expected to occur from time to time during the activity.	$\leq 10^{-2}$	Low	Moderate	Moderate	High	Extreme
C	Possible	> 20%	Every 4 – 5 years	Could happen when additional factors are present. Easy to postulate a scenario for the occurrence but considered doubtful. Expected to occur once during the activity.	$\leq 10^{-3}$	Low	Moderate	Moderate	High	High
D	Unlikely	> 5%	Every 5 – 20 years	A rare combination of factors would be required for an occurrence. Conceivable and could occur at some time. Could occur during the activity.	$\leq 10^{-4}$	Low	Low	Moderate	Moderate	High
E	Remote	> 1%	Every 20 – 100 years	A freak combination of factors would be required for an occurrence. Not expected to occur during the activity. Occur in exceptional circumstances.	$\leq 10^{-5}$	Low	Low	Moderate	Moderate	High
F	Hypothetical	< 1%	Not in 100 years	Generally considered hypothetical or non-credible. Black Swan.	$\leq 10^{-6}$	Low	Low	Low	Low	Moderate

5.2.4. Risk Evaluation

5.2.4.1. Identify and Evaluate Controls

Controls are any measures exercised that modify the impact or risk. Controls act on an impact cause to reduce the consequence of the impact. Controls that act on the risk cause to reduce the likelihood of the risk occurring are termed preventative controls. Reactive controls are those that modify the consequence once the risk event has occurred. For each risk, all controls should be captured.

Risk Evaluation requires each control to be assessed for its effectiveness in managing the risk causes and consequences. This may be different from the effectiveness of the control to deliver its original designed purpose.

5.2.4.2. Determine ALARP Status

The ALARP status of each impact and risk is assessed based on the sufficiency of the controls already established and the opportunity for new controls to be implemented. A cross-functional team is assembled to ensure the risks and controls are assessed from different perspectives and to identify the possibility of additional controls that can reduce the risk. If no additional realistic and feasible controls are identified for the risk, then it is considered ALARP.

In alignment with NOPSEMA's ALARP Guidance Note (N-04300-GN0166, June 2020), Cooper Energy have adapted the approach developed by Oil and Gas UK (OGUK) (formerly UKOOA) (OGUK 2014) for use in an environmental context to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (Figure 5-2).

Specifically, the framework considers impact consequence and several guiding factors:

- Activity type
- Risk and uncertainty
- Stakeholder influence.

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

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

A **Type C** decision typically involves sufficient complexity, high potential impact, uncertainty, or stakeholder influence to require a precautionary approach. In this case, relevant good practice still must be met but additional assessment is required, and the precautionary approach is applied for those controls that only have a marginal cost benefit. In accordance with the regulatory requirement to demonstrate that environmental impacts and risks are ALARP, Cooper Energy has considered the above decision context in determining the level of assessment required. This is applied to each aspect described in Section 6.

The assessment techniques considered include:

- Good practice
- Engineering risk assessment
- Precautionary approach

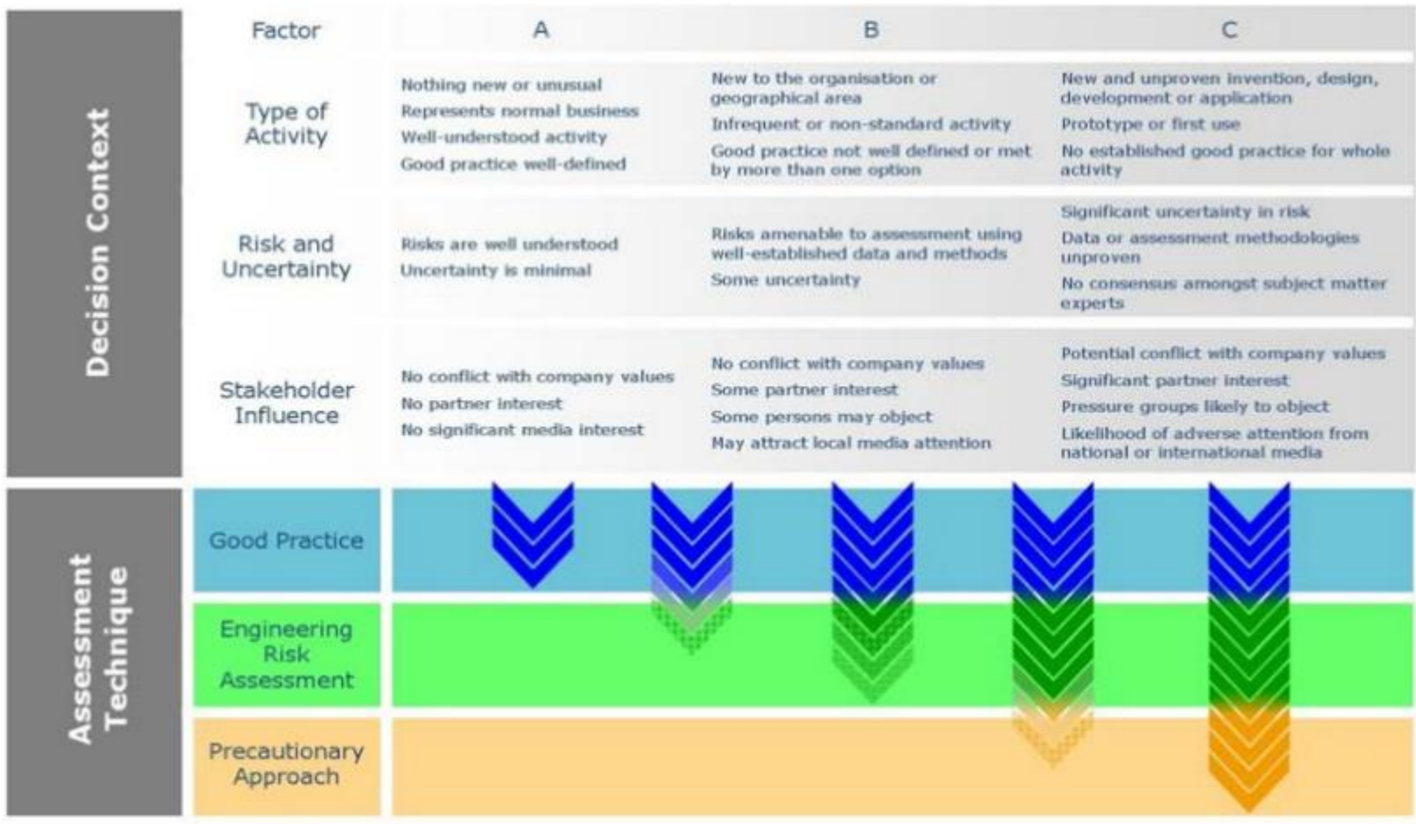


Figure 5-2: Impact and Risk Uncertainty Decision Making Framework

Good Practice

OGUK (2014) defines 'Good Practice' as the recognised risk management practices and measures that are used by competent organisations to manage well-understood hazards arising from their activities.

'Good Practice' can also be used as the generic term for those measures that are recognised as satisfying the law.

For this EP, sources of good practice include:

- Requirements from Australian legislation and regulations
- Relevant Australian policies
- Relevant Australian Government guidance
- Relevant industry standards
- Relevant international conventions
- Changing regulator expectations and/or continuous improvement.

If the ALARP technique determines the controls to be 'Good Practice', further assessment ('Engineering Risk Assessment') is not required to identify additional controls. However, additional controls that provide a suitable environmental benefit for an insignificant cost may be identified.

Engineering Risk Assessment

All potential impacts and risks that require further assessment are subject to an 'Engineering Risk Assessment'.

Based on the various approaches recommended in OGUK (2014), Cooper Energy believes the methodology most suited to this Activity is a comparative assessment of risks, costs, and environmental benefit. A cost–benefit analysis should show the balance between the risk benefit (or environmental benefit) and the cost of implementing the identified measure, with differentiation required such that the benefit of the risk reduction measure can be seen and the reason for the benefit understood.

Precautionary Approach

OGUK (2014) state that if the assessment, considering all available engineering and scientific evidence, is insufficient, inconclusive, or uncertain, then a precautionary approach to hazard management is needed. A precautionary approach will mean that uncertain analysis is replaced by conservative assumptions that will result in control measures being more likely to be implemented. That is, environmental considerations are expected to take precedence over economic considerations, meaning that a control measure that may reduce environmental impact is more likely to be implemented. In this decision context, the decision could have significant economic consequences to an organisation.

5.2.4.3. Evaluate the Acceptability of the Potential Impacts and Risk

Cooper Energy considers a range of factors when evaluating the acceptability of environmental impacts or risks associated with its activities. This evaluation is based on NOPSEMA's Guidance Notes for EP Content Requirement (N04750-GN1344, September 2020) and guidance issued in Guideline – Environment Plan decision making (N-04750-GL1721, June 2021).

The acceptability evaluation for each aspect associated with this activity is undertaken in accordance with Table 5-3.

Table 5-3 Cooper Energy Acceptability Evaluation

Factor	Criteria / Test
Cooper Energy Risk Management Protocol	Is the risk severity Extreme (i.e. not within the Company's risk appetite), or High (i.e. requires involvement from the Managing Director to approve the treatment plan)?
Principles of Ecologically Sustainable Development (ESD)	Is there the potential to affect biological diversity and ecological integrity? (Consequence Level 4 and 5). Do activities have the potential to result in serious or irreversible environmental damage? If yes: is there significant scientific uncertainty associated with aspect? If yes: has the precautionary principle been applied to the aspect?
Legislative and Other Requirements	Are there any good practice control measures which have not been adopted, including those identified in relevant EPBC listed species recovery plans or approved conservation advices? If not adopted, have alternate control measures been adopted that provide equal or better levels of protection?
Internal Context	Is the impact or risk provided for within Cooper Energy Management System (CEMS) Standards and Processes? If no, what additional provisions will be made?
External Context	Are there any objections and claims regarding this aspect which have not been resolved? If yes, is there anything which precludes reaching a resolution?

5.2.4.4. Principles of ESD and Precautionary Principle

The principles of ESD are considered in Table 5-4 in relation to acceptability evaluations.

Under the EPBC Act, the Minister must also take into account the precautionary principle in determining whether or not to approve the taking of an action. The precautionary principle (Section 391(2) of the EPBC Act) is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there may be threats of serious or irreversible environmental damage.

Table 5-4 Principles of Ecologically Sustainable Development (ESD)

ESD Principle		Relevance to Acceptability
A	Decision making processes should effectively integrate both long term and short term economic, environmental, social, and equitable considerations	*This principle is inherently met through the EP assessment process. This principal is not considered separately for each acceptability evaluation.*
B	If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	*An evaluation is completed to determine if the activity will result in serious or irreversible environmental damage. Where the activity has the potential to result in serious or irreversible environmental damage, an assessment is completed to determine if there is significant uncertainty in the evaluation.*
C	The principle of inter-generational equity—that the present generation should ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations.	*Where the potential impacts and risk are determined to be serious or irreversible the precautionary principle is implemented to ensure the environment is maintained for the benefit of future generations.*
D	The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.	*An assessment is completed to determine if there is the potential to impact biological diversity and ecological integrity.*
E	Improved valuation, pricing and incentive mechanisms should be promoted	*Not considered relevant for petroleum activity acceptability demonstrations.*

5.2.5.Risk Monitoring, Review and Record

Risks, risk treatments and controls require continual monitoring and review to determine whether assumptions and decisions remain valid. The risk environment and risk continually change, and treatment plans can also alter the risk. Stakeholders (which may be internal and external to the company) need to be consulted and kept informed.

The monitoring, review and recording activities provide assurance that:

- Emerging risks are identified, and existing risks remain relevant and managed
- Controls continue to be effective and efficient in design and operation
- Controls required for the risk to be ALARP are effectively implemented and operating as expected
- Risk management objectives remain appropriate and are supported by effective treatment activities
- The process for managing risk is operating effectively and efficiently
- Information on risk changes and treatment activities are documented
- Stakeholders are consulted and informed regularly of risk management progress and performance.

Additional aspects of monitoring and review are described in the Implementation Strategy in Section 9 of this EP include:

- Analysing and lessons learnt from events (including near-misses), changes, trends, successes and failures
- Detecting changes in the external and internal context (e.g., new conservation plans issued)
- Chemical selection and discharge process.

6. Risk and Impact Evaluation

To meet the requirements of the regulations (evaluation of environmental impacts and risks, environmental performance outcomes and standards), this section evaluates the impacts and risks associated with the Petroleum Activity appropriate to the nature and scale of each impact and risk and details the control measures that are used to reduce the risks to ALARP and an Acceptable level.

Environmental Performance Outcomes (EPO), Environmental Performance Standards (EPS), and Measurement Criteria are described in Section 8.

6.1. Impact and Risk Scoping

Interactions between activities and aspects are shown in Table 6-1. Where no disturbance or discharge of emission are identified in Section 3, then no planned interactions are shown. If no planned or unplanned aspects are identified for an activity, then no impacts or risks are identified, and it is not included in the subsequent section.

Within this section, impacts are framed as either a “lower order impact” or a “higher order impact”. Higher order impacts require a higher order of evaluation, as described in the NOPSEMA Environment Plan decision making guideline (N-04750-GL1721 A524696 June 2021).

All impacts are evaluated at the lower order until one or more factors trigger the impact to be evaluated at a higher level. These factors are:

- Uncertainty or complexity in the impact or risk assessment which requires further analysis or discussion, for example where modelling is required to understand the nature and scale of an impact.
- ALARP decision context B and above (refer to Section 5.2.4).
- Residual risk severity moderate and above (refer to Section 5.2.4).
- Stakeholder concerns (refer to Section 10).

Impacts and risks determined to be lower order (as per Section 5.2.4) are presented in Section 6.2, whilst higher order impacts and risks are evaluated in more detail in Section 6.3 onwards. The differentiation between higher and lower order impacts and risks is colour coded in Table 6-1. In some circumstances, lower order risks have been evaluated in more detail within Section 6.3 for the sake of clarity.

Table 6-1: Aspect-Activity Interactions

	ASPECT																	
ACTIVITY	**Physical Presence**		**Planned Emissions**				**Planned Discharges**						**Unplanned Impacts**			**Accidental Release**		
Lower Order Impacts and Risks – blue Higher Order Impacts and Risks – green	Interaction with Other Marine Users	Seabed Disturbance	Light Emissions	Underwater Sound Emissions	Atmospheric Emissions	Climate Change	Drill Cuttings and Fluids	Cement	Other	Cooling Water and Brine	Deck Drainage, Operational discharges and Bilge	Sewage, Greywater and Putrescible	Interaction with Marine Fauna	Introduction of IMS	Waste (Hazardous and Non-hazardous)	Minor LOC (Chemicals and Hydrocarbons)	MDO / Vessel Collision	LOWC
Surveys																		
Geophysical				H												L		
Geotechnical		L																
Well Construction																		
MODU Positioning		L													L			
Drilling Operations		L					L											H
BOP Installation and Testing									L									H
Cementing Operations								L										H
Well Completions								L										H
Well Clean-up / Flow-back			L		L													H
Well Suspension																		H
Logging																		H

	ASPECT																	
ACTIVITY	**Physical Presence**		**Planned Emissions**				**Planned Discharges**						**Unplanned Impacts**			**Accidental Release**		
Installation and Commissioning																		
Pre-lay Works		L																
Pipeline Crossing																		
Installation – infield Flowlines and Umbilicals		L																
Installation – Other Subsea Infrastructure		H																
Subsea Equipment Preservation and Start Up		L							L		L					L		
Operations																		
Subsea Operations	L			L		L			L							L		
IMR		L							L							L		
Support Operations																		
Vessel	L		L	H	L	L			L	L	L	L	L	H	L	L	H	
MODU	L	L	L	H	L	L				L	L	L	L	H	L	L	H	
Divers																		
Helicopters				H	L	L												
ROV		L												H		L		

6.2. Lower Order Impact and Risk Evaluation

6.2.1. Planned Impacts and Risks

Table 6-2: Lower Order Planned Impact and Risk Evaluation

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
Physical Presence								

Physical Presence – Interaction with Other Users:
• Subsea operations (subsea infrastructure)
• Vessel operations
• MODU operations
	Changes to the functions, interests and activities of other marine users	The physical presence of the offshore infrastructure, vessels and MODU can result in the displacement of other users.
		The operational area has gazetted PSZs for existing subsea wells Casino-4 and Casino-5 under Victorian Gazettal Notice G29-05, and Henry-2 and Netherby-1 under Victorian Gazettal Notice A194517.
		Applications to establish PSZs around the Annie-2 and Juliet-1 well locations will be accompanied by a report on consultation up to date at that time. The PSZs for Annie-2 and Juliet-1 would remain established in the Gazette and will remain in force until revoked.
		Commercial fisheries (State and Commonwealth)
		The operational area overlaps various commonwealth and state-managed fisheries management areas (refer to Table 4-4), with fishing records that indicate possible activity in two commonwealth and three state fisheries in the vicinity of the operational area (Table 4-4).
		The existing and future PSZs are small in comparison to the larger fishing areas and are not significant to commercial fishers. Commercial fishers have not raised claims or objections with the existing or proposed PSZs. Impacts to commercial fisheries are predicted to be localised and temporary. Impacts have been assessed as **Level 1**.
		Shipping and Industry
		Shipping and industry activities in the operational area are expected to be limited to high shipping traffic and occasional traversing vessels related to surrounding production and exploration activities.
		The proposed Annie-2 and Juliet-1 PSZs will add small areas of exclusion, however this is close to the existing operational area and unlikely to have significant impact on shipping and industry activities which are further south and east.
		There are no designated shipping lanes in the vicinity of the operational area (Australian Hydrographic Office 2021). AMSA have not raised claims or objections with existing or proposed PSZs.
		Given shipping and industry stakeholders have not raised claims or objections to the existing or proposed PSZs , impacts to shipping and industry have been assessed as **Level 1**.
		Recreational Fishers and Tourism
		Key tourist and recreational activities in the area include sight-seeing, surfing and fishing however, these are generally land-based or near-shore activities and are not impacted by the proposed activities.
		The existing and proposed PSZs will result in exclusion of tourist and recreational marine users. Given the limited size of PSZs (typically
			Level 1	A	C1: Marine exclusion and caution zones
					C2: Pre-start notifications
					C3: Marine Order 27 Safety of navigation and radio equipment
					C4: Ongoing consultation
					C5: Fisheries Damages Protocol
					C6: Marine Order 30: Prevention of collision
						N/A	N/A	Acceptable, based on:
								• Impacts well understood.
								• Consequence is Level 1 , therefore no potential to affect biological diversity and ecological integrity.
								• Activity will not result in serious or irreversible damage.
								• Good practice controls defined and implemented.
								• Legislative and other requirements have been identified and met:
								  ○ OPGGSA 2006
								  ○ Navigation Act 2012
								• CEMS Standards and Processes have been identified.
								• no claims or objections raised by stakeholders through engagement.

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		500m radius), impacts to tourists and recreational fishers are expected to be minimal. Given the number and size of existing and proposed PSZs and the low number of users expected in the area, impacts to recreational fishers and tourists have been assessed as **Level 1**.						
Emissions								

Emissions – Light
• Well clean-up / flow-back – flaring
• Vessel operations
• MODU operations
	• Change in ambient light
	• Change in fauna behaviour (attraction, disorientation)
		Ambient light, marine turtles, seabirds and migratory shorebirds
		Sources of light from the activity include navigation and safety lighting from MODU and vessels during the activity. These will be continuous while vessels / MODU are in use, however intermittent and short term over the duration of the activity. There is no permanent source of light offshore at the Otway facilities.
		Light emissions will also result from the flaring activities. Flaring is proposed to occur during well clean-up / flow-back activities (Section 3.6.4.6) and for a period of up to 24 hours for each of the two wells.
		Light emissions will result in a change in ambient light within the Light Exposure Area, with a Level 1 consequence within that area.
		Light emissions may result in a localised change to marine fauna's behaviour. Species with the greatest sensitivity to light are marine turtles, seabirds and migratory shorebirds.
		The National Light Pollution Guidelines for Wildlife (Commonwealth of Australia (CoA), 2020a) has been reviewed and light sensitive species have been identified. The purpose of the guideline is to minimise the adverse impacts on marine fauna from artificial lighting. The guidelines recommend a 20 km threshold as a precautionary limit based on observed effects of sky glow on marine turtle hatchlings demonstrated to occur at 15–18 km and fledgling seabirds grounded in response to artificial light 15 km away (CoA 2020a).
		The PMST report for the Light Exposure Area identified three marine turtle species; loggerhead turtle (endangered), leatherback turtle (endangered) and green turtle (vulnerable), that are likely to / may have a habitat within the area. There are no known BIAs or habitats critical to the survival of marine turtle species within the Light Exposure Area, and no nesting sites or nesting behaviours identified in the Light Exposure Area.
		There are nine BIAs for bird species within the operational area, and there are no known nesting sites within 20 km of the activity (the light assessment boundary of 20 km from the source will be used as the extent of light exposure, in accordance with National Light Pollution Guidelines for Wildlife (CoA, 2020)).
		Given the presence of sensitive receptors within the light exposure area, and the short-term nature of light emissions, the impact of light emissions to marine turtles and birds will be **Level 1**.
			Level 1	A	None	N/A	N/A	Acceptable, based on:
								• Impacts well understood.
								• Consequence level is Level 1, therefore no potential to affect biological diversity and ecological integrity.
								• Activity will not result in serious or irreversible damage.
								• Good practice controls defined and implemented.
								• Legislative and other requirements have been identified and met:
								  ○ National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds (2020a)
								  ○ EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species
								• Activity will not impact the recovery of:
								  ○ Albatrosses and Giant Petrels as per National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016
								• CEMS Standards and Processes have been identified.
								• No stakeholder objections or claims have been raised.

		Plankton, fish and sharks The National Light Pollution Guidelines for Wildlife (CoA 2020a) does not identify plankton and fish as species which are sensitive to light emissions. Impacts, if any would be limited to temporary behavioural	Level 1			N/A	N/A	

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		changes in small numbers of animals in the surface waters. The consequence of impact of light emissions to plankton and fish is assessed as **Level 1**.						
Emissions – Atmospheric • Well clean-up / flow-back – flaring • Vessel operations • MODU operations • Helicopter operations	Change in Air Quality	**Ambient air quality** Atmospheric emissions will be generated by the combustion of fuel for power generation by the vessel, MODU and helicopters. These emissions will be continuous whilst the vessels and MODU are in use, however intermittent and short term over the duration of the activity. There is no combustion equipment offshore during normal operations. The use of fuel (specifically marine-grade diesel) to power engines, generators and mobile and fixed plant (e.g., ROV, back-deck crane, generator), and the flaring and venting of natural gas, will result in emission of GHG such as carbon dioxide (CO_2), methane (CH_4) and N_2O, along with non-GHG such as sulphur oxides (SOX) and nitrous oxides (NOX). Potential receptors above the sea surface within the operational area that may be exposed to reduced air quality include seabirds and marine fauna that surface for air (e.g. marine mammals and marine turtles). Emissions will be small in quantity and will dissipate quickly into the surrounding atmosphere, therefore any localised reduction in air quality is not expected to result in any measurable effect. Therefore, impacts to marine fauna and social receptors (e.g. commercial fisheries, local towns) from a change in air quality are not expected and have not been evaluated further. Given the localised and temporary nature of the change in air quality, the consequence of any impacts from atmospheric emissions are assessed as **Level 1**. Greenhouse Gas Emissions have received additional evaluation in Section 6.3.	Level 1	A	C7: Planned Maintenance System C8: Selection of high efficiency burner. C9: Emissions and Discharge Standards	N/A	N/A	Acceptable, based on: • Impacts well understood. • Consequence level is Level 1, therefore no potential to affect biological diversity and ecological integrity. • Activity will not result in serious or irreversible damage. • Good practice controls defined and implemented. • Legislative and other requirements have been identified and met: ○ Marine Order 97 (Marine pollution prevention – air pollution) 2013 • CEMS Standards and Processes have been identified. • No stakeholder objections or claims have been raised.
Planned Discharges								
Planned Discharges – Drill Cuttings and Fluids • Drilling operations • Contingency drilling • Completions	• Change in sediment quality • Change in water quality	Planned drilling discharges include seabed discharges of drill cuttings and fluids. Approximately 150 m^3 of cuttings and 1,500 m^3 of water-based drilling fluids will be discharged at the seabed during top-hole sections for each well. At the surface, 180 m^3 of drill cuttings and 2,000 m^3 of associated drill fluids will be discharged. Well completion activities will also use around 350 m^3 water-based fluids / brine which will be displaced to sea at surface. Planned discharge of cuttings and adhered fluids from the surface will occur intermittently during drilling (typical discharges in batches of between 10-100 m^3). Residual barite and bentonite may also be discharged at the end of drilling as a slurry. The intermittent nature of the discharges greatly reduces the extent of a change in water quality (Neff, 2005). Hinwood *et al.* (1994) and Neff (2005) note that within 100 m of the discharge point, a drilling cuttings and fluid plume released at the surface will have diluted by a factor of at least 10,000, while Neff (2005) states that in well-mixed oceans waters (as is likely to be the case within	Level 2	A	C7: Planned maintenance system (solids control equipment) C10: Cooper Energy Offshore Chemical Assessment Procedure.	N/A	N/A	Acceptable based on: • Impacts well understood. • Consequence level is Level 1, therefore no potential to affect biological diversity and ecological integrity • Risk level to receptors a result of the change in ambient conditions is low • Activity will not result in serious or irreversible damage. • Activity will be undertaken in a manner consistent with relevant legislation, industry standards and guidelines, offshore practises and benchmarking. • Good practice controls defined and implemented. • CEMS and Processes have been identified. • No stakeholder objections or claims have been raised.

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		the drilling area), drilling mud is diluted by more than 100-fold within 10 m of the discharge. As such discernible increases in turbidity from drill cutting discharges during riserless drilling (i.e. direct discharge to the seabed) are expected to be short-lived, highly localised and limited to within a close proximity of the source. Hinwood *et al*. (1994) explain that the main environmental disturbance from discharging drilling cuttings and fluids is associated with the smothering and burial of sessile benthic and epibenthic fauna. An impact threshold from cuttings deposition of 3-24 mm was derived by Trannum *et al*. (2009 cited in RPS. 2019b). The threshold was based on a decrease in species count, abundance of individuals, and biomass of marine animals observed as a result of smothering and burial of benthic fauna. RPS (2019b) predicted seabed deposition of drill cuttings and fluid discharges from modelling a release volume of 1,690 m^3 over 7.6 days from a well located in the north west shelf of Western Australia. A conservative seabed deposition threshold of 1 mm was predicted up to 1.24 km from the well. This predicted range is considered a comparative yet conservative estimate for the activity given the seabed discharge volume of drill cuttings and fluid for the activity will be 1,650 m^3. Benthic fauna within the operational areas of the Annie-2 and Juliet-1 wells is expected to be limited to patchy epifauna as found in surveys of the operational area and facilities (Table 4-3), Fugro, 2020. The epifauna, including sponges, bryozoans and hydroids, though patchy in their distribution, were observed on both hard and unconsolidated substrates. Rock cuttings from drilling will add to the unconsolidated substrates and will redistribute over time influenced by the surrounding morphology, currents, prevailing weather and would not be expected to significantly alter the overall character of the seabed, or its ecological amenity. Any decrease in the abundance and biomass of epifauna would be localised and recoverable, with no threat to EPBC Act listed threatened benthic fauna. A water-based drilling mud (WBM) will be the primary choice of drill fluid at each well location; the Cooper Energy Offshore Chemical Assessment Procedure provides the framework and triggers for the preferential selection of lower toxicity WBMs over synthetic fluids. The process also provides for the preferential selection of specific grades of chemical, being OCNS CHARM rating of GOLD or SILVER, a non-CHARM “E” or “D” classification or PLONOR. Where this is not achievable, further assessment, justification and investigation of alternatives is required to be undertaken. Based on the low overall ecotoxicity associated with water-based fluids; no effect concentrations would not be expected to be exceeded beyond the near vicinity of the well and would only be apparent for short durations (Neff, 2010). Water and sediment quality within the operational area is expected to be representative of the expected quality found in Otway Basin waters. Given smothering impacts are limited to the near vicinity of the proposed wells, the high energy marine environment, and change in						

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		water quality will be localised and temporary, the impacts from planned drill cuttings and fluid discharges from the seabed will be **Level 2**.						
	Risk event • Injury / mortality	**Plankton and fish** The riser and BOP will enable cuttings and fluids from deeper well sections to be brought back to the MODU. Solids control equipment will remove solids from drilling fluids, these will then be discharged from the surface. Approximately 180 m^3 of cuttings and 2,000 m^3 of drilling fluids will be discharged at the surface for each well. Receptors with the potential to be exposed and most at risk of impact to an increase in turbidity levels from the surface discharge of drill cuttings and fluids include pelagic fish and plankton in vicinity of the well locations. Jenkins and McKinnon (2006) reported that levels of suspended sediments greater than 500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods greater than 96 hours. Jenkins and McKinnon (2006) also indicated that levels of 100 mg/L may affect the larvae of several marine invertebrate species and that fish eggs and larvae are more vulnerable to suspended sediments than older life stages. RPS-APASA (2014) predicted the in-water extent of total suspended sediments by modelling drilling discharge for a well in the north west shelf of Western Australia. The model predicted the extent of total suspended sediment concentrations at 2-3 mg/L at a distance of 225 m from the well. Using a highly conservative buffer of 225 m for each proposed well, fish larvae within this localised area may be vulnerable to impacts from an increase in total suspended sediments if exposed over 96 hours. High energy oceanographic processes at the well locations will result in rapid dispersion of total suspended sediments from surface discharge of drill cuttings and fluids. Rapid dispersion of total suspended sediments and the transient nature of fish larvae reduces the likelihood of 96-hour exposure of fish larvae to drill cuttings and fluids which is required to illicit potential injury or mortality. Rapid dilution and dispersion of surface discharges of drill cuttings and fluids from high energy oceanographic processes eliminates the potential for toxic effects to fish larvae. Fish larvae are likely to be transient, exposure to total suspended sediments will be short term, localised and the risk of injury or mortality **low**.	Level 1	A		Remote (E)	Low	
Planned Discharges – Cement • Drilling (cementing operations)	Change in water quality	Cement will be discharged during drilling activities. Cement job excess, which is pumped to the seabed is expected to be 50 m^3. A discharged batch of cement slurry may be up to 40 m^3, with occasional smaller batches during cleaning (< 1 m^3 per job). This will be discharged at the surface. The cement particles will disperse under action of waves and currents, and eventually settle out of the water column; the initial discharge will generate a downwards plume, increasing the initial mixing of receiving waters.	Level 1	A	C10: Cooper Energy Offshore Chemical Assessment Procedure.	N/A	N/A	Acceptable based on: • Impacts well understood. • Consequence level is Level 1, therefore no potential to affect biological diversity and ecological integrity. • Risk level to receptors a result of the change in ambient conditions is low.

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		Modelling of surface cement discharges (approximately 78 m^3 over a one-hour period) (BP 2013) showed that within two hours suspended solid concentrations ranged between 0.005-0.05 mg/m^3 within the extent of the plume (approximately 150 m horizontal and 10 m vertical); and by four hours post-discharge, that concentrations were <0.005 mg/m^3. These volumes are greater than the expected cement wash volumes during drilling, and results are considered conservative. Mixed cement discharged at the seabed during displacement will contain chemical additives. Terrens et. al (1998) suggests that once cement has hardened the chemical constituents are locked into the hardened cement. As such the extent of the impact is limited to the subsurface waters directly adjacent to the displaced subsea cement (expected to be in the order of 10-50 m of each well) and pelagic waters within 150 m of each well following the surface discharge of cement slurry from washing the cement unit. Water quality within the operational area is expected to be representative of the expected quality found in the Otway Basin waters. Given that exposure to in water concentrations are expected to be limited due to the rapid dispersion and dilution (BP, 2013), changes to water quality will be localised and temporary and are assessed as **Level 1**.						• Activity will not result in serious or irreversible damage. • Good practice controls defined and implemented. • Cooper Energy MS Standards and Processes have been identified. • No stakeholder objections or claims have been raised.
	Change in habitat	Cement job excess, which is pumped to the seabed is expected to be 50 m^3. Cement overspill on the seabed will change seabed habitat within 10-50 m of each well. Benthic environments in the operational area includes hard calcarenite of varying relief and some areas of unconsolidated sediment. Habitat within 50 m of the Annie-2 and Juliet-1 wells includes patchy epifauna representative, which is representative of the region (Table 4-3, Fugro 2020). Cement overspill would not be expected to significantly alter the overall character of the seabed, or its ecological amenity. Impacts to epifauna would be localised and recoverable, with no threat to EPBC Act listed threatened benthic fauna. Benthic habitats within the operational area are represented throughout the SE marine region. Any impacts will be highly localised, are expected to be recoverable, and will not affect the long-term success of the ecosystem and are assessed as a **Level 1**.	Level 1					

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
	Risk event: • Injury / Mortality	A surface discharge of cement slurry may be up to 40 m^3, with occasional smaller batches during cleaning (< 1 m^3 per job). Surface cement slurry discharges is expected to result in a temporary suspended solid plume (approximately 150 m horizontal and 10 m vertical) with cement concentrations ranged between 0.005 - 0.05 mg/m^3 within the extent of the plume. Jenkins and McKinnon (2006) reported that levels of suspended sediments greater than 500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods greater than 96 hours. Jenkins and McKinnon (2006) also indicated that levels of 100 mg/L may affect the larvae of several marine invertebrate species and that fish eggs and larvae are more vulnerable to suspended sediments than older life stages. Neither the modelling by de Campos *et al* (2017) or BP (2013) suggest that suspended solids concentrations from a discharge of the cement washing will be at or near levels required to cause an effect on fish or invertebrate larvae, i.e. predicted levels were well below a 96-hr exposure at 100 mg/L, or instantaneous 500 mg/L exposure. Planktonic communities within the operational area will be typical of the offshore marine environment in the region. Given the high energy marine environment and naturally high mortality of plankton, any impacts will be localised and temporary and have been assessed as **Level 1**.	Level 1	A		Remote (E)	Low	
Planned Discharges – Other • BOP installation and testing • Subsea operations • IMR • ROV	Change in water quality	During BOP installation and testing, hydraulic fluid is discharged. Modelling undertaken by BP indicates that the maximum plume and length associated with BOP Function testing to reach dilutions of 3000 times, is in the order of 51 and 81 m respectively, with a maximum displacement of 98 m (BP, 2013). Volumes of hydraulic fluid discharged during ROV operations will be similar to those discharged during BOP function testing, therefore impacts are expected to be limited to 100 m from the discharge point. During operations hydraulic fluid may be discharged through valve actuation. During IMR activities, hydraulic fluid, MEG and other chemicals such as dye may be used and discharged to the marine environment. All chemicals that are discharged into the marine environment are assessed under the Cooper Energy Offshore Chemical Assessment Procedure, to ensure that their ecotoxicity profiles are of an acceptable level. Water quality within the operational area is expected to be representative of the expected quality found in the Otway Basin waters. Given the high energy marine environment, discharges during BOP installation and testing, operations, IMR and ROV operations will dissipate rapidly and any change in water quality will be localised and temporary. Impacts are assessed as Level 1.	Level 1	A	C10: Cooper Energy Offshore Chemical Assessment Procedure	N/A	N/A	Acceptable based on: • Impacts well understood. • Consequence level is Level 1, therefore no potential to affect biological diversity and ecological integrity. • Risk level to receptors a result of the change in ambient conditions is low. • Activity will not result in serious or irreversible damage. • Good practice controls defined and implemented. • Cooper Energy MSS and Processes have been identified. • No stakeholder objections or claims have been raised.
	Risk event: • Injury / mortality	**Plankton**	Level 1	A		Remote (E)	Low	

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		Early life stages of fish (embryos, larvae) and other plankton would be most susceptible to the toxic exposure from chemicals in the hydraulic fluid discharges, as they are less mobile and therefore can become exposed to the plume at the outfall. However, these are expected to rapidly recover once the activity ceases, as they are known to have high levels of natural mortality and a rapid replacement rate (United Nations Environment Program (UNEP), 1985). Planktonic communities within the operational area will be typical of the offshore marine environment in the region. Given the high energy marine environment, discharges will dissipate rapidly and any impacts to plankton will be localised and will not result in significant impacts on population level of organisms that would affect ecological diversity or productivity within Commonwealth marine areas. Rather it is considered to result in an undetectable, limited local degradation of the environment, rapidly returning to original state by natural action. The risk level has been determined as Low.						
Planned Discharges – Other • Subsea equipment preservation and start up	Change in water quality	Following subsea infrastructure installation, equipment is inspected and tested through flooding, cleaning and hydrotesting. Flooding, cleaning and testing fluids will be discharged at either well or manifold locations. The discharged fluids are expected to include MEG, and seawater with oxygen scavenger, corrosion inhibitor, biocide and dye. All chemicals are selected in accordance with the Cooper Energy Offshore Chemical Procedure to ensure ecotoxicity profiles are of an acceptable level. The procedure includes provision for further discharge assessment to investigate PEC/PNEC levels in the environment. The major constituents of the flooding, cleaning and test fluids (mostly water) are non-toxic, readily degradable or dispersible. Subsea discharges will rapidly dissipate into the environment with any minor toxic constituents (e.g. biocide) being diluted to PNEC levels rapidly, and in close proximity to the discharge point. Water quality within the operational area is expected to be representative of the expected quality found in the Otway Basin waters. The consequence of the subsea discharge of the waste water to the water quality and sediment quality is assessed as Level 1 consequence because of rapid dilution, the relatively low volumes and given that the discharges are temporary and short term. There is likely to be high dilution and dispersion of the discharged fluids in the open ocean environment.	Level 1	A	C10: Cooper Energy Offshore Chemical Assessment Procedure	N/A	N/A	Acceptable based on: • Impacts well understood. • Consequence level is Level 1, therefore no potential to affect biological diversity and ecological integrity. • Risk level to receptors a result of the change in ambient conditions is low. • Activity will not result in serious or irreversible damage. • Good practice controls defined and implemented. • Cooper Energy MSS and Processes have been identified. • No stakeholder objections or claims have been raised.
	Risk event: • Injury / mortality	The risk of injury / mortality to fauna is associated with both the toxicity of the chemicals and their dosages in relation to the PNEC. Rapid dilution to PNEC is expected in the vicinity of the discharge location. There is no discernible impact expected beyond very localised and short-term reduction in water quality.				Remote (E)	Low	
Planned Discharges – Cooling Water and Brine; Sewage, greywater and putrescible; Deck drainage,	• Change in water quality • Injury/mortality	**Ambient water quality** Routine vessel discharges include: Cooling water – seawater is used as a heat exchange medium for the cooling of machinery engines. The seawater goes through a heat	Level 1	A	C7: Planned Maintenance System C9: Emissions and Discharge Standards	-	Low	Broadly Acceptable, based on: • Impacts well understood. • Consequence level is Level 1, therefore no potential to affect biological diversity and ecological integrity.

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
operational discharges and bilge; • MODU operations • Vessel operations		exchanger that transfers heat from the vessel engines and machinery to the seawater. Once the seawater goes through the system it is discharged back into the ocean. Brine – brine is generated from the water supply system. Brine is discharged to the open ocean at a salinity of approximately 10% higher than seawater. The volume of discharge is dependent on the amount of people on board the vessel that require fresh (or potable) water. sewage and grey water – the volume of sewage and grey water discharge is dependent on the number of people on board the CSV and other vessels. Approximately 0.04 m^3 and 0.45 m^3 of sewage/grey water will be generated per person, per day (EMSA 2016). putrescible waste – food waste will be generated on board the CSV and vessels, approximately 1 L of food waste per person, per day is expected. deck drainage and bilge –may comprise of water, particulate matter, residual chemicals and oils caught in bunds and on deck. Contaminated water, directed to an oily water treatment system, is treated to a concentration of 15 ppm (or less) oil in water before discharge. Discharges will result in localised impact on water quality from increased temperature, salinity, nutrients, and chemical toxicity. Planned MODU and vessel discharges would be of low volume during in-water activities of short duration. The MODU will be stationary within the operational area for extended durations, while other vessels will be transiting in and out of the area. **Increased Temperature and salinity** Modelling of continuous wastewater discharges (including cooling water) undertaken by Woodside for its Torosa South-1 drilling program in the Scott Reef complex found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being <1 °C above ambient within 100 m (horizontally) of the discharge point, and 10 m vertically (Woodside, 2014). Brine water will sink through the water column where it will be rapidly mixed with receiving waters and dispersed by ocean currents. As such, temperature and salinity impacts are expected to be limited to the source of the discharge where concentrations are highest. **Chemical Toxicity** Release of scale inhibitors and biocides into the environment have the potential to result in acute and chronic toxicity to marine fauna. Standard marine vessel discharges typically use these chemicals in low concentrations, which upon discharge, rapidly dilute to below PNEC Temporary and localised reduction in water quality (nutrients and biochemical oxygen demand) Monitoring of sewage discharges for another offshore project (Woodside 2014) determined that a 10 m^3 sewage discharge reduced to ~1% of its original concentration within 50 m of the discharge location. In addition, monitoring at distances 50, 100, and 200 m downstream of the platform and at five different water depths confirmed that discharges were rapidly diluted and elevations in water quality monitoring parameters (e.g., total nitrogen, total phosphorous, and selected metals) were not recorded						• Risk level to receptors a result of the change in ambient conditions is low. • Activity will not result in serious or irreversible damage. • Good practice controls defined and implemented. • Legislative and other requirements have been identified and met: ○ Marine Order 91 – Marine pollution prevention – oil (as relevant to vessel class) ○ Marine Order 95 – Marine pollution prevention – garbage (as appropriate to vessel class) ○ Marine Order 96 – Marine pollution prevention – sewage (as appropriate to vessel class) • Activity will not impact on the values and functions of the Bonney Upwelling KEF. • Cooper Energy MS Standards and Processes have been identified. • No stakeholder objections or claims have been raised.

Aspect	Predicted Impacts and Risks	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		above background levels at any station. During the Activity, the amount of sewage and grey water to be discharged per day will be significantly lower than 10 m³ for support vessels (1-3 m³), and in the order of the modelled scenario for the MODU. Open marine waters are typically influenced by regional wind and large-scale current patterns resulting in the rapid mixing of surface and near surface waters and the low volume discharges, thus it is expected that any planned operational discharges would disperse quickly over a small area. Therefore, the consequence of impacts to water quality will be Level 1.						
	Risk event: • Injury /mortality	**Plankton** Mortality rates for plankton are naturally high with distribution often patchy and linked to localised and seasonal productivity that produces sporadic bursts in phytoplankton and zooplankton populations (Department of Environment Heritage Water and the Arts (DEWHA), 2008). A change in water quality as a result of routine vessel discharges is unlikely to lead to injury or mortality of plankton at a measurable level and will not result in a change in the viability of the population or ecosystem. There are no KEFs within the operational area. Therefore, the risk to plankton from planned surface operational discharges have been evaluated as Low. Impacts to larger marine fauna (such as fish, seabirds, marine mammals and marine reptiles) are not expected.	Level 1	A		Remote (E)	Low	

6.2.2. Unplanned Impacts

Table 6-3: Lower Order Unplanned Events Risk Evaluation

Aspect	Predicted Impacts	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
Physical Presence								
Physical Presence - Interaction with Marine Fauna • Vessel operations • MODU operations	• Change in fauna behaviour (avoidance) • Injury / mortality	**Marine mammals, marine reptiles, fish** Marine fauna interactions could occur as a result of movement of vessels within the operational area. Interactions could cause a change in marine fauna behaviour or injury / mortality. Megafauna that are within the surface waters and breach often are most at risk from marine fauna interactions within the operational area. Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels and facilities, however, the reaction of whales to the approach of a vessel is variable. Some species are curious and often approach ships that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster-moving ships (Richardson *et al*., 1995). Collisions between larger vessels with reduced manoeuvrability and large, slow-moving cetaceans occur more frequently where high vessel traffic and cetacean habitat occurs (Whale and Dolphin Conservation Society, 2003). Laist *et al*. (2001) identified that larger vessels with reduced manoeuvrability moving in excess of 10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels such	Level 2	A	C11: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans. Caution zone extended to 500m between whales and project vessels.* *Cooper Energy will apply an increased caution zone around whales, providing additional protection to whales from potential vessel strikes.	Unlikely (D)	Low	Broadly Acceptable, based on: • Impacts well understood. • Residual risk (severity) is Low. • Consequence level is Level 2, therefore no potential to affect biological diversity and ecological integrity. • Activity will not result in serious or irreversible damage. • Good practice controls defined and implemented. • Legislative and other requirements have been identified and met: ○ EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans ○ National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA 2017b) ○ Section 229 of the EPBC Act

Aspect	Predicted Impacts	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		as tankers travelling faster than 14 knots and with limited manoeuvrability. Vessels used to support these activities do not have the same limitations on manoeuvrability and would typically travel at economy speeds (or lower) when conducting activities within the scope of this EP, inside the operational area. Listed threatened and migratory marine fauna presence in the operational area includes: • Four threatened marine mammal species; Southern Right Whale (Endangered), Blue Whale (Endangered), Sei Whale (Vulnerable) and Fin Whale (Vulnerable) • Eight migratory marine mammals; Killer Whale, Dusky Dolphin, Southern Right Whale, Blue Whale, Sei Whale, Fin Whale, Pygmy Right Whale and Humpback Whale). • Three marine mammal BIAs for Pygmy Blue Whale (Distribution and Foraging) and the Southern Right Whale (Known Core Range). • Three migratory and threatened marine reptiles, Leatherback Turtle, Loggerhead Turtle and Green Turtle. No BIA's have been identified within the operational area for marine reptiles. • Three threatened fish species; Blue Warehou (Conservation Dependent), Southern Bluefin Tuna (Conservation Dependent) and Australian Grayling (Vulnerable). This does not have an associated BIA within the operational area. • Two threatened shark species; Great White Shark (Vulnerable), Eastern School Shark (Conservation Dependent). There Great White Share has Distribution BIA within the operational area. • Three migratory shark species; Great White Shark, Shortfin Mako, Mackerel Porbeagle. The operational area has no threatened species presence or BIAs for pinnipeds, dugongs or dolphins, however Australian fur-seals and long-nosed fur-seals may be present. The following management plans and conservation advices identify vessel strike as a threat: • CMP for the Blue Whale (CoA, 2017); • CMP for the Southern Right Whale (Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), 2012); • Conservation Advice for the Sei Whale (TSSC, 2015c); • Conservation Advice for the Fin Whale (TSSC, 2015d); and • Recovery Plan for Marine Turtles in Australia (CoA 2017) The occurrence of physical interactions with marine fauna is very low with no incidents occurring during Cooper Energy activities in the region. If an incident occurred, it would be restricted to individual fauna and not have impacts to local population levels. The consequence of an impact is predicted to limited to individuals, assessed as Level 2, as short-term impacts to species or habitats of recognized conservation value, not affecting local ecosystem function. The impact is conceivable and could occur, however it would require a rare combination of factors and is therefore considered Unlikely (D)						○ Activity will not impact the recovery of: ○ Marine turtles as per the Recovery Plan for Marine Turtles in Australia (CoA 2017). ○ White Shark as per the Recovery Plan for the White Shark (Carcharodon carcharias) (DSEWPaC 2013). ○ Australian Sealion as per the Recovery Plan for the Australian Sealion (DSEWPaC, 2013). ○ Blue Whale per the CMP for the Blue Whale, 2015-2025 ○ Southern Right Whale as per CMP for the Southern Right Whale, 2011-2021. ○ Conservation Advice for the Sei Whale (TSSC, 2015c); ○ Conservation Advice for the Fin Whale (TSSC, 2015d); and • Cooper Energy MS Standards and Processes have been identified. • No stakeholder objections or claims have been raised.
Unplanned Discharges								

Aspect	Predicted Impacts	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
Unplanned Discharge – Minor LOC (Chemicals and Hydrocarbons) • Surveys (Geophysical) • MODU operations • Vessel operations • ROV operations	Change in water quality	**Ambient water quality** LOC scenarios include: • Hydraulic line failure (~1 m^3) • Refuelling / bunkering dry break couplings failure (~50 m^3) • Minor LOC from subsea infrastructure (e.g. dropped objects from campaign activities) • Riser volume of in the order of 15 m^3 of well fluids released in the event of retention valve failure during MODU emergency disconnect. • Unplanned discharge from ROV < 200 L hydraulic fluid • Hydraulic line failure is associated with small volume spill events – with the maximum volume based upon the loss of an intermediate bulk container ~1 m^3. AMSA (2015) suggests the maximum credible spill volume from a refuelling incident with continuous supervision is approximately the transfer rate over 15 minutes. Assuming failure of dry-break couplings and an assumed ~200 m^3/h transfer rate (based on previous operations), this equates to an instantaneous spill of ~50 m^3. A loss of 15 m^3 of fluids from the riser (if retaining valves failed) would be expected to result in changes to water quality in both surface waters and within the water column The potential impacts to water quality are assessed consequence Level 1 minor local impacts with nil to negligible remedial recovery to water systems. This assessment considers the energetic offshore environment in the Otway fields which would be expected to quickly disperse releases of this nature, resulting in minor local impacts. This assessment considers any indirect impacts to species arising from theoretical exposure would also be negligible given the limited exposure duration and extent due to rapid dispersion and return to ambient conditions post event. While the impact is conceivable and could occur, however it would require a rare combination of factors and is therefore considered Unlikely (D) and as such the overall risk level being Low.	Level 1	A	C1: Marine exclusion and caution zones C4: Ongoing consultation C6: Marine Order 30: Prevention of collisions C7: Planned Maintenance System C12: MODU Material Transfer Procedures C13: Vessel compliant with MARPOL Annex I, as appropriate to class (i.e. SMPEP or equivalent)	Unlikely (D)	Low	Broadly Acceptable, based on: • Impacts well understood. • Residual risk (severity) is Low. • Consequence is Level 1, therefore no potential to affect biological diversity and ecological integrity. • Activity will not result in serious or irreversible damage. • Good practice controls defined and implemented. • Legislative and other requirements have been identified and met: ○ AMSA's Marine Order Part 91 (Marine pollution prevention – oil Marine) ○ Guidelines for Offshore Marine Operations GOMO 0611-1401 (2013) • Activity will not impact the recovery of EPBC listed species. • Cooper Energy MS Standards and Processes have been identified. • No stakeholder objections or claims have been raised.
Unplanned Discharge - (Hazardous / Non-hazardous Waste) • Vessels operations • MODU operations	• Change in water quality • Change in fauna behaviour • Injury / mortality	**Seabirds and migratory Shorebirds, Marine Turtles and Marine Mammals** The handling and storage of materials and waste on board MODUs and vessels has the potential for accidental over-boarding of hazardous/non-hazardous materials and waste. Small quantities of hazardous/non-hazardous materials (solids and liquids) will be used, and wastes created, handled, and stored on board until transferred to port facilities for disposal at licensed onshore facilities. However, accidental releases to sea are a possibility, such as in rough ocean conditions when items may roll off or be blown off the deck. Waste accidently released to the marine environment can cause a change in fauna behaviour, a change in water quality, and may lead to injury or death to individual marine fauna through ingestion or entanglement. The following management plans and conservation advice identify marine debris as a threat:	Level 2	A	C9: Emissions and Discharge Standards C14: Waste Management Practices	Unlikely (D)	Low	Broadly Acceptable, based on: • Impacts well understood. • Residual risk (severity) is Low. • Consequence level is below 4, therefore no potential to affect biological diversity and ecological integrity. • Activity will not result in serious or irreversible damage. • Good practice controls defined and implemented. • Legislative and other requirements have been identified and met: ○ Marine Order 95 – Marine pollution prevention – garbage (as appropriate to vessel class) ○ Protection of the Sea (Prevention of Pollution from Ships) Act 1983.

Aspect	Predicted Impacts	Consequence Evaluation	Consequence	ALARP Decision Context	Control Measures	Likelihood	Residual Risk Severity	Acceptability Outcome
		• National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC 2011) • Recovery Plan for Marine Turtles in Australia (CoA 2017) • Draft Wildlife Conservation Plan for Seabirds (CoA, 2019) • Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (CoA, 2018) • Blue Whale Conservation Management Plan 2015 - 2025 (2015) • Conservation Management Plan for the Southern Right Whale 2011 – 2021 (2012) • Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (2013) • Commonwealth Conservation Advice on *Dermochelys coriacea* (2008) DAWE (2022) reports that there have been 104 records of cetaceans in Australian waters impacted by plastic debris through entanglement or ingestion since 1998 (humpback whales being the main species). However, the Threat Abatement Plan (2018) suggests that most marine plastic debris are associated to shipping and fishery activities (fishing gear, balloons and plastic bags). Waste will be handled in accordance with AMSA Discharge Standards and respective vessel Garbage Management Plans (GMP). Given this, any waste lost overboard would be in minimal quantities. The consequence of any impacts from marine debris would be limited and is assessed as Level 2. This assessment considers any indirect impacts to species arising from theoretical exposure to hazardous and non-hazardous wastes. While the impact is conceivable and could occur, from this activity, which is relatively short term, it is considered Unlikely (D) and as such the overall risk level is Low.						○ Navigation Act 2012 – Chapter 4 (Prevention of Pollution). • Activity will not impact the recovery of: ○ Albatross and Giant Petrel populations breeding and foraging as per the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC 2011). ○ Marine turtles as per the Recovery Plan for Marine Turtles in Australia (CoA 2017). • Cooper Energy MSS and Processes have been identified. • No stakeholder objections or claims have been raised.

6.3. Seabed Disturbance

6.3.1. Cause of Aspect

Seabed disturbance will occur within the operational area as a result of the following activities (Table 6-4). These activities are described in Section 3, indicative footprints are described below.

Table 6-4: Seabed Disturbance Estimated Footprints

Cause of Aspect	Activity component	Area of Impact
Site Surveying	Geotechnical Survey	<20 m^2 accounting for area of contact between seabed and equipment frames. The direct impact (from coring and grabs) will be smaller, i.e. <0.1m^2 per sample.
Drilling	MODU Positioning	Mooring will require between 8 and 12 anchors (dependent on mooring analysis) ranging from 15 to 30MT each, with an individual footprint of between 30 m^2 and 60 m^2 at each well location. Total footprint estimate: 760m^2.
	Drilling and Cementing Operations	Seabed deposition of drilling cuttings within 1.24 km of each well (RPS, 2019b) and seabed cement job excess within 10-50 m of each well.
Installation and Commissioning	Pre-lay, crossing and Stabilisation	Estimates for installation are 350 mattresses approx. Disturbance is expected to be limited to within the pipeline and umbilical corridor. Total footprint estimate: 0.006 km^2
	Installation In-field Flowlines and Umbilicals	Direct footprint of lines 0.3 km^2 Disturbance corridor 5.6 km^2 During installation activities, some equipment and infrastructure may be temporarily wet parked on the seabed. Wet parking will occur within the operational area and is accounted for in the disturbance corridor.
	Installation of subsea equipment	Direct footprint <25 m^2
Operations	IMR	Span rectification and stabilisation, movement and preparation of seabed directly beneath pipelines and umbilicals if repairs required. Nominally <25 m^2 disturbance during IMR campaign
Support Operations	Vessel operations	Anchoring may be required where it is too shallow to use vessel's dynamic positioning mode (i.e. closer to shore in state waters). Disturbance estimated based on 4-point mooring arrangement (2 x bow and 2 x stern) with disturbance in the order of 10m^2 per anchor accounting for deployment, setting and recovery.
	ROV Operations	ROV typically recovered after every trip. Some disturbance from flying close to seabed or if set on seabed temporarily: < 10 m^2 Transponders are typically also deployed attached to equipment (e.g. gravity anchors), or to the seabed on a frame or ballast. Transponders: 1.5 m^2 per frame

6.3.2. Predicted Environmental Impacts (Consequence)

Potential impacts from seabed disturbance are:

- Change in benthic habitat.

Potential risk events associated with change in water quality arising from seabed disturbance are:

- Impacts to benthic and demersal invertebrate communities
- Impacts to fish and commercial fisheries.

6.3.3. Impact and Risk Evaluation

6.3.3.1. Impact: Change to benthic habitat

Inherent Consequence Evaluation

The greater area of seabed disturbance will occur as a result of the drilling and installation activities. This will result in impacts to the benthic habitat from direct disturbance for a relatively small area (< 1 km^2).

During operations, there will be some minor seabed disturbance associated with periodic IMR activities. There is also a potential for seabed scouring, a result of the infrastructure being in place, whereby currents may erode sediments around the equipment. Any such impacts would be minimal, limited to the immediate vicinity of the infrastructure; scouring is a natural feature on the Otway shelf; the underlying hard calcareous seabed, highly variable relief, patches of unconsolidated sediments and exposure to prevailing weather from the south result in frequent areas of bare hard caprock, and limited deposition of terrigenous sediment. The operational area is similarly characterised by hard calcarenite platform with patches of unconsolidated fine-course sediments. Epifauna are associated with both substrate types (Fugro, 2020).

The operational area benthic habitat is typical of the broader area at this water depth, and it does not intersect any Australian Marine Parks or spatially defined KEFs. The operational area does include hard substrate. The SE Marine bioregional plan identifies rocky reefs and hard ground as a KEF; this KEF is located in all areas of the South-east Marine Region continental shelf including Bass Strait, from the sub-tidal zone shore to the continental shelf break.

Seabed disturbance will be limited to the operational areas and given the natural context and processes which prevail in this region, the seabed disturbances associated with the activity are not expected to change the character or ecological amenity of the seabed, with disturbances ultimately recoverable via natural processes. The consequence of this impact has been evaluated as Level 1.

6.3.3.2. Risk Event: Benthic and demersal invertebrate communities

Inherent Consequence Evaluation

The installation of infrastructure will potentially result in the suspension of sediments, and redeposition that could cause impact on benthic and demersal invertebrate communities. This type of disturbance will be minimal accounting for the lack of fine, soft substrates in the area; those that are present appear to be mobile, as inferred from sand waves and localised burial of equipment observed during inspection (Figure x, Fugro 2020). Rock cuttings from drilling will add to the unconsolidated substrates and will redistribute over time influenced by the surrounding morphology, currents, prevailing weather and would not be expected to significantly alter the overall character of the seabed.

Benthic fauna is generally sparse and characteristic of the broader region. No significant areas of primary production have been identified during surveys (Table 4-3). Historical surveys of the Casino pipeline route noted the interspersed presence of sponge habitats throughout the survey area and found it representative of what is expected throughout the Otway Basin. Invertebrate species located in the vicinity of the current and future pipeline alignments include sponges, hydrozoans, cnidarians and bryozoans (Fugro, 2020, Figure 6-1).

Any disturbance to invertebrate communities from the installation of infrastructure is expected to be localised and short term based on expectations that the communities would likely recover over a short period. Kukert (1991) showed that approximately 50% of the macrofauna on the bathyal sea floor were able to burrow back to the surface through 4-10 cm of rapidly deposited sediment. Dernie *et al*. (2003) conducted a study that showed the full recovery of soft sediment assemblages from physical disturbance could take between 64 and 208 days. Mobile invertebrates are generally less vulnerable than sessile taxa to sedimentation, as they are able to move to areas with less sediment accumulation or by more efficiently physically removing particles

(Fraser, *et al*. 2017). Sessile invertebrates are particularly vulnerable to sedimentation because they are generally unable to reorientate themselves to mitigate a build-up of particulates. However, some sessile taxa, including species of sponges and bivalves, have the capacity to filter out or to physically remove particulates (Roberts, Davis and Cummins 2006, Pineda, Duckworth and Webster 2016). Sediment-burrowing infauna and surface epifauna invertebrates (particularly filter feeders) which inhabit the seabed directly around subsea infrastructure locations are expected to be most impacted by seabed disturbance activities. The sensitivity of such infauna and epibenthic communities to smothering, change in benthic habitat, and change in water quality are expected to be low and recoverable given the resilience to natural stressors including storm events and associated episodic increases in particulate load. Recoverability from disturbance, including direct infrastructure footprints is observed through pipeline inspections. A range of epifauna including sponges, bryozoans and hydrozoans have colonised the Stage I & II flowlines and umbilicals, and seabed immediately adjacent (Figure 6-1).

Physical changes associate with the installation of equipment will be long-term but localised; direct disturbances to the hard seabed and associated communities (a KEF in the SE) are recoverable. The lines and structures do not significantly change the character of the seabed; new lines and structures will be progressively colonised. As such, the consequence of disturbance to seabed communities is expected to be Level 2.

Inherent Likelihood

The time period of these activities and associated consequences is in the range every 5-20 years. The inherent likelihood of a **Level 2** consequence occurring is therefore rated as **D**.

Inherent Risk Severity

The inherent risk severity of impacting benthic and demersal invertebrate communities is considered **Low**.

6.3.3.1. Risk Event: Fish and commercial fishers

Inherent Consequence Evaluation

The installation of infrastructure will potentially result in the suspension of sediments, and redeposition that could cause impact on fish, including commercial species.

Mobile invertebrates such as fish, are generally less vulnerable than sessile taxa to sedimentation, as they are able to move to areas with less sediment accumulation or by more efficiently physically removing particles (Fraser, *et al*. 2017).

The sediments in this area are regularly mobilised through natural processes. Given the sand or fine gravel present as substrate within the operational area, disturbance to fish species by the installation of subsea structures is expected to be localised and likely to recover over a short period. The potential impacts during operations are smaller still, with disturbance limited to occasional vessel movements or IMR activities.

Commercially fished invertebrate and fish species are known to occur within operational area. Given the mobile nature of commercial species of invertebrates and fishes, impacts are assessed as are **Level 1** consequence.

Inherent Likelihood

Given the nature of this activity, the inherent likelihood of a Level 1 consequence occurring is rated **D**.

Inherent Risk Severity

The inherent risk severity of impacting benthic and demersal invertebrate communities is considered **Low**.

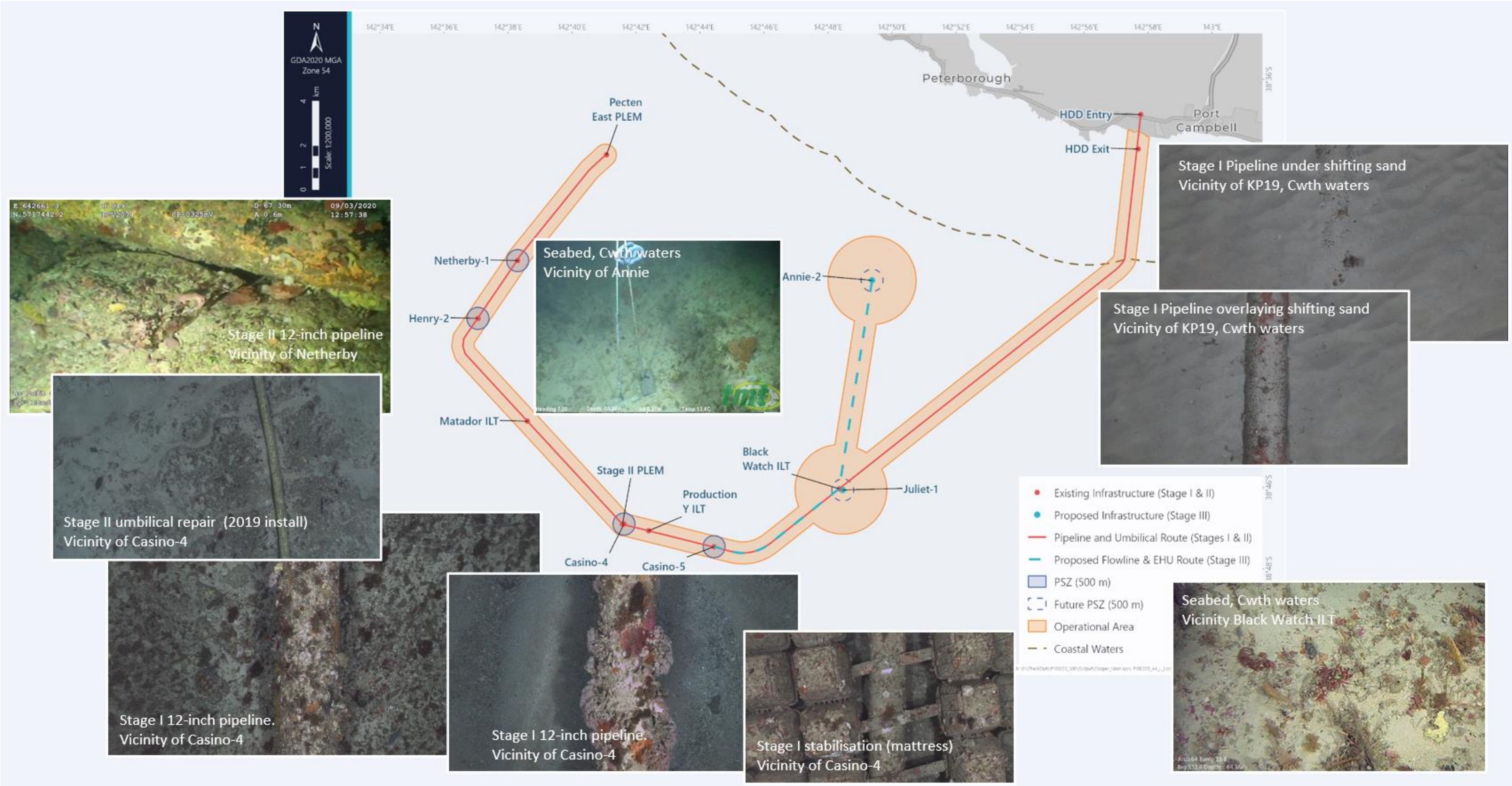


Figure 6-1: Facilities and Seabed Stills – Operational Area

6.3.4.Control Measures, ALARP and Acceptability Assessment

Table 6-5 provides a summary of the control measures and ALARP and Acceptability Assessment relevant to seabed disturbance.

Table 6-5: Seabed Disturbance ALARP, Control Measures and Acceptability Assessment

Seabed Disturbance	
ALARP Decision Context and Justification	**ALARP Decision Context: Type A** Seabed disturbance in the offshore environment is a common occurrence both nationally and internationally with well-defined industry good practice. Locally, mooring is an activity commonly undertaken by multiple industries (e.g. shipping, fisheries, oil and gas) particularly given the well-developed nature of the shipping and petroleum industry within the Otway Region. The area of impact, and therefore the scale of the impact, is expected to be small, and the species present associated with the seabed expected to recover. Given this, Cooper Energy believes ALARP Decision Context A should apply.
Control Measure	**Source of Good Practice Control Measures**
C7: Planned Maintenance System	Critical equipment on vessels and MODU will be maintained in accordance with preventative maintenance system to ensure effective operation. Includes: Solids control equipment.
C15: Installation Procedures	Installation procedures shall be developed which take into account seabed relief and potentially sensitive seabed features. Equipment will be placed according to pipeline alignment drawings.
Impact and Risk Summary	
Residual Impact Consequence	Level 1 - Localised short-term impacts to benthic habitat with no remedial actions or recovery required.
Residual Risk Consequence	Level 2 – Temporary and localised impacts or disturbances to benthic marine fauna, with recovery in weeks
Residual Risk Likelihood	Unlikely – with the controls in place it is considered unlikely that short-term impacts to species or habitats would occur weeks
Residual Risk Severity	Low
Demonstration of Acceptability	
Principles of ESD	Seabed disturbance is evaluated as having Level 2 risk consequence which is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.
Legislative and Conventions	No legislation or conventions relevant to these impacts
Internal Context	Relevant management system processes adopted to implement and manage hazards to ALARP include: • Risk Management (MS03) • Technical Management (MS08) • Health Safety and Environment Management (MS09) • Supply Chain and Procurement Management (MS11) • External Affairs & Stakeholder Management (MS05) Activities will be undertaken in accordance with the Implementation Strategy (Section 9).

External Context	No stakeholder objections or claims have been raised related to these impacts.
Acceptability Outcome	Acceptable

6.4. Atmospheric and GHG Emissions

6.4.1. Cause of Aspect

6.4.1.1. Types of emissions

Emissions are composed of products from the combustion of hydrocarbons and associated production processes. These products include particulate matter which may cause localised air quality impacts, and greenhouse gas emissions (GHG's) which influence the climate.

GHGs will be caused by the activity through the production, processing, transmission and end use of hydrocarbons. GHG's are emitted to the atmosphere when hydrocarbons are burned, flared, vented or released as fugitive emissions either at the plant or through transmission.

GHG emissions include carbon dioxide (CO_2), water vapour, nitrous oxide (N_2O), sulphur dioxide (SO_2), methane (CH_4), and Volatile Organic Compounds (VOCs). Under the National Greenhouse and Energy Reporting (NGER) regime, emissions are described as either Scope 1, 2 or 3, which relate to who has operational control of those emissions (Clean Energy Regulator (2021)). These scopes, as they relate to the activity, are described below and illustrated in Figure 6-2. Table 3-7 summarises the Scope 1, 2 and 3 emissions profiles for the Otway Operations, including those associated with the gas product use.

Scope 1 Emissions

GHG emissions are released as a result of burning fuel and/or flaring activities during offshore campaigns. These emissions are known as Scope 1 emissions. During day-to-day operations i.e. subsea wells producing gas through the subsea pipeline there are negligible Scope 1 emissions associated with the Otway Offshore Operations.

Cooper Energy has other Scope 1 emissions associated with the Otway Operations, which are outside of the activity description covered by this EP but are generated as part of the gas processing at the onshore Athena Gas Plant. Cooper Energy has direct control of, and legislated responsibility for, the emissions associated with the onshore processing of hydrocarbons.

Scope 2 Emissions

Electricity used at the Athena Gas Plant, when purchased from the grid, is generated from a mix of renewable and non-renewable sources. GHG's are generated in the process of making the energy that supplies the grid.

Scope 3 Emissions

Purchases

Energy is required to manufacture materials (e.g. cement) and structures (e.g. pipelines and subsea trees), and for things like employee travel. The associated 'embedded emissions' are Scope 3 emissions; these are distinct from other Scope 3 emissions (products sold) in that they are 'controllable' by Cooper Energy to the extent Cooper Energy choose to purchase those materials which have embedded emissions; these are referred to as 'controllable Scope 3 emissions'.

Products sold

Once processed the refined products are sold to domestic customers for various uses. Energy, including gas, is in high demand domestically (Table 6-8, external context). Once the refined products leave the Athena Gas Plant, emissions associated with the distribution and use of those products are known as Scope 3 (indirect) emissions. Cooper Energy does not have control of, or legislated responsibility for, emissions downstream of the process facility (i.e., for transportation or end use).

As such, Scope 3 emissions are considered to be relevant under the indirect consequences provision (Section 527E) of the EPBC Act. The potential impacts of these emissions are assessed below.

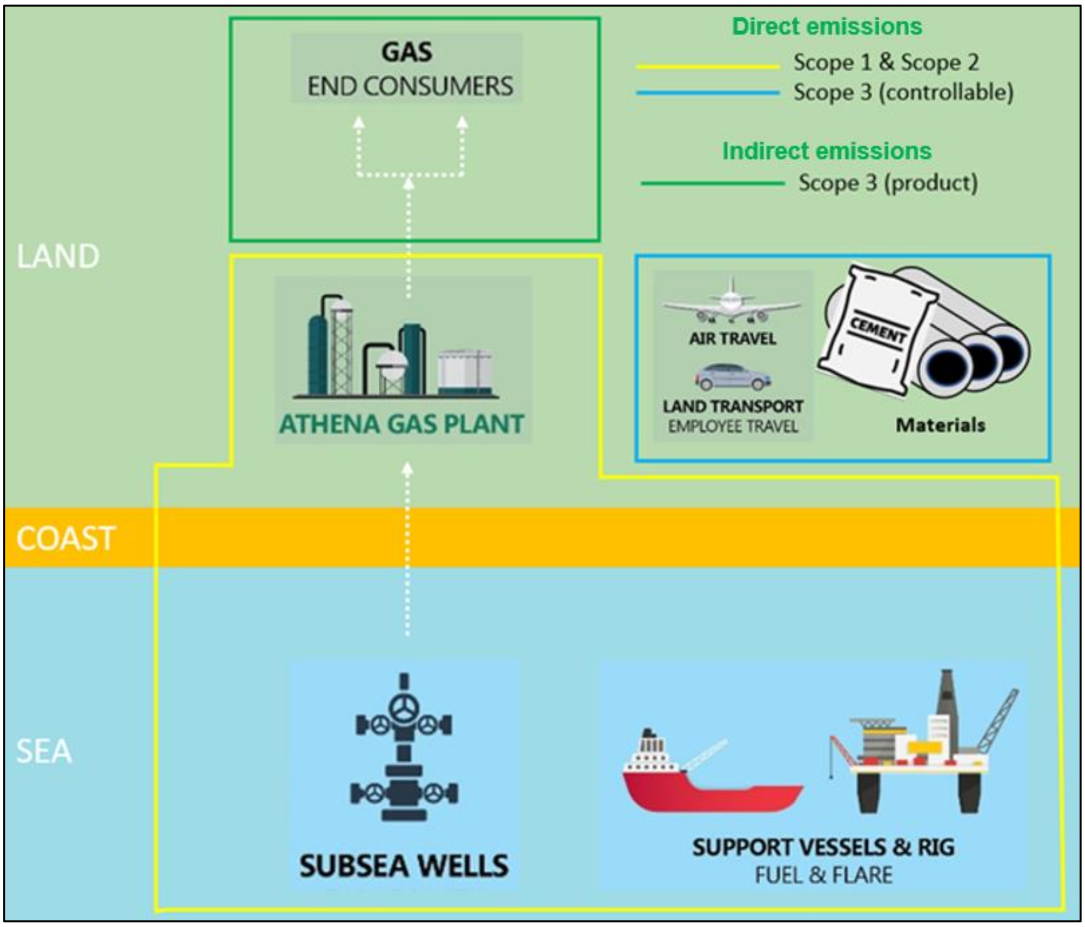


Figure 6-2: Scope 1, 2, 3 illustrative boundaries.

6.4.1.2. Quantity of emissions

Emissions estimates for the activity and downstream of the activity are described in Section 3. The majority of emissions are downstream of production and processing and are associated with the use of the products (i.e., Scope 3 emissions). For context, The south-east domestic gas market requires around 380 PJ of gas per year and ~4000 PJ in aggregate over the next decade. The Otway offshore gas fields described within this EP are estimated to provide in the order of 5% of the south-east gas needs, over their remaining life.

So while Scope 3 emissions from the activity are small in the context of the south-east Australian market, they are considered to be relevant under the indirect consequences provision (Section 527E) of the EPBC Act and therefore the potential impacts of these emissions are assessed below.

6.4.1.3. Cooper Energy's Organisation Carbon Neutral Certification

Since financial year 2019/20 Cooper Energy has voluntarily been a carbon neutral organisation. In June 2021, Cooper Energy received certification to this effect under the Climate Active program, which is backed by the Australian Government. Cooper Energy's organisational boundary captures all the company's Scope 1, Scope 2 and controllable Scope 3 emissions.

Cooper Energy retains carbon neutrality through the acquisition and surrender of carbon credit units. This voluntary process gives Cooper Energy a detailed understanding of its' emissions profile and provides a real cost of carbon for business activities. Evidence of independent verification of Cooper Energy's calculation, reporting, and surrender of carbon credit units is publicly available through certification provided by Climate Active which is available on the Climate Active website.

6.4.1.4. Cooper Energy's Opt-in Gas Product Carbon Neutral Certification

The downstream Scope 3 emissions not within Cooper Energy's direct control are not within the company's organisation boundary but have been captured in an opt-in gas product carbon neutral certification, awarded in December 2021. This is significant for a number of reasons:

- The entire lifecycle of Cooper Energy's gas is captured by a Carbon Neutral certification. The organisational certification for all emissions within Cooper Energy's organisation boundary, and the opt-in gas product certification for everything downstream of that boundary and outside the direct control of the company.
- It provides a means by which Cooper Energy can work with its' customers in support of their sustainability initiatives and emissions reduction targets by supplying them a certified carbon neutral gas (i.e. lifecycle emissions net-zero) under commercial arrangements.
- By supplying net-zero gas to customers and thereby reducing their Scope 1 emissions, it will therefore also decrease Cooper Energy's Scope 3 emissions.

Cooper Energy expects a growing quantity of its sales gas emissions to be offset using this certification as new and amended gas sales agreements are signed.

6.4.2. Impact characterisation (consequence)

6.4.2.1. Ecosystem Impacts

GHGs absorb longwave radiation reflected from the earth's surface thereby trapping heat within the earth's atmosphere and contributing to the greenhouse effect. While the scope 3 emissions from the Otway Offshore Operations add to the GHG load in the atmosphere resulting in global warming potential, they are small on a state, national and global scale. The International Panel on Climate Change (IPCC) have estimated human activities and associated GHG emissions since the pre-industrial period to present have caused between 0.8°C and 1.2°C of warming (IPCC, 2022b).

Table 6-6 summarises findings of the IPCC in relation to observed climate change impacts in Australia. Table 6-7 summarises expectations from the IPCC in relation to projected climate change impacts in Australia by 2050.

Impacts of climate change such as altering global temperature, influencing rainfall patterns and fire regimes are likely to influence and change the vegetation structures across all terrestrial ecosystems within Australia (Dunlop *et al*., 2012; Table 6-6). Climate change has been shown to impact ecosystems through alterations such as species ranges, competition, and habitat availability.

Table 6-6: Summary of IPCC observed climate change for Australia

Key Component of Environmental Change	Projected Impacts of Ecosystems
Ocean acidification	Average pH of surface waters has decreased since the 1880s by about 0.1 (over 30% increase in acidity).
Sea surface temperature	Increased by 1.0°C from 1900-2019 (0.09º C/decade), with an increase of 0.16-0.20o C/decade since 1950 in the south-east. Eight of the ten warmest years on record occurred since 2010.
Sea temperature extremes	Intense marine heatwave in 2011 near Western Australia (peak intensity 4°C, duration 100 days) - likelihood of an event of this duration estimated to be about 5 times higher than under pre-industrial conditions. Marine heatwave over northern Australia in 2016 (peak intensity 1.5°C, duration 200 days). Marine heatwave in the Tasman Sea and around southeast mainland Australia and Tasmania from September 2015 to May 2016 (peak intensity 2.5°C, duration 250 days) - likelihood of an event of this intensity and duration has increased about 50-fold. Marine heatwave in the Tasman Sea from November 2017 to March 2018 (peak intensity 3°C, duration 100 days). Marine heatwave on the Great Barrier Reef in 2020 (peak intensity 1.2°C, duration 90 days) (BoM, 2020)
Sea level rise	Relative sea level rise was 3.4 mm/year from 1993-2019, which includes the influence of internal variability (e.g. ENSO) and anthropogenic greenhouse gases.
Air temperature extremes over land	Weather extremes are occurring more frequently. In 2019, the national average maximum temperature exceeded the 99th percentile on 43 days (more than triple the number in any of

Key Component of Environmental Change	Projected Impacts of Ecosystems
	the years prior to 2000) and exceeded 39°C on 33 days (more than the number observed from 1960 to 2018 combined) c
Drought	Reduced occurrence of droughts across most of northern and central Australia since 1970s. More droughts in the South West since 1970s,
Extreme weather events	Intensification of heavy precipitation will increase the frequency and severity of tropical cyclones and flooding events. Flooding frequencies will be 1.4 to 2 times higher at a 2°C global warming increase.

Source: IPCC (2022b)

Table 6-7: Summary of IPCC projected impacts of climate change to the future vulnerability of particular taxa in Australia

Taxa	Potential Vulnerability
Birds	Changing thermal regimes including increasing thermal stress and changes in plant productivity are identified causal leads to changes in body size, mass and condition and other traits linked to heat exchange.
Fish species at risk of extinction	Changes in rainfall, run-off, air temperatures and the frequency of extreme events (such as drought, fire, flood) compound risk from other key threats, especially invasive species to species which are already at risk of extinction.
Freshwater Taxa	Changed hydrological regimes leads to. substantial changes to the composition of faunal assemblages in Australian rivers well before the end of this century. With gains/losses balanced for fish but suitable habitat area predicted to decrease for may crayfish and turtle species and nearly all frog species.
Invertebrates	Marine heatwaves and ocean acidification lead to the degradation invertebrate assemblages habitats through increased coral bleaching events, and a reduction in seagrass meadows, mangroves and kelp forests.
Mammals	Increasing ocean temperatures leads to behavioural, physiological, phenological, and distributional changes in marine mammals as a response to habitat degradation, altered food-web dynamics and ecological interactions

Source: IPCC (2022b)

6.4.3.Control Measures, ALARP and Acceptability Assessment

Table 6-8 provides a summary of the control measures and ALARP and Acceptability Assessment relevant to Atmospheric and GHG Emissions.

Table 6-8: Atmospheric Emissions – Climate Change ALARP, Control Measures and Acceptability Assessment

Atmospheric Emissions – Climate Change	
ALARP Decision Context and Justification	**ALARP Decision Context: Type A** The climate is influenced by the concentration of GHG emissions in the atmosphere. Cooper Energy has a detailed understanding of it's emissions profile, being a certified carbon neutral organisation. Given this, Cooper Energy applies ALARP Decision Context A.
Control Measure	**Source of Good Practice Control Measures**
Activity Emissions (Scope 1, 2 and controllable Scope 3)	
Manage	

C9: Emissions and Discharge Standards	National (AMSA) and International (IMO / MARPOL) Emissions and Discharge Standards for vessels.
C16: Emissions Reduction Opportunities	Cooper Energy Climate Action Policy: Cooper Energy contributes to a low emissions economy by prioritising Environmental, Social and Governance with investment in offset projects. The policy states that Cooper Energy identifies and, where practicable, implements opportunities for greenhouse gas emissions reductions within its' operations and through its' supply chain. Cooper Energy's energy transition strategy includes a new emissions reduction plan and process that will be in place during the term of this EP. The process will assess and implement emission reductions opportunities across Cooper Energy's portfolio (including Otway Offshore Operations) to ensure efficient allocation of resources. As relevant to the Otway Offshore Operations the process involves: • Opportunity identification by a cross-functional team (including Otway Operations) • Opportunity development and screening using corporate carbon price assumptions • Portfolio wide optimisation and selection for funding • Project implementation
Review	
C17: CEMS MS11 Supply Chain and Procurement management. Supplier Assessments.	MS11 includes provision for the assessment of supplier carbon reduction initiatives, collaboration opportunities and lower carbon emission intensive alternatives through the contractor evaluation process. The selection process for key services during offshore campaigns will include a review of opportunities for low carbon alternatives within the supply chain.
C18: Corporate Risk Review	Cooper Energy Climate Action Policy: Cooper Energy considers the resilience of their business strategy and financial plans for different climate scenarios, including Paris aligned sub-2-degree scenarios. CEMS MS3 Risk Management requires that top corporate risks are assessed and maintained in a corporate risk register, which is reviewed regularly with the Board. Climate change is assessed as both a physical risk and a transitional risk, meaning the reviews include: • Physical risks of climate change on the business; and • Transitional risks such the ongoing need for Cooper Energy's product, adequacy of broader climate and sustainability goals and product mix in the context of evolving state and national roadmaps to net-zero and changing policy settings.
Report	
C19: NGER Scheme Reporting	Control based on legislative requirements to provide the national reporting framework for the reporting and dissemination of information related to greenhouse gas emissions, energy consumption and energy production to meet the objectives of the legislation(s).
C20: Task Force on Climate Related Financial Disclosures (TCFD) principles, future iterations or equivalents	TCFD principles are important for all businesses to improve their own understanding of their long-term climate related risks and opportunities. Cooper Energy align to the TCFD principles for reporting. Climate change financial disclosures are described as part of annual sustainability reporting.
Scope 3 (product) Emissions	

Manage	
C19: Value Chain Opportunities	Cooper Energy Climate Action Policy. Cooper Energy supports customers in reaching their sustainability targets through collaboration to address the broader challenge of reducing downstream Scope 3 emissions. Cooper Energy has calculated the emissions intensity of its gas product, enabling customers to opt-in to the purchase of carbon neutral gas. Cooper Energy's energy transition strategy includes a stream to identify and assess evolving low carbon energy technology, opportunities and partnerships with respect to decarbonisation of the Company's value chain. This is an evolving process and will complement the Company's direct emissions reduction plan. It will similarly involve: • Opportunity identification (including alignment and partnerships with customers and suppliers where appropriate) • Opportunity development and screening using corporate carbon price assumptions • Portfolio wide optimisation and selection for funding • Project implementation
Review	
C18: Corporate Risk Review	Cooper Energy Climate Action Policy: Cooper Energy considers the resilience of their business strategy and financial plans for different climate scenarios, including Paris aligned sub-2-degree scenarios. CEMS MS3 Risk Management requires that top corporate risks are assessed and maintained in a corporate risk register, which is reviewed regularly with the Board. Climate Change is assessed as both a physical risk and a transitional risk, meaning the reviews include: • Physical risks of climate change on the business; and • Transitional risks such the ongoing need for Cooper Energy's product, adequacy of broader climate and sustainability goals and product mix in the context of evolving state and national roadmaps to net-zero and changing policy settings.
Report	
C21: Task Force on Climate Related Financial Disclosures (TCFD) principles, future iterations or equivalents	TCFD principles are important for all businesses to improve their own understanding of their long-term climate related risks and opportunities. Cooper Energy align to the TCFD principles for reporting. Climate change financial disclosures are described as part of annual sustainability reporting.
Consequence	Level 1. Air quality impacts are predicted to be low level and localised. Cooper Energy's emissions from the activities in this EP will be net-zero. GHG emissions as an indirect consequence of the activities in this EP are a very small component of state and national emissions. Cooper Energy has established a means by which to offset the emissions associated with the use of products generated by the activity.
Demonstration of Acceptability	
Principles of ESD	Atmospheric emissions and direct GHG emissions associated with the activity are evaluated as having Level 1 consequence which is not considered as having the potential to result in serious or irreversible environmental damage. An assessment against the principles is presented in relation to GHG emissions given the broader ESG governance focus on this aspect.

<table>
<tr><td rowspan="5"></td><td>Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equity considerations.</td><td>The Cooper Energy Values and Cooper Energy Management System integrates long and short-term economic, environmental, social and equity considerations, providing the framework, policies and process to guide responsible decision making and subsequent implementation.</td></tr>
<tr><td>If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (precautionary principle).</td><td>Cooper Energy recognises the influence of GHG emissions on the climate and the threats associated with climate change. Though emissions from the activity are small in the context of state and national emissions, Cooper Energy is implementing a range of measures to mitigate environmental damage.</td></tr>
<tr><td>The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.</td><td rowspan="2">Cooper Energy prioritises health, biological diversity, productivity and ecological integrity through the implementation of CEMS, reducing impacts to ALARP and acceptable levels, and by offsetting the company's direct emissions via sustainable, ecologically sound offset projects.</td></tr>
<tr><td>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.</td></tr>
<tr><td>Improved valuation, pricing and incentive mechanisms should be promoted.</td><td>Gas is in high demand within the south-east domestic market (see external context below). Gas from the Otway offshore activities is produced local to customers, utilises existing infrastructure, skills and resources.</td></tr>
<tr><td>Legislative and Conventions</td><td colspan="2">• The Paris Agreement (2015, United Nations Framework Convention on Climate Change (UNFCCC)) and subsequent Nationally Determined Contributions
• National Greenhouse and Energy Reporting Act 2017 (Cwth)
• Safeguard Mechanism under Carbon Farming Initiative Amendment Act 2014 (Cwth)
• Emissions Reduction Fund under Carbon Credits (Carbon Farming Initiative) Act 2011 (Cwth)
• Climate Change Act 2017 (Vic)
• The Environment Protection Act 2017 (Vic)</td></tr>
<tr><td>Internal Context</td><td colspan="2">Cooper Energy has Carbon Neutral certification by Climate Active.

Cooper Energy's 'Climate Action Policy' outlines the Company's objective to commit to sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The Policy outlines three purpose statements:
• To provide clean, reliable, and affordable energy focused on south-eastern Australia, with active participation in society's decarbonization journey.
• To inspire our people to contribute to future energy solutions for our customers and our communities.
• To operate in innovative and responsible ways, with an emphasis on care, shareholder value and sustainability.</td></tr>
</table>

	The Policy also commits the company to the following: • Recognise the important role of renewables and the key role gas plays in complementing and supporting the deployment of renewable technologies • Are making our contribution to a low emissions economy by prioritising Environmental, Social and Governance (ESG) with investment in offset projects and consideration of future sustainable energy projects • Identify and, where practicable, implement opportunities for greenhouse gas emission reduction within our operations and through our supply chain • Factor carbon pricing into business decisions and commercial models • Identify, manage and mitigate material climate change risks to our activities • Voluntarily align our climate change related disclosures, including our emissions, with the Task Force on Climate Related Financial Disclosures (TCFD) principles • Disclose Cooper Energy's governance around climate change, including: − material short, medium and long-term climate-related risks and opportunities on our business, strategy and financial planning; and – the resilience of our strategy, taking into account different climate scenarios, including Paris-aligned scenarios • Align with our customers' sustainability and emissions reduction initiatives which will enable collaboration to address the broader challenge of reducing downstream Scope 3 emissions; and • Work with governments and stakeholders in the design of climate change regulation and policies. Cooper Energy's Risk and Sustainability Committee oversights the Company's sustainability policies and practices. Relevant management system processes adopted to implement and manage hazards to ALARP include: • Risk Management (MS03) • Health Safety and Environment Management (MS09) • Supply Chain and Procurement Management (MS11)
External Context	Gas demand in the local SE Australia energy market is predicted to remain strong over the coming years (ACCC, 2022). This demand relates to critical and necessary energy needs for current and next generations as the energy transition progresses. The majority of gas use within Australia relates to manufacturing and electricity generation, where gas is will continue to firm and support renewables (DIISER 2021, AEMO 2022). The AEMO report '2022 Integrated Systems Plan' for the National Electricity Market is described by DCCEEW as Australia's roadmap to Net Zero. The report anticipates a continued critical role for gas-fired power generation for peak loads and firming through the time horizon to 2050, and describes how, over time, gas fired generation emissions will need to be offset elsewhere. Cooper Energy has already begun establishing the mechanisms for this, via its organisational carbon neutral certification, and its gas product certification. Projections for gas demand in the SE Australian market are in the region of ~380 PJ / year and ~4000 PJ in aggregate over the next decade. Gas demand under accelerated energy transition scenarios may reduce the demand; Victoria's gas substitution roadmap predicts, for a rapid transition scenario, gas demand in the order of 1800 PJ in aggregate over the next decade (DELWP, 2022). Gas supplied from Cooper Energy's Otway offshore operations are projected to provide around 180 PJ aggregated gas into the SE market between 2022 and 2034, representing a small but crucial proportion of the projected domestic demand, via local, established infrastructure. Cooper Energy recognises the need to decarbonise as a responsible corporate citizen and consistent with the precautionary principle, a defining principle of ESD,

	has implemented measures to reduce the threat of serious or irreversible environmental degradation resulting from its direct GHG emissions. The activity will be undertaken in a manner consistent with relevant legislation, industry standards and guidelines, offshore practices and benchmarking. Emissions, energy consumption, and energy production data will be reported annually to the Clean Energy Regulator in accordance with the NGER requirements. The Paris Agreement provides the international framework and context to Australia's Nationally Determined Contributions (43% below 2005 levels by 2030) and the long-term goal of net zero emissions by 2050.
Acceptability Outcome	Acceptable

6.5. Underwater Sound Emissions

6.5.1. Cause of Aspect

Underwater sound emissions will occur as a result of the following activities:

- Geophysical surveys
- Operations of subsea infrastructure
- Inspections, maintenance and repair
- Vessel operations
- MODU operations
- Helicopter operations.

6.5.2. Aspect Characterisation

6.5.2.1. Continuous sound

Acoustic modelling

Vessel, MODU and normal operations will generate sound; vessels represent the louder of the sources associated with the offshore activities. Cooper Energy commissioned JASCO Applied Sciences (JASCO) to undertake a modelling study of underwater sound levels associated with the activities. This study considers MODU, and vessel generated noise.

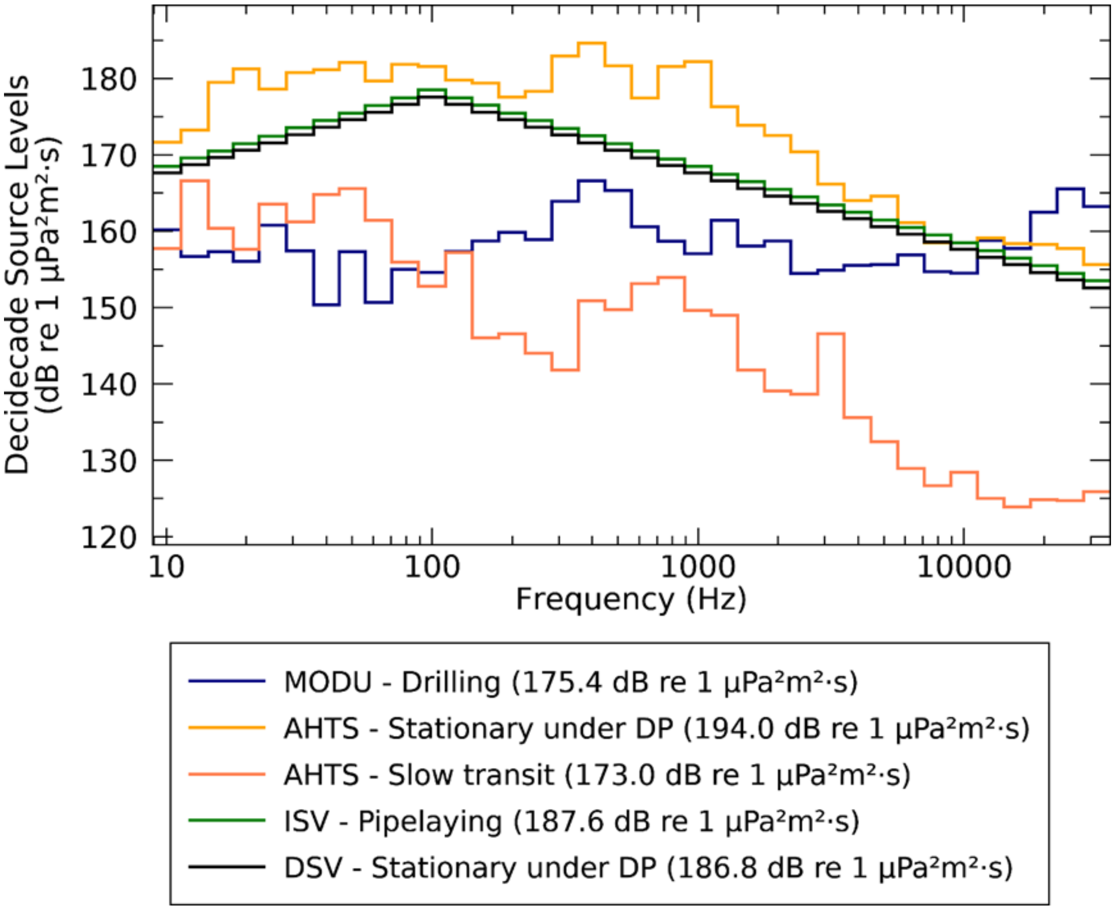
The modelling was undertaken to assist in understanding the potential acoustic impact on receptors including marine mammals (cetaceans and otariid seals), turtles, and fish (including eggs and larvae). Estimated underwater acoustic levels are presented as sound pressure levels (SPL), and accumulated sound exposure levels (SEL24h) as appropriate for different noise effect criteria. Different combinations of activities were modelled at different locations across the field Table 6-9. The source characteristics for the Otway offshore activities are shown in Figure 6-3.

Locations selected are considered representative of the Otway offshore activity area for the types of activity. The Annie-2 well location was selected for multiple modelling iterations; this well is the closest to shore and shallowest well location. The selected vessels and associated sound source levels are also considered to be representative. The vessel(s) for the Otway offshore activities will be selected as part of a tender process as planning progresses. Vessel specifications are expected to be analogous to those considered by Connell *et al*. (2022) whose modelling accounted for a range of AHTS and construction vessels. As such the modelling is considered appropriate to inform the impact and risk assessment for the Otway offshore activities.

Table 6-9: Sound source levels for Petroleum Activity

Scenario #	Scenario name	Description	Location
1	Drilling Prelays	1 x Anchor Handler within 2 km of location DP/slow transit	Annie-2
2	MODU Mooring	Moored Semi Sub idle 1x Anchor Handler on bridle 2x Anchor Handlers within 2 km of location (hooking up anchors)	Annie-2
3	MODU drilling and OSV under standby	Anchored MODU drilling 1x Anchor Handler on standby within 2 km	Annie-2
4	MODU Drilling Operations with Standby OSV and resupply	Anchored MODU drilling 1x Anchor Handler on standby within 2 km 1x Anchor Handler at MODU undertaking resupply	Annie-2

5	Installation (ISV) Annie EHU	Laying flowlines and umbilicals – 600m/hour	Between Annie-2 & Casino-5
6	Vessel noise from a Dive Support Vessel (DSV) and a Hyperbaric Rescue Vessel (HRV) under DP.	DSV and HRV stationary on location	Annie-2



Source: Connell et al. (2022)

Figure 6-3: Energy source level spectra for modelled sound sources

Noise effect criteria

Different species groups perceive and respond to sound differently, and so a variety of exposure criteria for the different types of impacts and species groups are considered. The following noise effect thresholds (Table 6-10), based on current best available science, have been used in the impact and risk assessment:

- Frequency-weighted accumulated sound exposure levels (SEL_{24h}) from the NOAA Technical Guidance (NMFS 2018) for the onset of PTS and TTS in marine mammals
- Un-weighted SPL for behavioural threshold for marine mammals based on NOAA (2019)
- Frequency-weighted accumulated sound exposure levels (SEL_{24h}) from Finneran *et al*. (2017) for the onset of PTS and TTS in marine turtles
- Sound exposure guidelines for fish, fish eggs, and larvae (Popper, *et al*. 2014).

Recent Commonwealth guidance has defined “injury to blue whales” as both PTS and TTS hearing impairment, as well as any other form of physical harm arising from anthropogenic sources of underwater sound (Table 2-5).

Numerous studies on marine mammal behavioural responses to sound exposure have not resulted in consensus in the scientific community regarding the appropriate metric for assessing behavioural reactions (Connell, Koessler and McPherson 2021).

The NOAA (2019) behavioural threshold was derived based on studies examining behavioural responses to drilling and dredging (NOAA 2018), referring to Malme et al. (1983)., Malme *et al*. (1984), and Malme *et al*. (1986), which were considered in Southall *et al* (2007). Malme *et al*. (1986) found that playback of drillship sound did not produce clear evidence of disturbance or avoidance for levels below an SPL of 110 dB re 1 µPa, however, possible avoidance occurred for exposure levels approaching 119 dB re 1 µPa. Malme *et al*. (1984) determined that measurable reactions usually consisted of rather subtle short-term changes in speed and/or heading of the whale(s) under observation.

Previous literature reviews (e.g., Southall *et al* (2007)) identified varying responses for most marine mammals between SPLs of 140–180 dB re 1 µPa. For low frequency whales (e.g., blue, fin, sei, southern right) the data indicated no or very limited responses at a received level of 90–120 dB re 1 µPa, with an increasing probability of avoidance and behavioural effects from 120–160 dB re 1 µPa. With regard to an exploration drilling program within the Otway Basin, advice provided by Brandon Southall to Beach Energy when asked "what, in your opinion, for this particular project, could be the sound levels which could cause effects starting at ‘response’ and ending at ‘disturbance/displacement’ for blue whales, and thus displace them from food” responded that based on studies on feeding blue whales off California the response change points were in the 130–140 dB re 1 µPa range (Beach Energy 2020). Therefore, the NOAA (2019) behavioural threshold for marine mammals of a SPL at 120 dB re 1 µPa is likely to represent a conservative threshold.

Table 6-10: Noise effect criteria for continuous sound

Receptor	Behavioural	Impairment			Injury	
		Masking	Temporary threshold shift	Recoverable injury	Permanent threshold shift	Mortality or potential mortal injury
Low-frequency cetaceans	SPL: 120 dB re 1 µPa	N/A	SEL_{24h}: 179 dB re 1 µPa^{2}s	N/A	SEL_{24h}: 199 dB re 1 µPa^{2}s	N/A
Mid-frequency cetaceans	SPL: 120 dB re 1 µPa	N/A	SEL_{24h}: 178 dB re 1 µPa^{2}s	N/A	SEL_{24h}: 198 dB re 1 µPa^{2}s	N/A
High-frequency cetaceans	SPL: 120 dB re 1 µPa	N/A	SEL_{24h}: 153 dB re 1 µPa^{2}s	N/A	SEL_{24h}: 173 dB re 1 µPa^{2}s	N/A
Otariid seals	SPL: 120 dB re 1 µPa	N/A	SEL_{24h}: 199 dB re 1 µPa^{2}s	N/A	SEL_{24h}: 219 dB re 1 µPa^{2}s	N/A
Turtles	(N) High (I) Moderate (F) Low	N/A	SEL_{24h}: 200 dB re 1 µPa^{2}s	N/A	SEL_{24h}: 220 dB re 1 µPa^{2}s	N/A
Fish (no swim bladder)	(N) Moderate (I) Moderate (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	N/A	(N) Low (I) Low (F) Low
Fish (swim bladder not	(N) Moderate (I) Moderate	(N) High (I) High	(N) Moderate (I) Low	(N) Low (I) Low	N/A	(N) Low (I) Low

involved in hearing)	(F) Low	(F) Moderate	(F) Low	(F) Low		(F) Low
Fish (swim bladder involved in hearing)	(N) High (I) Moderate (F) Low	(N) High (I) High (F) High	SPL: 158 dB re 1 µPa for 12 hours	SPL: 170 dB re 1 µPa for 48 hours	N/A	(N) Low (I) Low (F) Low
Fish eggs and fish larvae (also relevant to plankton)	(N) Moderate (I) Moderate (F) Low	(N) High (I) Moderate (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	N/A	(N) Low (I) Low (F) Low

Relative risk (high, moderate, low) is given for fauna at three distances from the source (near [N] = tens of metres, intermediate [I] = hundreds of metres, and far [F] = thousands of metres).

Modelling outputs

Table 6-11 summarises the outcomes of the modelling, showing the exposure criteria for PTS, TTS and behavioural responses, and the furthest modelled distances to them for each scenario at the relevant locations. This has been depicted in Figure 6-4 which shows predicted ensonified areas representative of scenario's 2 and 4 which result in the larger ensonified area by some margin and are therefore used for assessment purposes. Full details of the modelling can be found in (Connell *et al*, 2022).

For this assessment, the PTS and TTS 24 h criteria were applied to a range of fauna whose ranges overlap the operational area. Criteria for marine mammals that may be undertaking biologically important behaviours, such as calving, foraging, resting or migration were also used, to understand the radius for TTS and PTS onset and associated likelihood of accumulated exposure; the smaller the radius, the less likely accumulated exposure approaching the 24 h threshold.

Table 6-11: Maximum horizontal distances (R_{max}) from any modelled scenario to reach noise effect criteria

Receptor	Behavioural	Temporary Threshold Shift	Recoverable Injury	Permanent Threshold Shift
Low-frequency cetaceans	SPL: 7.87 km	SEL_{24h}: 3.03 km	N/A	SEL_{24h}: 0.31 km
Mid-frequency cetaceans	SPL: 7.87 km	SEL_{24h}: 0.16 km	N/A	SEL_{24h}: 0.05 km
High-frequency cetaceans	SPL: 7.87 km	SEL_{24h}: 1.15 km	N/A	SEL_{24h}: 0.26 km
Otariid seals	SPL: 7.87 km	SEL_{24h}: 0.08	N/A	SEL_{24h}: 0.05 km
Turtles	N/A	SEL_{24h}: 0.29 km	N/A	SEL_{24h}: 0.05 km
Fish	N/A	SPL (for 12h): 0.13 km	SPL (for 48h): 0.03	N/A

The largest distances, by some margin, relate to Scenario 2 and 4 (as described in Table 6-9).

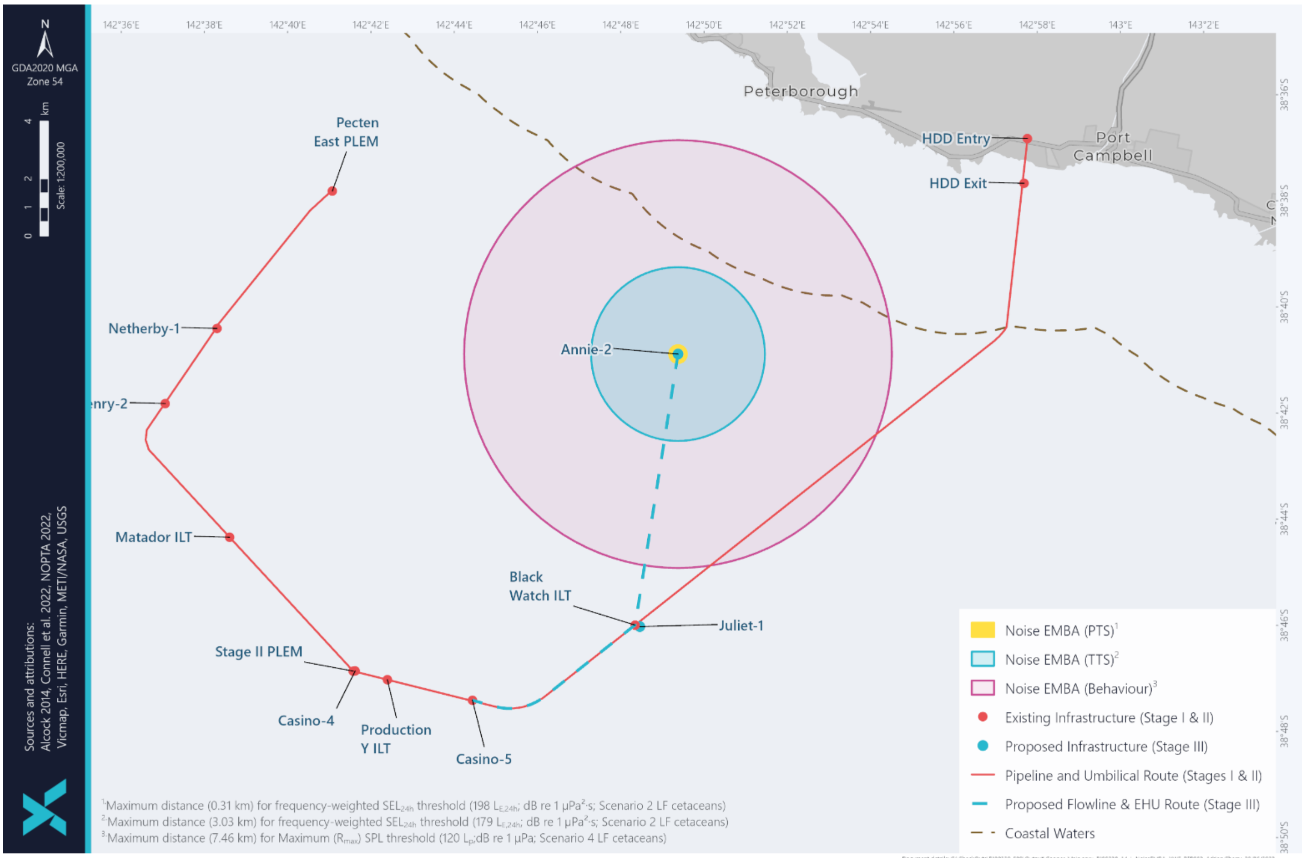


Figure 6-4: Noise Behaviour, PTS / TTS Maximum EMBA Annie-2

6.5.2.2. Impulsive sound

Acoustic modelling

Impulsive sound will be generated by survey and positioning equipment throughout the activity.

Connell et al. (2021) have provided empirical estimations of the effect ranges from survey equipment (e.g., MBES, sidescan sonar, and sub-bottom profilers) and positioning equipment (ultra-short baseline; USBL). The source characteristics determined from the literature review (McPherson and Koessler 2021) and used the subsequent impact and risk assessment are shown in Table 6-12.

Table 6-12: Positioning and survey equipment source frequencies and sound levels

Emission source	Example equipment	Source frequency range	Source sound level
USBL	Sonardyne Ranger	18–36 kHz	SPL: 204 dB re 1 µPa @ 1 m SEL$_{SS}$: 173 dB re 1 µPa^{2}s @ 1 m PK: 170 dB re 1 µPa @ 30 m
MBES	R2Sonic 2024 Reson SeaBat 8101	200–400 kHz	SPL: 221 dB re 1 µPa @ 1 m SEL$_{SS}$: 130 dB re 1 µPa^{2}s @ 40 m PK: 170 dB re 1 µPa @ 40 m
Sidescan sonar	EdgeTech 4200	70–400 kHz	SPL: 205 dB re 1 µPa @ 1 m SEL$_{SS}$: 176 dB re 1 µPa^{2}s @ 1 m PK: 210 dB re 1 µPa @ 1 m
Sub-bottom profiler (with boomer)	Applied Acoustics AP3000	100–1,000 Hz	SPL: 203.3 dB re 1 µPa @ 1 m SEL$_{SS}$: 172.6 dB re 1 µPa^{2}s @ 1 m

Sub-bottom profiler (with CHIRP)	Edgetech X-star system CHIRP Applied Acoustics AA301	2–16 kHz	SPL: 191.7 dB re 1 µPa PK: 215 dB re 1 $µPa^2m^2$

SEL_{SS} is per-pulse SEL (i.e., not an accumulated value).

Noise effect criteria

Different species groups perceive and respond to sound differently, and so a variety of exposure criteria for the different types of impacts and species groups are considered. The following noise effect thresholds (Table 6-13), based on current best available science, have been used in the impact and risk assessment:

- Peak pressure levels (PK) and frequency-weighted accumulated sound exposure levels (SEL_{24h}) from the US National Oceanic and Atmospheric Administration (NOAA) Technical Guidance (NMFS 2018) for the onset of PTS and TTS in marine mammals
- Marine mammal behavioural threshold based on the current NOAA (NOAA 2019) criterion for marine mammals of 160 dB re 1 µPa (SPL) for impulsive sound sources
- Peak pressure levels (PK) and frequency-weighted accumulated sound exposure levels (SEL_{24h}) from Finneran *et al*. (Finneran, *et al*. 2017) for the onset of PTS and TTS in marine turtles
- Marine turtle behavioural response threshold of 166 dB re 1 µPa (SPL) (Commonwealth of Australia 2017a) as applied by the US NMFS, along with a sound level associated with behavioural disturbance 175 dB re 1 µPa (SPL) (McCauley, *et al*. 2000)
- Sound exposure guidelines for fish, fish eggs and larvae (Popper, *et al*. 2014).

Recent Commonwealth guidance has defined “injury to Blue Whales” as both PTS and TTS hearing impairment, as well as any other form of physical harm arising from anthropogenic sources of underwater noise (Table 2-5).

Table 6-13: Noise effect criteria for impulsive sound

Receptor	Behavioural	Impairment			Injury	
		Masking	Temporary threshold shift	Recoverable injury	Permanent threshold shift	Mortality or potential mortal injury
Low-frequency cetaceans	SPL: 160 dB re 1 μ Pa	N/A	SEL_{24h}: 168 dB re 1 μPa²s PK: 213 dB re 1 μPa	N/A	SEL_{24h}: 183 dB re 1 μPa²s PK: 219 dB re 1 μPa	N/A
Mid-frequency cetaceans	SPL: 160 dB re 1 μ Pa	N/A	SEL_{24h}: 170 dB re 1 μPa²s PK: 224 dB re 1 μPa	N/A	SEL_{24h}: 185 dB re 1 μPa²s PK: 230 dB re 1 μPa	N/A
High-frequency cetaceans	SPL: 160 dB re 1 μ Pa	N/A	SEL_{24h}: 140 dB re 1 μPa²s PK: 196 dB re 1 μPa	N/A	SEL_{24h}: 155 dB re 1 μPa²s PK: 202 dB re 1 μPa	N/A
Otariid seals	SPL: 160 dB re 1 μ Pa	N/A	SEL_{24h}: 188 dB re 1 μPa²s PK: 226 dB re 1 μPa	N/A	SEL_{24h}: 203 dB re 1 μPa²s PK: 232 dB re 1 μPa	N/A
Turtles	SPL: 166 dB re 1 μ Pa SPL: 175 dB re 1 μ Pa	N/A	SEL_{24h}: 189 dB re 1 μPa²s PK: 226 dB re 1 μPa	N/A	SEL_{24h}: 204 dB re 1 μPa²s PK: 232 dB re 1 μPa	N/A
Fish (no swim bladder)	(N) High (I) Moderate (F) Low	(N) Low (I) Low (F) Low	SEL_{24h}: >>186 dB re 1 μPa² s	SEL_{24h}: >216 dB re 1 μPa²s PK: >213 dB re 1 μPa	N/A	SEL_{24h}: >219 dB re 1 μPa²s PK: >213 dB re 1 μPa
Fish (swim bladder not involved in hearing)	(N) High (I) Moderate (F) Low	(N) Low (I) Low (F) Low	SEL_{24h}: >>186 dB re 1 μPa² s	SEL_{24h}: 203 dB re 1 μPa²s PK: >207 dB re 1 μPa	N/A	SEL_{24h}: 210 dB re 1 μPa²s PK: >207 dB re 1 μPa
Fish (swim bladder involved in hearing)	(N) High (I) High (F) Moderate	(N) Low (I) Low (F) Moderate	SEL_{24h}: 186 dB re 1 μPa²s	SEL_{24h}: 203 dB re 1 μPa²s PK: >207 dB re 1 μPa	N/A	SEL_{24h}: 207 dB re 1 μPa²s PK: >207 dB re 1 μPa
Fish eggs and fish larvae (also relevant to plankton)	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	N/A	SEL_{24h}: >210 dB re 1 μPa²s PK: >207 dB re 1 μPa

Relative risk (high, moderate, low) is given for fauna at three distances from the source (near [N] = tens of metres, intermediate [I] = hundreds of metres, and far [F] = thousands of metres

Modelling output

Empirical estimates of the distances to thresholds were either taken from equivalent and comparable sources in literature or estimated using a simple spreading loss calculation and associated literature inputs (McPherson and Koessler 2021). The estimated maximum from any of the individual positioning or survey equipment to reach the respective noise effect criteria is summarised in Table 6-14.

Where criteria (defined in Section 6.5.2.2) contain weighted thresholds, unweighted estimated levels and unweighted literature values were compared to the weighted threshold as part of a conservative distance calculation (McPherson and Koessler 2021). If weighted estimates were compared to thresholds, they would be reached at closer distances than the unweighted estimates presented in Table 6-14) (McPherson and Koessler 2021).

Table 6-14: Estimated maximum horizontal distance from any equipment to reach noise effect criteria

Receptor	Behavioural	Impairment			Injury	
		Masking	Temporary threshold shift	Recoverable injury	Permanent threshold shift	Mortality or potential mortal injury
Low-frequency cetaceans	SPL: <130 m	N/A	SEL_{24h}: — PK: —	N/A	SEL_{24h}: — PK: —	N/A
Mid-frequency cetaceans	SPL: <130 m	N/A	SEL_{24h}: — PK: —	N/A	SEL_{24h}: — PK: —	N/A
High-frequency cetaceans	SPL: <130 m	N/A	SEL_{24h}: — PK: —	N/A	SEL_{24h}: — PK: —	N/A
Otariid seals	SPL: <130 m	N/A	SEL_{24h}: — PK: —	N/A	SEL_{24h}: — PK: —	N/A
Turtles	SPL: <130 m	N/A	SEL_{24h}: — PK: within metres	N/A	SEL_{24h}: — PK: within metres	N/A
Fish (no swim bladder)	N/A	N/A	SEL_{24h}: within metres	SEL_{24h}: within metres PK: within metres	N/A	SEL_{24h}: within metres PK: within metres
Fish (swim bladder not involved in hearing)	N/A	N/A	SEL_{24h}: within metres	SEL_{24h}: within metres PK: within metres	N/A	SEL_{24h}: within metres PK: within metres
Fish (swim bladder involved in hearing)	N/A	N/A	SEL_{24h}: within metres	SEL_{24h}: within metres PK: within metres	N/A	SEL_{24h}: within metres PK: within metres
Fish eggs and fish	N/A	N/A	N/A	N/A	N/A	SEL_{24h}: within metres

Receptor	Behavioural	Impairment			Injury	
		Masking	Temporary threshold shift	Recoverable injury	Permanent threshold shift	Mortality or potential mortal injury
larvae (also relevant to plankton)						PK: within metres

6.5.3.Predicted Environmental Impacts and Risks

Potential impacts of underwater sound emissions are:

- Change in ambient sound.

Potential risk events associated with underwater sound emissions are:

- Behavioural changes to marine fauna; and
- Auditory impairment (masking, TTS, recoverable injury), or auditory injuries (mortality or potential mortal injuries, PTS) to marine fauna

6.5.4. Impact and Risk Evaluation

6.5.4.1. Continuous sound

Impacts: Change in Ambient Sound

Inherent Consequence Evaluation

Ambient underwater sound is the level of sound which exists in the environment without the presence of the activity. Passive acoustic monitoring commissioned by Origin from April 2012 to January 2013, 5 km offshore from the coastline east of Warrnambool, identified that ambient underwater noise in coastal areas is generally higher than further offshore, with a mean of 110 dB re 1 µPa and maximum of 161 dB re 1 µPa (Duncan *et al*.,2013).

Underwater modelling for the activity (Connell *et al*., 2022) indicated that sound at an SPL of 110 dB re 1 µPa would extend up to approximately 20 km from the source, for a number of the modelling scenarios (that is Scenarios 2, 4 and 5).

Given that vessel activities are relatively short term, that DP use is intermittent over those periods, and the localised extent of the change above an SPL of 110 dB re 1 µPa (approximately 20 km), the consequence of this impact has been evaluated as Level 1, as underwater sound will return to existing ambient levels following completion of the activity with no remedial or recovery work required.

Risk event: Behavioural Changes (Marine Mammals)

Inherent Consequence Evaluation

Acoustic modelling indicated that the R_{max} from the source to SPL behavioural noise effect criteria for all marine mammals varied for each scenario, with distances ranging from <1 km for slow moving vessels (Scenario 1), to 7.87 km for mooring operations (Scenario 2). A summary of impacts for marine mammals with potential to be present is provided in the following sections.

Otariid Seals

The distances to the behavioural threshold ranged with a maximum of 7.87 km from Scenario 2. The Australian fur-seal and the long-nosed fur-seal may occur within the behavioural EMBA. Impacts may include temporary avoidance of vessels when undertaking activities, however as there is no overlap of the ensonified area with biologically important areas, the consequence to Otariid seals has been assessed as **Level 2**.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Unlikely**.

Inherent Risk Severity

The inherent risk severity of continuous underwater sounds causing behavioural changes to otariid seals is considered **Low**.

High-frequency Cetaceans

High-frequency cetaceans include sperm whales, beaked whales and large delphinid species such as killer whales and pilot whales. Porpoises and some species of dolphins form the group of very high-frequency cetaceans (Southall *et al*., 2019). The PMST Report identified that high-frequency cetaceans such as pygmy sperm whale may occur within the area that may be affected, however no biologically important areas or behaviours were identified within this area.

The distances to the behavioural threshold ranged with a maximum of 7.87 km from Scenario 2. Impacts may include temporary avoidance of vessels when undertaking activities, however as there is no overlap of the ensonified area with biologically important areas, the consequence to high-frequency cetaceans has been assessed as **Level 2**.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Unlikely**.

Inherent Risk Severity

The inherent risk severity of continuous underwater sounds causing behavioural changes to high frequency cetaceans is considered **Low**.

Mid-frequency Cetaceans

The PMST Report identified several mid-frequency dolphin species, beaked and toothed whales within the behavioural EMBA, however, no biologically important areas or behaviours were identified within this area.

The distances to the behavioural threshold ranged with a maximum of 7.87 km from Scenario 2. Impacts may include temporary avoidance of vessels when undertaking activities, however as there is no overlap of the ensonified area with biologically important areas, the consequence to mid frequency cetaceans has been assessed as **Level 2**.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Unlikely**.

Inherent Risk Severity

The inherent risk severity of continuous underwater sounds causing behavioural changes to mid-frequency cetaceans is considered **Low**.

Low-frequency Cetaceans

Low-frequency cetaceans include baleen whales such as sei whale, finn whale, southern right whale and blue whale. Potential presence within the behavioural EMBA and biologically important behaviours for listed threatened low-frequency cetaceans are summarised in Table 6-15.

The distances to the behavioural threshold ranged with a maximum of 7.87 km from Scenario 2, related to offshore vessels. Vessel activities are relatively short term, with peak noise during DP use, which will be intermittent over the course of the activities.

Table 6-15: Low-frequency Cetacean presence and biological important behaviours

Species	Biologically Important Behaviours	J	F	M	A	M	J	J	A	S	O	N	D
Pygmy blue whale foraging BIA	Yes – Foraging (annual high use) BIAs		P	P									
Southern right whale – core coastal	Yes – known core range, adjacent to				S							S	

Species	Biologically Important Behaviours	J	F	M	A	M	J	J	A	S	O	N	D
	aggregation area BIA												
Southern right whale – aggregation	No							P	P				
Sei whale	No												
Fin whale	No												

S – expected shoulder period; P – Peak period

Blue Whales

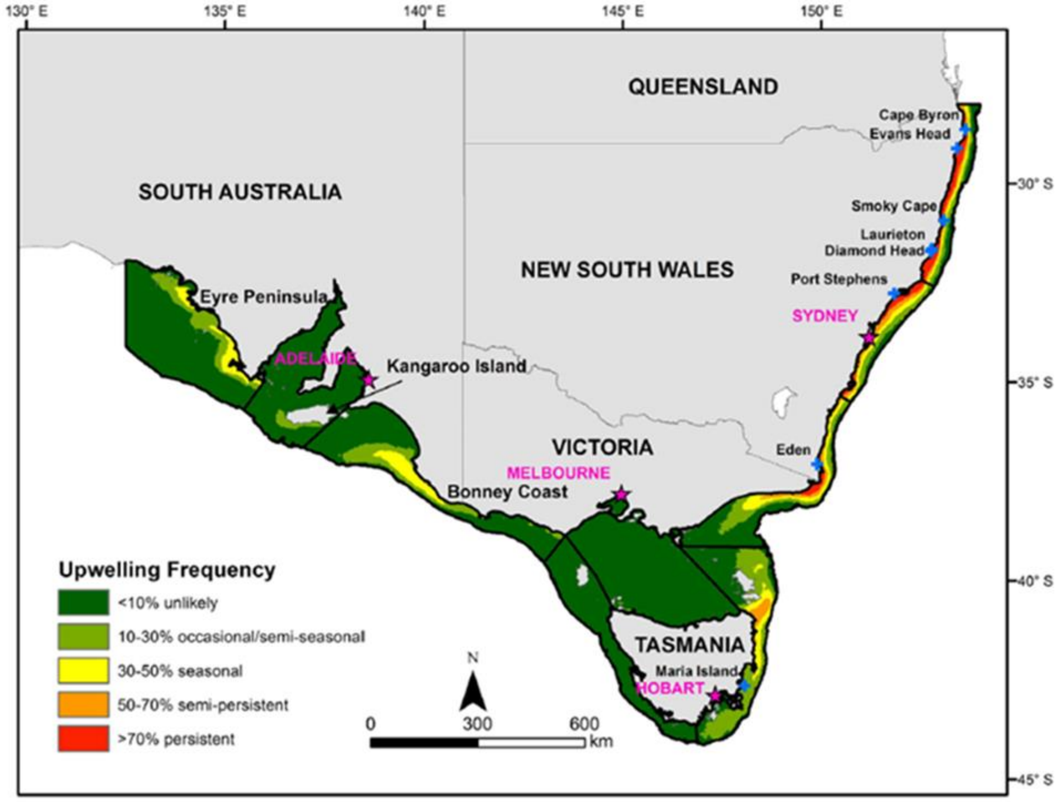
A foraging BIA (annual high use) for the PBW has been identified within the area where the behavioural criteria is reached. PBW typically occur during peak foraging in February and March, but also from November through to June. Offshore activities have overlapped this period, in this region, for decades. The period provides the most suitable weather to undertake offshore activities; activities are typically planned to coincide with suitable weather windows.

The conservation management plan (CMP) for the blue whale (CoA, 2017) Action A.2.3 details that '*anthropogenic noise in BIAs will be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area*'. The CMP assesses the threat from shipping and industrial noise, as a Minor consequence which is defined 'as individuals are affected but no affect at a population level'. The conservation plan details that given the behavioural impacts of noise on pygmy blue whales are largely unknown, a precautionary approach has been taken regarding assignation of possible consequences, hence even Minor consequences to individuals is considered a precautionary assessment in the CMP.

Given no population level effects are predicted from shipping and industry noise, it follows that Action A.2.3 may not be needed to achieve the CMP objective which is ultimately aimed at population recovery: '*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*'. Though shipping and industry has been present offshore southeast Australia (and within blue whale BIAs) for decades, estimates indicate blue whale populations are recovering (e.g. Branch *et al*. 2007; Balcazar *et al*. 2015, McCauley *et al*. 2018), albeit at a slower rate compared to other species such as the humpback whale (Noad *et al*. 2019, TSSC 2022).

The potential consequence has been rated as a **Level 2**, based on:

- The conservative approach taken in the sound modelling and use of the furthest distances to impact criteria being used.
- The higher sound emissions are from slow moving or stationary vessels on DP; these types of activity are limited in duration and DP use is intermittent.
- The area of potential impact from the development is a relatively small percentage (~0.14%) of the high-density foraging BIA (35,627 km^2); hence any displacement from a very localised area around a vessel on DP would not be expected to impact on a whales overall foraging success in the region. Consistent with the CMP assessment of industry and vessel noise, no population level effects are predicted.
- Limited food sources are expected to be present within the vicinity of the predicted ensonified area for behavioural disturbance. Upwelling and productivity in the region have been shown to be episodic, and of relatively low frequency near to Otway offshore infrastructure (Huang and Wang 2019). As such, any behavioural disturbances resulting from underwater sound is not expected to significantly impact the foraging success of any individual.



Source: Huang and Wang (2019)

Figure 6-5: Upwelling Frequency in the Bass Strait

Southern Right Whale

Southern right whales migrate annually from their nursery grounds (lower latitudes) in winter, to their feeding grounds (higher latitudes) in summer. The southern right whale 'known core range' includes the areas where whale presence may occur (DSEWPaC 2012). The Otway offshore assets and related activities overlap this core coastal range, and there is the potential for southern right whales to be transiting through the area offshore Victoria during pipeline installation activities scheduled for May-July as they move to coastal aggregation areas (Table 6-15).

Southern right whales move through the known core range to reach shallow and more sheltered waters adjacent the coastline. The area adjacent the coastline is nominated as a migrating and resting area for southern right whales. Every austral winter southern right whales move into the coastal waters in this region, including areas adjacent high vessel activity, such as the Port of Portland and Port Phillip Bay. Breeding and calving habitat is identified along much of the south Australian and Western Australian coasts; an area of breeding habitat has also been identified in Victoria around Warrnambool, to the east of the Otway assets.

There is a small overlap between vessel noise contours for some activities, and the migration and resting corridor, which runs the length of the Victorian coastline, adjacent Peterborough; within this area, there is potential for behavioural impacts on migrating and resting whales (Figure 6-6).

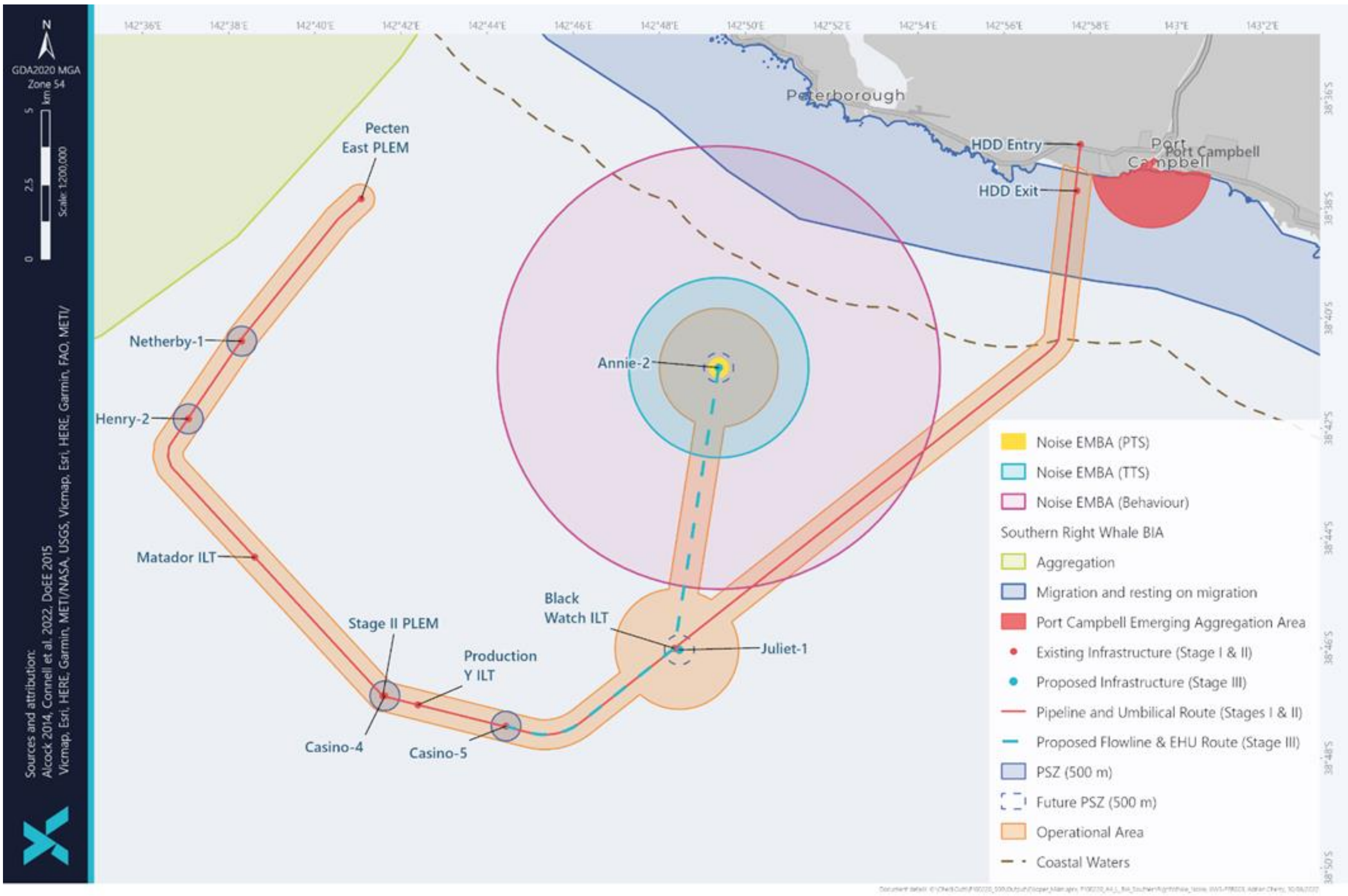


Figure 6-6: Noise Behaviour, PTS / TTS Maximum EMBA Annie-2 in relation to Southern Right Whale BIA

The extent and duration of impacts will vary based on the activity being undertaken. The conservation management plan for the southern right whale (DSEWPaC, 2012a) identifies (for the SE population) shipping noise as a minor consequence, and industrial noise as a moderate consequence where:

- Minor consequence is defined as – individuals are affected by no affect at population level, and
- Moderate consequence is defined as – population recovery stalls or reduces.

The conservation plan details that given the behavioural impacts of noise on southern right whales are largely unknown, a precautionary approach has been taken regarding assignation of possible consequences.

As a highly mobile migratory species, southern right whales travel thousands of kilometres between habitats used for essential life functions. Southern right whales may avoid the area where the behavioural criteria are reached, however given their mobility, this is unlikely to result in stopping their movements to and from the migration and resting area, or the coastal aggregation areas.

The potential consequence of has been rated as **Level 2**, based on:

- The conservative approach taken in the sound modelling and use of the furthest distances to impact criteria being used.
- The higher sound emissions are from slow moving or stationary vessels on DP; these types of activity are limited in duration and DP use is intermittent.
- The largest area of potential impact within the southern right whale core coastal area (217,825 km^2) is small, for example ~0.03% for discrete period during mooring or resupply to MODU.
- The area of potential impact is small and does not prevent migration through identified migration and resting corridors. Consistent with the CMP assessment of industry and vessel noise, no population level effects are predicted.

Other Low-frequency Cetaceans

The EPBC PMST report identified the presence of several additional low-frequency cetacean species within the areas that may be impacted by sound, including the fin whale (vulnerable and migratory) and sei whale (vulnerable and migratory).

Sei whales are primarily found in deep water oceanic habitats and are thought to complete long annual seasonal migrations from subpolar summer feeding grounds to lower latitude winter breeding grounds (TSSC 2015a). In Australian waters, sei whales have been infrequently recorded off Tasmania, New South Wales, Queensland, the Great Australian Bight, Northern Territory and Western Australia (TSSC 2015a). The conservation advice for sei whales assesses the threat of anthropogenic noise and acoustic disturbance as minor, with the extent over which the threat may operate as moderate-large (TSSC 2015a). No specific management action for managing underwater sound emissions is defined in the conservation advice.

Fin whales are generally thought to undertake long annual migrations from higher latitude summer feeding grounds to lower latitude winter breeding grounds; however, the full extent of their distribution in Australian waters is uncertain (TSSC 2015b). The conservation advice for sei whales assesses the threat of anthropogenic noise and acoustic disturbance as minor, with the extent over which the threat may operate as moderate-large (TSSC 2015b). No specific management action for managing underwater sound emissions is defined in the conservation advice.

Given the relatively short duration of activities, and localised extent of potential behavioural changes the consequence of this risk has been evaluated as **Level 2**, as underwater sound may result in localised short-term impacts to species of conservation value not affecting local ecosystem function.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Possible**, given the overlap with the foraging BIA for the pygmy blue whale and core coastal range for the southern right whale.

Inherent Risk Severity

The inherent risk severity of continuous underwater sounds causing behavioural changes to low frequency cetaceans is considered **Moderate**.

Risk event: TTS and PTS (Marine Mammals)

Inherent Consequence Evaluation

Acoustic modelling indicated:

- The R_{max} from the source to the PTS SEL_{24h} noise effect criteria were 0.05 km, 0.31 km, 0.05 km and 0.26 km for the otariid seals, low-frequency, mid-frequency, and high-frequency cetaceans respectively (Table 6-11).
- The R_{max} from the source to the TTS SEL_{24h} noise effect criteria were 0.08 km, 3.03 km, 0.16 km and 1.15 km for the otariid seals, low-frequency, mid-frequency, and high-frequency cetaceans respectively (Table 6-11).

The $SEL2_{4h}$ is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. This would require the same individual animal to remain within ~50 to 300 m of the vessel at roughly the same depth, for at least a 24-hour period, before PTS auditory injury may occur, or within 80 m to 3 km of the noise source for at least a 24-hour period before TTS auditory impairments may occur.

No BIAs and/or biologically important behaviours otariid seals, mid and high frequency cetaceans were identified in range of possible PTS or TTS associated with the activity. Given that the otariid seals, and some low, mid and high frequency cetaceans (if present) are expected to be transitory through the area, the risk of auditory injury (PTS and TTS) is not considered credible and has not been evaluated further for these species.

The subject of likelihood of either PTS or TTs onset is assessed further below for low frequency cetacean species, including the southern right whale and pygmy blue whale, which have BIAs that do overlap the activity, and which are identified as undertaking biologically important behaviours in the region.

Blue Whales

A foraging BIA for the PBW (annual high use) has been identified within the area where the PTS and TTS criteria is reached. PBW typically occur during peak foraging in February and March, but also from November through to June, and as such there is potentially an overlap during which activities are proposed to occur.

Though activities may overlap with foraging blue whales, the risk of PTS or TTS are not considered credible for the following reasons:

- TTS and PTS values do not incorporate animal movement and therefore it is highly unlikely an animal would be exposed within these ranges over a continuous 24 hr period. It is also unlikely for the noise to be maintained constantly at the high rate as rig and vessel operations (and corresponding noise levels) vary over a 24-hr period.
- The area where injury due to accumulated noise exposure is possible is very small in the context of the species range and behaviour. The largest radius for potential injury relates to TTS from the Scenario 2; this involves multiple vessels, and a constantly variable TTS contour up to 3 km. The typical variation in the TTS contour alone reduces the potential for accumulated exposure.
- Blue whale foraging ranges are expansive (e.g. Möller *et al*. 2020), extending throughout Otway shelf waters, however foraging behaviours are dependent upon availability of food sources (e.g. patches of krill), which are not uniformly distributed. Primary productivity is linked to episodic upwelling systems, and the area where the Otway offshore assets are located has a low frequency of upwelling (Huang and Wang, 2019), hence fewer and smaller foraging opportunities. A blue whale in the vicinity of the activity would be expected to be wandering in search of food, and not stationary for long periods.
- At any one time, the area of potential impact would be up to 15.46 km^2 which equates to ~0.05% of the high-density foraging BIA (35,627 km^2). Blue whales migrate, forage and move throughout the region; individuals would not be exposed to activity noise for long enough and close enough for TTS onset. Blue whales have been recorded swimming at mean speeds of 2.8 km/hr +/- 2.2 km/hr whilst migrating and foraging (Owen, Jenner & Jenner 2016) or faster (Möller *et al*. 2020). Accounting for swimming speeds across this range, a whale would be expected to move through any TTS zone associated with the project well before TTS onset.
- A type of foraging behaviour (observed in tagged blue whales) involving area restricted searches was reported by Owen et. al. 2016 as occurring out to the 1000 m isobath; over a 24h period, area restricted searches occurred over an area of 220 km^2. The maximum project TTS contours cover an area of 15.46 km^2. Therefore, area restricted searches, if any, could be expected to occur well in excess of any project TTS contour, and would preclude TTS onset.
- If whales were to interrupt their foraging within the TTS zone to feed on a discrete patch of krill for >24 hours, the movement of plankton (and therefore krill) with the currents would move the feeding zone passively through the TTS zone before TTS onset. Minimum average currents in the Operational Area are around 0.15 m/s in May (RPS 2019a). A discrete patch of krill moving with the plankton (and therefore the current) would move at 540 m/h, moving through the TTS zone well before TTS onset.
- Recent drilling activities within the Otway have overlapped pygmy blue whale foraging periods and blue whales were observed during the campaign. Reported behaviours were in line with published information on foraging behaviours and movements described above, that is, blue whales were not stationary for extended periods of time, or significantly restricted in their range, and were never considered to be at risk of TTS (MMO observation data, comms Beach Energy, 2022).

The evidence suggests that the presence of pygmy blue whales for extended (≥24 hour) periods, and consistently within close proximity (<3.03 km) to the vessel/MODU, is not credible. Therefore, the risk of auditory impairment or injury to marine mammals is not considered credible and has not been evaluated further.

Inherent Likelihood

Not applicable.

Inherent Risk Severity

Not applicable.

Southern Right Whale

Southern right whales migrate annually from their nursery grounds (lower latitudes) in winter, to their feeding grounds (higher latitudes) in summer. The Otway offshore assets and related activities overlap this core coastal range and the migration and resting corridor. Known and emerging aggregation are not overlapped.

Though activities may overlap with southern right whales moving through the region, the risks of PTS or TTS are not considered credible for the following reasons:

- The area where injury due to accumulated noise exposure is possible is very small in the context of the species range and behaviour. The largest area of potential impact within the southern right whale core coastal area (217,825 km^2) is small (~15.5 km^2) which equates to <0.01% of the core coastal area.
- The largest radius for potential injury relates to TTS from the Scenario 2; this involves multiple vessels, and a constantly variable TTS contour up to 3 km. The typical variation in the TTS contour alone due to the continual variation in operations reduces the potential for accumulated exposure.
- TTS and PTS values do not incorporate animal movement and therefore it is highly unlikely an animal would be exposed within these ranges over a continuous 24 hr period. Southern right whales are highly mobile species and move throughout the region. Observations of southern right whales during MODU operations off the Victorian coast in previous years have involved individuals swimming near to the MODU for a brief period before continuing on (Appendix 3).
- Southern right whales that are moving through the core coastal area are unlikely to be experience onset of PTS or TTS given the predicted speeds the whales have been observed to travel at. Studies report swim speeds for the southern right whale at between 3 – 3.3 km / hr (Mate *et al*. 2011; Mackay *et al*. 2015 cited in Charlton 2017). This is supported by recent observations of southern right whales at Port Campbell that include one cow and calf pair 1 km of the shore, and then observed to have travelled around 3 km further offshore within 1.5 hrs (Ref ID 713 and 711, 23 June 2022 (SWIFT, 2022).

The evidence suggests that in relation to the presence of southern right whales for extended (≥24 hour) periods, consistently within close proximity (<3.03 km) to a vessel, is not credible. Therefore, the risk of auditory impairment or injury to southern right whales is not considered credible and has not been evaluated further.

Inherent Likelihood

Not applicable.

Inherent Risk Severity

Not applicable.

Risk Event: Behavioural Changes (Turtles)

Inherent Consequence Evaluation

Continuous sound sources have been identified as high risk of causing behavioural disturbance to turtles within the near (tens of metres), and a moderate risk within the intermediate (hundreds of metres), vicinity of a sound (Table 6-10). This risk reduces low within the far (thousands of metres) vicinity of a sound (Table 6-10).

The PMST report for the operational area, identifies that marine turtle species listed as threatened and / or migratory under the EPBC Act have the potential to present, including:

- Loggerhead turtle, leatherback turtle (endangered, migratory)
- Green turtle, hawksbill turtle (vulnerable, migratory).

No BIAs or critical habitat occur within the predicted ensonified area for behavioural changes for marine turtles.

The Recovery Plan for Marine Turtles in Australia (CoA, 2017) identifies noise interference as a threat to turtles. It details that exposure to chronic (continuous) loud noise in the marine environment may lead to avoidance of important habitat.

The extent of the area of impact is predicted to be within the operational area for the duration of vessel activities. The severity is assessed as **Level 1** and acceptable based on:

- The Recovery Plan for Marine Turtles in Australia (CoA, 2017) details that exposure to chronic (continuous) loud noise in the marine environment may lead to avoidance of important habitat and no marine turtle important habits are located within the area that maybe impacted.
- Avoidance behaviour may occur within the operational area where no marine turtle important habits are located.
- Low numbers of marine turtles are predicted in the operational area and therefore impacts would be limited to a small number of individuals.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Unlikely**.

Inherent Risk Severity

The inherent risk severity of continuous underwater sounds causing behavioural changes to turtles is considered **Low**.

Risk Event: TTS and PTS (Turtles)

Inherent Consequence Evaluation

Acoustic modelling indicated that the R_{max} from the source to the TTS SEL_{24h} noise effect criteria was 0.29 km for turtles (Table 6-11). The PTS SEL_{24h} noise effect criteria was 0.05 km for turtles (Table 6-11).

Note that the SEL_{24h} is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. Specifically for marine turtles, this requires them to remain within ~300 m of the highest noise generating activities at least a 24-hour period before TTS auditory impairments may occur, and 50 m for PTS. Given that marine turtles (if present) are expected to be transitory through the area, the risk of auditory impairment is not considered credible, and has not been evaluated further.

Inherent Likelihood

Not applicable.

Inherent Risk Severity

Not applicable

Risk Event: Behavioural changes (Fish including eggs and Larvae)

Inherent Consequence Evaluation

Continuous sound sources have been identified as medium risk of causing behavioural disturbance to fish with no swim bladders, or those with bladders not involved in hearing, or to fish eggs or larvae, within the near (tens of metres) and intermediate (hundreds of metres) vicinity of a sound (Table 6 10). Continuous sound sources have been identified as high risk of causing behavioural disturbance to fish with swim bladders involved in hearing within the near (tens of metres), and a medium risk within the intermediate (hundreds of metres) vicinity of a sound (Table 6-10).

The operational area is within a distribution BIA for the great white shark, though no habitat critical to the survival of the species or behaviour are identified. The Recovery Plan for the White Shark (DSWEPC, 2015) does not identify anthropogenic noise as a threat to the species.

The operational area overlaps with activity for several managed commercial fisheries. However, given that behavioural disturbances to fish are expected only up to hundreds of metres of the vicinity of a sound (Table 6-10), and that this is within the exclusion zones for the MODU and ISV and the existing gazetted PSZs around the infrastructure, the risk of indirectly impacting commercial fisheries from underwater sound emissions is not considered credible, and has not been evaluated further.

Given the relatively short duration, and localised extent of potential behavioural changes (e.g., up to hundreds of metres from the source), the consequence of this risk has been evaluated as **Level 2**, as underwater sound may result in localised short-term impacts to species of conservation value not affecting local ecosystem function.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Unlikely**.

Inherent Risk Severity

The inherent risk severity of continuous underwater sounds causing behavioural changes to fish is considered **Low**.

Risk Event: Masking, TTS, Recoverable Injury, Mortality or Potential Mortal Injury (Fish including eggs and Larvae)

Inherent Consequence Evaluation

Sound produced by the MODU and/or vessel operations reach the sound levels associated with physiological effects, recoverable injury, and TTS for some fish species in close proximity to the sound sources (130 m for TTS and 30 m fore recoverable injury), but in order for the thresholds to be exceeded, the fish must remain at those distances for either 12 or 48 h. Given that fish are expected to be transitory through the area, the risk of auditory impairment is not considered credible, and has not been evaluated further.

Continuous sound sources have been identified as a moderate to high risk of causing masking within the near (tens of metres) and intermediate (hundreds of metres) vicinity of a sound source for all fish groups (Table 6-10). As identified in Section 6.5.4.1, some threatened and/or migratory species, have been identified within the predicted ensonified area for masking.

Given the relatively short duration, and localised extent of impacts, the consequence of this risk has been evaluated as **Level 2**, as underwater sound may result in localised short-term impacts to species of conservation value not affecting local ecosystem function.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Unlikely**.

Inherent Risk Severity

The inherent risk severity of continuous underwater sounds causing physical impacts to fish is considered **Low**.

6.5.4.2. Impulsive sound

Impacts: Change in Ambient Sound

Inherent Consequence Evaluation

Ambient underwater sound is the level of sound which exists in the environment without the presence of the activity. Passive acoustic monitoring commissioned by Origin from April 2012 to January 2013, 5 km offshore from the coastline east of Warrnambool, identified that ambient underwater noise in coastal areas is generally higher than further offshore, with a mean of 110 dB re 1 µPa and maximum of 161 dB re 1 µPa (Duncan *et al*.,2013).

Empirical estimates of impulsive underwater sounds associated with the activity (McPherson and Koessler 2021) indicated that sounds may extend up to ~130 m from the source (Table 6-13).

Given the infrequent and short duration (e.g., hours to days) of use of any of the positioning or survey equipment, and the very localised extent of change (e.g., up to ~130 m), the consequence of this impact has been evaluated as **Level 1**, as underwater sound will return to existing ambient levels following completion of the activity with no remedial or recovery work required.

Risk Event: Behavioural Changes (Marine Mammals)

Inherent Consequence Evaluation

Empirical estimates indicated that the maximum distance from an equipment sound source to the SPL behavioural noise effect criteria for all marine mammals was <130 m (Table 6-13). This distance was associated with the use of sidescan sonar with a highly directional source output beam pattern (McPherson and Koessler 2021). Other equipment was predicted to have smaller exposure areas (e.g., 36 m from positioning equipment, <10 m from MBES, and <12 m for sub-bottom profilers) (McPherson and Koessler 2021).

The PMST report for the operational area, identifies that several marine mammal species listed as threatened and/or migratory under the EPBC Act have the potential to be present, including:

- Sei whale (vulnerable, migratory)
- Blue whale (endangered, migratory)
- Fin whale (vulnerable, migratory)
- Southern right whale (endangered, migratory)

In addition, a foraging BIA for the pygmy blue whale, and the core coastal range BIA for the southern right whale also overlaps with the predicted ensonified area for behavioural disturbance.

Given the infrequent and short duration (e.g., hours to days) of use of any of the positioning or survey equipment, and the very limited spatial area (e.g., up to ~130 m) of exposure to impulsive sounds above behavioural thresholds, the consequence of this risk event has been evaluated as **Level 2**, as underwater sound may result in localised short-term impacts to species of conservation value not affecting local ecosystem function.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Remote**.

Inherent Risk Severity

The inherent risk severity of impulsive underwater sound causing behavioural changes to marine mammals is considered **Low**.

Risk Event: TTS and PTS (Marine Mammals)

Inherent Consequence Evaluation

Empirical estimates indicated that the SEL_{24h} and PK noise effect criteria for TTS or PTS for all marine mammal groups (i.e., low-frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, or otariid seals) was not predicted to be exceeded (Table 6-13). As such, auditory impairments or auditory injuries to marine mammals from impulsive sound from positioning or survey equipment is not evaluated further.

Inherent Likelihood

Not applicable.

Inherent Risk Severity

Not applicable.

Risk Event: Behavioural Changes (Turtles)

Inherent Consequence Evaluation

Empirical estimates indicated that the maximum distance from an equipment sound source to the SPL behavioural noise effect criteria for all marine turtles was <130 m (Table 6-13). As per the discussion above for marine mammals, this distance varied with equipment source (Section 6.5.4.2). This is consistent with the relative risk criteria from Popper *et al* (2014) that suggest that behavioural changes (e.g., avoidance, diving) would only be expected for individuals near the source (high risk of behavioural impacts within tens of metres of source and moderate risk of behavioural impacts within hundreds of metres of the source) (McPherson and Koessler 2021).

The PMST report (for the operational area, identifies that marine turtle species listed as threatened and / or migratory under the EPBC Act have the potential to present, including:

- Loggerhead turtle, leatherback turtle (endangered, migratory)
- Green turtle, hawksbill turtle (vulnerable, migratory).

No BIAs or critical habitat occur within the predicted ensonified area for behavioural changes for marine turtles.

Given the infrequent and short duration (e.g., hours to days) of use of any of the positioning or survey equipment, and the very limited spatial area (e.g., up to ~130 m) of exposure to impulsive sounds above behavioural thresholds, the consequence of this risk event has been evaluated as **Level 2**, as underwater sound may result in localised short-term impacts to species of conservation value not affecting local ecosystem function.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Remote.**

Inherent Risk Severity

The inherent risk severity of impulsive underwater sound causing behavioural changes to turtles is considered **Low.**

Risk Event: TTS and PTS (Turtles)

Inherent Consequence Evaluation

Empirical estimates indicated that the SEL24h noise effect criteria for TTS or PTS for marine turtles was not predicted to be exceeded (Table 6-13), and as such, the risk of auditory impairment or injury to marine turtles from cumulative ≥24-hour exposure is not considered credible and has not been evaluated further.

Empirical estimates indicated that the maximum distance from an equipment sound source to the PK noise effect criteria for TTS or PTS for marine turtles was only within metres of the sound source (Table 6-13).

As described in Section 6.5.4.2, four species listed as threatened and/or migratory under the EPBC Act have the potential to present within the predicted ensonsified area. However, no BIAs or critical habitat occur for marine turtles within the predicted ensonified area.

Given the infrequent and short duration (e.g., hours to days) of use of any of the positioning or survey equipment, and the very limited spatial area (e.g., within metres) of exposure to impulsive sounds above auditory impairment or injury thresholds, the consequence of this risk event has been evaluated as Level 2, as underwater sound may result in localised short-term impacts to species of conservation value not affecting local ecosystem function.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Remote**.

Inherent Risk Severity

The inherent risk severity of impulsive underwater sound causing auditory impairment or injury to turtles is considered **Low**.

Risk Event: Behavioural Changes (Fish, including Eggs and Larvae)

Inherent Consequence Evaluation

Impulsive sound sources have been identified as a high risk of causing behavioural disturbance to fish with no swim bladder, and fish with swim bladder not involved in hearing, within the near (tens of metres) vicinity of a sound, and a moderate risk within the intermediate (hundreds of metres) vicinity of a sound (Table 6-13). For fish with swim bladder involved in hearing, impulsive sound sources have been identified as a high risk within the near (tens of metres) intermediate (hundreds of metres) vicinity of a sound (Table 6-13). Impulsive sound sources have been identified as a moderate risk of causing behavioural disturbance to fish eggs and larvae within the near (tens of metres) vicinity of a sound; this reduces to a low risk beyond this distance.

However, the only survey equipment with energy below 1 kHz is the sub-bottom profiler using a boomer acoustic source, all other equipment which operates at higher frequencies is unable to be heard by most fish, which further reduces the risk of any behavioural change (McPherson and Koessler 2021).

The operational area is within a distribution BIA for the great white shark, though no habitat critical to the survival of the species or behaviour are identified. The Recovery Plan for the White Shark (DSWEPC, 2015) does not identify anthropogenic noise as a threat to the species.

Given the infrequent and short duration (e.g., hours to days) of use of any of the positioning or survey equipment, and the very limited spatial area (e.g., hundreds of metres) of exposure to impulsive sounds above behavioural thresholds, the consequence of this risk event has been evaluated as **Level 2**, as underwater sound may result in localised short-term impacts to species of conservation value not affecting local ecosystem function.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Remote**.

Inherent Risk Severity

The inherent risk severity of impulsive underwater sound causing behavioural changes to fish is considered **Low**.

Risk Event: Masking, TTS, Recoverable Injury, Mortality or Potential Mortal Injury (Fish, including Eggs and Larvae)

Inherent Consequence Evaluation

Based on the relative risk criteria from Popper et al. (2014), there is a low risk of masking for all fish groups, apart from those with a swim bladder involved in hearing, which have a moderate risk at a far (thousands of metres) distances of the sound source (McPherson and Koessler 2021). However, this is only relevant for a sub-bottom profiler using a boomer acoustic source, as all other sources have signals outside the hearing range of most fish in the region (McPherson and Koessler 2021).

Impulsive sounds from survey equipment could result in physiological impacts to fish from the sidescan sonar, but not for the MBES or positioning equipment (McPherson and Koessler 2021).

Empirical estimates indicated that the SEL24h noise effect criteria for TTS, recoverable injury, and mortality or potential mortal injury for fish was only within metres of the sound source (Table 6-13). Note that the SEL_{24h} is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. Specifically for fish, this requires them to remain within metres of the sidescan sonar for at least a 24-hour period before auditory impairments or injuries may occur. Given that fish (if present) are expected to be transitory through the area, the risk of auditory impairments or injuries from an accumulated 24-hour exposure is not considered credible and has not been evaluated further.

Empirical estimates indicated that the PK noise effect criteria for recoverable injury, and mortality or potential mortal injury for fish was only within metres of the sound source (Table 6-13).

Given the infrequent and short duration (e.g., hours to days) of use of any of the positioning or survey equipment, and the very limited spatial area (e.g., metres) of exposure to impulsive sounds above auditory impairments or injury thresholds, the consequence of this risk event has been evaluated as **Level 2**, as underwater sound may result in localised short-term impacts to species of conservation value not affecting local ecosystem function.

Inherent Likelihood

The inherent likelihood of this consequence occurring is considered **Remote**.

Inherent Risk Severity

The inherent risk severity of impulsive underwater sound causing auditory impairment or injury to fish is considered **Low**.

6.5.5. Control Measures ALARP and Acceptability Assessment

Table 6-16 provides a summary of the control measures and ALARP and Acceptability Assessment relevant to continuous sound emissions. A detailed assessment has been undertaken and, as part of Cooper Energy's stakeholder engagement for previous projects and impacts, Cooper Energy has sought advice from Australian Antarctic Division (AAD) on measures implemented or considered by the AAD for voyages into sensitive areas. Suggestions from the AAD are noted in Table 6-16.

Table 6-16: Underwater Sound Emissions ALARP, Control Measures and Acceptability Assessment

Underwater Sound Emissions	
ALARP decision context and justification	**ALARP Decision Context: Type A** Impacts from sound emissions are relatively well understood, however there is the potential for uncertainty in relation to the level of impact. Activities are well practised, and there are no conflicts with company values, no partner interests, and no significant media interests.

	Because the potential impacts to marine fauna of conservation value are evaluated as Level 2, Cooper Energy believes ALARP Decision Context A should apply. **ALARP Decision Context: Type B** ALARP decision context B has been applied in relation to blue whales and southern right whales because there is a residual (low) risk in relation to behavioural disturbance to this species within a BIA. The conservation management plans for these species considers indicate that at certain times of year and for certain activities, additional mitigation actions and an adaptive management plan may be required in keeping with a precautionary approach. Further controls to manage residual risks have been considered and several additional controls have been adopted. The adopted controls ensure the project environmental outcomes can be met and are not inconsistent with the objectives and relevant actions of species recovery plans.
Control Measures	**Sources of Good Practice Control Measures**
C11: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans describes strategies to ensure whales and dolphins are not harmed during offshore interactions with vessels. Vessels adhere to the distances and vessel management practices of EPBC Regulations (Part 8) and Wildlife (Marine Mammals) Regulations 2009 with increased caution zone of 500 m between whales and project vessels. *Risk event addressed: Behavioural changes*
C7: Planned Maintenance System	Power generation and propulsion systems on the CSV and other vessels will be operated in accordance with manufacturer's instructions and ongoing maintenance to ensure efficient operation. *Risk event addressed: Behavioural changes*
Additional Controls Adopted	
C22: Campaign Risk Review	Risk reviews are standard practice for offshore campaigns. The Cooper Energy Environmental Protocol (CMS-EN-PRO-0001) describes how environmental impact and risk management, including risk assessments, is undertaken for activities including offshore campaigns. As part of pre-campaign planning a risk review will be undertaken to re-assess campaign environmental impacts and risks to ensure ALARP and acceptability criteria are met. The assessment of environmental impacts and risks will focus on aspect: subsea noise, and risks to endangered whale species, specifically pygmy blue whales, and southern right whales. The review will seek to identify an environmental window where risks to endangered whales (from subsea noise) are avoided, where practicable, and in any case, ensure that risks are continually reduced to levels that are ALARP and acceptable. The review framework is described in Section 9.10 and considers: - Facility drivers - Campaign drivers - Seasonal environmental sensitivities - Campaign risk events (subsea noise) - Campaign Risk controls *Risk event addressed: Behavioural changes.*
C23: Blue whale CMP Action A.2.3 (DAWE 2015) and Adaptive Management	The impact and risk assessment has shown the potential for interaction between whales and the activity, with some uncertainty around the likelihood if impacts. This uncertainty is addressed through the implementation adaptive management measures.

<table>
<tr><td></td><td>Action A.2.3 (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) will be implemented in accordance with DAWE guidance on key terms (2021), where the action is needed to achieve the objective of the blue whale CMP (EPO6). This will involve:
• Application of precautionary criteria (thresholds) to establish parameters for impact and risk assessment.
• Adaptive Management measures will be implemented for vessels on DP operating the defined BW season to reduce the risk of BW displacement occurring during operations (DAWE 2021). See Section 9 for
Risk event addressed: Behavioural changes</td></tr>
<tr><td>C24: Southern Right Whale CMP and Adaptive Management</td><td>The impact and risk assessment has shown the potential for interaction between whales and the activity, with some uncertainty around the likelihood if impacts. This uncertainty is addressed through the implementation adaptive management measures.
Following review of the species recovery plan, Cooper Energy considers that at certain times of year and for certain activities, additional mitigation actions and an adaptive management plan may be required in keeping with a precautionary approach. This will involve:
• Application of precautionary criteria (thresholds) to establish parameters for impact and risk assessment .
• Adaptive Management measures will be implemented for vessels on DP operating in the defined SRW season to reduce the risk of SRW displacement occurring during operations.</td></tr>
<tr><td colspan="2">Impact and Risk Summary</td></tr>
<tr><td>Residual Impact Consequence</td><td>Level 1 – Minor local impacts or disturbances to flora/fauna, nil to negligible remedial / recovery works on land/water systems</td></tr>
<tr><td>Residual Risk Consequence</td><td>Level 2 – Localised short-term impacts to species or habitats of recognised conservation value not affecting local ecosystem function; remedial, recovery work to land, or water systems over days / weeks</td></tr>
<tr><td>Residual Risk Likelihood</td><td>Due to the proposed controls, the behavioural changes from continuous sound: Unlikely (D) - Conceivable and could occur at some time. Could occur during the activity although a rare combination of factors would be required for the occurrence.</td></tr>
<tr><td>Residual Risk Severity</td><td>Auditory impairment or auditory injury from continuous sound: Low (E)</td></tr>
<tr><td colspan="2">Demonstration of Acceptability</td></tr>
<tr><td>Principles of ESD</td><td>Underwater sound emissions are evaluated as having Level 2 consequence which is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.</td></tr>
<tr><td>Legislative and Conventions</td><td>Noise emissions will be managed in accordance with legislative requirements.
Noise emissions will:
• Not impact on the recovery of marine turtles as per the Recovery Plan for Marine Turtles in Australia (CoA, 2017).
• Be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area in accordance with DAWE guidance on key terms (2021), where the action is needed to achieve the objective of the blue whale CMP (CoA, 2017).
• Not impact the recovery of the blue whale as per the CMP for the Blue Whale (CoA 2017).
• Not impact southern right whale established or emerging aggregation BIAs or the migration and resting on migration BIA (CoA 2015b).
• Not impact the recovery of the southern right whale as per the CMP for the Southern Right Whale (DSEWPaC, 2012).</td></tr>
</table>

	• Not impact the recovery of the white shark as per the Recovery Plan for the White Shark (DSEWPaC, 2013a). Actions from the CMP for the Blue Whale (CoA 2017) applicable to the activity in relation to assessing and addressing anthropogenic noise have been addressed as per: • Assessing the effect of anthropogenic noise on blue whale behaviour. Section 0 assesses the effects of anthropogenic noise from the activity on blue whale behaviour. • Be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area. Mitigation measures will be implemented to reduce the risk of displacement occurring during operations where modelling indicates that behavioural disturbance within a Foraging Area may occur (DAWE, 2021).
Internal context	Relevant management system processes adopted to implement and manage hazards to ALARP include: • Risk Management (MS03) • Health Safety and Environment Management (MS09) • Supply Chain and Procurement Management (MS11) Activities will be undertaken in accordance with the Implementation Strategy (Section 9).
External context	Activity will be undertaken in a manner consistent with relevant legislation, industry standards and guidelines, offshore practices and benchmarking. The activity is not predicted to result in impacts to species that would be inconsistent with recovery plans or conservation advices.
Other requirements	No stakeholder objections or claims have been received regarding underwater sound emissions. Cooper Energy has previously sought advice from the AAD in relation to the management of impacts from noise. The consultation outcomes are presented within the BMG Closure Project Phase I EP (NOPSEMA ID: 6825) and are not repeated here. Suggestions provided by the AAD have been re-evaluated within the ALARP assessment process below in the context of the Otway activities.
Acceptability outcome	Acceptable

Table 6-17: Underwater sound emissions extended ALARP Assessment for possible blue whale foraging period

Additional Control Measures Considered	Related Risk Event	Benefit	Recognised Good Practice?	Sacrifice	Introduced Risks	Conclusion (Implement / Reject)
Eliminate Activity	PTS, TTS and behavioural disturbance of whales from vessel noise. Rated as L2 consequence and Low risk in relation to these project activities.	By not undertaking the activity, sound sources would be eliminated.		N/A	N/A	Reject Rationale: Option not feasible. The activity is existing.
Eliminate use of DP vessels during defined periods when blue whales or southern right whales are more likely to occur	As above	By avoiding periods when blue whales and southern right whales are more likely to occur, impacts to species of conservation significance during biologically important behaviours can be eliminated (for the species of concern).	There are examples of this type of control being applied in well defined, discrete areas, for example, the exclusion of vessels from Logans Beach, Warrnambool (June-Oct) which is an established nursery for southern right whales in the south east. This type of control is not typical of entire BIA's such as blue whale foraging areas, which encompass the entire south east coastline. No offshore industry in the region limits vessel activity to being outside either pygmy blue whale or southern right whale	Eliminating the use of DP vessels during blue whale and southern right whale seasons would preclude vessel operations entirely. Limits schedule flexibility so as to make it impossible (or impracticable) to operate.	This has the same or near same effect as eliminating the activity, at least the offshore campaign component of the activity. This introduces significant risks, whereby vessel use would be so restricted in their operational window so as to make operating impracticable and would not be compatible with the safe and efficient operation of the facility.	Reject Rationale: Option not feasible. The activity is existing. In this region, southern right whales occur over winter; blue whales occur over summer. There is no environmental window which avoids both species.

			season within the broader species BIA's. It would be impossible for multiple existing industries to operate offshore south east Australia if seasons were avoided.			
Anchoring of vessels to hold position rather than use DP	As above	By anchoring vessels, sound emissions related to vessel DP would be reduced. The risks remain low.	This is not feasible as the ISV, MODU and support vessels are required to move during the activities (i.e., not operate from a static position). Additionally, vessels must be able to react to an errant vessel, person overboard or other safety issue.	Not considered feasible.	N/A	Reject. Rationale: Option not feasible.
Limit power to thrusters of DP vessels to reduce underwater sound contours	As above	Limiting thruster power may reduce the underwater sound contours though would not eliminate them. Risks expected to remain low.	Thruster power is determined by safety limits and operational requirements. Thruster levels are optimised to operating modes and conditions. It is not safe to adjust thruster power outside of operationally defined ranges, and therefore the control is not selected.	Not considered feasible.	N/A	Reject. Rationale: Option not feasible.

DP vessel underwater sound reduction in design (DNV Silent notation)	As above	Vessel design can reduce underwater sound.	Stakeholder feedback: AAD advised their new state of the art survey/ice breaker vessel *Nuyina* which will operate in the Antarctic has been designed to reduce underwater sound and vibration. The vessel has been assigned DNV Silent R notation equivalence at 8 kn electric propulsion for science acoustic work. Currently not typical for industry. A review of industry vessels operating inside and outside of Australian waters has not identified any vessels assigned the DNV Silent notation.	Given the current absence of industry vessels with silent notation, this measure is not considered to be feasible for the project.	N/A	Reject. Rationale: Option not feasible.
Implement safe shut-down points	As above	Shutting down vessel DP could reduce impacts from subsea underwater sound. Shutting down vessel DP is possible where activities can be first made safe. This action would not be immediate but should reduce the	Not typically applied to DP vessels. Typically applied to activities that generate impulsive underwater sound such as piling and seismic survey. During consultation, AAD noted use of shutdown zones for	Cost associated with shutting down DP, requiring suspension of program. Potential cost >$100K.	Retrieval of subsea equipment (e.g., ROV) required prior to DP shutdown. Increased frequency of handling through the splash zone and on deck increases personnel H/S risk exposure. This is considered manageable	Implement Rationale: reduces risk of displacement. Costs are not grossly disproportionate to the risk reduction achieved in relation to temporary operational subsea noise.

		risk of displacement if whales are foraging in the vicinity. Risks would remain low.	explosive use (during wharf construction) in Antarctica.		through existing systems for control of work. Good reliability at project operational level.	
Deploy bubble curtains around MODU and / or vessels.	As above	Increased confidence no foraging blue whales in the vicinity which could be injured or displaced. Risks would remain Low.	Bubble curtains were raised as an idea during project ALARP workshops and also by the AAD during stakeholder consultation. No known examples of bubble curtains being used as mitigation for DP vessels.	Not considered feasible	Discussions with technology providers indicates the deployment of bubble curtains offshore in environments like the Otway presents a number of challenges, including: Providing oil-free air to the seabed would require a large quantity of large diesel-run air compressors. At least one additional dedicated DP support vessel would likely be required for these compressors. Currents – Bubble curtains are drastically impacted by currents. Current speeds and directional shifts with wind and tide, which in the dynamic environment of the Otway would result in bubble curtains being distorted and ineffective by the time bubbles rise	Reject Rationale: Option not feasible.

					from the seabed to surface. Alternate options such as the deployment of hoses on close to vessel thruster locations or offset on buoys present SIMOPS and safety risks including congestion of the vessel and MODU safety zone and potential interference with/from thrusters. As a result, the use of bubble curtains is not considered effective, feasible or practicable.	
Dedicated daily aerial surveys during activities	As above	Increased confidence no foraging blue whales in the vicinity which could be injured or displaced. Risks would remain Low.	Aerial survey typically applied to activities that generate impulsive noise such as seismic survey.	Daily aerial surveys could introduce significant costs to new stage activities, and potential double the cost of IMR activities.	HSE risks associated with aerial survey (can be managed via existing control of work processes). Moderate reliability at the project operational level.	Reject
Opportunistic monitoring from project vessels and helicopters	As above	Increased confidence no foraging blue whales in the vicinity which could be injured or displaced. Risks would remain Low.	Yes. Opportunistic monitoring is typically integrated into offshore industry operations including from vessels and helicopters (where used for crew changes).	Costs associated with inducting crew accounted for in planning.	No introduced risks. Good reliability at the project operational level.	Implement Rationale: supports reducing risk of displacement. Costs are not grossly disproportionate to the risk reduction achieved in relation to temporary operational subsea

						underwater sound emissions. Integrated into C36 and C37.
Dedicated MMO to undertake pre-activity and PTS / TTS zone observations for all vessel activities associated with the new stage of the activity, and IMR activities that are undertaken during identified pygmy blue whale and southern right whale seasons.	As above	Increased confidence no foraging blue whales in the vicinity which could be injured or displaced. Higher confidence in identifying whales and whale behaviour compared to opportunistic monitoring alone. Risks would remain Low.	Yes. Though not typically applied in industry in this region for vessel activities there are examples of this control being applied to vessel activities elsewhere in known foraging areas / where important behaviours are known to occur. AAD advised in relation to rock blasting activities (wharf construction) in the Antarctic, dedicated MMO's were used.	Additional cost of MMO mob/demob and time offshore accounted for in planning.	No introduced risks. Good reliability at the project operational level.	Implement Rationale: supports reducing risk of displacement. Costs are not grossly disproportionate to the risk reduction achieved in relation to temporary operational subsea underwater sound emissions. Integrated into C36 and C37.
Drone surveillance from vessel	As above	May provide slight increase in visibility beyond nominal MMO viewing platform height for the duration of drone flight. This could provide slight increased confidence no foraging blue whales in the vicinity which could be injured or displaced. Risks would remain Low.	Not for this activity type. Some examples of drone use nearshore and offshore particularly for scientific study, though weather sensitive, and not for sustained periods.	Additional cost of drone hire/purchase and pilot for the duration of the campaign estimated circa $60K.	Dropped object risks. Risks of loss of equipment. Not considered reliable at the operational level for this activity.	Reject Rationale: The measure is not typical practice for this type of activity and does not result in a discernible reduction in risk, whilst adding cost and additional operational HSEC risks. The costs/risks are grossly disproportionate to the risk reduction achieved in relation to temporary operational

						subsea underwater sound emissions.
Monitor oceanographic precursors (early warning system)	As above	There are oceanographic and biological precursors such as SST, eddies and primary production which may provide an indication of increased secondary production (including krill), which may then be conducive to successful foraging (e.g. Murphy *et al*. 2017). The benefit of this early warning system is dependent on reliability of these precursors as indicators of blue whale foraging; currently, reliability is likely to be low, which could lead to many false positives. Risks would remain Low.	Not typically applied in offshore industries. Primary productivity measurements are not an accurate pre-cursor to feeding activity. There can be a significant lag between peaks in Chl-A levels and peaks in krill presence. Other factors determine presence of foraging marine mammals aside from prey levels.	Administrative costs of monitoring and interpreting environmental precursors estimated circa $50K.	Reliability is likely to be low, which could lead to many false positives with significant cost and schedule impact to the project.	Reject rationale: The measure is not typical practice for this type of activity and does not result in a discernible reduction in risk. The option adds cost and there is limited confidence in operational reliability for this application. The costs are grossly disproportionate to the risk reduction achieved in relation to temporary operational subsea underwater sound emissions.
Satellite imagery	As above	Satellite imagery can be used to gather oceanographic and biological information to support the understanding of presence of marine mammals in the area.	Not typically applied in offshore industries. Sourcing and interrogating satellite imagery is possible, however at the operational level is not considered reliable.	Administrative costs of monitoring and interpreting satellite images.	Reliability is likely to be low with limited additional benefit relative to accepted controls.	Reject Rationale: The measure is not typical practice for this type of activity and does not result in a discernible reduction in risk. The option adds cost and there is limited confidence in

		Risks would remain Low.				operational reliability for this application. The costs are grossly disproportionate to the risk reduction achieved in relation to temporary operational subsea underwater sound emissions.
Infra-red systems	As above	Infra-red (IR) systems could enhance the ability of MMOs to visually detect the presence of foraging whales. Risks would remain Low.	Infra-red systems are not available as a real-time monitoring tool for operations and have the following limitations: Poor performance of the system in sea states greater than Beaufort Sea State 4 (due to the inability to adequately stabilise the camera) (Verfuss *et al*. 2018; Smith *et al*. 2020). Conditions such as fog, drizzle, rain limit detections to be made using IR (Verfuss *et al*. 2018). Detection range for large baleen whales is 1 to 3 km.	Additional cost of IR tech hire/purchase and operators for the duration of the campaign estimated circa $100K.	Reliability is likely to be low with limited additional benefit relative to accepted controls.	Reject Rationale: The measure is not typical practice for this type of activity and does not result in a discernible reduction in risk. The option adds cost and there is limited confidence in operational reliability for this application. The costs are grossly disproportionate to the risk reduction achieved in relation to temporary operational subsea underwater sound emissions.
Passive Acoustic Monitoring (PAM)	As above	PAM can be used to detect marine mammal calls, and support	Not typical for offshore vessel activities. Likely to be some interference from vessel noise at	Additional cost of PAM tech hire / purchase and operators for the duration of the	Reliability considered lower than direct observations, with limited additional benefit	Reject Rationale: The measure is not typical practice for this type of activity and

		sightings made by MMO. Feedback from AAD indicated PAM was utilised during rock blasting activities in the Antarctic to verify subsea noise levels; if noise levels were higher than anticipated then explosive charges could be reduced.	close range. Not safe to adjust vessel DP thrust on the basis of subsea noise profiles; operational safety considerations take precedence.	campaign estimated circa $100K.	relative to accepted controls.	does not result in a discernible reduction in risk. The option adds cost and there is limited confidence in operational reliability for this application. The costs are grossly disproportionate to the risk reduction achieved in relation to temporary operational subsea underwater sound emissions.

6.6. Introduction, Establishment and Spread of IMS

6.6.1. Cause of Aspect

Unplanned introduction of invasive marine species (IMS) may occur as a result of the following activities:

- Vessel operations
- MODU operations

IMS are marine plants or animals that have been introduced into a region beyond their natural range and can survive, reproduce and establish founder populations. Species of concern are those that are not native, are likely to survive and establish in the region, and are able to spread by human mediated or natural means. Factors that dictate their survival and invasive capabilities depends on environmental factors such as water temperature, depth, salinity, nutrient levels, habitat type and competition.

IMS have historically been translocated and introduced around Australia by a variety of natural and anthropogenic means. In relation to the facilities and activities, the introduction, establishment and spread of IMS could occur as / within a number of different pathways and risk events (Table 6-18).

Table 6-18: IMS Risk: Pathways for potential introduction, establishment and spread of IMS

Risk event	Pathway to introduction	Means of establishment	Mechanisms of spreading
IMS is transferred into the field, becomes established and spreads	IMS within biofouling on MODU or vessels dislodged to the seabed IMS within biofouling on equipment that is routinely submerged in water, and which is dislodged to the seabed	Suitable habitat and conditions available for IMS in field.	Once established may spread by itself if conditions are suitable. In field equipment may provide connectivity allowing spread across infrastructure. Other anthropogenic influence (e.g. fishing) could spread established IMS within and outside of the field.
IMS is transferred between vessels, establishes on vessels and is spread to other areas (e.g. ports)	Discharge of ballast water containing IMS. Cross contamination of IMS between vessels and the MODU	Suitable habitat and conditions available for IMS on vessels and within ballast and seawater systems.	IMS spreads between ports and other facilities via vessels acting as a vector.
IMS is transferred out of the field, becomes established at locations inside or outside the region and spreads.	Already established populations of IMS within the offshore field via natural or anthropogenic influences are recovered with equipment and dislodged whilst being transferred to shore.	Suitable habitat and conditions available for IMS at shoreside facilities.	Once established may spread by itself if conditions are suitable. May become established on structures at ports, and from there spread to vessels which then become a vector for the spread of IMS.

6.6.2. Aspect Characterisation

6.6.2.1. IMS associated with MODU, vessels and project equipment

Since the DAFF (and predecessors) introduction of mandatory ballast water regulations, where ballast water must be exchanged outside territorial sea (12 Nm off the Australian coast, including islands), risk of IMS from international shipping has been greatly reduced. Therefore, the risk of IMS introduction into territorial waters from international shipping should be negligible to low. Domestic ships that discharge or exchange water at any Australian port has variable risk ratings depending on where the ballast water was last acquired.

DAWR (2017) suggest that biofouling has been responsible for more foreign marine introductions than ballast water and provides guidelines as to the management of IMS from biofouling (Marine Pest Sectoral committee 2009). For the activities, the MODU, vessels and equipment may be sourced internationally and domestically. During the activity, vessels will transit between the MODU and domestic ports. Each vessel has the potential to host IMS. There will be periods where the MODU and vessels work in close proximity, where there may be potential for IMS to translocate from one vessel to another, for example, through ballast exchange, or dislodged biofouling, if vessels are not managed appropriately.

6.6.2.2. IMS already established in the region

A variety of IMS has established within ports around Australia. Even within the same region, different ports typically host a different mix of established IMS (https://www.marinepests.gov.au/pests/map, Australian Government 2019; Parks Victoria 2019). Ports are often suitable for establishment of IMS because they are regularly exposed to IMS from many different vessels that may lay-up for long periods of time. Ports also typically have shallow areas and hard structures which provide suitable substrate for establishment. IMS can be translocated from a port in either vessel ballast or as biofouling.

Table compares known IMS across domestic locations relevant to the operational and layup history of the Ocean Monarch and support vessels whilst in Australian waters. Whilst the number of IMS potentially occurring within Australian waters is extensive, the list below is compiled from the known IMS listings on the Australian Government Marine Pest website, IMS listed as of most concern on the Victorian Parks website (Australian Government 2019; Parks Victoria 2019) and advice from State Government Biosecurity dept.

Table 6-19: Comparison of known IMS in key Domestic Ports servicing offshore operations

Location	Dampier and Port Headland (WA)	Fremantle (WA)	Portland Vic (Otway)	Melbourne Vic (Gippsland)
Climatic Region	Subtropical	Temperate	Temperate	Temperate
Species Present (green)				
Asian Shore Crab				
Asian Date or Bag Mussel				
European Fan Worm				
European Green Shore Crab				
New Zealand Screw Shell				
Northern Pacific Sea Star				
Colonial Sea Squirt				

Advice from the Victorian Government DJPR indicated NZ Screw Shell and Pacific Oyster are also established in the Gippsland Region (Pers comms DJPR 2019).

Prior to and during operations, the Cooper Energy IMS Risk Management Protocol will be implemented for all vessels, MODU and submersible equipment, and will consider all regions visited by the facilities (international and domestic). Further information on the IMS Risk Management Protocol is provided within Section 9.9.

6.6.3. Predicted Environmental Impact (Consequence)

The potential impacts and risk events associated with of IMS introduction (assuming their survival, colonisation and spread) include:

- Displacement or reduction in native marine species diversity and abundance causing
- Changes to conservation values of protected areas.
- Displacement of native marine species

- Socio-economic impacts on commercial fisheries
- Changes to conservation values of protected areas.

6.6.4.Impact and Risk Evaluations

6.6.4.1. Risk Event: Displacement or reduction in native marine species diversity and abundance causing changes to conservation values of protected areas

Inherent Consequence Evaluation

The introduction of an IMS can have a range of impacts on the receiving environment and can potentially alter the ecosystem dynamics of an area. Due to the complexity of ecosystems and level of interactions between and amongst biotic and abiotic receptors; there is no sure way to predict how an individual species may interact with a foreign environment.

Once an IMS is established, its level of invasiveness and ecosystem damage is determined by a range of factors detailed above. IMS have the potential to change ecosystem dynamics by competing for natural resources, reducing the availability of natural resources, predation, change natural cycling processes, segregation of habitat, spread of viruses, change in water quality, producing toxic chemicals, disturb, injure or kill vital ecosystem organisms (ecosystem engineers and keystone species), change surrounding ecosystems, change conservation values of protected areas and create new habitats.

IMS have proven economically damaging to areas where they have been introduced and established, particularly as IMS are difficult to eradicate from areas once established (Hewitt, *et al*. 2002). If the introduction is captured early, eradication may be effective but is likely to be expensive, disruptive and, depending on the method of eradication, harmful to other local marine life. It has been found that highly disturbed nearshore environments (such as marinas) are more susceptible to colonisation than open-water environments, where the number of dilutions and the degree of dispersal are high (Paulay, *et al*. 2002).

Predicted impacts from IMS if introduced to the operational area could affect marine fauna and benthic habitats that may utilise the operational area and protected marine areas present in the wider region. However, the operational area benthic habitat is typical of the broader area at this water depth, and it does not intersect Australian Marine Parks.

If IMS were transferred between the MODU and support vessels, or vice-versa whilst working within the operational area and IMS is spread, there is the potential for local impacts to receptors where IMS has become established, including benthic communities, listed marine fish species, coastal and offshore industry. These potential impacts extend beyond the operational area drive a consequence Level 4.

Inherent Likelihood

Any IMS introduced to the operational area would be expected to remain fragmented and isolated, and only within the vicinity of the infrastructure (i.e., it would not be able to propagate to nearshore environments. The chances of successful colonisation inside the operational area are considered small given:

- The nature of the benthic habitats near the operational area where seabed contact is made (i.e., predominantly bare silt and sands with patchy occurrences of hard substrate, and outside of coastal waters where the risk of IMS establishment is considered greatest (BRS 2007).
- BRS (2007) estimated the probability of an IMS incursion as 2% chance at 24 nm, which was also based on a 50 m depth contour. The operational area is approximately from the nearshore to offshore, beyond 50m. Work at the wells occurs in water depths of 60-70 m, decreasing the probability of incursion for the activities involving larger vessels and MODU.
- The subsea infrastructure is relatively isolated from surface infrastructure which might be suitable for colonisation and is distant from major ports.

The likelihood of IMS becoming established within the operational area as a result of the activities is considered Remote (E).

The transfer of IMS between vessels, including the MODU, within the operational area, and which may then become established elsewhere is also considered here. A number of factors reduce the chance of IMS translocating between vessel/MODU:

- Support vessels will come alongside the MODU where required; time alongside is relatively short, and managed via DP; there is typically no or minimal contact between support vessels and the MODU

- The offshore environment within the Otway region is highly dispersive, and vessels will be frequently moving; these conditions are not typically conducive to the establishment of marine organisms onto a new surface
- There are a number of international and national management measures which already manage the potential introduction of IMS.

The likelihood of the transfer of IMS between vessels within the operational area, and which may then become established elsewhere, as a result of the activities is considered **Remote (E**).

Inherent Risk Severity

The inherent risk severity of IMS causing displacement or reduction in native marine species diversity and abundance is considered **Moderate**.

6.6.4.2 Risk: Socio-economic impacts on commercial fisheries

Inherent Consequence Evaluation

IMS have proven economically damaging to areas where they have been introduced and established, particularly as IMS are difficult to eradicate from areas once established (Hewitt, *et al*. 2002). If the introduction is captured early, eradication may be effective but is likely to be expensive, disruptive and, depending on the method of eradication, harmful to other local marine life. It has been found that highly disturbed nearshore environments (such as marinas) are more susceptible to colonisation than open-water environments, where the number of dilutions and the degree of dispersal are high (Paulay, *et al*. 2002).

IMS can have a primary and/or secondary impact on socio economic receptors. Primary impacts include direct damage to vessels, equipment and infrastructure which may then cause flow on affects and lead to a reduction in efficiency, productivity and profit. The presence of fouling organisms within a marine environment is likely to have the same or similar impacts to socio-economic receptors.

Secondarily, ecological impacts associated with IMS introduction may have an impact to socio-economic receptors through reduction in ecological values. Marine pest species can deplete fishing grounds and aquaculture stock, with between 10% and 40% of Australia's fishing industry being potentially vulnerable to marine pest incursion. For example, the introduction of the Northern Pacific Seastar (*Asterias amurensis*) in Victorian and Tasmanian waters was linked to a decline in scallop fisheries (Dommisse and Hough 2004).

Predicted impacts from IMS if introduced to the operational area could affect marine fauna, benthic habitats, and commercial fisheries that may utilise the operational area and protected marine areas present in the wider region. As described in Section 4.4.2, eleven managed fisheries were identified, of which three have recorded fishing efforts. Habitats for these resources exist across the area, any colonisation of IMS in the area around the Otway offshore facilities are unlikely to represent a limited resource for native species.

If IMS were transferred between the MODU and support vessels, or vice-versa whilst working within the operational area, IMS could be translocated and introduced to other local areas beyond the operational area; ports and other offshore industry could potentially be exposed through both ballast and biofouling. If an IMS is spread, there is the potential for local impacts to receptors where IMS has become established, including benthic communities, listed marine fish species, coastal and offshore industry. These potential impacts beyond the operational area drive a consequence **Level 4**.

Inherent Likelihood

The likelihood of IMS becoming established within the operational area as a result of the activities is considered **Remote (E)**.

Inherent Risk Severity

The inherent risk severity of IMS causing impacts to socio-economic receptors is considered **Moderate**.

6.6.5.Control Measures, ALARP and Acceptability Assessment

Table 6-20 provides a summary of the control measures and ALARP and Acceptability Assessment relevant to introduction, establishment and spread of IMS.

Table 6-20: Introduction, Establishment and Spread of IMS Control Measures, ALARP and Acceptability Assessment

Invasive Marine Species	
ALARP decision context and justification	**ALARP Decision Context: Type B** The introduction, establishment and spread of IMS has been assigned a Level 4 consequence; the likelihood of this consequence occurring is considered Remote. The causes resulting in an introduction of IMS from a planned release of ballast water or vessel, or equipment biofouling are well understood and effectively managed by international and national requirements and industry guidance. Cooper Energy and their offshore service partners are experienced in industry requirements and their operational implementation through their existing ongoing operations. No objections or concerns were raised during stakeholder consultation regarding this activity or its potential impacts and risks. Based on a Moderate risk severity, Cooper Energy believes ALARP Decision Context B should apply.
Control Measures	**Sources of Good Practice Control Measures**
C25: Cooper Energy IMS Risk Management Protocol (CMS-EN-PCD-0002)	The National biofouling management guidelines for the petroleum production and exploration industry (DAFF 2009) recommend a biofouling risk assessment is undertaken for vessels and MODUs and, where necessary, conducting in water inspection, cleaning and antifouling renewal. These guidelines should also be read in conjunction with the Anti-fouling and In-water Cleaning Guidelines (DoA 2015). In line with these recommendations Cooper Energy uses an IMS Risk Assessment to evaluate IMS risks. Prior to and during operations the Cooper Energy IMS Risk Management Protocol will be implemented for all vessels, MODU and submersible equipment, and will consider all regions visited by the facilities (international and domestic). The Cooper Energy IMS Risk Management Protocol has been prepared to align with: • Advice from the Victorian Government Marine Biosecurity Section. • National biofouling management guidelines for the petroleum production and exploration industry (DAFF 2009) • Australia Biofouling Management Requirements (DAWE 2022) • Guidelines for the control and management of a ships' biofouling to minimise the transfer of invasive aquatic species (IMO Biofouling Guidelines; IMO 2011). • Reducing marine pest biosecurity risks through good practice management Information paper (NOPSEMA 2020) Further information on the Cooper Energy IMS Risk Management Protocol is provided within Section 9.9.

Control Measures Considered	**Related Risk Event**	**Benefit**	**Recognised Good Practice?**	**Sacrifice**	**Introduced Risks**	**Conclusion**
Utilise local vessels only	Introduction of IMS	Through utilising local vessels, the risk of introducing an IMS from an outside source is prevented.	No. There is a standard suite of management measures to manage this risk (as detailed in Coopers IMS Risk Management	Through specifying local vessels only, this drastically restricts the types of vessels that can be used which would result in potentially both schedule and	None.	Reject. Rationale: the project cost (operational and schedule constraints) this would implement is too high. Further to this, if no local vessels are

			Protocol) – the use of local vessels is not one of these.	financial costs. Some activities would be impossible.		identified as being suitable to complete this activity in the future, then further assessment would be required. Given this management measure removes all operational flexibility, the costs are grossly disproportionate to the level of risk reduction achieved.

Impact and risk summary	
Residual Impact Consequence	NA
Residual Risk Consequence	Level 4: Extensive medium to long-term impact on highly valued ecosystems, species populations or habitats.
Residual Risk Likelihood	Remote: A combination of factors would be required for an occurrence. Not expected to occur during the activity. Occur in exceptional circumstances.
Residual Risk Severity	Moderate
Demonstration of Acceptability	
Principles of ESD	Introduction, establishment and spread of IMS is evaluated as having Level 4 consequence which has the potential to result in serious or irreversible environmental damage. With the established processes in place, there is little residual uncertainty associated with this aspect as the activities are well known, the cause pathways are well known, and activities are well regulated and managed. It is not considered that there is significant scientific uncertainty associated with this aspect. Therefore, the precautionary principle has not been applied beyond the precautionary measures already integrated into the IMS protocol.
Legislative and Conventions	The control measures proposed to manage this risk are meet the following requirements: • Biosecurity Act 2015 (Cwth) - Chapter 5, Part 3 (Management of discharge of ballast water) & Chapter 4 (Managing biosecurity risks) • International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004 (the BWMC) • Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 • AMSA Marine Order 98: Marine Pollution Prevention - Anti-fouling Systems. • Environment Protection Act 1970 (Vic) • Environment Protection (Ships Ballast Water) Regulations 2006 • Australian Ballast Water Management Requirements (DAFF 2020) • Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (IMO 2011)

	• National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (CoA 2009) • Australia Biofouling Management Requirements (DAWE 2022)
Internal context	The environmental controls proposed reflects Cooper Energy's HSEC Policy commitment to take all reasonably practicable steps to protect the health and safety of workers, contractors, partners, and communities, and ensuring its business is conducted in an environmentally responsible manner. Relevant management system processes adopted to implement and manage hazards to ALARP include: • MS03 – Risk Management • MS09 - Health, Safety and Environment Management • MS11 – Supply Chain and Procurement Management
External context	No stakeholder objections or claims have been received regarding IMS.
Acceptability outcome	Acceptable

6.7. Accidental Hydrocarbon Release

Accidental hydrocarbon releases to the environment could include both gas and liquid hydrocarbons.

This section addresses the higher order (most severe or worst-case) spill scenarios. Worst-Case Discharge modelling developed for the Annie-1 well (drilled in 2019), which accesses the same reservoir as Annie-2, has been considered an appropriate analogue to apply for the activity considering existing and future wells, flow characteristics, reservoir and hydrocarbon properties (Section 3.5). The Annie-2 well location is planned within ~500m of Annie-1 site.

Minor LOC scenarios and LOC from subsea infrastructure are assessed in Table 6-3.

6.7.1. Cause of Aspect

Activities associated with the Otway Offshore Operations have the potential to result in an accidental release of hydrocarbons to the marine environment. Guidance on the identification of worst-case credible spill scenarios is given in AMSA's Technical guidelines for preparing contingency plans for Marine and Coastal Facilities (AMSA, 2015) and Technical Report on Calculation of Worst-Case Discharge (SPE, 2016). A range of credible accidental release scenarios up to and including worst case scenario of LOWC, are described in Table 6-21.

Table 6-21: Accidental Hydrocarbon Release Types, Causes and Estimated Volumes

Accidental Hydrocarbon Release	Cause of Aspect	Fluid Type and Volume	Release location	Source control response
Accidental release scenarios from infrastructure				
Subsea leak from SST	Potential failure scenarios during production (WWC, 2021): - Defective material/bolting - Corrosion - Valve failure - External impact In each scenario, multiple valves / barrier would have to fail for a leak to eventuate. WWC (2021) consider these scenarios unlikely and note that subsurface safety valve (SSSV) failure would have to accompany the tree damage in these scenarios to result in an uncontrolled release of hydrocarbons. Regular testing of the SSSV during operations would reveal mechanical issues that would cause the SSSV functionality to falter. Refer Table 6-3.	Gas / condensate mix. Low leak rate via tortuous leak path through subsurface and surface equipment. Nominal rate approx. 100 L/day	Casino-4 Casino-5 Henry-2 Netherby-1 Annie-2 Juliet-1	Initial response by gas plant personnel scaling up through IMT
Pipeline rupture	Pipeline rupture (external impact) release over several minutes as system shuts in and pipeline pressure falls to ambient. Flowline contains primarily gas, with approximately 100m^3 condensate distributed along the length of the flowline system. With a single rupture point in the pipeline system, a conservative estimate 50m^3 condensate release as the system shuts in.	Gas / Condensate Estimated 50m^3 condensate	Between HHD exit and Casino-4. Could occur further towards Pecten East end though scenario is less severe due to water depths.	Initial response by gas plant personnel scaling up through IMT

Accidental Hydrocarbon Release	Cause of Aspect	Fluid Type and Volume	Release location	Source control response
Accidental release during well construction				
Subsea release from riser (auto shut-in)	MODU drift off leading to emergency disconnect. Shear of riser subsea (auto shut-in as planned) volume of well fluids released equivalent to riser. Refer Table 6-3.	Mix of well fluids 15 m^3	Annie-2 Juliet-1	On-site response utilising project equipment and personnel.
Release from well (manual shut-in)	MODU drift off leading to shear of riser subsea (auto shut-in failure – manual shut-in with ROV) LOWC through pressure control equipment at seabed for 24 – 48 hours. Refer Table 6-3.	Mix of well fluids 15 m^3 plus 48 hours of well release (restricted flow, gas / condensate released)	Annie-2 Juliet-1	On-site response utilising project equipment and personnel. Off-site support as required e.g. debris clearance.
LOWC – Topsides	Hydrostatic barrier failure inside the well prior to or during the setting of downhole plugs (riser in place). Well fluids escaping at surface via the riser and well fluids handling package. Fluids captured and processed via well clean-up package or diverted overboard, if necessary, for safety of personnel. Kick resolved via choke/kill, well controlled on site. If release cannot be controlled, MODU moves off ensuring safety of personnel on board. Additional failures within subsea pressure control equipment could result in protracted subsea release (see LOWC subsea).	Mix of well fluids 100 m^3	Annie-2 Juliet-1	On-site response utilising project equipment and personnel.
LOWC – Subsea	MODU drift or move off leading to uncontrolled disconnect from the well (auto shut-in failure, manual shut-in with ROV fails); extended LOWC at seabed to the marine environment. To determine the potential causes and parameters for LOWC, Cooper Energy reviewed reservoir parameters and release scenarios for each well included in this EP. Cooper Energy aligns to SPE 2016 guidelines for determining worst case discharge (WCD). The WCD modelling from the Annie-1 well has been used on the basis that:	Subsea release of gas and 24,113 m^3 of condensate over 84 days	Annie-2 Juliet-1 Note: Modelling location is Annie field (closest field to shore and therefore considered conservative for planning purposes)	Initial onsite response. Extensive off-site support.

Accidental Hydrocarbon Release	Cause of Aspect	Fluid Type and Volume	Release location	Source control response
	- the hydrocarbon composition and reservoir characteristics are considered analogous to those of Annie-2 and Juliet-1; - Annie and Juliet reservoirs, though modest in terms of overall production, are undepleted and therefore will initially be higher pressure than currently producing reservoirs. - Annie is the closest field to shore and therefore, in relation to hydrocarbons from a LOWC, is likely to represent the shortest timeframe to shore. - Annie-2 location is planned within ~500m Annie-1 location. - Modelling simulation length was 120 days, extending across summer and winter conditions. A release duration of 84 days was applied; this exceeds the predicted time to kill Otway wells via relief well drilling for mid and local cases, and therefore provides additional conservatism for response planning (Section 7.4).			
Release of fuel during bunkering	Refer Table 6-3.	50 m^3 of MDO	Spill to containment, deck or ocean.	Onsite response.
Vessel releases (offshore campaigns)				
Hydraulic line failure	Refer Table 6-3.	1 m^3 of hydraulic fluid	Spill to containment, deck or ocean.	Onsite response.
LOC – Passing or visiting Vessel Collision with support vessel	Navigational error or loss of position resulting in a high energy collision between a support vessel and another project or third-party vessel could result in hull damage and fuel tank rupture. For the impact assessment the vessel largest fuel tank volume was used as recommended by AMSA's guideline for indicative maximum credible spill volumes for other, non-oil tanker, vessel collision (AMSA 2015). This was assessed to be 250 m^3 of MDO or marine gas oil (MGO).	250 m^3 of MDO	Surface release within the operational area. Modelling location is Annie field (closest field to shore and therefore considered conservative for planning purposes)	Vessel and off-site resources.

Accidental Hydrocarbon Release	Cause of Aspect	Fluid Type and Volume	Release location	Source control response
	The release was modelled to occur over a 6-hour period, which is considered to be a short (and therefore conservative) approach. Vessel grounding was not assessed as a credible risk. There are no emergent features within the operational area.			
Other (offshore campaigns)				
ROV	Loss of hydraulic fluid	< 200 L	Release within the operational area.	Operator on vessel
Helicopter crash / ditch in operational area	Equipment malfunction leading to helicopter ditching into ocean. Fuel tank compromised during landing resulting in a release of fuel to sea. Refer Table 6-3.	3 m^3 of Jet A1 (entire fuel tank volume)	Surface release in the operational area	Project and offsite resources.

6.7.2. Aspect Characterisation

6.7.2.1. Quantitative Hydrocarbon Spill Modelling

Quantitative spill modelling was undertaken for the two credible, worst-case spill scenarios:

- Scenario 1 – LOWC – 24,113 m^3 subsea release over 84 days under summer and winter conditions
- The scenario examined an 84-day subsea release of condensate following a well blowout incident at the Annie-1 release site, tracked for a period of 120 days. A total of 100 spill trajectories were simulated over the summer period (October to March) and 100 spill trajectories were simulated over the winter period (April to September).
- Scenario 2 – LOC Vessel Incident – 250 m^3 surface release. The scenario examined a 250 m^3 release of MDO over 6 hours as a result of support vessels colliding with each other, resulting in the loss of fuel. The release was tracked for 30 days. A total of 100 spill trajectories were simulated for the summer period (October to March) and 100 spill trajectories were simulated for the winter period (April to September).

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

The SIMAP system, the methods and analysis presented herein use modelling algorithms which have been anonymously peer reviewed and published in international journals. Further, RPS warrants that this work meets and exceeds the ASTM Standard F2067-13 “Standard Practice for Development and Use of Oil Spill Models”.

The SIMAP model can track hydrocarbons to levels lower than biologically significant or visible to the naked eye. Therefore, reporting thresholds have been specified (based on the scientific literature) to account for “exposure” on the sea surface and “contact” to shorelines at meaningful levels.

6.7.2.2. Thresholds

Table 6-22 describes the concentration thresholds used in the impact assessment that have been defined for the different exposure types (surface, in-water, shoreline). These impact thresholds and exposure pathways are then applied at a receptor level for use in the consequence evaluations. These thresholds align with the NOPSEMA environmental bulletin ‘Oil Spill modelling’ (NOPSEMA, 2019).

Table 6-22: Justification for Hydrocarbon Impact Thresholds

Exposure Level	Impact Threshold	Justification
Surface Oil		
Low	0.1 - 10 g/m^2	To better assess the potential for sea surface exposure, each of the 100 spill trajectories was tracked to a minimum reporting threshold thickness of 0.1 g/m^2 (~0.1 µm). Oil of this thickness is described as having a sheen appearance on the water surface according to the Bonn Agreement (2009) Oil Appearance Code (BAOAC) and is below levels that have been found to cause environmental harm. Interestingly, Peakall *et al*. (1985) stated the oil thicknesses less than 1 µm was not harmful to seabirds.
Moderate	10 - 25 g/m^2	Literature reviews by Engelhardt (1983), Clark (1984), Geraci and St. Aubin (1988), Jenssen (1994), and Scholten *et al*. (1996) regarding the effects of oil on aquatic birds and marine mammals indicate that the threshold layer thickness at which wildlife can be affected ranges between 10 µm (~10 g/m^2) and 25 µm (~25 g/m^2). Hence, 10 µm was selected to define the moderate exposure zone and 25 µm the high exposure zone.
High	>25 g/m^2	Literature reviews by Engelhardt (1983), Clark (1984), Geraci and St. Aubin (1988), Jenssen (1994), and Scholten *et al*. (1996) regarding the effects of oil on aquatic birds and marine mammals indicate that the threshold layer thickness at which wildlife can be affected ranges between 10 µm (~10 g/m^2) and 25 µm (~25 g/m^2). Hence, 10 µm was selected to define the moderate exposure zone and 25 µm the high exposure zone.
Shoreline		
Low	1 - 100 g/m^2	There are many different types of shorelines, ranging from cliffs, rocky beaches, sandy beaches, mud flats and mangroves, and each of these influences the volume of oil that can remain stranded ashore and its thickness before the shoreline saturation point occurs. For instance, a sandy beach may allow oil to percolate through the sand, thus increasing its ability to hold more oil ashore over tidal cycles and various wave actions than an equivalent area of water; hence oil can increase in thickness onshore over time. A sandy beach shoreline was assumed as the default shoreline type for the modelling herein, as it allows for the highest carrying capacity of oil (of the available open/exposed shoreline types). Hence the results contained herein would be indicative of a worst-case scenario, where the highest volume of oil may be stranded on the shoreline (when compared to other shoreline types, such as exposed rocky shores). In previous risk assessment studies, French-McCay *et al*. (2005a; 2005b) used a threshold of 10 g/m^2 to assess the potential for shoreline contact. This threshold used to define regions of socio-economic impact, such as triggering temporary closures of adjoining fisheries. This threshold value equates to approximately two teaspoons of hydrocarbon per square meter of shoreline contacted. The appearance is described as a stain/film. In this study, a more conservative threshold of 1 g/m^2 was selected to define the zone of potential "low shoreline contact".
Moderate	100 - 1000 g/m^2	French *et al*. (1996) and French-McCay (2009) have defined a hydrocarbon exposure threshold for avifauna (shorebirds) and wildlife (furbearing aquatic mammals and marine reptiles) on or along the shore at 100 g/m^2, which is based on studies for sub-lethal and lethal impacts. This threshold has been used in previous environmental risk assessment studies (see French-McCay, 2003; French-McCay *et al*., 2004, French-McCay *et al*., 2011; NOAA, 2013). The 100 g/m^2 shoreline contact threshold is also recommended in the AMSA foreshore assessment guide as the acceptable minimum thickness that does not inhibit the potential for recovery and is best remediated by natural coastal processes alone (AMSA, 2015b). It equates to approximately ½ a cup of hydrocarbon per square meter of shoreline contacted. The appearance is described as a hydrocarbon coat. Therefore, 100 g/m^2 has been selected to define the zone of potential "moderate shoreline contact". In addition, the shoreline contact threshold of 100 g/m^2 also represents the practical limit for shoreline response options (i.e. shoreline actionable threshold).

Exposure Level	Impact Threshold	Justification
High	>1000 g/m^2	Observations by Lin and Mendelssohn (1996) demonstrated that loadings of more than 1,000 g/m^2 of hydrocarbon during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing hydrocarbon impacts on mangroves (Grant *et al*., 1993; Suprayogi & Murray 1999). Hence, 1,000 g/m^2 has been selected to define the zone of potential "high shoreline contact". This threshold equates to approximately 1 litre of hydrocarbon per square meter of shoreline contacted.
In-water – Dissolved		
Low (Sublethal Effect)	1 ppb	The most toxic components of oil to water-column and benthic organisms are lower-molecular-weight compounds, which are both volatile and soluble in water. The polynuclear aromatic hydrocarbons (PAHs) exert the most toxic effects because they are semi-soluble and not highly volatile, so they persist in the environment long enough for significant exposure to occur (Anderson *et al*., 1974, 1987; Neff & Anderson, 1981; Malins & Hodgins, 1981; McAuliffe, 1987; NRC 2003, 2005). Entrained hydrocarbons are oil droplets suspended in the water column. These may come into contact with and adhere to filter feeding organisms and the gills of fish. The toxic PAH component of the oil is accounted for by the dissolved aromatic exposure thresholds.
Moderate (Lethal Effect for Sensitive Species)	10 ppb	
High (Lethal Effect for Less Sensitive Species)	300 ppb	
In-water – Entrained		
Low (Sublethal Effect)	100 ppb	Entrained hydrocarbons consist of oil droplets that are suspended in the water column and insoluble. As such, insoluble compounds in oil cannot be absorbed from the water column by aquatic organisms, hence are not bioavailable through absorption of compounds from the water. Exposure to these compounds would require routes of uptake other than absorption of soluble compounds. The route of exposure of organisms to whole oil alone include direct contact with tissues of organisms and uptake of oil by direct consumption, with potential for biomagnification through the food chain (NRC, 2003). The PAH component of entrained droplets will change over time as PAHs are removed through dissolution and degradation in the water column. Therefore, the environmental effects of undissolved droplets require different exposure thresholds that consider the total hydrocarbon content. A recent review of aquatic toxicity was carried out by French McCay (2018). In this review the author has identified the shortcomings of previously adopted thresholds for entrained hydrocarbons, e.g. ANZECC (2000) and Smit *et al*. (2009) and the author points out that THC/TPH thresholds derived from Water Accommodated Fraction (WAF) solutions prepared in the lab are inappropriate to apply to whole oil droplets resulting from a spill of hydrocarbons in the marine environment. The author goes on to identify more appropriate thresholds from more recent and more relevant literature. The thresholds described in French McCay (2018) cover a range of potential effects on the environment that have been broken down into 3 protection levels; 1) sublethal effects (or Predicted No Effect Concentration) for all life stages; 2) lethal effects for sensitive species and/or early life stages; and 3) lethal effects for less sensitive species and/or older life stages (Table 9). Each of the thresholds provided in French McCay (2018) are relevant to time-based exposure (or dose), that is, they need to be applied across a several-or-more day exposure, such as a 96-hour interval, to be appropriate. A simple approach to account for the time-based nature of the thresholds is to use time-based averaging in the model to calculate the potential exposure. The LC50 values quoted in French McCay (2018) are typically for 48 to 96 hours of exposure, thus the
Moderate (Lethal Effect for Sensitive Species)	1000 ppb	
High (Lethal Effect for Less Sensitive Species)	30,000 ppb	

Exposure Level	Impact Threshold	Justification
		conservative averaging over 48 hours is used in this study. To apply these thresholds for shorter durations of exposure, or to apply them instantaneously, to estimate potential impacts to the environment, would be extremely conservative and overly protective. However, the instantaneous concentrations could be used as screening values to demonstrate areas where hydrocarbons may be detected if a spill were to occur, without the assumption of an impact to the environment, such is the case for this study.

6.7.2.3. Weathering and Fate

A MDO was used for the containment loss from a vessel scenario. The MDO is a light persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3 (API of 37.6) and a low pour point (-14˚C). The low viscosity (4 cP) indicates that this oil will spread quickly when released and will form a thin to low thickness film on the sea surface, increasing the rate of evaporation. Approximately, 5% (by mass) of the oil is categorised as a group II oil (light-persistent) based on categorisation and classification derived from AMSA (2015a) guidelines. The classification is based on the specific gravity of hydrocarbons in combination with relevant boiling point ranges.

Figure 6-7 shows weathering graphs for a 250 m^3 release of MDO over 6 hours (tracked for 30 days) during three static wind conditions. The prevailing weather conditions will influence the weathering and fate of the MDO. Under lower wind-speeds (5 knots), the MDO will remain on the surface longer, spread quicker, and in turn increase the evaporative process. Conversely, sustained stronger winds (>15 knots) will generate breaking waves at the surface, causing a higher amount of MDO to be entrained into the water column and reducing the amount available to evaporate.

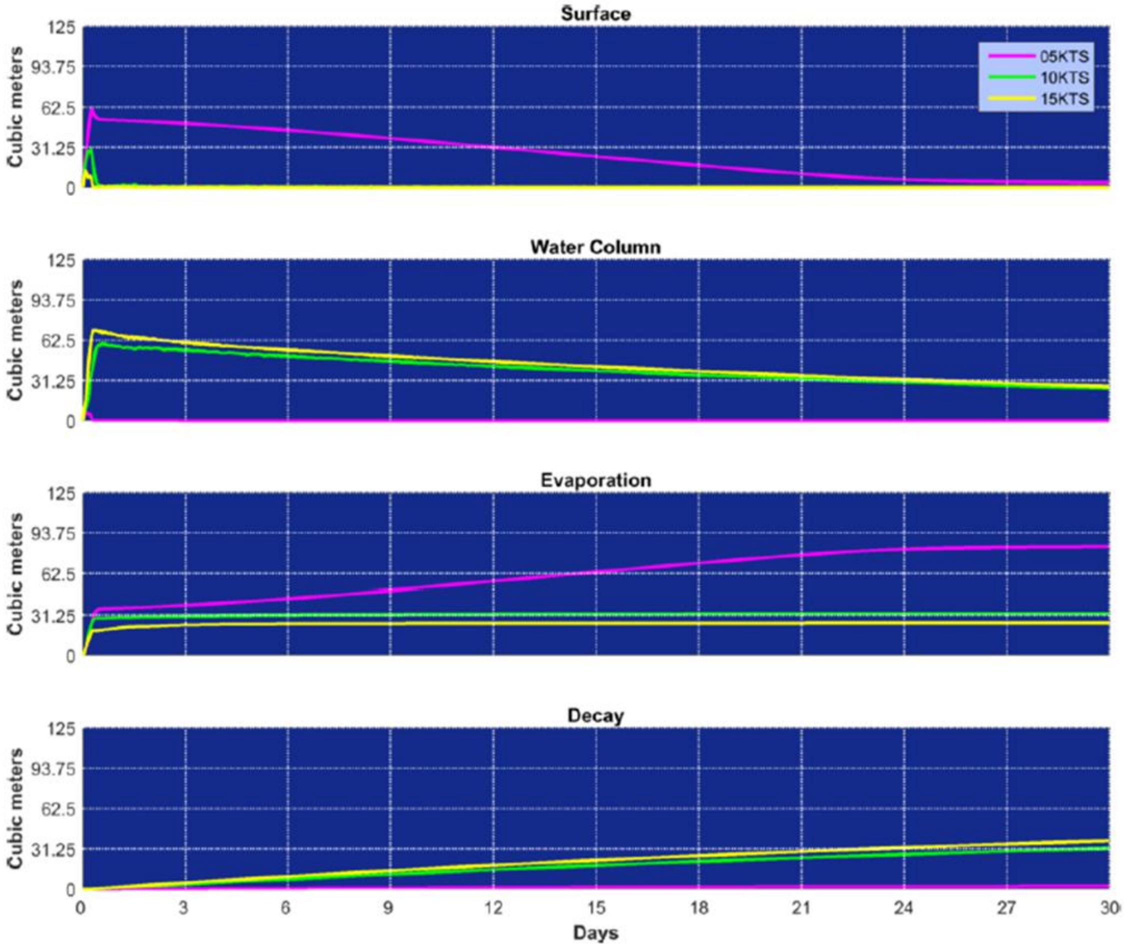


Figure 6-7: Weathering of MDO under three static wind conditions (5, 10 and 15 knots). The results are based on a 250 m^3 surface release of MDO over 6 hours and tracked for 30 days.

A proxy condensate, similar to Netherby condensate was used for the Annie LOWC modelling scenario; the scenario is considered representative of all reservoirs in field. The condensate has an API of 48.23, density of 728.6 kg/m^3 at 15ºC) with low viscosity (1.063 cP), classifying it as a Group I oil according to the International Tankers Owners Pollution Federation (ITOPF, 2014) and United States Environment Protection Agency (USEPA)/USCG classifications. The condensate comprises a significant portion of volatiles and semi to low volatiles (99% total) with very little residual components (<1%). This means that the condensate will evaporate readily when on the water surface, with limited persistent components to remain on the water surface over time.

Figure 6-8 shows weathering graphs for a subsea release of proxy condensate from Annie field over 24 hours (tracked for 30 days) under three static wind conditions. This volume represents the predicted maximum daily discharge rate which occurred on day 1. Rapid evaporation occurs during the first 24 hours (while the condensate is still spilling). Under all static wind conditions the condensate is predicted to readily entrain into the water column under all wind speeds (in particular the higher wind speeds). Due to the high volatility of the condensate, little is predicted to remain on the water surface after the spill ceases.

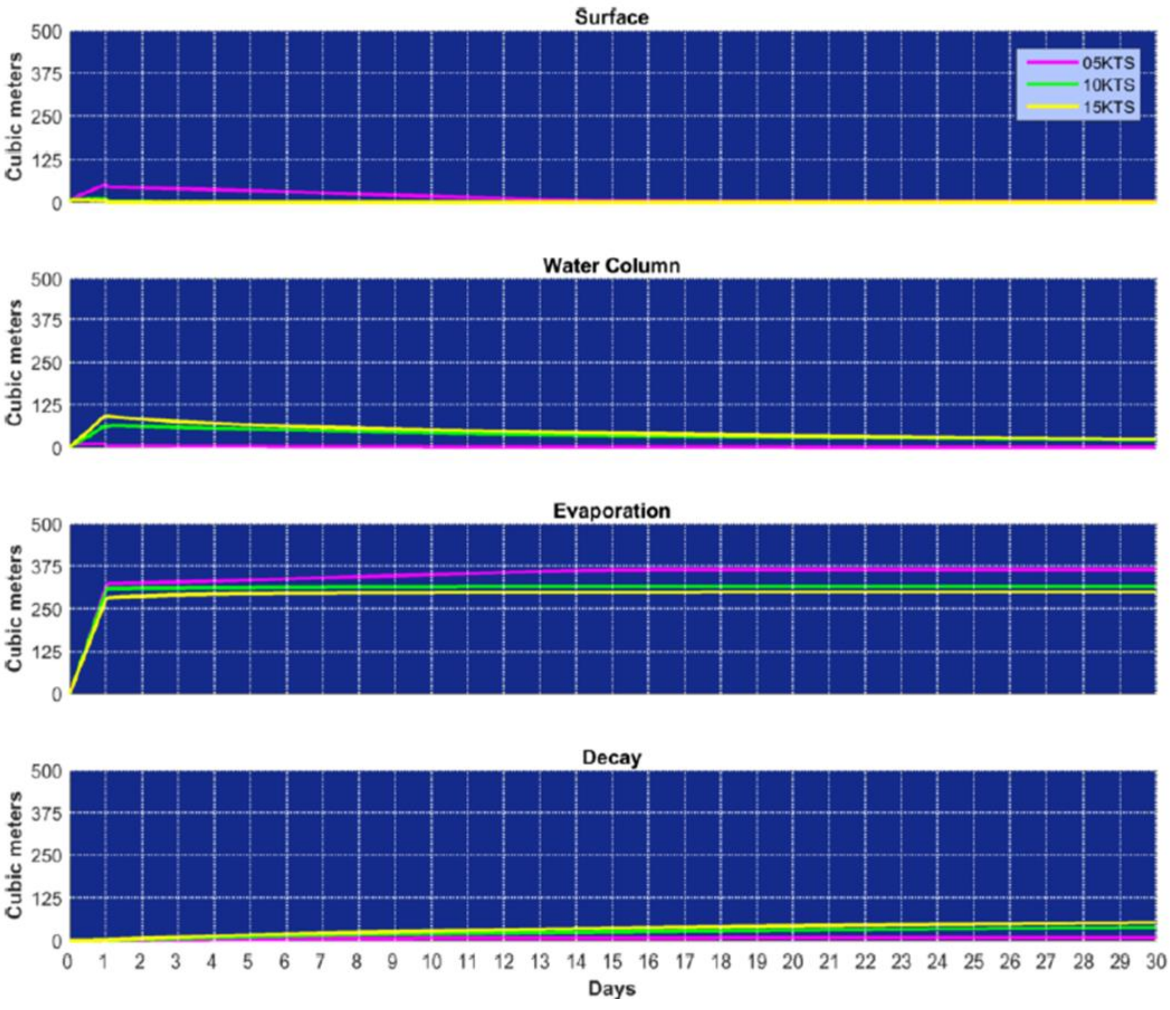


Figure 6-8: Weathering of proxy condensate under three static wind conditions (5, 10 and 15 knots). The results are based on a 294.2 m^3 spill of condensate released over 24 hours and tracked for 30 days

6.7.2.4. Modelling Outputs

Below are scenario summaries of the results from the modelling report provided in Appendix 5 for LOC – vessel collision and LOWC.

LOC – Vessel Collision

Below is a summary of the results from the stochastic modelling undertaken for a LOC caused by vessel collision and outline the area potentially exposed to hydrocarbons.

Surface Exposure (Figure 6-9)

- For summer conditions, the maximum distance predicted for low, moderate and high sea surface exposure was 145 km (west), 10 km (west) and 7 km (west-north-west).
- For winter conditions, the maximum distance predicted for low, moderate and high sea surface exposure was 193 km (east), 16 km (east) and 6 km (south-east).

Shoreline Exposure

- Probability of shoreline contact ranged from 58% (summer; 1 g/m^2) to 54% (winter; 1 g/m^2)
- The minimum time before shoreline contact was approximately 19h (summer) and 16h (winter) with the maximum volume of oil ashore was 33.8 m^3 (summer) and 42.13 m^3 (winter).
- Multiple Local Government Area (LGA)s (and sub-LGAs) were predicted to be contacted by oil at different thresholds. Otway Ranges (low threshold), Otway Plain (IBRA) (low threshold) and Colac Otway (low threshold)[7] were predicted to be the first shoreline receptors to be exposed to visible sea surface exposure, at 1 hour.
- The Otway IMCRA was the only receptor identified as potential exposure at high threshold during summer.

In-water Exposure – Dissolved

At the surface (0-10m) depth layer:

- During summer, the Otway IMCRA received the highest probability of exposure to dissolved hydrocarbons. The Twelve Apostles Marine National Park received a probability of 10% at low exposure to dissolved hydrocarbons at 1 ppb. No dissolved hydrocarbon exposures were predicted at deeper layers.
- During winter, the Otway IMCRA received the highest probability of exposure to dissolved hydrocarbons at 15% for 1 ppb. The Twelve Apostles Marine National Park received a probably of 8% chance of exposure to dissolved hydrocarbons at 1 ppb.
- No locations were exposed at or above the high exposure threshold for either season.
- Dissolved hydrocarbons were predicted to cross into Victorian state waters at 1 ppb with probabilities of 10% and 8% during summer and winter conditions, respectively.

In-water Exposure – Entrained

- In the surface (0-10 m) depth layer, low entrained hydrocarbon exposure extended up to 51 km towards the northwest and 60 km southeast from the release. There was no exposure at the moderate threshold.
- There are 34 BIAs that the release location resides within the greatest probabilities of high exposure during summer and winter conditions were predicted.
- Two AMPs (Apollo, Beagle) and 8 Marine National Parks are within the potential exposure area. The highest predicted probability of impact was to the Twelve Apostles at 14% in winter from entrained hydrocarbons.
- No entrained hydrocarbons were predicted at deeper layers. Probability of exposure to the low threshold ranged from 1 to 17%. The IMCRA Otway was predicted to have the highest probability of exposure at the low threshold (17%)[8].

[7] *OSM modelling for Annie-1 Well for Cooper Energy*

[8] *OSM modelling for Annie-1 Well for Cooper Energy*

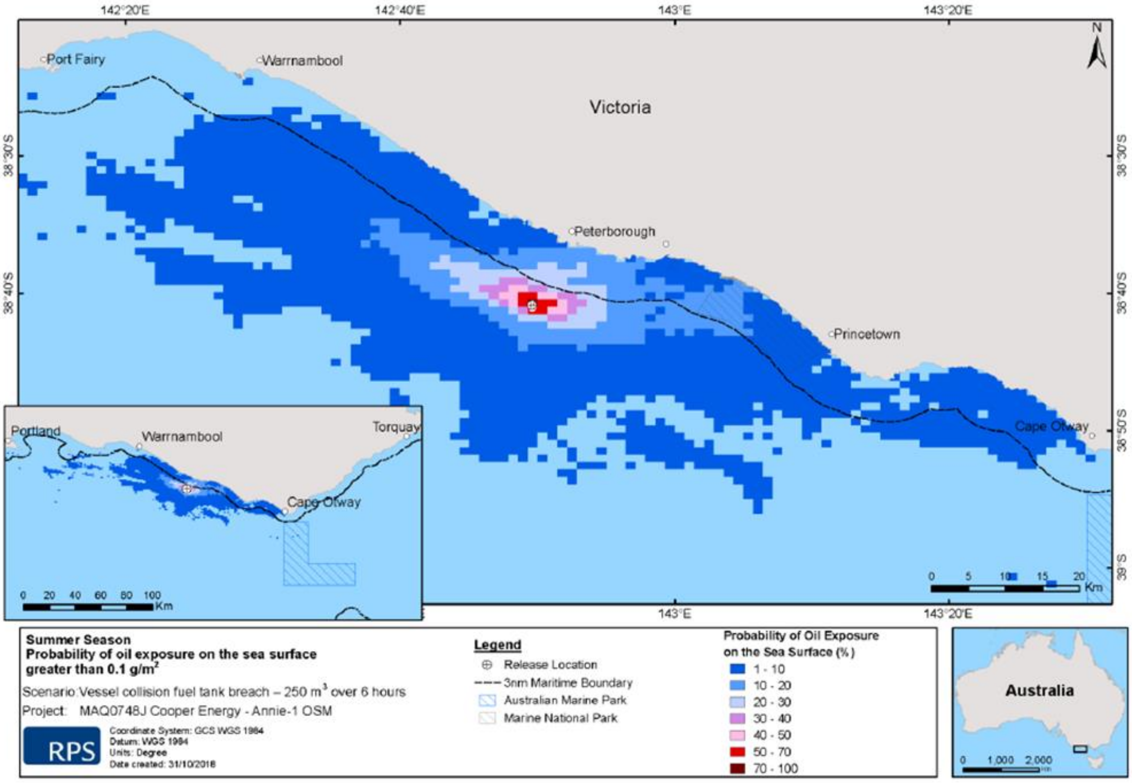


Figure 6-9: Probability of oil exposure on the sea surface for low threshold (0.1 g/m²) in the event of a 250m³ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer (October-April) wind and current conditions.

LOWC

Stochastic analysis

Below is a summary of the results from the stochastic modelling undertaken for a LOWC during well construction activities and outline the area potentially exposed to hydrocarbons.

Surface Exposure (Figure 6-10)

- The maximum distance predicted for low and moderate sea surface exposure was 174 km (east) and 1 km (west-north-west) respectively while no exposure at the high threshold was observed.

Shoreline Exposure

- The predicted probability of contact to any shoreline at, or above, the minimum shoreline contact threshold (1 g/m²) was 100%
- The minimum time before oil contact was approximately 21 hours.
- The maximum volume of oil to accumulate on a particular shoreline receptor was 151 m³, predicted at Warrnambool Plain, with a 100% probability of shoreline loading.

In-water Exposure

<u>Dissolved</u>

- In the surface (0-10 m) depth layer, of 34 BIAs were predicted to be exposed to dissolved hydrocarbons at or above the high threshold.
- There is one AMP (Apollo) and four National Parks (Point Addis, Twelve Apostles, Discovery Bay and Bunurong Marine) within the area of potential exposure. Twelve Apostles recorded the only park with potential exposure at 100% for dissolved hydrocarbons at 1 ppb.
- Victorian State Waters had a 100% probability of encountering 1 ppb of dissolved hydrocarbons.

<u>Entrained</u>

- There is one AMP (Apollo) and one National Park (Twelve Apostles) within the area of potential exposure. Twelve Apostles recorded the only park with potential exposure at 95% probability of exposure to entrained hydrocarbons at 1 ppb.
- Victorian State Waters had a 95% probability of exposure to entrained hydrocarbons at low probability of exposure of 1 ppb.
- No AMPs are predicted to be exposed to entrained hydrocarbons at, or above the low threshold during the annualised conditions. Otway recorded the highest probability of low entrained exposure with 100%.

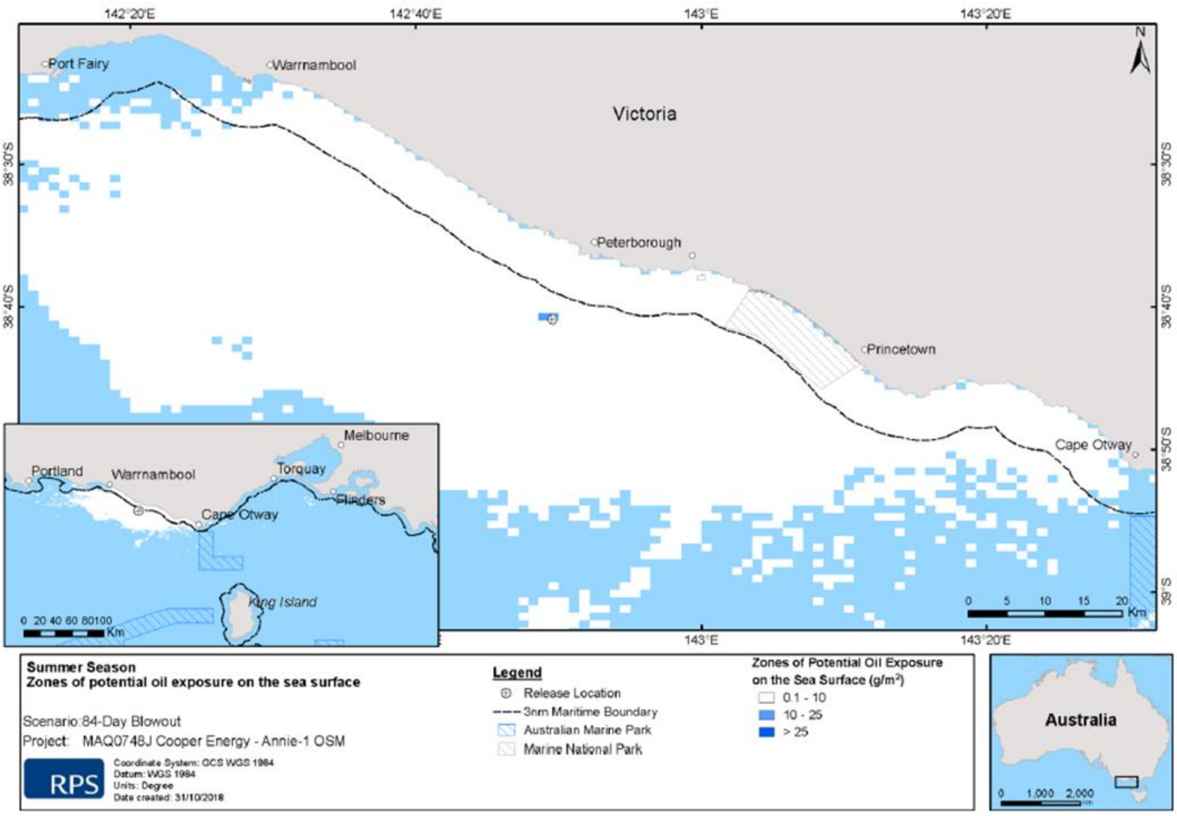


Figure 6-10: Zones of potential oil exposure on the sea surface, in the event of a 24,113 m^3 subsea release of condensate over 84 days at the Annie-1 release site, tracked for 120 days. The results were calculated from 100 spill trajectories.

Deterministic analysis

Deterministic analysis was used to assess the impact of the individual simulation considered to have the greatest impact on the environment. The scenario was selected based on the length of shoreline contacted by the condensate at, or above, the shoreline actionable threshold (100 g/m^2) and the greatest volume ashore overall. This simulation was identified as Model Run 5 during winter season.

Some of the key outcomes were:

- The maximum area of exposure on the sea surface at the visible hydrocarbon threshold occurred throughout the scenario reached its peak within the first four days and was approximately 135 km^2. Additionally, the maximum length of actionable shoreline hydrocarbon was approximately 35 km.
- A significant portion of the hydrocarbon was predicted to evaporate upon reaching the water surface. At the conclusion of the simulation period, approximately 20,000 m^3 spilled hydrocarbon was lost to the atmosphere through evaporation. Approximately 4,000 m^3 of hydrocarbon was predicted to have decayed by the end of the simulation. Additionally, approximately 500 m^3 remained within the water column.
- Initial shoreline contact was predicted to occur within 71 hours of the initial release and at the conclusion of the simulation approximately 200 m^3 was predicted to remain on shorelines.

6.7.3. Predicted Environmental Impacts and Risk Events

Hydrocarbon spill events, including LOC – vessel collision and LOWC, have the potential to expose ecological and social receptors to different hydrocarbon expressions and concentrations. Hydrocarbon expressions include:

- Surface
- Shoreline
- In-water.

Exposure of receptors to surface shoreline and in-water hydrocarbons have the potential to result in:

- Toxicity effects/physical oiling
- Reduction in intrinsic values/visual aesthetics
- Impacts to commercial businesses.

6.7.4. Impact and Risk Evaluation

6.7.4.1. Risk Event: LOC – Vessel Collision

The ecological and social receptors with the potential to be exposed to surface, shoreline accumulation and in-water hydrocarbons from a LOC caused by vessel collision event are evaluated in Table 6-23, Table 6-24, and Table 6-25 respectively.

Table 6-23: Consequence Evaluation for MDO Hydrocarbon Exposure – Surface

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
Ecological Receptors			
Marine Fauna	Avifauna	Several threatened, migratory and/or listed marine species have the potential to be rafting, resting, diving and feeding within the area predicted to be contacted by surface hydrocarbons at moderate exposure levels. There are several foraging BIAs that are present within the area potentially exposed to surface hydrocarbons at moderate exposure levels for gannet, albatross, petrel, and shearwater species. Foraging BIAs are typically large broad areas (Appendix 3). Avifauna can feed via surface skimming or diving – both exposing the bird to any oil on the water surface. Wedge-tailed shearwater breeding BIA is also within the area potentially exposed to surface hydrocarbons at moderate exposure levels. Breeding activities do not occur in oceanic waters. Breeding birds however will utilise oceanic waters to forage during breeding.	When first released, the MDO has higher toxicity due to the presence of volatile components. Individual birds rafting, resting, diving and feeding within surface hydrocarbons at moderate exposure levels at the time of the spill may suffer impacts however it is unlikely that a large number of birds will be affected. Seabirds exposed to surface hydrocarbons at moderate exposure levels may experience acute or chronic toxicity impacts, however the area of contact is localised (i.e. areas of concentrations >10g/m^2 out to 16 km) and temporary (~36 hrs) due to the rapid weathering of the MDO. The presence of birds within surface hydrocarbons at moderate exposure levels is expected to be limited to foraging individuals of a transitory nature, given the absence of offshore aggregation areas in the area. The National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 identifies marine pollution as a threat (DSEWPaC 2011). The activity will be conducted in a manner which is not inconsistent with the relevant management actions. The potential consequence to seabirds from a worst case MDO release (vessel collision) is assessed as **Level 2** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
	Marine Reptiles	There may be marine turtles in the area predicted to be exposed to surface hydrocarbons at moderate exposure levels. There are no BIAs or habitat critical to the survival of the species within this area.	Marine turtles are vulnerable to the effects of oil at all life stages. Marine turtles can be exposed to surface oil externally (i.e. swimming through oil slicks) or internally (i.e. swallowing the oil). Ingested oil can harm internal organs and digestive function. Oil on their bodies can cause skin irritation and affect breathing. The area exposed by moderate levels of surface hydrocarbons from a vessel collision event is limited to offshore open waters (16 km from the release site within the operational area) over a maximum period of 36 hours. The number of marine turtles that may be exposed to MDO surface hydrocarbons is expected to be low due to the localised and temporary presence of surface hydrocarbons at moderate exposure levels and the absence of BIAs or habitat critical to the survival of the species within this area. The potential impact would be limited to individual transiting marine turtles, with population impacts not anticipated.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			Marine pollution is listed as a threat to marine turtle in the Recovery Plan for Marine Turtles in Australia, 2017 – 2027, particularly in relation to shoreline oiling of nesting beaches. There are no nesting beaches within the EMBA, and the activity will be conducted in a manner which is not inconsistent with the relevant management actions. The potential consequence to marine turtles from a worst case MDO release (vessel collision) is assessed as **Level 2** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
	Marine Mammals (Pinnipeds)	There may be pinnipeds in the area predicted to be exposed to surface hydrocarbons at moderate exposure levels. There are no BIAs for pinnipeds within this area.	Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. Oiling of pinnipeds can lead to hypothermia if the fur is affected, or poisoning if oil is ingested, resulting in reduced foraging and reproductive fitness or death (DSEWPaC 2013). The oiling of fur seals from exposure to MDO surface hydrocarbons is not likely. MDO is considered a light hydrocarbon that rapidly evaporates (Figure 6-7). Fur seals are more likely to be exposed to volatile hydrocarbon fumes from ingestion or inhalation and less likely to be physically oiled externally (Yaghmour *et al*. 2022). The area exposed by moderate levels of surface hydrocarbons from a vessel collision event is limited to offshore open waters (16 km from the release site within the operational area) over a maximum period of 36 hours. The number of pinnipeds exposed is expected to be low, with population impacts not anticipated, due to the localised and temporary presence of surface hydrocarbons at moderate exposure levels and the absence of BIAs in the area. Conservation Listing Advice for the *Neophoca cinerea* (Australian sea lion) (TSSC, 2010) identifies oil spills as a potential threat to habitat. Activities within this Environment Plan will not be inconsistent with the conservation and management priorities outlined in this advice. Given that fur seals are vulnerable to poisoning from ingestion, the potential consequence to pinnipeds from a worst case MDO release (vessel collision) is assessed as **Level 3** based on the potential for medium term impacts to species of recognised conservation value but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
	Marine Mammals (Cetaceans)	Several threatened, migratory and/or listed marine cetacean species have the potential to be migrating, resting or foraging within an area predicted to be exposed to surface hydrocarbons at moderate exposure levels. The following BIAs are within the area exposed to surface hydrocarbons: • Pygmy blue whale known foraging and distribution BIA • Southern right whale known core area BIA • Southern right whale aggregation, connecting habitat and migration and resting BIAs	Physical contact by individual whales of MDO is unlikely to lead to any long-term impacts. Given the mobility of whales, only a small proportion of the population would surface in the affected areas, resulting in short-term and localised consequences, with no long-term population viability effects. Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behaviour disturbance (including avoidance of the area) may occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may disrupt behaviours such as migration, or displace individuals from important habitat, such as foraging, resting or breeding. The area exposed by moderate levels of surface hydrocarbons from a vessel collision event is limited to offshore open waters (16 km from the release site within the operational area) over a maximum period of 36 hours. If whales are foraging or aggregating in the region at the time of the spill, a greater number of individuals may be present in the area exposed by moderate levels of surface hydrocarbons. However due to the rapid weathering of MDO and the short duration of the surface exposures at higher concentrations (e.g. >10 g/m^2), this is not considered likely. Low levels of surface hydrocarbons could occur within the southern right whale aggregation BIA from Port Fairy/Warrnambool. Conservation Management Plan for the blue whale and the southern right whale identifies habitat modification as a threat. Activities within this Environment Plan will not be inconsistent with the conservation and management priorities outlined in these Conservation Management Plans. The potential consequence to cetaceans from a vessel collision (MDO) event is assessed as **Level 2** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
Social Receptors			
Natural Systems	KEFs	Bonney Coast Upwelling and West Tasmania Canyons KEFs are within the area predicted to be exposed to surface hydrocarbons at low exposure levels. Values associated with this area are high productivity and aggregations of whales, seals, sharks and seabirds.	Based on the worse case potential consequence to key receptors within the Bonney Coast Upwelling and West Tasmania Canyons KEFs (e.g. seabirds, pinnipeds and cetaceans), the potential consequence to this KEF is assessed to be **Level 3** as per the assessment for pinnipeds. Refer also to: • Seabirds • Marine mammals (Pinnipeds) • Marine mammals (Cetaceans).

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
	State Marine Protected Areas	Eight National Parks are present within the area predicted to be exposed to surface hydrocarbons. Values associated with these areas include providing habitats for a diverse range of invertebrates, fish, mammals and birds.	Based on the worse case potential consequence to key receptors (e.g. seabirds, pinnipeds and cetaceans) the potential consequence to this protected area is assessed to be **Level 3** as per the assessment for pinnipeds. Refer also to: • Seabirds. • Marine mammals (Pinnipeds, Cetaceans).
Human Systems	Recreation and Tourism (including recreational fisheries)	Marine pollution can result in impacts to marine-based tourism from reduced visual aesthetic. MDO is known to rapidly spread and thin out on release and consequently, a large area may be exposed to surface hydrocarbons. Low exposure thresholds (1 g/m^2) are predicted up to 194 km E (summer) or 177 km NE (winter) of the release location. Local government areas and sub-areas where low threshold surface oil is predicted include Warrnambool and South West, Geelong, Greater Melbourne and Latrobe-Gippsland.	Visible surface hydrocarbons (i.e. a rainbow sheen) have the potential to reduce the visual amenity of the area for tourism and discourage recreational activities. However, the relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as **Level 2** as they could be expected to result in localised short-term impacts. Refer also to: • Marine Mammals (Pinnipeds, Cetaceans). • State Marine Protected Areas.
	Shipping	Shipping occurs within the area predicted to be exposed to surface hydrocarbons.	Vessels may be present in the area exposed to sea surface oil, however, due to the short duration of surface exposure (95% evaporated within a few days) impacts would be localised and short term, consequently, the potential consequence is considered to be **Level 1.**
	Oil and gas	Oil and gas platforms are located within the area predicted to be exposed to surface hydrocarbons.	Oil and gas infrastructure present in the area exposed to surface hydrocarbons could be potentially oiled. However, due to the short duration of surface exposure (95% evaporated within a few days) impacts would be localised and short term, consequently, the potential consequence is considered to be **Level 1.**

Table 6-24: Consequence Evaluation for MDO Hydrocarbon Exposure – Shoreline

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
Ecological Receptors			
Habitat	Rocky Shoreline	Rocky shores are within the area potentially exposed to hydrocarbons ashore. As MDO is not sticky or viscous, if it contacts rocky shorelines, it is not expected to stick with tidal washing expected to influence the longevity of exposure.	The sensitivity of a rocky shoreline to oiling is dependent on a number of factors including its topography and composition, position, exposure to oceanic waves and currents etc. Exposed rocky shorelines are less sensitive than sheltered rocky shorelines. One of the main identified values of rocky shores/scarps is as habitat for invertebrates (e.g. sea anemones, sponges, sea-squirts, molluscs). Rocky areas are also utilised by some pinniped and bird species; noting that foraging and breeding/nesting typically occurs above high tide line. The impact of oil on any organism depends on the toxicity, viscosity and amount of oil, on the sensitivity of the organism and the length of time it is in contact with the oil. Even where the immediate damage to rocky shores from oil spills has been considerable, it is unusual for this to result in long-term damage and the communities have often recovered within 2 or 3 years (IPIECA, 1995). The potential consequence to rocky sites from a vessel collision (MDO) event is assessed as **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. Refer also to: • Marine Invertebrates. • Seabirds and Shorebirds. • Pinnipeds.
	Sandy Shoreline	Sandy beaches are within the area potentially exposed to hydrocarbons ashore. Sandy beaches are the predominant habitat type within the stretch of coast where shoreline contact could be expected from a vessel collision (MDO) event. MDO would be expected to penetrate porous sediments of sandy shorelines quickly but may also be washed off shorelines just as quick via waves and tidal flushing. NOAA (2014) note that as MDO is readily and completely degraded by naturally	Sandy beaches are considered to have a low sensitivity to hydrocarbon exposure. Sandy beaches provide habitat for a diverse assemblage (although not always abundant) of infauna (including nematodes, copepods and polychaetes); and macroinvertebrates (e.g. crustaceans). Due to proximity to shore, a release of MDO may reach the shoreline prior to it completely weathering and consequently impacts due to toxicity and/or smothering of infauna may occur. The potential consequence to sandy shorelines from a worst-case loss of MDO is assessed as **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. Refer also to: • Marine Invertebrates.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		occurring microbes, it could be expected to disappear from shorelines within one to two months. MDO has the potential to be buried due to the continual washing in the intertidal zone.	• Seabirds and Shorebirds. • Pinnipeds. • Recreation.
	Mangroves	Strands of mangroves are within the area potentially exposed to hydrocarbons ashore, however, within the stretch of coast expected to be exposed from vessel collision (MDO) event, there is no coastal habitat mapped specifically as this vegetation type. Oil can enter mangrove forests when the tide is high and be deposited on the aerial roots and sediment surface as the tide recedes. This process commonly leads to a patchy distribution of the oil and its effects because different places within the forests are at different tidal heights (IPIECA 1993, NOAA 2014). The physical smothering of aerial roots by hydrocarbons, particularly heavy or viscous oils, can block the trees' breathing pores used for oxygen intake and result in the asphyxiation of sub-surface roots International Petroleum Industry Environmental Conservation Association (IPIECA 1993).	Mangroves are considered to have a high sensitivity to hydrocarbon exposure. Mangroves can be killed by heavy or viscous oil, or emulsification, that covers the trees' breathing pores thereby asphyxiating the subsurface roots, which depend on the pores for oxygen (IPIECA 1993). Mangroves can also take up hydrocarbons from contact with leaves, roots or sediments, and it is suspected that this uptake causes defoliation through leaf damage and tree death (Wardrop *et al.* 1987). Acute impacts to mangroves can be observed within weeks of exposure, whereas chronic impacts may take months to years to detect. Given the non-viscous nature of MDO and impacts are expected to be limited to the volatile component of the hydrocarbon, however given their sensitivity to hydrocarbons, the potential consequence to mangroves is assessed to be **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.
	Saltmarsh	Communities of saltmarsh are within the area potentially exposed to hydrocarbons ashore; and is present within some estuaries and inlet/riverine systems. Some of the saltmarsh habitat along this coast will be representative of the Subtropical and Temperate Saltmarsh TEC. Oil can enter saltmarsh systems during the tidal cycles if the estuary/inlet is open to the ocean. Similar to mangroves, this can lead to a patchy	Saltmarsh is considered to have a high sensitivity to hydrocarbon exposure. Saltmarsh vegetation offers a large surface area for oil absorption and tends to trap oil. Evidence from case histories and experiments shows that the damage resulting from oiling, and recovery times of oiled marsh vegetation, are very variable. In areas of light to moderate oiling where oil is mainly on perennial vegetation with little penetration of sediment, the shoots of the plants may be killed but recovery can take place from the underground systems. Good recovery commonly occurs within one to two years (IPIECA 1994). The potential consequence to saltmarsh is assessed to be **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		distribution of the oil and its effects, because different places within the inlets are at different tidal heights. Oil (in liquid form) will readily adhere to the marshes, coating the stems from tidal height to sediment surface.	
Marine Fauna	Invertebrates	Invertebrates that live in intertidal zones include crustaceans, molluscs and infauna, and can be present in wide range of habitats including sandy beaches and rocky shores (refer also to the exposure evaluation for these habitats). Exposure to hydrocarbons for invertebrates is typically via direct contact and smothering but can also occur via ingestion.	The impact of oil on any marine organism depends on the toxicity, viscosity and amount of oil, on the sensitivity of the organism and the length of time it is in contact with the oil. Acute or chronic exposure, through surface contact, and/or ingestion can result in toxicological impacts, reproductive impacts, smothering and potentially cause death. However, the presence of an exoskeleton (e.g. crustaceans) will reduce the impact of hydrocarbon absorption through the surface membrane. Other invertebrates with no exoskeleton and larval forms may be more sensitive to impacts from hydrocarbons. If invertebrates are contaminated by hydrocarbons, tissue taint can remain for several months, but can eventually be lost. As MDO is expected to rapidly spread out, a large portion of the coast with the potential to be exposure to hydrocarbons comprises habitats that are suitable for intertidal invertebrates could be exposed, with the potential consequences assessed as **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.
	Seabirds and Shorebirds	Listed marine, threatened and/or migratory bird species have the potential to be breeding, foraging, feeding, roosting or resting within the area potentially exposed to hydrocarbons ashore. This fauna can be present in wide range of habitats including sandy beaches and rocky shores (refer also to the exposure evaluation for these habitats). There are several seabird foraging, breeding and aggregation BIAs throughout the area, however these species are oceanic foragers, not shoreline foragers. No habitat critical to the survival of the species have been identified. Given hydrocarbons may wash ashore prior to weathering, there is the potential for both physical	Shoreline species may suffer both direct oiling and potential displacement from foraging and/or nesting sites. Acute or chronic toxicity impacts (death or long-term poor health) to small numbers of birds is possible, however this is not considered significant at a population level. Direct oiling of nesting sites is considered unlikely as hydrocarbons would typically accrue within the upper swash zone, and nests would occur above this level on a beach. However, oiled fauna may track oil into their nests, which may then have subsequent impacts on any eggs present. This would be more of a risk for fauna, such as the Little Penguin, that must traverse the intertidal area to reach nesting sites. There are no known breeding locations for penguins along the Otway mainland coast at risk of shoreline oil accumulation. In addition, given the volatility of the exposed oil, any impact to nests is expected to occur to individuals and not considered to pose a long-term risk at population level. Consequently, the potential impacts to seabirds from shoreline hydrocarbon exposure event are considered to be **Level 2**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		oiling and toxicity (e.g. surface contact or ingestion; particularly for shorebirds utilizing the intertidal area. Noting that these events will be temporary, so length of exposure is limited.	
	Marine Reptiles	Turtles nesting on exposed shores would be exposed by direct contact with skin/body. However, there are no BIAs or habitat critical to the survival of the species within the shorelines that could be potentially affected. Therefore, shoreline exposure to marine turtles is not expected and not evaluated further.	NA
	Marine Mammals (Pinnipeds)	Listed marine and/or threatened pinniped species have the potential to present within the area predicted to be exposed to hydrocarbons ashore. There is an Australian Sea Lion Foraging (male) BIA present within the potential monitoring spill EMBA (monitoring). Pinnipeds hauling out on exposed shores could be exposed by direct contact of oil with skin/body. Direct oiling is possible but expected to have a limited window for occurring due to rapid weathering and flushing of MDO.	Pinnipeds have high site fidelity and can be less likely to exhibit avoidance behaviours, thus staying near established colonies and haul-out areas. Fur seals are particularly vulnerable to hypothermia from oiling of their fur (DSEWPaC 2013) and consequently, once onshore hydrocarbons pose a significant hazard to pinnipeds with biological impacts caused from ingestion possibly resulting in reduced reproduction levels. Conservation Listing Advice for the *Neophoca cinerea* (Australian sea lion) (TSSC, 2010) identifies oil spills as a potential threat to habitat. Activities within this Environment Plan will not be inconsistent with the conservation and management priorities outlined in this advice. The potential consequence to pinnipeds from exposure are assessed as **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.
Social Receptors			
Natural System	Wetlands	Four Wetlands of International Importance (RAMSAR) are present within the potential monitoring area. Two further RAMSAR sites are located within 10 km of the EMBA. Four wetland communities with TEC status are present within the potential monitoring area; Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains, Tasmanian white gum (Eucalyptus viminalis) wet forest, Karst springs and associated alkaline fens	The impacts of hydrocarbons on wetlands are generally similar to those described for mangroves and saltmarshes. The degree of impact of oil on wetland vegetation are variable and complex, and can be both acute and chronic, ranging from short-term disruption of plant functioning to mortality. Spills reaching wetlands during the growing season will have a more severe impact than if oil reaches wetlands during the times when many plant species are dormant. Wetland habitat can be of particular importance for some species of birds and invertebrates. As such, in addition to direct impacts on plants, oil that reaches wetlands also affects these fauna utilising wetlands

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		of the Naracoorte Coastal Plain Bioregion, Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community.	during their life cycle, especially benthic organisms that reside in the sediments and are a foundation of the food chain. The potential consequence to wetlands from exposure are assessed as **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. Refer also to: • Marine Invertebrates. • Seabirds and Shorebirds.
Human System	Coastal Settlements	Coastal settlements are within the area potentially exposed to hydrocarbons ashore; however, the stretch of coast expected to be exposed is not densely populated. Noting that these events will be temporary, so duration of exposure is also limited. Most of the hydrocarbons will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA 1995) and expected to be visible.	Visible hydrocarbons have the potential to reduce the visual amenity of the area for coastal settlements. Given MDOs rapid weathering and potential for tidal flushing and rapid degradation, the potential consequence to coastal settlements is assessed as **Level 2** based on the potential for localised short-term impacts. Refer also to: • Rocky Shores. • Sandy Beaches.
	Recreation and Tourism	Recreational and tourism activities occur within the area potentially exposed hydrocarbons ashore; however, the stretch of coast expected to be exposed, as such the volume of recreation/tourism is not as high as other places. Noting that these events will be temporary, so duration of exposure is also limited. Most of the oil will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA 1995) and expected to be visible.	Visible hydrocarbons stranded on a shoreline have the potential to temporarily reduce the visual amenity of the area for tourism and discourage recreational activities. The potential consequence to recreation and tourism is assessed as **Level 2** based on the potential for localised short-term impacts. Refer also to: • Rocky Shores. • Sandy Beaches. • Coastal Settlements.
	Heritage	Specific locations of spiritual and ceremonial places of significance, or cultural artefacts, are often unknown, but are expected to be present along the mainland coast. Therefore, there is the potential that	Hydrocarbons stranded on a shoreline have the potential to temporarily reduce the Heritage value of the area. However, it is expected that these sites would be above the high tide mark. Thus, the potential

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		some of these sites may be within the area potentially exposed to hydrocarbons ashore. Three national heritage places are present within the potential monitoring EMBA; Point Nepean Defence Sites and Quarantine Station Area, Great Ocean Road and Scenic Environs and Quarantine Station and Surrounds. Noting that these events will be temporary, so duration of exposure is also limited. Most of the oil will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA 1995) and expected to be visible.	consequence to heritage is assessed as **Level 2** as they could be expected to result in localised short-term impacts. Refer to: • Rocky Shores. • Sandy Beaches. • Coastal Settlements.

Table 6-25: Consequence Evaluation for MDO Hydrocarbon Exposure – In-water

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
Ecological Receptors			
Habitat	Coral	Soft corals may be present within reef and hard substrate areas within the area predicted to be exposed above thresholds. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of the MDO residue.	Exposure of entrained hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Shigenaka 2001). Contact with corals may lead to reduced growth rates, tissue decomposition, and poor resistance and mortality of sections of reef (NOAA 2010). However, given the lack of coral reef formations, and the sporadic cover of hard or soft corals in mixed nearshore reef communities along the Otway coast, such impacts are considered to be limited to isolated corals. Thus, the potential consequence to corals is assessed as **Level 2** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Macroalgae	Macroalgae may be present within reef and hard substrate areas within the area predicted to be	Reported toxic responses to oils have included a variety of physiological changes to enzyme systems, photosynthesis, respiration, and nucleic acid synthesis (Lewis & Pryor 2013). A review of field studies

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		exposed above thresholds, however, it is not a dominant habitat feature in the EMBA. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of the MDO residue.	conducted after spill events by Connell *et al.* (1981) indicated a high degree of variability in the level of impact, but in all instances, the algae appeared to be able to recover rapidly from even very heavy oiling. Given the restricted range of exposure (shallow nearshore and intertidal waters only) and the predicted lower concentrations of hydrocarbons that could reach these waters, any impact to macroalgae is not expected to result in long-term or irreversible damage. Consequently, the potential impacts to macroalgae are considered to be **Level 2**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Seagrass	Seagrasses may be present within the area predicted to be exposed above thresholds.	There is the potential that exposure could result in sub-lethal impacts, more so than lethal impacts, possibly because much of seagrasses' biomass is underground in their rhizomes (Zieman *et al.* 1984). Given the restricted range of exposure (shallow nearshore and intertidal waters only) and the predicted lower concentrations of hydrocarbons expected to be in these waters, any impact to seagrass is not expected to result in long-term or irreversible damage. Thus, the potential consequence to seagrass is assessed as **Level 2** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
Marine Fauna	Plankton	Plankton are likely to be exposed to entrained hydrocarbon. Exposure is predicted in the 0-10 m water depth, which is also where plankton are generally more abundant. Entrained phase MDO may intersect the Bonney Upwelling KEF and the West Tasmanian Canyons KEF. While a spill would not affect the upwelling itself, if the spill occurs at the time of an upwelling event, it may result in krill being exposed to low (effects) level entrained phase MDO (99% species protection). Pygmy blue whales feeding on this krill may suffer from reduced prey, however, these impacts are expected to be extremely localised and temporary.	Relatively low concentrations of hydrocarbon are toxic to both plankton [including zooplankton and ichthyoplankton (fish eggs and larvae)]. Plankton risk exposure through ingestion, inhalation and dermal contact. Plankton are numerous and widespread but do act as the basis for the marine food web, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have re-established, the plankton community may take weeks to months to recover (ITOPF 2011a), allowing for seasonal influences on the assemblage characteristics. Thus, the potential consequence to plankton is assessed as **Level 2** based on the potential for short-term and localised impacts, but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
	Invertebrates	The modelling indicates that temporary patches of entrained MDO may be present at 0-10 m water depth. Impact by direct contact of benthic species with hydrocarbon in the deeper areas of the release area is not expected given the surface nature of the spill and the water depths throughout much of the EMBA. Species closer to shore may be affected although these effects will be localised, low level and temporary, noting that in-water thresholds selected for interpretation are effects levels for 95-99% species protection. Filter-feeding benthic invertebrates such as sponges, bryozoans, abalone and hydroids may be exposed to sub-lethal impacts, however, population level impacts are considered unlikely. Tissue taint may occur and remain for several months in some species (e.g. lobster, abalone) however, this will be localised and low level with recovery expected. In-water invertebrates of value have been identified to include squid, crustaceans (rock lobster, crabs) and molluscs (scallops, abalone). Several commercial fisheries for marine invertebrates are within the area predicted to be exposed above the impact threshold: • Cth Southern Squid Jig Fishery • Bass Strait Central Zone Scallop Fishery. • Victorian Abalone Fishery • Victorian Rock Lobster Fishery • Victorian Giant Crab Fishery • Victorian Scallop Fishery.	Acute or chronic exposure through contact and/or ingestion can result in toxicological risks. However, the presence of an exoskeleton (e.g. crustaceans) reduces the impact of hydrocarbon absorption through the surface membrane. Invertebrates with no exoskeleton and larval forms may be more prone to impacts. Localised impacts to larval stages may occur which could impact on population recruitment that year. Tainting of recreation or commercial species is considered unlikely to occur, however if it did it is expected to be localised and low level with recovery expected. Thus, the potential consequence to invertebrates including commercially fished invertebrates is assessed as **Level 2** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
	Fish and Sharks	Entrained hydrocarbon droplets can physically affect fish exposed for an extended duration (weeks to months). Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest. Several fish communities in these areas are demersal and therefore more prevalent towards the seabed, which modelling does not predict is exposed >10m water depth. Therefore, any impacts are expected to be highly localised. There is a known distribution, foraging and breeding (nursery area) BIA for the great white shark in the area predicted to be over the impact threshold, however, it is not expected that this species spends a large amount of time close to the surface where thresholds are predicted to be exceeded.	Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2010). Subsurface hydrocarbons could potentially result in acute exposure to marine biota such as juvenile fish, larvae, and planktonic organisms, although impacts are not expected cause population-level impacts. Impacts on fish eggs and larvae entrained in the upper water column are not expected to be significant given the temporary period of water quality impairment, and the limited areal extent of the spill. As egg/larvae dispersal is widely distributed in the upper layers of the water column it is expected that current induced drift will rapidly replace any oil affected populations. Thus, the potential consequence to fish and sharks including commercially fished species is assessed as **Level 2** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Pinnipeds	Localised parts of the foraging range for NZ fur-seals and Australian fur-seals and also foraging range BIA for the Australian sea lion (male) may be temporarily exposed to low concentrations of entrained MDO in the water column (no dissolved phase).	Exposure to hydrocarbons in the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds, however given the temporary and localised nature of the spill, their widespread nature, the low-level exposure zones and rapid loss of the volatile components of MDO in choppy and windy seas (such as that of the EMBA), the potential consequence is assessed as **Level 2** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Cetaceans	Several threatened, migratory and/or listed marine species have the potential to be migrating, resting or foraging within an area predicted to be above the surface thresholds. Known BIAs are present for distribution and foraging PBW and known core range aggregation and connecting habitat and migration and resting o for southern right whale.	Cetacean exposure to entrained hydrocarbons can result in physical coating as well as ingestion (Geraci and St Aubin 1988). Such impacts are associated with 'fresh' hydrocarbon; the risk of impact declines rapidly as the MDO weathers. Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behavioural disturbance (including avoidance of the area) may occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may disrupt behaviours such as migration, or displace individuals from important habitat, such as foraging or aggregations areas.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			If whales are foraging or aggregating in the region at the time of the spill, a greater number of individuals may be present in the area exposed to hydrocarbons. Hydrocarbons could occur within the southern right whale aggregation BIA from Port Fairy/Warrnambool. However due to the rapid weathering and dispersion of MDO and the short duration of exposures at higher concentrations, impacts to individuals is not considered likely. Conservation Management Plan for the blue whale and the southern right whale identifies habitat modification as a threat. Activities within this Environment Plan will not be inconsistent with the conservation and management priorities outlined in these Conservation Management Plans. The potential consequence to cetaceans from a vessel collision (MDO) event is assessed as **Level 2** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
Social Receptors			
Human System	Commercial Fisheries and Recreational Fishing	In-water exposure to entrained MDO may result in a reduction in commercially targeted marine species, resulting in impacts to commercial fishing and aquaculture. Actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA 2002) which can have economic impacts to the industry. Several commercial and state fisheries operate in the EMBA and overlap the spatial extent of the water column hydrocarbon predictions.	Any acute impacts are expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Impacts from entrained exposure are unlikely to manifest at a fish population viability level. Actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA, 2002) which can have economic impacts to the industry. Any exclusion zone established would be targeted around the release area and spill trajectories, and due to the rapid weathering of MDO would only be in place for a short period after release, therefore physical displacement to vessels is unlikely to be a significant impact. The potential consequence to commercial and recreational fisheries is assessed as **Level 2** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning. Refer also to: • Fish and Sharks. • Invertebrates.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
	Recreation and Tourism	In-water exposure to entrained MDO could overlap and may result in a negative impact to recreation and tourism activities. Tourism and recreation activities can be indirectly exposed to impacts from in-water hydrocarbons, as the activities are often linked to the presence of ecological features, such as marine fauna (e.g. whale watching, recreational fishing).	Any impact to receptors that provide nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism activities. However, the relatively short exposure durations (of generally low exposures) indicate short-term and localised consequences, assessed as **Level 2**. Refer also to: • Fish and Sharks • Cetaceans • Invertebrates • Recreational Fishing
Natural System	State Marine Protected Areas	Marine protected areas predicted to be exposed to entrained hydrocarbons above thresholds in Australian Marine Parks; Apollo, Beagle. Conservation values for these areas include high marine fauna and flora diversity, including fish and invertebrate assemblages and benthic coverage (sponges, soft corals, macroalgae).	Based on the worse case potential consequence to key receptors the consequence to protected marine areas is assessed **Level 2.** Refer to: • Invertebrates. • Macroalgae. • Pinnipeds.
	KEFs	Bonney Coast Upwelling and West Tasmania Canyons are predicted to be exposed to entrained hydrocarbons above thresholds. Values associated with these areas are: Bonney Coast Upwelling - Brings cold nutrient rich water to the sea surface and supports regionally high productivity and high species diversity. Whales and many endangered and listed species frequent the area, possibly relying on the abundance of krill that provide a food source to many seabirds and fish. Higher predator species such as little penguins and Australian fur seals also feed on baitfish. West Tasmania Canyons - Influence currents, act as sinks for rich organic sediments and debris, and can trap waters or create upwellings that result in	Based on the worse case potential consequence to key receptors within these KEFs, the potential consequence is assessed to be **Level 2**. Refer also to: • Coral. • Macroalgae. • Seagrass. • Plankton. • Invertebrates • Seabirds. • Fish and Sharks. • Marine mammals (Pinnipeds, Cetaceans).

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		productivity and biodiversity hotspots. Sponges are concentrated near the canyon heads and are associated with an abundance of fish.	

6.7.4.2. Risk Event: LOWC

The ecological and social receptors with the potential to be exposed to surface, shoreline accumulation and in-water hydrocarbons from a LOC caused by a LOWC are evaluated in Table 6-26, Table 6-27, and Table 6-28 respectively.

Table 6-26: Consequence Evaluation for Gas and Condensate Exposure – Surface

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
Ecological Receptors			
Marine Fauna	Avifauna	Several threatened, migratory and/or listed marine species have the potential to be rafting, resting, diving and feeding within the area predicted to be contacted by surface hydrocarbons. There are several foraging BIAs that are present within the area potentially exposed to surface hydrocarbons for gannet, albatross, petrel, and shearwater species. Foraging BIAs are typically large broad areas. The birds can feed via surface skimming or diving – both exposing the bird to any oil on the water surface. Wedge-tailed shearwater breeding BIA is also within the area potentially exposed to surface hydrocarbons at moderate exposure levels. Breeding activities do not occur in oceanic waters. Breeding birds however will utilise oceanic waters to forage during breeding.	Avifauna rafting, resting, diving or feeding within surface hydrocarbons at moderate exposure levels (>10 g/m^2) are likely to be oiled resulting in damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs (ITOPF 2011a). The area exposed by moderate levels of surface hydrocarbons from a LOWC event is predicted to be confined within 1 km of the well site. The area exposed is considered offshore open waters. The presence of surface hydrocarbons at moderate exposure levels is predicted to be temporarily present over a maximum period of 98 days (84 days of uncontrolled release, 14 days of condensate weathering). Acute or chronic toxicity impacts (death or long-term poor health) to avifauna is possible, however this is not considered significant at a population level due to the localised and temporary exposure of moderate levels of surface hydrocarbons. The presence of birds within surface hydrocarbons at moderate exposure levels is expected to be limited to foraging individuals of a transitory nature, given the absence of offshore aggregation areas in the area. The National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 identifies marine pollution as a threat (DSEWPaC 2011). The activity will be conducted in a manner which is not inconsistent with the relevant management actions. The potential consequence to seabirds from a LOWC event is assessed as **Level 2** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
	Marine Reptiles	There may be marine turtles in the area predicted to be exposed to surface hydrocarbons at moderate exposure levels. However, there are no BIAs or habitat critical to the survival of the species within this area. Marine turtles exposed to surface hydrocarbons at moderate exposure levels is limited to transiting individuals, surfacing to breathe within the surface slick.	Marine turtles are vulnerable to the effects of oil at all life stages. Marine turtles can be exposed to surface oil externally (i.e. swimming through oil slicks) or internally (i.e. swallowing the oil). Ingested oil can harm internal organs and digestive function. Oil on their bodies can cause skin irritation and affect breathing. The area exposed by moderate levels of surface hydrocarbons from a LOWC event is limited to offshore open waters (1 km from well site) over a period of 98 days. The number of marine turtles that may be exposed to surface hydrocarbons during a LOWC event is expected to be low due to the localised and temporary presence of surface hydrocarbons at moderate exposure levels and the absence of BIAs or habitat critical to the survival of marine turtles within this area.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			The potential impact would be limited to individual transiting marine turtles, with population impacts not anticipated. Marine pollution is listed as a threat to marine turtles in the Recovery Plan for Marine Turtles in Australia, 2017 – 2027, particularly in relation to shoreline oiling of nesting beaches. There are no nesting beaches within the EMBA, and the activity will be conducted in a manner which is not inconsistent with the relevant management actions. The potential consequence to marine turtles from a LOWC event is assessed as **Level 2** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
	Marine Mammals (Pinnipeds)	There may be pinnipeds in the area predicted to affected by surface hydrocarbons at moderate exposure levels. There are no BIAs for pinnipeds within this area.	Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. Oiling of pinnipeds can lead to hypothermia if the fur is affected, or poisoning if oil is ingested, resulting in reduced foraging and reproductive fitness or death (DSEWPaC 2013). The oiling of fur seals from exposure to gas or condensate surface hydrocarbons is not likely. Gas and condensate are considered light hydrocarbons that rapidly evaporates (Figure 6-8). In the event of a LOWC event, fur seals are more likely to be exposed to volatile hydrocarbon fumes from ingestion or inhalation and less likely to be physically oiled externally (Yaghmour *et al*. 2022). The area exposed by moderate levels of surface hydrocarbons from a LOWC event is limited to offshore open waters (1 km from well site) over a period of 98 days. The number of pinnipeds exposed is expected to be low, with population impacts not anticipated, due to due to the localised and temporary presence of surface hydrocarbons at moderate exposure levels and the absence of BIAs in the area. Conservation Listing Advice for the *Neophoca cinerea* (Australian sea lion) (TSSC, 2010) identifies oil spills as a potential threat to habitat. Activities within this Environment Plan will not be inconsistent with the conservation and management priorities outlined in this advice. Given that fur seals are vulnerable to poisoning from ingestion, the potential consequence to pinnipeds from a LOWC event is assessed as **Level 3** based on the potential for medium term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
	Marine Mammals (Cetaceans)	Several threatened, migratory and/or listed marine cetacean species have the potential to be migrating, resting or foraging within an area	Physical contact by individual whales of MDO is unlikely to lead to any long-term impacts. Given the mobility of whales, only a small proportion of the population would surface in the affected areas, resulting in short-term and localised consequences, with no long-term population viability effects. Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behaviour disturbance

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		predicted to be exposed to surface hydrocarbons at moderate exposure levels. The following BIAs are within the area exposed to surface hydrocarbons at moderate exposure levels: pygmy blue whale known foraging and distribution BIA • Southern right whale known core area BIA • Southern right whale aggregation, connecting habitat and migration and resting BIAs	(including avoidance of the area) may occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may disrupt behaviours such as migration, or displace individuals from important habitat, such as foraging, resting or breeding. The area exposed by moderate levels of surface hydrocarbons from a LOWC event is limited to offshore open waters (1 km from well site) over a maximum period of 98 days. If whales are foraging or aggregating in the region at the time of the spill, potential exposure to moderate levels of surface hydrocarbons is expected to be limited to transient individuals given the localised moderate exposure area (<1 km from well site). Low levels of surface hydrocarbons could occur within the southern right whale aggregation BIA from Port Fairy/Warrnambool. Conservation Management Plan for the blue whale and the southern right whale identifies habitat modification as a threat. Activities within this Environment Plan will not be inconsistent with the conservation and management priorities outlined in these Conservation Management Plans. The potential consequence to cetaceans from a LOWC event is assessed as **Level 2** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
Social Receptors			
Natural Systems	Commonwealth Areas, Parks and Reserves	The Apollo Marine Park is the only AMPs within the area predicted to be exposed to >10 g/m^2 surface oil. The Twelve Apostles Marine National Park is also within exposure range. The major conservation values for this AMP are identified as foraging areas for some species of birds (e.g. petrels, shearwaters, albatross), and foraging for pygmy blue and southern right whales.	Based on the proximity to, and potential exposure of key receptors within marine parks and reserves (i.e. described above), the potential impacts and risks to Marine Parks and reserves are considered to be **Level 2**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning. Relatively low concentrations of hydrocarbon can be toxic to plankton. Plankton risk exposure through ingestion, inhalation and dermal contact. Refer also to: • Avifauna • Marine mammals (Cetaceans).
Human Systems	Coastal Settlements	There are several local government areas identified as potentially affected in the event of a surface >10g/m^2 hydrocarbon exposure	Visible surface hydrocarbons have the potential to reduce the visual amenity of the area for public use and activities. Due to the nature of the hydrocarbons, they would rapidly weather and would have a short residence time at a given shoreline location. The potential impacts and risks to coastal settlements from a

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		Due to its solid state, a more credible threshold for visibility may be >10 g/m^2. At this threshold, the hydrocarbon is not expected to the visible from most coastal settlements.	LOWC event are considered to be **Level 2** as they could be expected to result in localised short-term impacts
	Recreation and Tourism	Visible hydrocarbons stranded on shorelines have the potential to reduce the visual amenity of the area for tourism and discourage recreational activities. However, the short sections of coastline (localised) potentially affected by peak shoreline loading, which are ranked as Low	Visible surface hydrocarbons have the potential to reduce the visual amenity of the area for tourism and discourage recreational activities. It is expected that the majority of these activities are undertaken in coastal waters, not at large distances offshore. Due to the nature of the hydrocarbons, they would rapidly weather and would have a short residence time at a given shoreline location. Consequently, the potential impacts and risks to recreation and tourism from a LOWC event are considered to be **Level 2** as they could be expected to result in localised short-term impacts Refer also to: • Coastal Settlements; • Marine Mammals (Pinnipeds, Cetaceans); and • State Marine Protected Areas.
	Heritage	Hydrocarbons stranded on a shoreline have the potential to temporarily reduce the heritage value of the area. However, the short sections of coastline (localised) potentially affected by peak shoreline loading, are ranked as Low	Visible surface hydrocarbons have the potential to reduce the visual amenity of known heritage sites along the coast. Due to the nature of the hydrocarbons, they would rapidly weather and would have a short residence time at a given shoreline location. Consequently, the potential impacts and risks to recreation and tourism from a LOWC event are considered to be Level 2 as they could be expected to result in localised short-term impacts. Refer also to: • Coastal Settlements.

Table 6-27: Consequence Evaluation for Gas and Condensate Exposure – In-water

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
Ecological Receptors			

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
Habitat	Seagrass	Seagrasses may be present within the area exposed to in-water hydrocarbons.	There is the potential that exposure could result in sub-lethal impacts, more so than lethal impacts, possibly because much of seagrasses' biomass is underground in their rhizomes (Zieman *et al*., 1984). Given the restricted range of exposure (shallow nearshore and intertidal waters only) and the predicted lower concentrations of hydrocarbons expected to be in these waters, any impact to seagrass is not expected to result in long-term or irreversible damage. Consequently, the potential impacts to seagrass are considered to be considered to be **Level 2** as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Macroalgae	Macroalgae may be present within reef and hard substrate areas within the area predicted to in-water hydrocarbons, however, it is not a dominant habitat feature in the EMBA. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of any condensate not already evaporated.	Reported toxic responses to oils have included a variety of physiological changes to enzyme systems, photosynthesis, respiration, and nucleic acid synthesis (Lewis & Pryor 2013). A review of field studies conducted after spill events by Connell *et al* (1981) indicated a high degree of variability in the level of impact, but in all instances, the algae appeared to be able to recover rapidly from even very heavy oiling. Given the restricted range of exposure (shallow nearshore and intertidal waters only) and the predicted lower concentrations of hydrocarbons expected to be in these waters, any impact to macroalgae is not expected to result in long-term or irreversible damage. Consequently, the potential impacts to macroalgae are considered to be considered to be **Level 2** as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Coral	Soft corals may be present within reef and hard substrate areas within the EMBA. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of the MDO residue.	Exposure of entrained hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Shigenaka, 2001). Contact with corals may lead to reduced growth rates, tissue decomposition, and poor resistance and mortality of sections of reef (NOAA, 2010).

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			However, given the lack of coral reef formations, and the sporadic cover of hard or soft corals in mixed nearshore reef communities along the Otway coast, such impacts are considered to be limited to isolated corals. Consequently, the potential impacts to corals are considered to be **Level 2** as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
Marine Fauna	Plankton	Plankton is found in nearshore and open waters in the water column. These organisms migrate vertically through the water column to feed in surface waters at night (NRDA, 2012). As they move close to the sea surface it is possible that they may be exposed to surface hydrocarbons but to a greater extent, dissolved or entrained in the water column.	Relatively low concentrations of hydrocarbon are toxic to both plankton [including zooplankton and ichthyoplankton (fish eggs and larvae)]. Plankton risk exposure through ingestion, inhalation and dermal contact with in-water hydrocarbons. Plankton is generally abundant in the upper layers of the water column and is the basis of the marine food web, so an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Reproduction by survivors or migration from unaffected areas is likely to rapidly replenish losses (Volkman *et al*., 2004). Oil spill field observations show minimal or transient effects on plankton (Volkman *et al*., 2004). Once background water quality is re-established, plankton takes weeks to months to recover (ITOPF, 2011a). Any impact is expected to be localised and temporary, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have re-established, the plankton community may take weeks to months to recover (ITOPF, 2011), allowing for seasonal influences on the assemblage characteristics. The potential impacts to plankton are considered to be **Level 2** as they could be expected to result in localised short-term impacts, but not affecting local ecosystem functioning.
	Invertebrates	Invertebrate species do occur within the EMBA and could be exposed above ecological impact threshold levels. Exposure would be short lived accounting	Acute or chronic exposure through contact and/or ingestion can result in toxicological risks. However, the presence of an exoskeleton (e.g. crustaceans) reduces the impact of hydrocarbon absorption through the surface membrane. Invertebrates with no exoskeleton and larval forms may be more prone to impacts. Localised impacts to larval stages may occur which could impact on population recruitment that year.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			Tainting of recreation or commercial species is considered unlikely to occur, however if it did it is expected to be localised and low level with recovery expected. Consequently, the potential impacts to invertebrates are considered to be **Level 2** as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
	Fish and Sharks	Fish are exposed to hydrocarbon droplets through a variety of pathways, including Direct dermal contact with diffusion across their gills (Hook *et al*., 2016)); Ingestion of contaminated prey; and Inhalation (e.g., elevated dissolved contaminant concentrations in water passing over the gills).	Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2010). Subsurface hydrocarbons could potentially result in acute exposure to marine biota such as juvenile fish, larvae, and planktonic organisms, although impacts are not expected cause population-level impacts. Potential impacts are assessed as **Level 2** as they could be expected to be localised and short-term.
	Pinnipeds	There may be pinnipeds in the area predicted to affected by hydrocarbons. There are no BIAs for pinnipeds within this area.	Hydrocarbons in the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds, however given the localised nature of the spill, and the rapid loss of the volatile components of condensate in choppy and windy seas (such as that of the EMBA) and impacts are expected to be temporary and localised (**Level 2** consequence).
	Cetaceans	Several threatened, migratory and/or listed marine species have the potential to be within the EMBA. Known BIAs are present for distribution and foraging PBW and known core range aggregation and connecting habitat and migration and resting o for southern right whale.	Cetacean exposure to entrained hydrocarbons can result in physical coating as well as ingestion (Geraci and St Aubin, 1988). Such impacts are associated with 'fresh' hydrocarbon; the risk of impact declines rapidly as the condensate weathers. Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behaviour disturbance (including avoidance of the area) may occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may disrupt behaviours such as migration, or displace individuals from important habitat, such as foraging, resting or breeding. The potential for environmental impacts would be limited to a relatively short period following the release and would need to coincide with a migration or

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			aggregation event to result in exposure to a large number of individuals. However, such exposure is not anticipated to result in long-term population viability effects. The potential consequence to cetaceans from a LOWC event is assessed as **Level 2** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.
Social Receptors			
Natural System	Commonwealth Areas, Parks and Reserves	No AMP are within the area predicted to be exposed to in-water concentrations above the environmental impact thresholds.	The concentration at which the water column within AMPs may be exposed is below the ecological no-effect (low) time-based exposure threshold. Given the temporary (1 hour instantaneous) nature of the exposure, and the limited effect on water quality, the consequence is ranked as **Level 1**.
	State Parks and Reserves	State Parks and reserves are within the EMBA.	Based on the proximity to, and potential exposure of key receptors within marine parks and reserves (i.e. described above), the potential impacts and risks to Marine Parks and reserves are considered to be **Level 2**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning. Refer to: • Invertebrates • Macroalgae
Human System	Commercial Fisheries	In-water exposure to entrained hydrocarbons may result in a reduction in commercially targeted marine species, resulting in impacts to commercial fishing and aquaculture. Actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA, 2002) which can have economic impacts to the industry. Several commercial and state fisheries operate in the EMBA and overlap the spatial extent of the water column hydrocarbon predictions.	Any acute impacts are expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Impacts from entrained exposure are unlikely to manifest at a fish population viability level. Any exclusion zone established would be limited to the safety exclusion zone around the vicinity of the release point, and due to the rapid weathering of hydrocarbons would only be in place whilst well-kill activities are enacted, therefore physical displacement to vessels is unlikely to be a significant impact. The potential consequence to commercial and recreational fisheries is assessed as **Level 2** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			Refer also to: • Fish and Sharks
	Recreation and Tourism	In-water exposure to entrained condensate could overlap and may result in a negative impact to recreation and tourism activities. Tourism and recreation activities can be indirectly exposed to impacts from in-water hydrocarbons, as the activities are often linked to the presence of ecological features, such as marine fauna (e.g. whale watching, recreational fishing).	Any impact to receptors that provide nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism activities. However, the relatively short exposure durations (of generally low exposures) indicate short-term and localised consequences, assessed as **Level 2**. Refer also to: • Fish and Sharks • Cetaceans • Invertebrates • Recreational Fishing

Table 6-28: Consequence Evaluation for Gas and Condensate Exposure - Shoreline

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
Ecological Receptors			
Habitat	Rocky Shoreline	Rocky shores are within the area potentially exposed to hydrocarbons ashore. Rapid evaporation is expected to occur during the first 24 hours with the condensate is predicted to readily entrain into the water column under all wind speeds (in particular the higher wind speeds) The tides and constant wave washing are expected to lead to rapid weathering of any hydrocarbons in the intertidal area and it is unlikely that toxicity or smothering effects to exposed fauna will occur on this type of shoreline. Oil can become concentrated as it strands ashore. However, as on all types of shoreline, most of the oil is concentrated along the	The sensitivity of a rocky shoreline to oiling is dependent on a number of factors including its topography and composition, position, exposure to oceanic waves and currents etc. Exposed rocky shorelines are less sensitive than sheltered rocky shorelines. One of the main identified values of rocky shores/scarps is as habitat for invertebrates (e.g. sea anemones, sponges, sea-squirts, molluscs). Rocky areas are also utilised by some pinniped and bird species; noting that foraging and breeding/nesting typically occurs above high tide line. The impact of oil on any organism depends on the toxicity, viscosity and amount of oil, on the sensitivity of the organism and the length of time it is in contact with the oil. Even where the immediate damage to rocky shores from oil spills has been

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		high tide mark while the lower/upper parts are often untouched (IPIECA, 1995).	considerable, it is unusual for this to result in long-term damage and the communities have often recovered within 2 or 3 years (IPIECA, 1995). The potential consequence to rocky sites from a worst-case condensate release is assessed as **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.
	Sandy Shoreline	Sandy beaches are predicted to be within the area potentially exposed to hydrocarbons ashore. Sandy beaches are the predominant habitat type within the stretch of coast where shoreline contact could be expected from a LOWC event. As the volatile components evaporate and the oil weathers, the oil will resolidify and the risk of exposure decreases. Oil can become concentrated as it strands ashore. However, as on all types of shoreline, most of the oil is concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA, 1995). A sandy beach may allow oil to percolate through the sand, thus increasing its ability to hold more oil ashore over tidal cycles and various wave actions than an equivalent area of water; hence oil can increase in thickness onshore over time.	Sandy beaches are considered to have a low sensitivity to hydrocarbon exposure. Sandy beaches provide habitat for a diverse assemblage (although not always abundant) of infauna (including nematodes, copepods and polychaetes); and macroinvertebrates (e.g. crustaceans). There is a very small area between Port Campbell and Shelly Beach where the OSTM indicates that shoreline oiling may occur above 100 g/m^2 may occur (1% probability of contact). This area is dominated by sheer rocky cliffs with very small areas of sandy beach/rock platform. This occurs only for the pipeline rupture scenario at the HDD. Given the low viscosity of this residue it is likely to permeate into sand areas in a similar way to MDO. The tides and constant wave washing are expected to lead to rapid weathering of any hydrocarbons in the intertidal area and it is unlikely that toxicity or smothering effects to exposed fauna will occur on this type of shoreline. Consequently, the potential impacts and risks to sandy shores from a worst-case loss of condensate are considered to be **Level 3**, as they could be expected to result in localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.
	Mangroves	Strands of mangroves are predicted to be within the area potentially exposed to hydrocarbons ashore; however, within the stretch of coast expected to be exposed, there is no coastal habitat mapped specifically as this vegetation type. Oil can enter mangrove forests when the tide is high and be deposited on the aerial roots and sediment surface as the tide recedes. This process commonly leads to a patchy distribution of the oil and its effects because different places within the forests are at different tidal heights (IPIECA 1993, NOAA, 2014).	Mangroves are considered to have a high sensitivity to hydrocarbon exposure. Mangroves can be killed by heavy or viscous oil, or emulsification, that covers the trees' breathing pores thereby asphyxiating the subsurface roots, which depend on the pores for oxygen. Mangroves can also take up hydrocarbons from contact with leaves, roots or sediments, and it is suspected that this uptake causes defoliation through leaf damage and tree death (Wardrop *et al*., 1987). Acute impacts to mangroves can be observed within weeks of exposure, whereas chronic impacts may day months to years to detect.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		The physical smothering of aerial roots by standard hydrocarbons can block the trees' breathing pores used for oxygen intake and result in the asphyxiation of sub-surface roots (International Petroleum Industry Environmental Conservation Association (IPIECA 1993). Rapid evaporation is expected to occur during the first 24 hours with the condensate predicted to readily entrain into the water column under all wind speeds (in particular the higher wind speeds). Due to the high volatility of the condensate, little is predicted to remain on the water surface after the spill ceases.	Given the non-persistent nature of the hydrocarbon there is expected to be minimal impact from smothering of aerial roots or seedlings. Consequently, the potential impacts and risks to mangroves from a LOWC event are assessed to be **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.
	Saltmarsh	Communities of saltmarsh are predicted to be within the area potentially exposed to hydrocarbons ashore; and is present within some estuaries and inlet/riverine systems. Some of the saltmarsh habitat along this coast will be representative of the Subtropical and Temperate Saltmarsh TEC. Oil can enter saltmarsh systems during the tidal cycles if the estuary/inlet is open to the ocean. Similar to mangroves, this can lead to a patchy distribution of the oil and its effects, because different places within the inlets are at different tidal heights. Oil (in liquid form) will readily adhere to the marshes, coating the stems from tidal height to sediment surface. Heavy oil coating is unlikely due to the highly volatile nature of the hydrocarbon.	Saltmarsh is considered to have a high sensitivity to hydrocarbon exposure. Saltmarsh vegetation offers a large surface area for oil absorption and tends to trap oil. Evidence from case histories and experiments shows that the damage resulting from oiling, and recovery times of oiled marsh vegetation, are very variable. In areas of light to moderate oiling where oil is mainly on perennial vegetation with little penetration of sediment, the shoots of the plants may be killed but recovery can take place from the underground systems. Good recovery commonly occurs within one to two years (IPIECA, 1994). The potential consequence to saltmarsh is assessed to be **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.
Marine Fauna	Invertebrates	Invertebrates that live in intertidal zones include crustaceans, molluscs and infauna. These fauna can be present in a wide range of habitats including sandy beaches and rocky shores (refer also the exposure evaluation for these habitats). Exposure to hydrocarbons for invertebrates is typically via direct contact and smothering but can also occur via ingestion.	There is a 1% probability of shoreline exposure to 100 g/m^2 at isolated areas of shoreline west of Port Campbell from an HDD pipeline release (no shoreline contact for the well failure scenario). Note that this is below oiling thresholds which cause ecological impacts. Inshore and intertidal benthic species may be exposed to condensate (albeit slightly weathered).Benthic communities associated with inshore reefs would be exposed to very low-level hydrocarbons.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			The predicted area of shoreline contact is mixed sand/shore platform. Residues deposited on these areas are rapidly remobilised due to wave and tidal action so any accumulation is likely to be short-term and temporary. At 100 g/m^2, resident fauna such as worms, molluscs and crustaceans may suffer lethal impacts if hydrocarbons penetrate into sediments. On this basis, impacts to near-shore benthic and shoreline assemblages are considered to be limited, localised, and if impacts occur, areas will be rapidly recolonised by adjacent species, and are assessed as **Level 2** consequence.
	Seabirds and Shorebirds	Listed marine, threatened and/or migratory bird species have the potential to be resting, feeding or nesting within the area predicted to be exposed to hydrocarbons ashore. This fauna can be present in wide range of habitats including sandy beaches and rocky shores (refer also the exposure evaluation for these habitats). There are several foraging, breeding and aggregation BIAs throughout the area, however these species are oceanic foragers, not shoreline foragers. Shorebirds will still utilise intertidal and onshore zones for feeding (no BIAs have been identified).	Shoreline species may suffer both direct oiling and potential displacement from foraging and nesting sites. Acute or chronic toxicity impacts (death or long-term poor health) to small numbers of birds is possible, however this is not considered significant at a population level. Direct oiling of nesting sites is considered unlikely as hydrocarbon would typically accrue within the upper swash zone, and nests would occur above this level on a beach. However, oiled fauna may track oil into their nests, which may then have subsequent impacts on any eggs present. This would be more of a risk for fauna, such as the Little Penguin, that have to traverse the intertidal area to reach nesting sites. There are no known breeding locations for penguins along the Otway mainland coast at risk of shoreline oil accumulation. In addition, given the volatility of the exposed oil, any impact to nests is expected to occur to individuals and not considered to pose a long-term risk at population level. Given the potential for sensitive shoreline habitat to be exposed to hydrocarbons above the actionable >100 g/m^2 shoreline exposure thresholds, the length of shoreline that has the potential to be exposed and the peak volume potentially accumulated ashore, the consequence has been assessed as **Level 2**.
	Marine Reptiles	Turtles nesting on exposed shores would be exposed by direct contact with skin/body. However, there are no BIAs or habitat critical to the survival of the species within the shorelines that could be potentially affected. Therefore, shoreline exposure to marine turtles is not expected and not evaluated further.	Marine turtles are vulnerable to the effects of oil at all life stages; effects on nesting populations include increased egg mortality, developmental defects, skin irritation, or mortality of hatchlings or adults. However, turtles are pelagic species and only go onshore for nesting. As nesting colonies of turtles are not expected to be present, any potential impact would be limited to individuals, with population impacts not anticipated.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
			Marine pollution is listed as a threat to marine turtle in the Recovery Plan for Marine Turtles in Australia, 2017- 2027, particularly in relation to shoreline oiling of nesting beaches. There are no nesting beaches within the EMBA, so impacts from shoreline oiling will not occur.
	Marine Mammals (Pinnipeds)	Listed marine and/or threatened pinniped species have the potential to present within the area predicted to be exposed to hydrocarbons ashore. There is an Australian Sea Lion Foraging (male) BIA present within the potential monitoring spill EMBA (monitoring). Pinnipeds hauling out on exposed shores could be exposed by direct contact of oil with skin/body. Direct oiling is possible but expected to have a limited window for occurring due to rapid weathering of condensate.	Pinnipeds have high site fidelity and can be less likely to exhibit avoidance behaviours, thus staying near established colonies and haul-out areas. Small colonies of NZ and Australian fur-seals occur at Lady Julia Percy Island, outside of the shoreline EMBA and at Moonlight Head/Cape Volney which is located in the entrained phase EMBA. The OSTM indicates that shoreline stranding of hydrocarbons at these locations is not predicted. Conservation Listing Advice for the Neophoca cinerea (Australian sea lion) (TSSC, 2010) identifies oil spills as a potential threat to habitat. The potential impacts to pinnipeds from a shoreline hydrocarbon exposure event are considered to be **Level 2**, as the impacts could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Social Receptors			
Natural System	State Parks and Reserves	There are State Parks and Reserves predicted to be within the area potentially exposed to hydrocarbon onshore. The Australian Marine Parks with probability of exposure within the potential monitoring EMBA include Apollo and Beagle Australian Marine Parks however these do not have shorelines. There are 96 State and Territory Reserves (74 terrestrial protected areas and 22 marine protected areas) and three regional forest agreements in place within the potential monitoring EMBA, It is expected that most of the oil on shorelines will be concentrated along the high tide mark while the lower / upper parts of the shore are often untouched (IPIECA, 1995). Values associated with these areas include providing habitats for a diverse range of invertebrates, fish, mammals and birds.	For those parks and reserves with boundaries that extend into the intertidal zone, any impact is expected to be restricted to the area seaward from the high tide line, and therefore represent a small proportion of the overall park or reserve area. Based on the potential risks of key ecological receptors (e.g. sandy beaches, pinnipeds), the potential impacts and risks to State marine protected areas are considered to be **Level 2**, as the impacts could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
	Threatened Ecological Communities	There are 11 Threatened Ecological Communities located within the potential monitoring EMBA with only six overlapping with coastal areas and therefore have a potential exposure to hydrocarbons. It is expected that most of the oil on shorelines will be concentrated along the high tide mark while the lower/upper parts of the shore are often untouched (IPIECA, 1995).	
	Wetlands	Wetlands are predicted to be within the area potentially exposed to hydrocarbon ashore including six Ramsar wetlands. Wetland habitat can be of particular importance for some species of birds and invertebrates. As such, in addition to direct impacts on plants, oil that reaches wetlands also affects these fauna utilising wetlands during their life cycle, especially benthic organisms that reside in the sediments and are a foundation of the food chain.	The impacts of hydrocarbons on wetlands are generally similar to those described for mangroves and saltmarshes. The degree of impact of oil on wetland vegetation are variable and complex, and can be both acute and chronic, ranging from short-term disruption of plant functioning to mortality. Spills reaching wetlands during the growing season will have a more severe impact than if oil reaches wetlands during the times when many plant species are dormant. The potential consequence to wetlands from exposure are assessed as **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. Refer also to: • Marine Invertebrates. • Seabirds and Shorebirds.
Human System	Coastal Settlements	Coastal settlements are within the area potentially exposed to hydrocarbons ashore; however, the stretch of coast to be exposed is not densely populated. Noting that these events will be temporary, so duration of exposure is also limited. Most of the hydrocarbons will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA 1995) and expected to be visible.	Visible hydrocarbons have the potential to reduce the visual amenity of the area for coastal settlements. Given its rapid weathering and potential for tidal flushing and rapid degradation, the potential consequence to coastal settlements is assessed as Minor based on the potential for localised short-term impacts.
	Recreation and Tourism	In the event of a significant spill event from the Otway offshore assets, it is possible that some impacts tourism perception may reduce numbers visiting the Shipwreck coastline. However, impacts associated with a spill event which is visible to the public	Visible hydrocarbons stranded on shorelines have the potential to reduce the visual amenity of the area for tourism and discourage recreational activities.

Receptor Group	Receptor Type	Exposure Evaluation	Consequence Evaluation
		would be limited in scale, very localised in impact and temporary in nature. The material released does not have a significant surface presence (i.e. low sheens except for an HDD pipeline rupture which is temporary and localised). In addition, visitation to the Twelve Apostles is for its aesthetics and scenery, two aspects which are not expected to be significantly affected by a limited release condensate spill. The impact to visitation is expected to be small on this basis. Releases from offshore facilities (e.g. pipeline rupture at PLEM and well blowout) are not expected to be visible from the shoreline.	Given condensates rapid weathering and potential for tidal flushing and rapid degradation, the potential consequence to coastal settlements is assessed as **Level 2** based on the potential for localised short-term impacts. Refer also to: • Rocky Shores. • Sandy Beaches.
	Heritage	Specific locations of spiritual and ceremonial places of significance, or cultural artefacts, are often unknown, but are expected to be present along the mainland coast. Therefore, there is the potential that some of these sites may be within the area potentially exposed to hydrocarbon ashore. Noting that these events will be temporary, so duration of exposure is also limited. Most of the oil will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA 1995) and expected to be visible.	Visible hydrocarbons have the potential to reduce the visual amenity of heritage sites. However, it is expected that these sites would be above the high tide mark. Thus, the potential consequence to heritage is assessed as **Level 2** as they could be expected to result in localised short-term impacts.

6.7.5.Control Measures, ALARP and Acceptability Assessment

Table 6-29 provides a summary of the control measures and ALARP and Acceptability Assessment relevant to worst case release scenarios.

Table 6-29: Accidental Hydrocarbon Release ALARP, Control Measures and Acceptability Assessment

Accidental Hydrogen Release	
ALARP Decision Context and Justification	**ALARP Decision Context: Type B** The activities proposed that could lead to a LOC are not new and have been undertaken by Cooper Energy in the time since they become titleholder and operator. The wells are operated per the regulatory accepted WOMP and the pipeline per the regulatory accepted safety case and integrity management plan. The risks associated with vessel collision and LOWC are well understood; given the spatial and temporal scale of a worst-case discharge, and the sensitivities in the region, a worst-case scenario has the potential to result in Level 3 consequences. Consequently, Cooper Energy believes that ALARP Decision Context B should be applied. However, from the outset of the planning phase, due to inherent complexity and some uncertainty associated with this aspect for this project, Context C has also been applied, and is reflected in: • The conservative assumptions used to characterise WCD scenarios for LOWC, • Detailed assessment of potential impacts and risks, • Detailed assessment of control measures and selection of contingency measures in line with a precautionary approach, • Preparation of detailed response plans.
Control Measure	**Source of Good Practice Control Measures**
Preventative	
C1: Marine exclusion and caution zones	PSZs are frequently installed over petroleum wells, structures and equipment via gazettal under the OPGGS Act where warranted by interaction risks. Temporary exclusion or caution zones are applied around vessels where they may be restricted in their manoeuvrability.
C2: Pre-start Notifications	Under the Navigation Act 2014 (Cth), the AHS are responsible for maintaining and disseminating hydrographic and other nautical information and nautical publications including: • Notices to Mariners • AUSCOAST warnings Relevant details will be provided to the Joint Rescue Coordination Centre (JRCC) to enable AUSCOAST warnings to be disseminated.
C12: MODU Material Transfer Processes	MODU will have a bulk fluid transfer process in place before commencing operations.
C7: Planned Maintenance System (MODU / Vessels)	PMSs ensure that safety-critical equipment is maintained in accordance with manufacturer specifications to enable optimal performance.
C3: Marine Order 27: Vessel surveys and certification	AMSA MO 27: Safety of navigation and radio equipment gives effect to SOLAS regulations regarding radiocommunication and safety of navigation and provides for navigation safety measures and equipment and radio equipment requirements.
C6: Marine Order 30: Prevention of collisions	AMSA MO 30: Prevention of collisions requires that onboard navigation, radar equipment, and lighting meets the International Rules for Preventing Collisions at Sea (COLREGs) and industry standards.

C26: Marine Order 31: SOLAS and non-SOLAS certification	All vessels contracted to Cooper Energy will have in date certification in accordance with AMSA Marine Order 31 [Vessel surveys and certification]).
C13: Vessel compliant with MARPOL Annex I, as appropriate to class (i.e. SMPEP or equivalent)	In accordance with MARPOL Annex I and AMSA MO 91 [Marine Pollution Prevention – oil], a Shipboard Marine Pollution Emergency Plan (SMPEP) or Shipboard Oil Pollution Emergency Plan (SOPEP) (according to class) is required to be developed based upon the Guidelines for the Development of Shipboard Oil Pollution Emergency Plans, adopted by IMO as Resolution Marine Environment Protection Committee (MEPC).54(32) and approved by AMSA. To prepare for a spill event, the SMPEP/SOPEP details: • Response equipment available to control a spill event; • Review cycle to ensure that the SMPEP/SOPEP is kept up to date; and • Testing requirements, including the frequency and nature of these tests. In the event of a spill, the SMPEP/SOPEP details: • Reporting requirements and a list of authorities to be contacted; • Activities to be undertaken to control the discharge of hydrocarbon; and • Procedures for coordinating with local officials. Specifically, the SMPEP/SOPEP contains procedures to stop or reduce the flow of hydrocarbons to be considered in the event of tank rupture.
C26: Marine Order 21: Safety and emergency arrangements	AMSA MO 21: Safety and emergency arrangements gives effect to SOLAS regulations dealing with life-saving appliances and arrangements, safety of navigation and special measures to enhance maritime safety.
C27: NOPSEMA accepted WOMP	Under Part 5 of the OPGGS (Resource Management and Administration) Regulations 2011, an accepted WOMP is required before well activities can be undertaken. The WOMP details well barriers and the integrity testing that will be in place for the activity. The accepted WOMP (and its implementation) is therefore considered a key component of the environmental risk management for the campaign.
C28: NOPSEMA accepted safety cases	Under OPGGS (Safety) Regulations 2009 the following safety cases will be required for the campaign: • MODU facility safety case • Campaign Safety Case Revision • Otway Offshore Operations Field Safety Case Each safety case will identify all hazards having the potential to result in major accident events (MAEs) associated with the respective facility. Safety cases therefore address major source control events associated with both the wells and the facilities (MODU) including surface and subsea well releases, and vessel collision. As part of MAE prevention and control, formal safety assessments are details and systematic assessment of the risk associated with each of those hazards, including the likelihood and consequences of each potential major accident event; and identifies the technical and other control measures that are necessary to reduce that risk to ALARP. The accepted safety cases (and their implementation) are therefore considered key components of the environmental risk management for the campaign.
Response	
OPEP C6: Source Control Emergency Response Plan	A source control emergency response plan (SCERP) is available for the activities. Where applicable to the campaign, the SCERP will address: • Arrangements for the provision of the Source Control IMT personnel (numbers, competency, capability for the duration of the response)

	• Arrangements for the provision of equipment and supplies • Arrangements for equipment and personnel monitoring and tracking • Activation and mobilisation plans, including activation and expenditure authority and regulatory approval processes • Logistics plans and providers • SIMOPS planning process • Deployment and installation plans • Well kill and shut-in plans.
C29: OPEP	Under the Regulations, the petroleum activity must have an accepted Oil Pollution Emergency Plan (OPEP) in place before the activity commences. In the event of a LOWC, the OPEP will be implemented. The Offshore Victoria OPEP has been developed and provides for emergency response for scenarios described under this EP. By committing to implement this EP, Cooper Energy acknowledges that any response will be implemented in accordance with the requirements described within the OPEP.
C30: OSMP	Cooper Energy's OSMP details the arrangements and capability in place for: • Operational monitoring of a hydrocarbon spill to inform response activities • Scientific monitoring of environmental impacts of the spill and response activities. Operational monitoring will allow adequate information to be provided to aid decision making to ensure response activities are timely, safe, and appropriate. Scientific monitoring will identify if potential longer-term remediation activities may be required and potential breaches of protected places management objectives, specifically those of Australian Marine Parks.
Impact and Risk Summary	
Residual Impact Consequence	N/A
Residual Risk Consequence	Level 3
Likelihood	An assessment of LOWC incidents was undertaken using SINTEF records (2013). This provided an indicative probability of a LOWC from well intervention or drilling that can be reasonably expected to occur, based on previous incidents. Statistics indicate the chances of the activity resulting in a LOWC are 1×10^{-4}; this aligns to a likelihood rating D (Unlikely) under the Cooper Energy risk matrix. The identified control measures to prevent a LOWC event include clear design and assurance standards, and consequently, it is considered Unlikely (D) that a LOWC would occur that as a rare combination of factors would be required for an occurrence; the event is conceivable and could occur at some time; and could occur during the activity.
Residual Risk	Moderate
Demonstration of Acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to a localized medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function; remedial, recovery work to land/water systems over months/year. The activities were evaluated as having the potential to result in a Level 3 consequence thus is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.

Legislative and Conventions	Legislation and other requirements considered relevant control measures include: • AMSA Marine Order 3 [Seagoing qualifications] • AMSA Marine Order 30 [Prevention of collisions] • AMSAs Marine Order 91 [Marine Pollution Prevention – oil] • OPGGS(E) Regulations (Cwlth) and OPGGS Regulation (Vic) – Cooper Energy Victorian OPEP (VIC-EPER-EMP-0001) • OPGGS(E) Regulations (Cwlth) and OPGGS Regulation (Vic) - Cooper Energy OSMP (VIC-ER-EMP-0002) • Navigation Act 2014 - Notifications
Internal Context	The environmental controls proposed reflects Cooper Energy's HSEC Policy commitment to take all reasonably practicable steps to protect the health and safety of workers, contractors, partners, and communities, and ensuring its business is conducted in an environmentally responsible manner. Relevant management system processes adopted to implement and manage hazards to ALARP include: • Risk Management (MS03) • Technical Management (MS08) • Health Safety and Environment Management (MS09) • Incident and Crisis Management (MS10) • Supply Chain and Procurement Management (MS11) • External Affairs & Stakeholder Management (MS05)
External Context	No objections or claims have been raised during stakeholder consultation. Suggestions from State emergency agencies have been adopted unless otherwise discussed and agreed.
Acceptability Outcome	Acceptable

7. Oil Spill Response Overview

7.1. Oil Spill Response Strategies

This section represents the risk assessment for oil spill response options as required by the Regulations. This Section informs the Offshore Victoria OPEP.

7.1.1. Hydrocarbon Spill Risks associated with the activities

Table 7-1 summarises the spill scenarios identified in Section 6.7 during the activities associated with this EP, and the relevant level. Spill levels are described in the Offshore Victoria OPEP.

Table 7-1: Hydrocarbon spill risks associated with the activities

Spill Risk	Spill Level	Fluid Type
Minor spill LOC	Level 1	MDO, hydraulic oil, chemical
Bunkering LOC	Level 1	MDO, chemical
Vessel Collision LOC	Level 1 / 2	MDO (Group II)
Subsea release up to LOWC	Level 1 / 2 / 3	Gas / Condensate

7.1.2. Response Option Selection

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

Net Environmental Benefit Analysis (NEBA) is the process of considering advantages and disadvantages of different spill response options (including no response) to arrive at a spill response decision resulting in the lowest overall environmental and social impacts. NEBA is undertaken at a strategic level to identify pre-determined recommended response strategies, and an operational NEBA is undertaken throughout the emergency response. The process requires the identification of sensitive environmental receptors and the prioritisation of those receptors for protection so that the strategic objectives of the response can be established.

Table 7-2 provides an assessment of the available oil spill response options, their suitability to the potential spill scenarios and their recommended adoption for the identified events.

7.2. Response Priority Areas

To support the identification of priority response areas, shoreline sensitivity analysis and mapping was undertaken guided by IPIECA principles and informed by the regional description of the environment and understanding of receptor presence in the region. The Response Priority Areas are detailed in the OPEP.

7.3. Pre-spill Net Environmental Benefit Assessment

Location specific information was used for each of the priority response planning areas to further refine receptor presence, with these receptors ranked based upon the sensitivity criteria detailed in the OPEP. An assessment of the effective spill response strategies and the net benefit they offer, specific to the sensitivities located within each of the priority response planning areas is also provided in the OPEP.

Table 7-2 provides an assessment of the available oil spill response options, their suitability to MDO and Otway fields condensate and their recommended adoption for Otway Offshore Operations and maintenance activities.

Table 7-2: Suitability of Response Options for MDO and Otway Condensates Spills

Response Option	Description	MDO Assessment	Viable Response?	Net Benefit?	Otway condensate	Viable Response?	Net Benefit?
Source Control	Limit flow of hydrocarbons to environment.	Achieved by vessel SMPEP	✓	✓	For Pipeline: ESD shutdown systems and operator response Procedures (refer Table 7-2). For well: In accordance with the Source Control Emergency Response Plan. The plan provides a response to release incidents from wells (refer Section 7.4).	✓	✓
Monitor & Evaluate	Direct observation – Aerial or marine; Vector Calculations; Oil Spill Trajectory Modelling; Satellite Tracking Buoys To maintain situational awareness all monitor and evaluate options suitable.	MDO spreads rapidly to thin layers. Aerial surveillance is considered more effective than vessel to inform spill response and identify if oil has contacted shoreline or wildlife. Vessel surveillance limited in effectiveness in determining spread of oil. Manual calculation based upon weather conditions will be used at the time to provide guidance to aerial observations. Oil Spill trajectory modelling utilised to forecast impact areas. Deployment of oil spill monitoring buoys at the time of vessel incident or LOWC during well construction will assist in understanding the local current regime during the spill event.	✓	✓	Modelling identifies that for condensate spills over 84% of the liquid residue will evaporate over the first few hours of release, with a further 14% over the first day, leaving approximately 2% of the spill volume potentially observable at the sea surface (in calm weather conditions). Slow leaks from the subsea pipelines are unlikely to create a surface sheen and if present, are expected to be within 1.5 km of the spill location. For an instantaneous pipeline rupture at the HDD location, surface hydrocarbons would only be expected to remain for a short period (hours). For a continuous significant spill event (well blowout) hydrocarbons will likely be present at the surface for the duration of the release. To maintain situational awareness all monitor and evaluate techniques will be considered during condensate spill incidents to understand the possible impacts.	✓	✓

Dispersant Application	Breakdown surface spill & draw droplets into upper layers of water column. Increases biodegradation and weathering and provides benefit to sea-surface /air breathing animals.	MDO, while having a small persistent fraction, spreads rapidly to thin layers. Insufficient time to respond while suitable surface thicknesses are present. Dispersant application can result in punch-through where dispersant passes into the water column without breaking oil layer down if surface layers are too thin. Application can contribute to water quality degradation through chemical application without removing surface oil. Considered not to add sufficient benefits.	X	X	Otway condensates have low levels of persistent hydrocarbon and will weather rapidly. Given the low viscosity of this liquid any surface oils will spread rapidly to thin layers, as reflected in predictive modelling, and are not suited to dispersant application due to potential “punch-through” (refer to MDO assessment).	Possible application for safety purposes (safe access to the well). Dispersant application only at the well site (Cwth waters)	Possible net benefit where it facilitates safe access to the well. Dispersant application only at the well site (Cwth waters)
Contain & Recover	Booms and skimmers to contain surface oil where there is a potential threat to environmental sensitivities. Relies on calm sea conditions, thicknesses >10µm to collect and adequate deployment timeframes.	MDO spreads and disperses rapidly to below recoverable thicknesses. The prevailing meteorological conditions in the Otway would also likely preclude containment and recovery techniques. In general, method only recovers approximately 10-15% of total spill residue, creates significant levels of waste, requires significant effort and suitable weather conditions (calm) to be deployed. Weather conditions limit deployment in the Otway offshore environment.	X	X	Given the low viscosity of the hydrocarbons, surface oils will not be present in suitable thicknesses to make contain and recover a viable response option.	X	X
Protect & Deflect	Booms and skimmers deployed to protect environmental sensitivities. Environmental	MDO has persistent components and has the potential to reach shorelines. Effective in protecting open estuaries that have environmental sensitivities (aquatic vegetation, recreational users) may benefit.	✓	✓	Otway condensates have no persistent hydrocarbon fractions and will weather rapidly within a few hours and will spread into thin layers rapidly due to its viscosity. Predictive modelling identifies that no sensitive estuary systems are threatened by surface oiling. It is noted that the	✓	✓

	conditions (e.g., current, waves limit application)	Within the surface oil EMBA is Curdies Inlet which has a high conservation value (e.g. wetlands) but is normally closed to the sea. Protection and deflection techniques should be considered is shoreline contact is predicted, the inlet is open to the sea and there is tidal exchange. These considerations mean that it is highly unlikely that MDO residue will enter the estuary. However booming or sand berms may offer some net benefit to estuarine environments which are open to the sea. Options which can be considered include a simple boom arrangement in the mouth of the estuary or installation of a temporary sand berm to prevent residue ingress. The latter is feasible as the inlet has machinery access and the inlet is periodically opened to the sea by Parks Victoria. No pre-identified booming locations have been identified given its lack of flow during the preparation of this EP. Shoreline booming (i.e. sea booming) is not considered viable due to the high energy environment of the Otway coast and the hazards of deploying and maintaining in such an environment.			closest inlet to the activity (and one of the more exposed sites from a spill scenario perspective) Port Campbell Bay has a very low probability of experiencing surface sheens during an instantaneous pipeline rupture at the HDD location. Due to the prevailing and generally dynamic conditions, measures to contain surface sheens are likely to have limited success compared to other strategies, however, may be of some benefit.		
Shoreline Clean-up	Where shoreline impact is predicted, shoreline clean-up assessment technique (SCAT)	Shoreline contact by MDO may occur at low levels from an MDO spill (generally less than 1000 g/m^2). Much of the shoreline affected by MDO residues is rock platform and backing cliffs where shoreline clean-up is hazardous and due to the nature of the	Possible (certain areas where access is possible)	Possible	Modelling predicts for all spill scenarios that minimal volumes of condensate residue will contact shorelines. A pipeline rupture at the HDD site is predicted to result in a shoreline volume of 1.25 m^3 of condensate residue 1 hour after the spill event. No shoreline residues are predicted	Possible (certain areas where access is possible)	Possible

	assessment is initiated. If SCAT and Net Environmental Benefit Assessment (NEBA) assess clean-up is of net benefit, initiate clean-up. Shoreline clean-up is a last response strategy due to the potential environmental impact; heavy resource requirements; health and safety concerns to responders; logistical complexities and waste management considerations	shoreline habitat remediates rapidly. Access to these areas is limited along the Otway coastline. MDO residue reaching accessible sand shorelines is likely to infiltrate sand where it will be susceptible to remobilisation by wave action (reworking) until naturally degraded. Due to the light nature of the product and its dispersion in the environment prior to reaching shorelines it is possible that there would be insufficient quantities for manual clean-up. MDO does not discolour shoreline as much as other hydrocarbon types. Manual collection techniques likely to have limited effectiveness. Use of sediment reworking is possible. However, the potential for shoreline assessment and clean-up will be considered as part of the NEBA in the event of a spill incident. Response strategy offers net benefit to shoreline species which are sensitive to oil spill residues (e.g. birds) (refer to Section 7.7 for risk and ALARP assessment).			from scenarios involving offshore asset releases. As per the MDO spill, residues reaching accessible sand shorelines are likely to infiltrate sand where the residue will be susceptible to remobilisation by wave action (reworking) until naturally degraded. Due to the light nature of the product and its dispersion in the environment prior to reaching shorelines it is possible that there would be insufficient quantities for manual clean-up. The response strategy may offer net benefits to shoreline species which are sensitive to oil residues (e.g. birds) (refer to Section 7.7 for risk and ALARP assessment). However, as per MDO shoreline assessment and clean-up is viable along certain sand sections of the Otway coast and will still be considered as part of a NEBA in the event of a spill incident.		
Oiled wildlife Response (OWR)	Consists of capture, cleaning and rehabilitation of oiled wildlife. May include hazing or pre-spill captive management.	Given limited size and rapid spreading of the MDO spill, large scale wildlife response is not predicted. However, there is the potential that individual birds could become oiled in the vicinity of the spill. OWR may offer net benefits for both seabirds and shorebirds within the surface oil and shoreline residue zones	✓	✓	Given the nature of the Otway condensate and its rapid spreading to thin layers and limited volumes of residue washed ashore, it is predicted there will be limited impacts to species sensitive to oil residues such as birds. However, OWR may offer net benefits to seabirds which come into contact and area affected by these minor residues.	✓	✓

	In Victoria, this is managed by DELWP.	>100 g/m^2 which result from the MDO spill. OWR is both a viable and prudent response option for this spill type (refer Section 7.8 for risk and ALARP assessment).			OWR is both a viable and prudent response option for this spill type (refer Section 7.8 for risk and ALARP assessment).		

7.4. SPILL RESPONSE: Source Control

7.4.1. Vessel Spill

Source control arrangements for significant vessel spills resulting from fuel tank perforation includes:

- Closing water-tight doors;
- Checking bulkheads;
- Determining whether vessel separation will increase spillage;
- Isolating penetrated tanks;
- Tank lightering, etc.

Source control relies heavily upon the activation of the vessels SOPEP / SMPEP (or equivalent).

Well-related source control activities are described in Section 7.4.2.

7.4.2. Source Control (LOWC)

Well source control activities, including methodologies and resources to implement source control and limit the hydrocarbon released to the environment are detailed in the Source Control Emergency Response Plan (SCERP). Figure 7-1 shows a conceptual timeline of key activities associated with source control planning. Table 7-3 provides an overview of the applicability of LOWC source control response options for the Otway operations and drilling. The subsequent sections provide further details on the scope of the activities and the resources required to implement them.

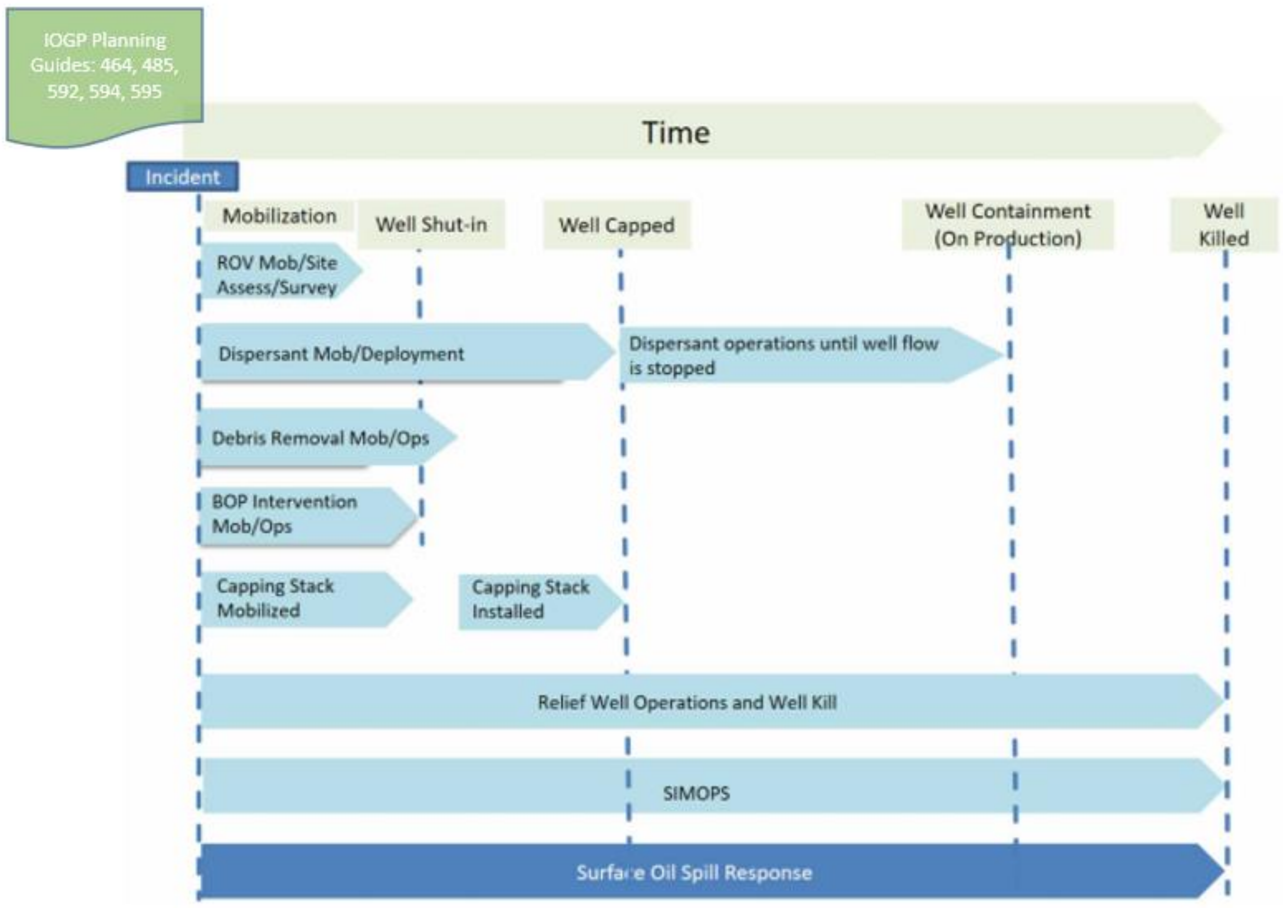


Figure 7-1 Source Control Conceptual Timeline (after IOGP Report 594 Jan 2019)

7-3 Overview of Level 3 Source Control Options Applicable to Otway Offshore Operations

Parameter	Site Survey and debris clearance.	Manual Intervention of Well Control Equipment	Subsea Dispersant Application	Well Capping	Relief Well
Operations	Yes – survey would be required to confirm the leak source.	Yes – manual intervention would be attempted if remote shut-in not possible	No – dispersant not expected to be of benefit for minor leaks of gas/condensate through tortuous leak path.	No – capping would not be suitable for a minor leak via tortuous leak path.	Yes – if intervention not successful then relief well would be activated.
Drilling	Yes – survey would be required to confirm the leak source. Debris clearance may be required to deal will equipment deployed to the well from the MODU	Yes – manual intervention would be attempted if auto-shut-in fails.	Possible. As a means of reducing VOCs at surface to support safe well access. Unlikely to be of benefit as an environmental impact mitigation measure.	Unlikely to be suitable for the Otway wells considering water depths and high energy environment. If high flow rates, given shallow water depths, a cap is unlikely to be deployable given VOCs and buoyancy at surface. Retained as a possible solution if low flow and conditions permit.	Yes – if intervention not successful then relief well would be activated.
Suitability/Functionality Feasibility *How does the response strategy perform to achieve its required risk reduction?*	Site survey assists in identifying equipment status and hazards. Debris clearance equipment is used to enable access to the well if obstructed. This option enables data to be gathered and the site to be prepared to both select and enable subsequent source control options.	Capability to manually intervene the well control equipment will be maintained throughout the campaign when well control equipment is deployed.	Subsea dispersant application is sometimes considered as an environmental mitigation to reduce shoreline loading of oil by increasing dispersion into the water column, enhancing dilution and weathering. Given Otway wells are gas/condensate, the efficacy of dispersant application would be expected to be low, however is retained as an option in a low-flow scenario where dispersant, if applied at the well, may help to reduce the concentration of VOCs at surface and thereby help reduce risks to response operators in the immediate vicinity of the well. The equipment to perform the task is available. Monitoring is required during the response to confirm	Well capping can curtail the hydrocarbon flow prior to permanent plugging of the well. In the context of the Otway development wells, this source control option is unlikely to be possible given the shallow water depths and high energy offshore environment. Anticipated WCD flow rates from the wells would affect cap landout and create a flammable environment at surface restricting access. Studies undertaken by Trendsetter Engineering have considered capping options for gas/condensate wells in the Bass Strait, in greater water depths (generally more amenable to capping) compared to the Otway facilities. The studies ruled out	This source control technique has been proven successful in Australia (e.g. Montara) and internationally (Macondo). Considered technically feasible and effective on blowout scenarios for the Otway wells. Stemming the flow of hydrocarbons from a well by injecting kill density fluid into the well bore is a proven method of regaining control of a well. This is often achieved by directionally drilling a relief well to intercept the wellbore and then pumping fluid to stem the flow. Once the well is stabilised, cement can be pumped into the well to form a permanent barrier to isolate the flow zone.

			optimum treatment rates and overall efficacy.	capping, including via direct and offset installation as an option for the reasons described above. Though essentially ruled out, Cooper Energy would consider the use of capping equipment on a case-by-case basis.	
Dependencies Effectiveness *Does the response strategy rely on other systems to perform its intended function?*	Response is reliant on availability of equipment and trained / experienced personnel to undertake activities: • Subsea debris removal equipment and operators. • Survey vessel, Construction and/or Support vessel. • Possible Safety Case and/or Revision.	Response is reliant on availability of equipment and trained / experienced personnel to undertake activities: • Subsea intervention equipment and operators. • Survey vessel, Construction and/or Support vessel. • Safety Case and/or Revision.	Response is reliant on availability of equipment and trained / experienced personnel to undertake activities: • Subsea decommissioning / dispersant application equipment and operators. • Construction and/or Support vessel. • Safety Case and/or Revision.	Response is reliant on availability of equipment and trained / experienced personnel to undertake activities: • Construction and/or Support vessel. • Well capping solution/vendor. • Well Control Specialist Company (including emergency air freight capability). • Safety Case and/or Revision.	Response is reliant on availability of equipment and trained / experienced personnel to undertake activities: • Drill rig and trained staff. • Well engineering services and management contractor. • Well Control specialists. • Well Equipment availability. • Safety Case and/or Revision.
Availability and Timely *The response strategy is available to perform its function, in sufficient time?*	Survey and debris clearance equipment is available within Australia as part of the AMOSC Subsea First Response Toolkit (SFRT). Similar packages are also available internationally including from Wild Well Control. Much of the equipment within the SFRT will already be available as part of the equipment mobilised for the campaign. Section 7.4.2.1 provides a comparison of equipment that will be mobilised for the campaign vs. the SFRT.	The campaign will have the capability to mount an intervention response. At least two work-class ROVs and tooling compatible with the subsea wells and project pressure control equipment will be mobilised for the campaign.	Subsea Dispersant equipment is available within Australia as part of the AMOSC. Other subsea dispersant equipment packages are available internationally including from Wild Well Control. Dispersant stocks are available within Australia through AMOSC and the National Plan. The OPEP includes a dispersant needs analysis.	Capping stack through Wild Well Control is available in Scotland and can be sea or air freight to Australia. Suitable CSVs are typically located in Singapore, NWS and within the region depending on industry activity. Estimated timeline to achieve successful capping option (if deemed suitable for the incident) is provided below.	Relief well MODU, services and equipment can be sourced via APPEA Mutual Aid MoU. Timeline breakdown is provided in below.

7.4.2.1. Site Survey, Debris Clearance and Intervention - Scope of Activity

Site survey and debris clearance are key preliminary tasks that assist in selecting subsequent source control options.

- Survey allows the response team to understand any issues which may preclude installation of equipment or other constraints to safely enter and work in the area.
- The need for debris removal activities will dependent upon the scenario, damage to the subsea facilities such as subsea well components, MOU riser and well control equipment. Debris clearance may involve the use of ROVs and cutting of equipment to ensure a clear path for manual intervention and/or capping.
- Intervention and is likely the earliest opportunity to stem or stop the release of hydrocarbons. Intervention would include the use of ROVs and tooling which can interface with the Otway wells and project subsea pressure control equipment.

Various options are available for equipment supply (Table 7-4). Response specialists such as AMOSC/Oceaneering and Wild Well control can provide equipment packages.

Table 7-4 Indicative survey and debris clearance equipment

Response Options	Equipment applicable to source control options
Survey Debris clearance Intervention	Cameras - inspection ROV operated ROVs Grinders / super grinders Impact wrenches Multipurpose cleaning tools Remote control units Hydraulic cutters Chopsaws Diamond wire cutters Hydraulic power units ROV dredges Torque tools Test jig Pressure control equipment intervention skid and operating equipment Linear valve override tools Manipulator knife Flying lead orientation tool Umbilicals

7.4.2.2. Site Survey, Debris Clearance and Intervention RTMs

Table 7-5 outlines the key activities and estimated response time model (RTM) associated with gaining access to inspection, debris clearance, intervention and subsea dispersant equipment. The RTM considers response times for:

- Sourcing applicable debris removal equipment and subsea dispersant will be through a 3rd party provider such as AMOSC (SFRT based in Western Australia); hardware may alternatively be mobilised via WWC (Houston) where it supports best case response times. Table 7-5 shows the RTM for the AMOSC SRFT equipment.
- Dispersant stores are available in Victoria (Geelong) and available through AMOSC's warehousing facilities who will also manage inventory levels through the response. The project RTM is aligned to industry RTM with the project variable component transportation time from warehouse to port facility.

Table 7-5 RTM Subsea First Response Tools

3rd Party (AMOSC)	Time (Days)	Cumulative (Days)
Initial notification to arrival of crews at warehouse to load trucks	0.25	0.25
Prepare and load equipment on trucks (5 in total)	0.65	0.90
Transit time (road) to Portland	3.00	3.90
Unload at Portland	0.31	4.21

Charge SAM	2.00	6.21
Load SFRT to vessel and sea fasten	0.13	6.33
Transit to Wellsite and commence scope	0.32	6.65
Set-up at site and deploy	1.00	7.65
Total Time (days)		**7.65**
Additional time to mobilise project vessel (base case)	0	
Additional time to mobilise additional vessel (contingency)	0 - 2	

7.4.2.3. Capping – Scope of Activity:

Capping provides a means to hydraulically seal a well and stop the flow of hydrocarbons during a LOWC, prior to the completion of a relief well should intervention be unsuccessful. Capping may not be suitable in all scenarios or under all environmental conditions; relief well drilling remains the primary source control solution in the event of a LOWC.

Various well capping solutions may be suitable in responding to a LOWC when drilling and a solution to cap during drilling campaigns will be maintained whilst there is a risk of LOWC.

Capping feasibility and solutions Otway Drilling Campaigns

The feasibility/effectiveness of well capping and relief well drilling is provided in Table 7-2. As shown in this assessment, capping is unlikely to be selected for regaining control of the Otway wells, as a loss of well control in shallow water depths with any of the wells flowing at absolute open flow (AOF) will require a relief well to perform the well kill. Running a capping stack into a high velocity jet stream of dry gas in shallow water is not considered practicable. Despite this, for a loss of well control event a capping stack will be considered on a case-by-case basis.

An example of where a capping equipment may be deployed would be if the well partially bridged downhole – reducing or eliminating flow sufficiently to consider running a capping stack. Under these circumstances the running of the capping stack would be dependent on many factors including but not limited to:

- Gas readings at the sea surface of less than 10% LEL
- Gas boil not effecting the stability of the vessel/s
- Suitable weather conditions for running the capping stack
- Risk assessment

Deployment Vessels

Cooper Energy also monitors the marine market and access to active vessels with a range of specifications that may be required for cap deployment. Vessels of the type and specification that would be required for this activity can typically be sourced from Singapore if not already in country.

The prerequisites for a capping vessel include:

- CSV type vessel or similar
- DP2 minimum
- Minimum 65T heave compensated crane
- Work class ROV Installed
- Australian Safety Case

Capping RTMs

Table 7-6 outlines the key activities and estimated timeframe associated with capping. The RTMs consider sourcing a vessel from various regions. The presence of a suitable vessel being in the region is dependent on other operator activities and schedules; vessel availability will be monitored by Cooper Energy and response time models adjusted to reflect best available timeframes.

Table 7-6 Capping System Installation Timeline

Activity Description - Capping Stack Source Control	Intl Case	Mid Case	Local Case

Capping Vessel Mobilisation Point		Asia - Singapore	Northwest Shelf	Victorian Waters
Capping Vessel Type		CSV	CSV	CSV
Capping Stack Equipment		Capping Stack	Capping Stack	Capping Stack
No.	Activity Description	Estimated Days	Estimated Days	Estimated Days
	Loss of containment event – Capping Stack feasible	-	-	-
1	Activate well control team and commence planning	2.0	2.0	2.0
2	Contract and mobilise CSV and transit to port facility (concurrent with activities No. 3-7)	23.0	14.0	6.0
3	Prepare capping stack package mobilisation from Scotland	5.5	5.5	5.5
3.1	*Initial callout to arrival of crews at warehouse to load trucks*	*0.5*	*0.5*	*0.5*
3.2	*Sourcing aircraft and obtaining landing rights*	*0.5*	*0.5*	*0.5*
3.3	*Equipment movement to Prestwick Airport*	*2.0*	*2.0*	*2.0*
3.4	*AN124 transit to Prestwick airport*	*2.0*	*2.0*	*2.0*
3.5	*Load AN124*	*0.5*	*0.5*	*0.5*
5	Air freight capping stack from Scotland (Prestwick Airport) to Melbourne (Airport)	1.5	*1.5*	*1.5*
6	Unload capping system and customs clearance	1.0	*1.0*	*1.0*
7	Transit capping stack / equipment to Port Facility	0.5	*0.5*	*0.5*
8	Assemble, perform functionality and pre-deployment checks	1.5	*1.5*	*1.5*
9	Load-out and sea fasten on CSV	1.0	*1.0*	*1.0*
10	Transit from port facility to Wellsite	0.7	0.7	0.7
11	Salvage operations to clear path for capping system (*if not completed prior*)	5.0	5.0	5.0
12	Position and deploy capping stack to well and perform shut-in operations	3.0	3.0	3.0
13	Well no longer flowing - source controlled	-	-	-
	TOTAL Time Estimate (days)	**34.7**	**25.7**	**21.7**

Notes:
Capping response concurrent with Inspection and Debris clearance response; cap deployment follows confirmation of suitable deployment pathway and agreement to release by provider.
Vessel with AU Safety Case preferentially selected.

The Cooper Energy well engineering team and well control partners would collectively assess the situation and evaluate equipment and logistics needs. Installing a subsea well cap requires access to personnel with specialised knowledge on the operation of such systems. Cooper Energy maintains contracts with well control companies (such as Wild Well Control) to supply technical services and guidance, equipment, specialised well control and capping installation.

7.4.2.4. Relief Well – Scope of Activity

The scope of drilling a relief well is the same as drilling a standard well although it will be a deviated well due to the need to drill at distance from the original flowing well. A relief well is typically drilled as a straight hole down to a planned kick-off point, where it is turned towards the target using directional drilling technology and tools to get within 30 - 60 m of the original well. The drilling assembly is then pulled from hole and a magnetic proximity ranging tool is run on wireline to determine the relative distance and bearing from the target well. Directional drilling continues with routine magnetic ranging checks to allow for the original well to be intersected. Once the target well is intersected dynamic kill commences by pumping kill weight mud and cement downhole to seal the original well bore.

Planning for the relief well will begin simultaneously with other well intervention options. Outline relief well plans, and methodology are contained in the activity SCERP. This plan details the process for relief well design with key activities prioritised as part of the immediate response operations:

- Mobilisation of well control and relief well specialists.
- Confirmation of relief well strategy with well specialist to define MODU/vessel requirements:
  - Confirm relief well location using geophysical site survey data. This will consider the prevailing weather at the time of the incident; seabed infrastructure in the area and directional drilling requirements for well intersection.
  - Validate relief well casing design.
- Screen available MODUs in the region with current Australian Safety Case and select MODU with appropriate technical specifications to execute the strategy. A memorandum of understanding has been established between Australian operators (including Cooper Energy) to expedite access to suitable MODUs, equipment and services for relief well drilling. If required Cooper Energy is able to request the

use of a MODU, equipment and services, that may be under contract to another operator. Minimum technical specifications for the well kill are assessed in the Well Control Modelling Report for Annie (Annie open hole scenario is considered the worst case with respect to LOWC), the selected MODU will meet these requirements and be capable of operating in the Metocean conditions at the relief well location.

- Prepare and submit regulatory documentation required for relief well activities.
- Mobilise necessary equipment and services such as directional drilling equipment and appropriate ranging tools for relief well strategy.

Relief well design

The SCERP and relief well plan includes technical details as to the design and equipment requirements to drill a relief well in the Otway fields. The APPEA relief well complexity assessment provides an overview of some of the key planning considerations which are addressed within these documents. Otway relief wells score 25 / low complexity (Table 7-7).

Detailed well kill modelling has demonstrated that the Otway wells can be killed via a single relief well. Relief wells are expected to have similar formation strength as existing wells in the Otway fields, hence modelling and planning has provided for formation fracture gradients recorded during historical drilling in the Otway. Based upon expected reservoir conditions and flow rate modelling, Annie-2 is utilised for the worst-case scenario outlined below and with respect to the Relief Well Complexity Assessment.

The basic design is for a directional relief well targeting the targeting the wellbore at base of the 244 mm (9-5/8”) casing (Annie-2 open hole scenario). The relief well architecture would comprise:

- 660 x 1067 mm (26” x 42”) conductor hole drilled to ~ 45-60m below seabed - sufficient depth as required for conductor loading and fatigue mitigation. 914 mm (36”) conductor will be installed and cemented to seabed.
- 445 mm (17-1/2”) surface hole directionally drilled riserless to ~530 m TVDRT (539m MDRT) in Narrawaturk Marl before running 340 mm (13-3/8”) surface casing, the well will be kicked off to achieve initial build up to the target sail angle
- 311 mm (12-1/4”) hole directionally drilled with BOPs installed to ~ 1,977 m TVDRT (2,273 m MDRT) before running 244 mm (9-5/8”) intermediate casing. The sail angle from the surface casing shoe is ~ 35.78° degrees until reaching proximity of the target well and dropping to inclination at TD ~ 0° with the relief well casing point is at 20 m West of Annie-2, giving 200 m of open hole below the casing shoe intersect the Annie-2 wellbore.
- 216 mm (8-1/2”) hole drilled up to TD of ~ 2,197 m TVDRT (2,494 m MDRT), allowing for 200 m depth to intersection with adjustments possible in any direction from vertical. This section of the well is designed to intercept the target wellbore, which may be iterative until success.

Table 7-7 Relief Well Complexity Assessment (after APPEA 2021)

	Complexity Category								
Design Parameter	**Low**			**Medium**			**High**		
Flow potential	Low pressure well (MASP < 5kpsi) and/or tight reservoir.			Low - moderate pressure well (MASP < 10kpsi), conventional reservoir.			High pressure well (MASP > 10kpsi) and/or high permeability reservoir		
Score	1	**2**	3	4	5	6	7	8	*9*
Reservoir Fluids	Dry Gas			Wet Gas / Condensate			Crude Oil		
Score	1	**2**	3	4	5	6	7	8	*9*
Trajectory (Relief Well)	- Max. inclination < 30˚ - Max. DLS < 2.5˚/30m - Nearest offset > 5km			- Max. inclination > 60˚ - Directional plan achievable with standard tools - Offset wells < 5km that required A/C screening			- Max. inclination > 60˚ - Short radius or high build rate through shallow formations - Multi-well location e.g. subsea drill-centre or platform		
Score	1	2	3	**4**	5	6	7	8	*9*
Surface location	No constraints on surface location			Seabed features, subsea or surface infrastructure limit choice of surface location			Detailed risk assessment or mooring design required to choose suitable relief well location due to existing infrastructure		
Score	1	2	3	**4**	5	6	7	8	*9*
Temperature	Max. BHST < 150˚C			- 150˚C < Max. BHST < 180˚C - and/or SBM required			BHST > 180˚C		
Score	1	**2**	3	4	5	6	7	8	*9*
Long-lead equipment (casing & wellheads)	Standard casing and wellheads specs – same as source well			Standard casing and wellheads specs – different from source well			Unusual casing and/or wellhead specs. May require additional effort to assure timely supply		
Score	1	**2**	3	4	5	6	7	8	*9*
Availability of technically suitable relief well rigs	Multiple suitable rigs likely to be operating offshore Australia			At least one suitable MODU likely to be operating offshore Australia, with alternative rigs available in the region			Limited availability of suitable rigs		
Score	1	2	3	4	**5**	6	7	8	*9*
Hazardous formation fluids (H2S or CO2)	None expected			Expected, but not likely to affect material selection or relief well location			Expected and may require special safety precautions, well materials, or affect the location of a relief well		
Score	1	2	3	**4**	5	6	7	8	*9*

MODU considerations

The default surface location offset distance of the relief well is 1 km from the flowing well. The Metocean conditions (prevailing wind and currents) are considered when finalising the surface location. The location of the relief well is positioned to ensure the relief well MODU is upwind for as much time as possible to limit potential exposure to hydrocarbons from the LOWC. This places a relief well in water depths between approximately 50 m and 60 m, depending on the target well.

The relief well can be executed using a semi-submersible MODU (moored) similar to that used for drilling the development wells.

Moorings are expected to extend approximately 2 km from the MODU and may therefore extend beyond the distance of the EP Activity operational area, which may expand by approximately 1-2 km radius under emergency conditions.

MODU mooring and anchor suitability analysis have been completed previously for the Otway Title areas and has concluded that MODU anchors (e.g. 15mT Stevpris Mk6, a commonly available size) or rental anchors of the same or higher performance would be appropriate for Otway locations. At least two anchor handling and tow support (AHTS) vessels would be required to tow the MODU (if not self-propelled) and install the moorings. An active MODU would already be supported by AHTS vessels and hence would likely be accompanied by those vessels during relief well drilling. AHTS vessels could also be sourced from hubs such as NWS and Singapore.

There are typically multiple semi-submersible MODUs capable of drilling such wells within Australian waters. Higher activity is typical in the NWS, though drilling MODU's have also been active in the SE region through much of the period 2017-22.

For planning purposes Cooper Energy assesses four mobilisation scenarios for sourcing a relief well MODU:

- Regional semi-submersible MODU in Victorian waters.
- Northwest Shelf semi-submersible MODU in West Australian waters.
- International (Asia) semi-submersible MODU in Singapore waters.
- International (Pacific) semi-submersible MODU in New Zealand waters.

The mobilisation case of a relief well semi-submersible MODU from New Zealand has been reviewed and should a suitable MODU be available it would also be considered as part of the relief well planning. Access to MODU in New Zealand would depend on MODU contract commitments at the time and Title holder / Joint Venture and MODU owner willingness to release MODU, and the existence of a valid Australian Vessel Safety Case.

International time case – MODU is mobilised from Singapore

The international case model has been developed to assess mobilising a suitable MODU from outside of Australian waters. This may be due to a number of reasons for example:

- No active working MODU in Australian waters
- Deficient MODU capabilities to drill and kill the well
- MODU unable to be released due to restrictions (such as biosecurity, well control event, equipment failure, weather, regulator enforcement etc.)
- Complex scopes to suspend well and demobilise from location i.e. deep-water mooring recovery

While other suitable MODU options are likely available closer to the relief well site there should not be a requirement to look further than the area of Singapore which continually services the oil and gas and maritime industries.

The base case transit time is the longest of all cases presented. Additionally, the selected MODU should have a current Australian Vessel Safety Case and no restrictions to enter the county.

Mid time case – MODU is mobilised from Northwest Shelf

The mid case model has been developed to assess bringing in a suitable MODU from the Northwest Self (NWS) (location Exmouth). This may be due to a number of reasons for example:

- No active suitable working MODU in local Victorian waters
- Deficient MODU capabilities to drill and kill the well
- MODU unable to be released due to restrictions (such as biosecurity, well control event, equipment failure, weather, regulator enforcement etc.)
- Complex scopes to suspend well and demobilise from location i.e. deep-water mooring recovery

The Exmouth point of departure for the mobilisation is a nominal position in the NWS; a MODU further North in the area would require additional transit time. However, this would not be excessive or warrant a separate RTM estimate.

The NWS is the presently the main activity hub for oil and gas operations in Australia, multiple companies have continuous MODU operations on the NWS. Hence the area is likely to hold multiple options for securing relief well semi-submersible MODU. Additionally, transit time is improved when compared to the base case transit time.

Local time case – MODU is mobilised from Victorian waters

The local case model has been developed to assess a technically capable and locally available semi-submersible MODU in the offshore Victoria area. Transit time is improved for the local case when compared to the base and mid case. A suitable local rig would be the preferred option during a relief well operation but may not be selected for several reasons for example:

- Lack of appropriate MODU capabilities to drill and kill the well
- RTM favours selection of alternate MODU (Complex scope to suspend well and demobilise from local location, stacked or requirement for hull inspection prior to mobilisation)
- MODU unable to be released due to restrictions (such as well control event, equipment failure, weather, regulator enforcement etc.)
- No MODU available locally during activities.

The Victorian offshore oil and gas sector is serviced sporadically by semi-submersible MODUs with Title holders mobilising more frequently to NWS (Mid case) from Asia. Therefore should a relief well MODU be required it will likely be mobilised from either the NWS or Asia. Response Time Model (RTM) estimates have been developed and will continue to be reviewed and updated to reflect the most favourable case mobilisation of relief well MODU to the relief well location.

Relief Well RTMs

Cooper Energy RTM models contain the same activities and time for well construction, dynamic kill and abandonment of the well. The time model only changes due to mobilisation point of the MODU.

Cooper Energy has estimated the following timeframes for the total relief well installation and well kill scope (refer Table 7-8). The series of cases is used to help understand critical activities to undertaking the relief well scope. Cooper Energy has assessed and selected a number of measures to debottleneck source control contingencies (ALARP assessment below).

Table 7-8 Relief Well Installation Timeline

Response Time Model – Relief Well Drilling & Well Kill		Intl Case	Mid Case	Local Case
MODU Mobilisation Point		Asia - Singapore	Northwest Shelf	Victorian Waters
No.	Activity description	Estimated Days	Estimated Days	Estimated Days
	Source Control Relief Well Activation Phase			
1	Activate Well Control Team, commence planning and notifications	2.0	2.0	2.0
2	Select MODU, inspect and complete contracting work scope	6.0	6.0	6.0
3	Demobilise equipment from MODU	1.0	1.0	1.0
4	Retrieve anchors and commence MODU move preparations	2.0	2.0	2.0
	MODU Transit Phase			
5	MODU mobilisation to relief well location	47.4	25.7	8.9
	Well Construction, Ranging & Intercept, Well Kill Phase			
6	Run anchors and position MODU	2.0	2.0	2.0
7	Mobilise equipment to rig	1.0	1.0	1.0
8	Prepare to Spud	0.5	0.5	0.5
9	Drill 26" x 42" Conductor Hole Section	0.8	0.8	0.8
10	Run and cement 36" Conductor	1.5	1.5	1.5
11	Directionally drill 17-1/2" Surface Hole Section	2.3	2.3	2.3
12	Run and cement 13-3/8" Surface Casing	1.2	1.2	1.2
13	Run and test BOP	2.2	2.2	2.2
14	Directionally drill 12-1/4" Intermediate Hole Section	8.8	8.8	8.8
15	Run and cement 9-5/8" Intermediate Casing	3.6	3.7	3.7
16	Directionally drill 8-1/2" Reservoir Hole Section, ranging runs #1-4	16.9	15.4	15.4
17	Pre-kill preparations	0.5	0.5	0.5
18	Well kill operations, attempt #1	1.5	1.5	1.5
19	Pre-kill preparation	0.5	0.5	0.5
20	Well kill operations, attempt #2, flow stopped	1.5	1.5	1.5
	Time to Complete Well Kill (days)	**103.9**	**80.0**	**63.2**
	Relief Well Abandonment Phase			
21	Plug and abandon Well	4.5	4.5	4.5
22	Pull BOPs	1.2	1.2	1.2
23	Remove wellhead	0.8	0.8	0.8
24	Retrieve anchors and release MODU	2.0	2.0	2.0
	Total Relief Well duration (days)	**112.4**	**88.5**	**71.7**

Regulatory Approval Timing Considerations

Planning for relief well drilling will occur in parallel to other tertiary well control responses. A key component of the relief well drilling will be the preparation, submission, and approval of the regulatory documents. Generally, for well operations the regulatory and risk management processes fall on critical path hence in an emergency these documents will require a high level of focus immediately to ensure they are in place prior to arrival of the MODU.

The following documents will require consideration:

- Vessel Safety Case (VSC)
  - The selected MODU is expected to have a valid VSC, and it is not expected to affect response times.
- Scope of Validation (SoV)
  - Any proposed significant change to an offshore facility (i.e. MODU or Vessel) will require a SoV to be proposed to NOPSEMA and agreed prior to submission of a SCR. Depending on the level of changes the time to complete and gain approval could possibly affect the response time to have regulatory documentation in place prior to start of relief well operations.
- Safety Case Revision (SCR)
  - The SCR will require preparation, submission and approval prior to operations and is expected to be on critical path for relief well activities (Table 7-9).
- Well Operations Management Plan (WOMP)
  - The in force WOMP is expected to be suitable for relief well drilling and not expected to require a revision and resubmitted.
- Environmental Plan (EP)
  - The EP is designed to provide for source control response activities. Significant changes may require resubmission subject to initial change assessment, though is not expected to affect overall response time.
- Well Activity Notice (WAN)
  - WAN is not expected to affect response time.

As part of the preparation of the above documentation a number of formal safety assessments will be conducted as part of risk management these include:

- Hazard Identification (HAZID) workshop (identity's risks, assesses hazards and mitigations to control works site hazards with aim to remove major accident events).
- Hazard Operations (HAZOP) workshop (risk assesses the operational sequence and place controls to reduce hazards to ALARP).
- Risk Assessments for safety critical equipment (Vessel Equipment, BOP, Mooring, Fluids Handling).

Table 7-9 Safety Case Revision Preparation and Approval Timeline

	Safety Case Revision Submission Key Steps (standard MODU)	Time Estimate (days)
1	Planning, regulatory consultation, HAZID/HAZOP Workshops, document preparation	2 weeks
2	Internal review cycle and submit	1 weeks
3	Priority Regulatory Assessment Period	1 week
	Total Time	**4 weeks (28 days)**

Response Agreements

Cooper Energy maintains contracts/agreements with specialist resources to supply well control expertise and support for drilling a relief well. This includes:

- Well engineering support services such as ADD Energy, AZTECH Well Construction, Airswift, Access Human Talent and Wild Well Control.

- Technical writing and risk engineering services to support regulatory documentation workflows and submissions is provided by experienced specialists such as ADD Energy.
- Wild Well Control: Well control specialists with experience in relief wells and the coordination of installation activities.
- Wellhead and casing materials supplier.
- Cooper Energy is party to the Industry Memorandum of Understanding to share drilling rigs, equipment and resources (well site services) in the event of an emergency. The MoU provides for the timely transfer of third-party contractual arrangements involved in the release of a MODU and well site services to the Titleholder for relief well drilling.
- Equipment and materials needed to construct a relief well will be able to be sourced either directly from suppliers or through the industry APPEA Mutual Aid MoU. All equipment and materials are tracked and identified prior to the commencement of the offshore activity through the “relief well readiness form” process (refer to OPEP Section 6.2 Source Control Resource Availability). All equipment and materials are expected to be sourced and transported to site during the SCR approval RTM, MODU transit and anchoring phase for the base and mid case response time model estimates. For the local MODU mobilisation case; an operational MODU would also have equipment and services, with additional equipment and services available via APPEA MoU.
- Cooper Energy will conduct a “relief well readiness check” and engage Title holders to ascertain and confirm the level of critical equipment inventories during the operational period for the purpose of drilling a relief well.

MODU activity outlook and monitoring

Cooper Energy keeps a watching brief on vessel availability through industry forums and vessel broker updates and is also a participant of the Australian Drilling Industry Steering Committee (DISC). Through DISC, Cooper Energy receives regular updates on the location and operational status of MODU’s operating in Australian waters, which could be made available for a source control response.

7.4.3. Source Control ALARP Evaluation

Source Control ALARP considerations are included in Table 7-10: Source Control ALARP Evaluation.

Table 7-10: Source Control ALARP Evaluation

Control Measures Considered	Related Risk Event	Benefit	Recognised Good Practice?	Sacrifice	Introduced Risks	Conclusion
Risk Avoidance						
Do not undertake activity Activity: Operations and drilling.	Moderate Risk Worst Case Loss of Well Control	Deferral / avoidance of other (relatively minor impacts and risks associated with the activity)	No. As operator and Titleholder there is an obligation to develop resources within that Title in accordance with the Act and work programs.	Gas resources not developed. Increased pressure on east coast domestic gas supply.	Meeting east coast gas demand would require other means of gas supply and development elsewhere.	Reject Rationale: Cooper Energy has an obligation to develop reserves from the Title Areas under their operation. Cooper Energy has a track record of safely developing and operating gas developments in the region.
Response Preparedness						
Build or purchase Capping Stack and (pre-position) have on Standby at Project Shorebase. Activity: Drilling.	As above	May allow for reduction in response time model by approx. 19 days where combined with standby vessel (Table 7-6, time required to mobilise rental capping stack additional to other RTM elements) Risks may be reduced from Moderate to Minor.	No. Not typical in the offshore industry in Australia. Typically, where confirmed as a feasible option, operators sign up to a capping stack accessible from overseas. Stacks are strategically placed around the globe to enable rapid deployment to other regions. Capping unlikely to be feasible for Otway wells.	\$2 - \$20MM. Build times likely to be 1-2 years. (\$2MM is to build a category 1 cap with capability to plug and kill the well but limited or no intervention capability), cost increases with complexity including ability to intervene post capping to estimated \$20MM. Considerable time (1-2yrs) and resources required to commission and fabricate bespoke capping stack for the project and then maintain near to field.	No significant introduced risks.	Reject Rationale: Provides no additional benefit over the capping provisions integrated into the project. Provides small reduction in time to cap compared to utilising industry capping solution but at significant additional cost and resource burden. Costs are considered to be grossly disproportionate to the potential reduction in environmental risks.
Maintain Agreement with Capping Stack provider Activity: Drilling	As above	Mobilisation time is reduced. Note RTM is based on mobilisation times advised by third party provider and hence reflect 'ready	Not typical in the Otway. Capping unlikely to be feasible.	Administrative costs Approx. \$500K to sign-up to capping stack in 'ready to deploy status'. This is not	No significant introduced risks.	Implement Rationale: Maintains relationship with capping stack provider. Potentially reduction in time to control source though given high

		to deploy status'. Risks reduced but remain Moderate.	Services are available and utilised by multiple operators for suitable projects.	proposed for Otway drilling given likely not a feasible option. Capping stack sent by air freight, e.g. from Scotland to Melbourne, loadout to Port of Melbourne (or similar) and sail to site.		initial WCD flow profiles and risks is within the Moderate category. Costs are not grossly disproportionate to the potential environmental risk reduction. Integrated via: OPEP C8 SCR Equipment
Mobilise capping stack vessel to standby in region. Activity: Drilling	As above	Combined with a local capping stack, having a vessel available on standby ready to deploy a stack has the potential to reduce response times by approx. 19 days depending on survey, debris clearance and intervention (operations which would be initiated in the first instance). Risks may be reduced from Moderate to Minor.	No. Not typical in the offshore industry in Australia. Typically operators will source vessels as needed either vessel of opportunity or via MoU. Capping unlikely to be feasible for Otway wells.	Estimated > $5MM for the duration of the campaign plus $2 - $20MM for the capping stack on standby in the region.	No significant introduced risks.	Reject Rationale: Any time saving with this option is unlikely to achieve capping before tapering of the high initial WCD flow rate. Costs are considered to be grossly disproportionate to the potential reduction in environmental risks.
Relief well MODU, services and equipment on standby in the region Activity: Drilling and / or operations	As above	This option could remove a significant proportion of time associated with the RTM MODU activation phase and transit phase (between 9 and 47 days) depending on options available on the day. Time to drill a relief well remains > 40 days by which time the well flow is predicted to have peaked and shoreline contact occurred (noting intervention and capping attempts to stop flow in the interim). Volume of oil ashore and risks would be reduced but would remain Moderate.	No. Not typical in the offshore industry in Australia. Typically operators will plan to source vessels as needed either vessel of opportunity or via MoU. Wells complexity assessment shows well can be drilled with typical MODU.	Estimated > $50MM for the duration of the campaign. Increased work load on project team to coordinate / maintain through critical planning and execution phases.	Operational environmental impacts and risks and safety risks at standby location. Increase biosecurity risks having MODU on standby.	Reject Rationale: Any time saving with this option would not achieve source control before either intervention/ capping or prevent high initial WCD flow rate and associated shoreline accumulation. The significant costs and planning burden are considered to be grossly disproportionate to the potential environmental risk reduction.

Wait to undertake project at a time when a MODU is drilling in the region and could support a relief well. Activity: Drilling and / or operations	As above	This option could remove a significant proportion of time associated with the RTM MODU activation phase and transit phase (between 9 and 47 days) depending on options available on the day. Time to drill a relief well remains > 40 days by which time the well flow is predicted to have peaked and shoreline contact occurred (unless intervention is successful in the interim) Volume of oil ashore and risks would be reduced but would remain Moderate.	No. Not typical in the offshore industry in Australia. Typically operators will plan to source MODU as needed e.g. via industry MoU or directly with MODU operators. Wells complexity assessment shows well can be drilled with typical MODU.	Committing to only undertaking drilling when a MODU is in the region would severely restrict operational flexibility and would (likely) lead to the exceedance of decommissioning deadlines set in General Direction 824.	Exceedance of deadlines set in General Direction 824.	Reject Rationale: Any time saving with this option would not achieve source control before tapering of the high initial WCD flow rate and associated shoreline accumulation. The significant costs, planning burden and risk to regulatory deadlines are considered to be grossly disproportionate to the potential environmental risk reduction.
Pre-drill relief well top holes for the existing and development well sites. Activity: Drilling and / or operations	As above	Estimated time saving of 2.3 days if section pre-drilled and conductor cemented. Unless combined with a MODU being on standby this option is not considered to provide significant benefit, noting time to move the MODU and drill the remaining well would still exceed the peak well flow period. The is also a real risk that the top-hole location would no longer appropriate or safe depending on the scenario and conditions offshore.	No. Not typical in the offshore industry in Australia.	Estimated at $49MM just to mobilise MODU and drill top hole for the 4 x well site locations. Plus $5MM+ to cut and recover wellheads at the end of campaign. Increased work load on project team to coordinate.	Increased SIMOPS Risk, Drilling risks. Operational Environmental Impacts and Risks. Safety Risks.	Reject Rationale: Any time saving with this option would not achieve source control before tapering of the high initial WCD flow rate and associated shoreline accumulation. Costs are considered to be grossly disproportionate to the potential reduction in environmental risks.
Maintain complete inventory (all materials and consumables) to drill relief well. Activity: Drilling and / or operations	As above	Ensures no equipment or consumables are critical path to drill a relief well. Unlikely to significantly reduce times unless combined with MODU being on standby, noting well site services and equipment are available through the APPEA MoU.	No. Not typical for individual operators to maintain their own inventory to drill a relief well unless undertaking well construction project where they may have spares available and/or complex wells.	Estimated at > $10MM to purchase + $0.75MM to store and maintain per annum. Increased work load on project team to maintain.	Yard HSEQ risks. Consumable expiry / maintenance.	Reject Rationale: Any time saving with this option would not achieve source control before tapering of the high initial WCD flow rate and associated shoreline accumulation. Costs are considered to be grossly

		Otway relief well can utilise standard equipment. Slight reduction in risk.				disproportionate to the potential reduction in environmental risks.
Long leads: Purchase and maintain inventory of casing to drill relief well. Activity: Drilling and / or operations	As above	Ensures these long leads are not critical path to drill a relief well. Unlikely to significantly reduce times unless combined with MODU being on standby, noting well site services and equipment are available through the APPEA MoU. Otway relief well can utilise standard equipment. Slight reduction in risk.	No. Not typical for individual operators to maintain their own inventory to drill a relief well unless undertaking well construction project where they may have spares available and/or complex wells.	Estimated at > $5MM to purchase + $0.5MM to store and maintain per year. Increased work load on project team to maintain.	Yard HSEQ risks.	Reject Rationale: Any time saving with this option would not achieve source control before tapering of the high initial WCD flow rate and associated shoreline accumulation. Costs are considered to be grossly disproportionate to the potential reduction in environmental risks.
Long leads: Purchase and maintain wellhead and conductor. Activity: Drilling and / or operations	As above	Ensures these long leads are not critical path to drill a relief well. Unlikely to significantly reduce times unless combined with MODU being on standby, noting well site services and equipment are available through the APPEA MoU. Otway relief well can utilise standard equipment. Slight reduction in risk.	No. Not typical for individual operators to maintain their own inventory to drill a relief well unless undertaking well construction project where they may have spares available and/or complex wells.	Estimated at >$2MM to purchase, + 0.1MM to store and maintain per year. Increased work load on project team to maintain.	Yard HSEQ risks.	Reject Rationale: Any time saving with this option would not achieve source control before tapering of the high initial WCD flow rate and associated shoreline accumulation. Costs are considered to be grossly disproportionate to the potential reduction in environmental risks.
Project vessel available with ROV and subsea intervention tooling. Activity: Drilling	As above	ROV available on the project provides the quickest means of implementing this response aspect. Likely to offer quickest response (within hours/days). Supports a shift in risk from Moderate to Minor.	Industry practice is currently to sign up to industry debris clearance package which can be transported to site in approx. 7 days and to source vessel of opportunity.	Typically captured in vessel rates / designed into the project.	No additional risk	Implement Provides means to immediately progress source control. Potentially significant reduction in time to control the well, may help prevent significant volumes of oil reaching the ocean and shorelines and therefore reduce consequence and overall risk from moderate to minor. Costs are currently integrated into current project design via project vessel and equipment selection

						and are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C8 SCR Equipment
Access to shared industry subsea intervention toolkit. Activity: Drilling	As above	Project equipment does not include complete debris clearance package, dispersant or dispersant application equipment. Required to support implementation of OPEP strategies. Reduction is risks if successful though likely to remain in the moderate category overall. Dispersant component unlikely to be required.	Yes, if project equipment is not available.	Approx. $400K for duration of campaign.	No introduced risks	Implement (debris clearance component) Rationale: Debris clearance equipment may be needed to access the well. Costs are not grossly disproportionate to the potential environmental risk reduction. Dispersant and associated equipment unlikely to be required. Integrated via: OPEP C8 SCR Equipment
Industry MoU for Mutual Aid for offshore incident. Drilling and operations.	As above	This could provide quickest access to a relief well MODU. Time to make well safe may add approx. 3-days to overall activation timeframe before transit phase. Time to drill a relief well remains > 40 days by which time the well flow is predicted to have peaked and shoreline contact occurred. Risks remain Moderate.	Yes. Industry initiative commonly adopted. Likely to provide the quickest possible timeframe to implement source control response. MoU for Mutual Aid: "To Facilitate the Release and Transfer of Drilling Units and Well-Site Services between Operators in Australian and Timor-Leste-administered Waters in preparedness for an offshore incident". This includes: a) Drilling Unit; and/or b) to the extent suitable for use in connection with the Offshore Incident, third party contractor personnel,	Costs upon activation. In accepting a MODU from another operator the recipient is liable for the costs incurred by that operator, which are difficult to quantify but could be significant, nominally $50M to re-instate their drilling campaign.	No introduced risks	Implement Rationale: likely to provide the quickest means to drill relief well. Though relief well drilling does not reduce risks below the moderate level, a relief well would reduce overall volumes released and eliminate any legacy issues (e.g. due to recharge). Costs upon activation are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C8 SCR Equipment

			equipment, materials, consumables and other well-site services (including, but not limited to, logistical support, cementing, well intervention and vessel support used in connection with such Drilling Units (collectively, "Well-Site Services").			
Monitoring of drilling inventories available including through APPEA MoU for the purposes of drilling relief well. Activity: Drilling	As above	Verification of available inventory which can be reflected in RTMs to identify and address potential bottlenecks. Slight reduction in risk.	Yes, good practice to verify and to reflect in RTMs.	Administrative effort only	No additional risk	Implement Rationale: identifies potential bottlenecks to relief well drilling prior to and during drilling to then consider alternate arrangements. Though relief well drilling does not reduce risks below the moderate level, a relief well would reduce overall volumes released. Costs of this option are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C8 SCR Equipment OPEP C9 SCR Resources Monitoring
MODU / Vessel contract tracking and forecasting via Vessel brokerage monthly (during drilling) MODU / vessel updates and/or participation with DISC. Activity: Drilling and Operations	As above	Save approximately 1-2 days in identifying suitable/ready MODUs and vessels. Slight reduction in risk.	Yes. Industry initiative commonly adopted.	Minor administrative costs.	No additional risk	Implement Rationale: maintains awareness of vessels and MODU's capable of supporting a source control response providing a small reduction in overall response times. Costs are not grossly disproportionate to the environmental risk reduction. Integrated via:

						OPEP C9 SCR Resources Monitoring
Source Control Contingency Response Plan developed, tested and utilised in the event of a source control incident. Activity: Drilling and operations	As above	Clear response plans, allowing basis for managing the source control response to best case timeframes on the day. Risks reduced but remain Moderate.	Yes. Required. APPEA DISC provides content guidelines.	Estimated $100K	No additional risk	Implement Rationale: Enables source control strategies to be clearly communicated and expedited. Costs are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C6 SCERP
WOMP and field safety case accepted which provide for source control activities. Activity: Drilling and operations	As above	Saves time and personnel resources during a response. Can be completed during the planning phase avoiding significant rework of plans in the event of a source control response. Slight reduction in risk.	Yes	Estimated $100K	No additional risk	Implement Rationale: Enables source control strategies to be clearly communicated and expedited. Costs are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C6 SCERP
Cooper Energy to maintain contracts with well control specialists. Activity: Drilling and operations	As above	This could save days required to contract required resources. Risks reduced but remain Moderate.	Yes. All operators rely on contractors for ramp-up support.	Estimated $100K	No additional risk	Implement Rationale: Enables source control strategies to be expedited. Costs are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C7 SCER Personnel
Pre-Mobilisation of Relief Well (Source Control) Personnel prior to drilling Activity: Drilling and / or operations	As above	This could save days required to form the broader source control team. May be of limited benefit considering expertise to commence a response are already available in the project team and ramp up via project and	No. All operators rely on contractors for ramp-up support as needed.	Estimated > $100K/day (> $10MM for the duration of the campaign).	No additional risk	Reject Rationale: A contingent of source control personnel are obtained though service providers who are also available to support other companies and projects in emergency conditions.

		emergency response contractors. Slight reduction in risk.				Mobilisations can occur quickly, and advice sought remotely in the interim, such that time savings (if any) are likely minimal. Costs are considered to be grossly disproportionate to the potential reduction in environmental risks.
Relief Well (Source Control) personnel resourcing plan in place prior to drilling. Activity: Drilling	As above	Of benefit to identify where resources would be coming from / key contacts and roles. Slight reduction in risk.	Yes	Estimated $20K. Mapped out as part of the SCERP.	No additional risk	Implement Rationale: Enables source control strategies to be expedited. Costs are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C7 SCER Personnel
Pre-identify a quadrant for suitable relief well locations. Activity: Drilling	As above	Assists in making decision on the area for optimal location for relief well based on weather conditions and subsea hazards. Risks reduced but remain Moderate.	Yes	As part of nominal relief well plans.	No additional risk	Implement Rationale: Enables source control strategies to be expedited. Costs are largely accounted for through existing project planning work and are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C6 SCERP
Nominal mooring analysis for drilling in field from moored MODU. Activity: Drilling	As above	Mooring analysis completed for the Otway Fields. Additional analysis completed prior to drilling, targeted at the development well location. Note: A site survey will be required at the time of LOWC to confirm location position and a new mooring analysis will be completed for the selected rig.	Not typical for solely for relief well purposes.	Already available to project. Mooring analysis completed as part of campaign preparations.	No additional risk	Implement Rationale: Enables source control strategies to be expedited. Costs are largely accounted for through existing project planning work and are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C6 SCERP

		Risks reduced but remain Moderate.				
Pre lay of relief well MODU moorings. Activity: Drilling	As above	May save 2-3 days, only if laid in correct locations. Locations may change at the time depending on scenario and offshore conditions. Risks reduced but remain Moderate.	Not typical for solely for relief well purposes.	Estimated > $10MM for coverage of all 4a well centres.	Additional impacts to seabed. Additional Risk to other sea users if RW outside existing PSZs (fisheries snag risk)	Reject Rationale: Any time saving with this option would not achieve source control before tapering of the high initial WCD flow rate and associated shoreline accumulation. Significant additional costs and project planning capacity are considered to be grossly disproportionate to the potential environmental risk reduction.
Pre-accepted safety case revision for possible relief well MODUs and source control vessels. Activity: Drilling	As above	Time saving and may assist in developing relationship with MODU operator. Multiple variables mean a particular MODU may not be available on the day, hence SCR of no benefit but significant effort and cost. MODU's / vessels for which safety cases were developed may not be available at the time, hence industry has utilised the MoU model which generally allows access to a range of MODUs and well site services. No risk reduction afforded.	No, no known examples of an accepted SCR specifically for a relief well MODU and vessels.	Estimated $500K + Regulator Levies. Increased work load on project team during critical planning and execution phase.	Risk of obscuring / overlooking optimal relief well MODU and source control vessels available at the time.	Reject Rationale: Any time saving with this option would not achieve source control before tapering of the high initial WCD flow rate and associated shoreline accumulation. MODUs and response vessel availability will change with time; facilities may be unavailable or may not be the most expedient option to support a response at the time one may be needed. There is a significant risk of wasted planning effort where directed at a single facility. There is also a risk of obscuring optimal (most expedient) options to drill a relief well where plans become tailored to a particular option. Costs are considered to be grossly disproportionate to the potential reduction in environmental risks.

Prepare outline safety case revision for MoU MODU prior to drilling. Activity: Drilling	As above	Unlikely to accelerate SCR times significantly noting that MODU selection is uncertain until the time of the event. There are pre-exiting safety cases which provide a basis for format. Major part of development of SCR is workforce engagement with the service partners for the scope, which is based on the MODU selected at the time. No risk reduction afforded.	Not typical but at least one example of this recently.	Estimated $100K. Increased work load on project team during critical planning and execution phase.	No additional risk	Reject Rationale: Any time saving with this option would not achieve source control before tapering of the high initial WCD flow rate and associated shoreline accumulation. MODUs and response vessel availability will change with time; facilities may be unavailable or may not be the most expedient option to support a response at the time one may be needed. There is a significant risk of wasted planning effort where directed at a single facility. There is also a risk of obscuring optimal (most expedient) options to drill a relief well where plans become tailored to a particular option. Costs are considered to be grossly disproportionate to the potential reduction in environmental risks.
Contract in place for Safety Case Expertise to expedite development. Activity: Drilling and operations	As above	Accelerates preparation times noting personnel familiarity with Titleholder systems, processes and field. Slight reduction in risk.	Yes	In place with Add Energy	No additional risk	Implement Rationale: Enables source control strategies to be expedited. Costs are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C7 SCER Personnel
In the event a suitable MODU not available through APPEA MoU, prepare mobilisation plan	As above	Identifies pathway to bring suitable MODU for relief well drilling into Australia and to the region. Some reduction in risk but remains Moderate.	Good practice as part of relief well planning.	Estimated $100K as part of relief well planning.	No additional risk	Implement Rationale: Assists in expediting source control strategies. Costs are not grossly disproportionate

for nominal MODU outside of Australia. Activity: Drilling.						to the environmental risk reduction. Integrated via: OPEP C10 SCR Logistics
Identify pathway for biosecurity clearance of a nominal MODU and vessels from southeast Asia prior to commencing well drilling. Activity: Drilling	As above	Time saving (accelerated biosecurity clearance) and reduction in HSEC risk - MODU able to mobilise directly to well site.	Yes, if MODU known.	Estimated $100K	Additional time for project team to maintain MODU/vessels in ready-to go state.	Implement Rationale: Assists in expediting source control strategies. Costs are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C10 SCR Logistics
Invasive Marine Species (IMS) Risk Assessment (RA) of most suitable relief well MODU prior to drilling (and updated if MODU changes) Activity: Drilling	As above	Assists in identifying IMS actions to be completed during mobilisation. Reduces risk of IMS transfers if mobilised. Only of benefit if MODU is known/contracted otherwise of no value.	Standard practice in the prequalification phase.	Estimated $50K	Additional time for project team to maintain IMS assessment.	Implement Rationale: Assists in expediting source control strategies. Costs are not grossly disproportionate to the environmental risk reduction. Integrated via: OPEP C10 SCR Logistics

7.4.4. Source Control Environmental Impact and Risk Assessment

For vessel-based source control options (ROV inspection and intervention and capping deployment), the impacts and risks associated with those activities relate to:

- Vessel discharges and emissions (sound, air emissions, bilge, etc.);
- Vessel risks (discharges of deck drainage, IMS introduction, megafauna strikes, equipment loss to the environment, etc.); and
- Seabed disturbance.

MODU-based source control activities have common impacts and risks from plug and abandonment described in Section 6, including:

- Subsea operational discharges
- Surface operational discharges.

No additional evaluation is required.

The environmental performance outcomes, standards and measurement criteria for response preparedness and implementation of source control activities are described in the OPEP.

7.5. SPILL RESPONSE: Monitor and Evaluate

7.5.1. Overview

Ongoing monitoring and evaluation of the oil spill is a key strategy and critical for maintaining situational awareness and to complement and support the success of other response activities. In some situations, monitoring and evaluation may be the primary response strategy where the spill volume/risk reduction through dispersion and weathering processes is considered the most appropriate response. Monitor and evaluate will apply to all marine spills. Higher levels of surveillance such as vessel/aerial surveillance, oil spill trajectory modelling and deployment of satellite tracking drifter buoys will only be undertaken for Level 2/3 spills given the nature and scale of the spill risk.

It is the responsibility of the Control Agency to undertake operational monitoring during the spill event to inform the operational response. Operational monitoring includes the following:

- Aerial observation;
- Vessel-based observation;
- Computer-based tools:
  - Oil spill trajectory modelling;
  - Vector analysis (manual calculation); and
  - Automated Data Inquiry for Oil Spills (ADIOS) (a spill weathering model).
- Utilisation of satellite tracking drifter buoys.

For vessel-based spills (unless classified as a facility under the OPGGS Act), the responsibility for operational monitoring lies with AMSA (Commonwealth waters) and Vic DoT (Victorian waters). For hydrocarbon infrastructure this is the responsibility of Cooper Energy.

7.5.2. Resources Required and Availability

The OPEP details the resources required to undertake monitor and evaluate activities, their availability and hence Cooper Energy’s capability to support a ‘monitor and evaluate’ response. The feasibility/effectiveness of a monitor and evaluate response is provided in Table 7-11.

Table 7-11: Feasibility / Effectiveness of Proposed Monitor and Evaluate Response

Parameter	Monitor and Evaluate

Suitability/Functionality **Feasibility** *How does the response strategy perform to achieve its required risk reduction?*	Implementation of monitoring is fundamental in informing all of the remaining response strategies. The response activity validates trajectory and weathering models providing forecasts of spill trajectory, determines the behaviour of the oil in the marine environment, determines the location and state of the slick, determines the effectiveness of the response options and confirms the impact on receptors. Monitoring and evaluation activities will continue throughout the response until the termination criteria have been met.
Dependencies **Effectiveness** *Does the response strategy rely on other systems to perform its intended function?*	The successful execution of monitoring relies on of the pre-planning of monitoring assets being completed to enable the shortest mobilization time of personnel, and equipment required for gaining situational awareness. To ensure the IMT can maintain the most accurate operating picture the monitoring data collected in the field will be delivered to the IMT as soon as possible,
Availability and Timely *Time the response strategy is available to perform its function?*	Time to be operational - Monitoring from aerial platforms will only operate in daylight hours; all other options are capable of 24-hour operations. Access to ADIOS is available within 1 hour of the establishment of the IMT with initial results available within 1 hour of accessing the system. Initial external modelling results are available 2 hours after initial request. The addition of alternative monitoring techniques Personnel downtime will be planned and managed to ensure appropriate levels of response personnel are maintained and rotated as required or until the response is terminated.

Cooper Energy maintains operational monitoring capability and implements operational monitoring for Level 2 or 3 infrastructure-based incidents and this response capability would be available to assist the Control Agencies in an MDO spill if requested. Cooper Energy would initiate Type II (scientific) monitoring in the event of any Level 2 or 3 spill.

Through this resourcing Cooper Energy is capable of:

- Acquiring knowledge of the spill conditions from any vessel-based MDO spill via deployed tracking buoys and undertaking manual trajectory calculations within 1 hour of EMT mobilisation;
- Activating and obtaining modelling forecast within 4 hours of spill;
- Deploying vessels of opportunity as soon as possible and aircraft within 24 hours to verify modelling/vector calculation forecast and provide real-time feedback of impacts/predicted impacts.

7.5.3. Monitor and Evaluate ALARP Evaluation

Cooper Energy considers that during a 'worst-case' spill event (Level 2 MDO spill or Level 2/3 LOWC), there are sufficient monitoring resources to respond in sufficient time to allow Cooper Energy to understand if protection priorities are threatened by spill residue (i.e. via satellite tracking buoy deployment; manual and computerised trajectory calculation and via aerial observation). On the basis of this availability, Cooper Energy considers that there are no other practicable controls, appropriate to the nature and scale of the oil spill risk, which could be implemented to affect more timely situational awareness and subsequent response activities. Resourcing and equipment details are provided in the OPEP.

7.5.4. Monitor and Evaluate 'Activity' Impact / Risk Evaluation

Cause of the Aspect:

The following hazards associated with operational monitoring have the potential to interfere with marine fauna:

- Additional vessel activity (over a greater area); and

- Aircraft use for aerial surveillance (fixed wing or helicopter).

Aspect Characterisation

The cause of these aspects is not considered to be any different to those planned under this EP (i.e. aircraft and vessel use). Consequently, no further aspect characterisation has occurred.

Impact or Risk:

The known and potential impacts of vessel and aircraft noise in the environment are:

- Potential behavioural impacts/damage to whale and pinniped species;
- Disruption to shoreline bird species.

Consequence Evaluation:

The potential impacts associated with aircraft and vessel activities shave been evaluated in this EP (planned activities). Based upon the nature and scale of the activities, the evaluation is considered appropriate for any aerial or marine surveillance undertaken and thus has not been considered further.

7.5.5.Control Measures, ALARP and Risk Assessment

Table 7-12 provides a summary of the EIA / ERA for monitoring and evaluation activities.

Table 7-12: Monitoring and Evaluation Activities EIA / ERA

ALARP Decision Context and Justification	**ALARP Decision Context A** The use of aircraft in offshore area is well practiced with the potential impacts and risks from these activities well understood. There is a good understanding of control measures used to manage these risks from aircraft. There is little uncertainty associated with the potential environmental impacts and risks, which have been evaluated as **Level 1**. No objections or concerns were raised during stakeholder consultation regarding analogous planned activities or their potential impacts and risks. As such, Cooper Energy believes ALARP Decision Context A should apply.
Control Measure	**Source of good practice control measures**
Consultation	Consultation in the event of a spill will ensure that relevant government agencies support the monitor and evaluate strategy thus minimising potential impacts and risks to sensitivities.
Maintain monitoring and evaluation capability	Cooper Energy will maintain the required level of response capability to implement a monitoring and evaluation strategy commensurate with the spill events detailed in this EP.
Likelihood	The likelihood of a worst-case scenario spill was determined to be Unlikely (D). As such, the likelihood of impacts from underwater noise in the event of a response have been determined to be **Remote (E)**.
Residual Impact Consequence	N/A
Residual Risk Consequence	N/A (Refer to relevant aspects in Section 6)
Residual Risk Likelihood	N/A (Refer to relevant aspects in Section 6)
Residual Risk Severity	N/A (Refer to relevant aspects in Section 6)
Demonstration of Acceptability	
Principles of ESD	The potential impact associated with this aspect are limited to standard aerial and vessel activities, which is not considered as having the potential to affect biological diversity and ecological integrity. The activities do not have the potential to result in serious or irreversible environmental damage.

	Consequently, no further evaluation against the principles of ESD is required.
Legislative and other requirements	Legislation and other requirements considered as relevant control measures include: • OPGGS Act 2006 (Commonwealth) • OPGGS Act 2010 (Victoria)
Internal context	Relevant management system processes adopted to implement and manage hazards to ALARP include: • Risk Management (MS03) • Technical Management (MS08) • Health Safety and Environment Management (MS09) • Incident and Crisis Management (MS10) • Supply Chain and Procurement Management (MS11) • External Affairs & Stakeholder Management (MS05)
External context	No stakeholder concerns have been raised to date regarding impacts and risks from protect and deflect strategies. As such, Cooper Energy considers that there is broad acceptance of the impacts and risks associated with the activity.
Environmental Performance	
The environmental performance outcomes, standards and measurement criteria for response preparedness and implementation of monitoring and evaluation activities are shown in the OPEP.	

7.6. SPILL RESPONSE: Protect and Deflect

7.6.1. Overview

Shoreline protection includes use of a boom to deflect hydrocarbons to other areas for recovery or towards an area where there will be reduced impact (compared to more sensitive sites). Sand berm can also be created across inlet openings to form a physical barrier to separate hydrocarbons from sensitive resources, Booming and skimming operations are dependent on current, wave and wind conditions.

7.6.2. Resources Required and Availability

Response resources will be activated via AMOSC in the first instance, with equipment and resources selected on the basis of the Tactical Response Plan (TRP) activation and subsequent Incident Action Plan (IAP), as defined in the OPEP.

The feasibility / effectiveness of a protect and deflect response is provided in Table 7-13

Table 7-13: Feasibility / Effectiveness of Protect and Deflect Response

Parameter	Protect and deflect
Suitability/Functionality How does the response strategy perform to achieve its required risk reduction?	Successful implementation of the protection and deflection response strategy will reduce the oil reaching the shoreline. Protection strategies can be used for targeted protection of sensitive receptors. The use of zoom and beach guardian boom is the most technically suitable and feasible application of the response strategy. Alternative offshore boom types cannot be deployed successfully in shallow water due to depth of draft. Chevron, cascade and exclusion booming formations will be deployed based on the location.
Dependencies Does the response strategy rely on other systems to perform its intended function?	Operational effectiveness of this response is dependent on monitoring and surveillance (including deterministic modelling predictions and visual surveillance) of the floating oil before stranding which enables the prioritization and targeted protection of environmental sensitivities. This will ensure boom is deployed at the sensitivities reducing the oil reaching the shorelines.
Availability and limitations Time the response strategy is available to perform its function?	Time to be operational - Based on the availability of personnel, equipment and vessels, the deployment of the response strategy will take place within 48 hours of response activation.

Parameter	Protect and deflect
	Protection and deflection operations will take place during daylight hours only and in appropriate weather and tide conditions. Deployed boom formations will require regular monitoring to ensure continued effectiveness. Personnel downtime will be planned and managed to ensure appropriate levels of response personnel are maintained and rotated as required or until the response is terminated.

7.6.3.Protect and Deflect ALARP Evaluation

Protect and deflect ALARP considerations are included in Table 7-11.

Table 7-14: Protect and Deflect Response ALARP Evaluation

Additional control measures	Benefit	Cost	Outcome
Implement optimum protect and deflect sooner by storing equipment at strategic locations	The environmental benefits associated with this option are negligible; existing logistics pathways have demonstrated that this equipment can be mobilised to potentially impacted shorelines before shoreline contact occurs.	Any equipment mobilised to site would need to be purchased by Cooper. Most equipment proposed to be used (available via the various agreements) can only be mobilised in an emergency as it needs to be stored and available in strategic locations nationwide for the whole industry. Purchasing such equipment would result in significant costs that are considered grossly disproportionate to the level of risk reduction achieved.	Not Selected

7.6.4. Protect and Deflect Impact and Risk Evaluation

Protect and deflect activities have the potential to result in:

- interactions with shoreline and nearshore habitats.

Cause of the aspect

The following hazards are associated with protection and deflection activities:

- Boom deployment and management (especially anchored boom)

Aspect characterisation

Under prevailing SW conditions, MDO or condensate could reach rocky shores and sheltered sandy bays and inlets. Protection and deflection would be focused on protection priorities in the more sensitive and accessible locations such as Curdies Inlet and Port Campbell.

Predicted Environmental Impacts and Risks:

The potential impacts of booming activities are:

- loss of seabed vegetation / disturbance to estuarine habitats from boom anchors
- restricting access to the area for recreational activities.

Assessment of Environmental Impacts and Risks:

Risk Event: Loss of seabed vegetation / disturbance to estuarine habitats from booming

Inherent Consequence Evaluation

Potential impacts of protect and deflect response vary, depending on the method used and the nearshore/shoreline habitat. Particular values and sensitivities in the area that may be affected by the spill include nearshore and estuarine habitats (such as seagrass) and shoreline habitats (sandy beach habitats).

Loss of vegetation may occur where equipment cannot be mobilise using existing tracks or where protection booms may be placed. Based upon the nature of the spill events associated with this EP, and the limited area of shoreline that would likely be exposed to hydrocarbons above impact / response thresholds, any impacts are likely to be highly localised the response infrastructure. These impacts would likely result in localised medium-term impacts to species or habitats with recover over months to a year.

As such the consequence has been ranked as a **Level 3.**

Inherent Likelihood

Given the low likelihood of the vessel collision event occurring, and modelling scenarios which indicate shoreline exposure has a low probability of occurring, this consequence is considered to have a Hypothetical likelihood of occurring.

Inherent Risk Severity

The inherent risk severity for this event is ranked as **Low**.

Risk Event: Restricting access to the area for recreational activities.

Inherent Consequence Evaluation

Potential impacts of protect and deflect response vary, depending on the method used and the nearshore/shoreline habitat. Particular values and sensitivities in the area that may be affected by the spill include local recreational activities along the coastline.

Based upon the nature of the spill events associated with this EP, and the limited area of shoreline that would likely be exposed to hydrocarbons above impact / response thresholds, any impacts are likely to be highly localised the response infrastructure. Areas maybe temporary restricted to the public while protection and deflection activities occur. As the diesel will weather rapidly this would only occur for days. As such, these impacts would likely result in localised short term impacts social receptors.

As such the consequence has been ranked as a **Level 2**.

Inherent Likelihood

Given the low likelihood of the vessel collision event occurring, and modelling scenarios which indicate shoreline exposure has a low probability of occurring, this consequence is considered to have a Hypothetical likelihood of occurring.

Inherent Risk Severity

The inherent risk severity for this event is ranked as **Low**.

7.6.5. Control Measures, ALARP and Risk Assessment

Table 7-15 presents the EIA / ERA for protect and deflect activities.

Table 7-15: Shoreline Protection and Deflection Activities EIA / ERA

ALARP Decision Context and Justification	**ALARP Decision Context A** Implementing protect and deflect response techniques is standard practice for marine oil spills. There is a good understanding of potential impacts and risks from these techniques, and the control measures required to manage these. There is little uncertainty associated with the potential environmental impacts and risks, evaluated as **Level 2** due to the small disturbance footprint expected with these techniques. No objections or concerns were raised during stakeholder consultation regarding this activity or its potential impacts and risks. As such, Cooper Energy considers ALARP Decision Context A should apply.
Control Measure	**Source of good practice control measures**
Maintain protect and deflect capability	Cooper Energy will maintain the required level of response capability to implement a protection and deflection strategy commensurate with the spill events detailed in this EP.
Develop TRPs for priority protection sites	Identify priority protection sites and apply tactical response planning measures
Ongoing consultation	Consultation in the event of a spill will ensure that relevant government agencies support the protect and deflect strategy thus minimising potential impacts and risks to sensitivities.

OSMP (Monitor response effectiveness)	Monitoring the response effectiveness will ensure response is terminated where the response is no longer effective or where a net environmental benefit is no longer present.
Use of Existing Tracks and Pathways	Utilising existing tracks and paths where possible will ensure the disturbance footprint associated with the implementation of this response technique is reduced to ALARP.
Impact and Risk Summary	
Residual Impact Consequence	N/A
Residual Risk Consequence	Level 2 - Localised short-term impacts to species or habitats of recognised conservation value not affecting local ecosystem function; remedial, recovery work to land, or water systems over days/weeks
Residual Risk Likelihood	The likelihood of a worst-case scenario spill was determined to be Unlikely (D). As such, the likelihood of impacts from protection and deflection activities have been determined to be **Remote (E)**.
Residual Risk Severity	**Low**
Demonstration of Acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to a localised short-term impact, which is not considered as having the potential to affect biological diversity and ecological integrity. The activities were evaluated as having the potential to result in a **Level 2** consequence thus is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.
Legislative and other requirements	Legislation and other requirements considered as relevant control measures include: • OPGGS Act 2006 (Commonwealth) • OPGGS Act 2010 (Victoria)
Internal context	Relevant management system processes adopted to implement and manage hazards to ALARP include: • Risk Management (MS03) • Technical Management (MS08) • Health Safety and Environment Management (MS09) • Incident and Crisis Management (MS10) • Supply Chain and Procurement Management (MS11) • External Affairs & Stakeholder Management (MS05)
External context	No stakeholder concerns have been raised to date regarding impacts and risks from protect and deflect strategies. As such, Cooper Energy considers that there is broad acceptance of the impacts associated with the activity.
Environmental Performance	
The environmental performance outcomes, standards and measurement criteria for response preparedness and implementation of Protect and Deflect activities are shown in the OPEP.	

7.7. SPILL RESPONSE: Shoreline Assessment and Clean-up

7.7.1. Overview

Any shoreline operations will be undertaken in consultation with, and under the control of Vic DoT, the Control Agency for Victoria, and the appropriate land managers of the shoreline affected.

Shoreline clean-up consists of different manual and mechanical recovery techniques to remove oil and contaminated debris from the shoreline to reduce ongoing environmental contamination and impact. It may include the following techniques:

- Natural recovery – allowing the shoreline to self-clean (no intervention undertaken);
- Manual collection of oil and debris – the use of people power to collect oil from the shoreline;

- Mechanical collection – use of machinery to collect and remove stranded oil and contaminated material;
- Sorbents – use of sorbent padding to absorb oil;
- Vacuum recovery, flushing, washing – the use of high volumes of low-pressure water, pumping and/or vacuuming to remove floating oil accumulated at the shoreline;
- Sediment reworking – move sediment to the surf to allow oil to be removed from the sediment and move sand by heavy machinery;
- Vegetation cutting – removing oiled vegetation; and
- Cleaning agents – application of chemicals such as dispersants to remove oil.

7.7.2.Resources Required and Availability

The number and tasks of personnel will vary according to the quantity of spill debris, its rate of delivery to the site and the disposal method chosen.

Response resources will be activated via AMOSC in the first instance, with equipment and resources selected based on the TRP activation and subsequent IAPs as defined in the OPEP.

The feasibility / effectiveness of a shoreline assessment and clean-up response is provided in Table 7-16.

Table 7-16: Feasibility / Effectiveness Shoreline Assessment and Clean-up

Parameter	Shoreline Assessment and Clean-up
Suitability/Functionality How does the response strategy perform to achieve its required risk reduction?	Successful implementation of the shoreline assessment and clean up response strategy will result in a reduction of oil on the shoreline, assist in preventing the remobilization of oil and act to reduce the lasting impact of the oil spill on shoreline receptors. The method of clean up chosen will be selected based on shoreline type, local knowledge of the conditions and the availability of equipment and personnel. Oil clean up quantities are estimated to recover 1 m^3 per person/per day (manual recovery) and 24 m^3 per team/per day (mechanical collection)
Dependencies Does the response strategy rely on other systems to perform its intended function?	Operational effectiveness of this response is dependent on the continuous use of monitoring and surveillance to help direct clean-up efforts towards the areas most affected by stranded oil which enables the prioritization and targeted clean-up of environmental sensitivities.
Availability and limitations Time the response strategy is available to perform its function?	Time to be operational - Shoreline Clean-up and Assessment Technique personnel will be available on site within 12 hours to commence terrestrial assessment. Based on the availability of personnel and equipment the clean-up activities will commence within 12 hours of response Activation. Personnel downtime will be planned and managed to ensure appropriate levels of response, personnel are maintained and rotated as required or until the response is terminated.

7.7.3. Shoreline Assessment and Clean-up ALARP Evaluation

Cooper Energy considers that during a ‘worst-case’ spill event (Level 2 MDO spill or Level 2/3 LOWC), there are sufficient assessment and clean-up responses in the region to quickly respond, in most circumstances prior to shoreline contact. In some circumstances, such as a release close to shore, assessment and clean-up resources would follow shoreline contact; there are no practicable means to mobilise personnel site pre-contact. Resourcing and equipment details are provided in the OPEP.

7.7.4.Shoreline Assessment and Clean-up Impact and Risk Evaluation

Shoreline assessment and clean-up activities have the potential to result in:

- Interactions with shoreline habitats.

Cause of Aspect

The following activities associated with shoreline clean-up tactics may interact with shoreline habitats:

- personnel and equipment access to beaches
- shoreline clean-up
- waste collection and disposal.

Aspect characterisation

The shorelines within the activity EMBA, particularly those close to the activity location and at higher probability of exposure, are predominantly rocky shore platforms backed by sheer rocky cliffs interspersed with sandy beaches. Rock platforms and cliffs/headlands are low sensitivity habitats and often inaccessible. Natural recovery methods are most effective, safe and feasible for these habitat types. Shoreline clean-up is only considered for sandy beaches that may be affected by hydrocarbon residues. For exposed rocky shores or exposed wave-cut platforms any oil residue deposited is rapidly removed from exposed faces and clean-up is usually not required (NOAA, 2013).

MDO and condensate weather rapidly, with either no, or only a small fraction comprising persistent residuals. Under low energy conditions, the residual components may form a thin liquid sheer on the coast and may persist in the environment; this may allow them to be physically removed.

Predicted Environmental Impacts and Risks

The potential impacts of these activities are:

- disturbance to cultural heritage
- damage to or loss of shoreline habitats
- disturbance to fauna habitat and fauna behaviours
- temporary exclusion of the public from amenity beaches.

Risk Event: Disturbance to cultural heritage

Inherent Consequence Evaluation

The movement of people, vehicles and equipment through backshore and dune areas may disturb cultural heritage artefacts that occur at the surface or are buried. The most likely cultural heritage artefacts to be present are shell middens, especially where freshwater and brackish water sources occur nearby, such as the Curdies Inlet. Disturbance or damage to such sites will be minimised by fencing off such areas and reporting its presence to the relevant state regulatory agency.

Based upon the potential for localised medium-term impacts to heritage, the consequence has been ranked as **Level 3**.

Inherent Likelihood

Given the low likelihood of the vessel collision event occurring, and modelling scenarios which indicate shoreline exposure has a low probability of occurring, this consequence is considered to have a Hypothetical likelihood of occurring.

Inherent Risk Severity

The inherent risk severity for this event is ranked as **Low**.

Risk Event: Damage to or loss of shoreline habitats

Inherent Consequence Evaluation

Sandy beaches have been used for the consequence evaluation as they are considered to provide a comprehensive indication of possible worst-case consequences as a result of implementing shoreline response activities (due to presence of potential sensitivities and the invasive nature of techniques such as mechanical collection). This is not to say that sandy beaches themselves are considered more sensitive than other habitats.

Based upon the low viscosity, it is possible that MDO will infiltrate porous shorelines (such as sandy beaches) where it washes onshore rapidly and has not significantly weathered. Consequently, mechanical recovery could be required (resulting in excavation of shorelines). If not done correctly, any excavation of hydrocarbon contaminated materials along the coast could exacerbate beach erosion to a point where its recovery longer term recovery.

Based upon the potential for localised medium-term impacts to shoreline habitats, the consequence has been ranked as **Level 3**.

Inherent Likelihood

Given the low likelihood of the vessel collision event occurring, and modelling scenarios which indicate shoreline exposure has a low probability of occurring, this consequence is considered to have a Hypothetical likelihood of occurring.

Inherent Risk Severity

The inherent risk severity for this event is ranked as **Low**.

Risk Event: Disturbance to fauna habitat and fauna behaviours

Inherent Consequence Evaluation

The noise and general disturbance created by shoreline clean-up activities could potentially disturb the feeding, breeding, nesting or resting activities of resident and migratory fauna species that may be present (such as shorebirds and seabirds). Any erosion caused by responder access to sandy beaches, or the removal of sand, may also bury nests.

On the basis that these disturbances could cause medium term impacts to local populations of shorebirds and seabirds, the consequence has been ranked as **Level 3**.

Inherent Likelihood

Given the low likelihood of the vessel collision event occurring, and modelling scenarios which indicate shoreline exposure has a low probability of occurring, this consequence is considered to have a Hypothetical likelihood of occurring.

Inherent Risk Severity

The inherent risk severity for this event is ranked as **Low**.

Risk Event: Temporary exclusion of the public from amenity beaches

Inherent Consequence Evaluation

The presence of hydrocarbons on shorelines, and associated clean-up operations, depending on location, necessitate temporary beach closures. This means recreational activities (such as swimming, walking, fishing, boating) in affected areas will be excluded until access is again granted by local authorities. Diesel and condensate weather rapidly, clean-up operations are expected to take days-weeks following source control. As such, these impacts would likely result in localised short term impacts social receptors. As such the consequence has been ranked as a **Level 2**.

Inherent Likelihood

Given the low likelihood of the vessel collision event occurring, and modelling scenarios which indicate shoreline exposure has a low probability of occurring, this consequence is considered to have a Hypothetical likelihood of occurring.

Inherent Risk Severity

The inherent risk severity for this event is ranked as **Low**.

7.7.5. Control Measures, ALARP and Acceptability Assessment

Table 7-17 provides the EIA / ERA for shoreline assessment and clean-up activities.

Table 7-17: Shoreline Assessment and Clean-up Activities EIA / ERA

ALARP Decision Context and Justification	**ALARP Decision Context A** The implementation of shoreline assessment and clean-up response techniques are standard practice for marine oil spills where there is the potential for shoreline exposures. There is a good understanding of potential impacts and risks from these techniques, and the control measures required to manage these. There is slight uncertainty associated with the potential environmental impacts and risks, which have been evaluated as **Level 3** due to the localised area of

	disturbance and (conservatively assessed) medium-term impacts associated with these response techniques. No objections or concerns were raised during stakeholder consultation regarding this activity or its potential impacts and risks. As such, Cooper Energy believes **ALARP Decision Context A** should apply.
Control Measure	**Source of good practice control measures**
Maintain shoreline assessment and clean-up capability	Cooper Energy will maintain the required level of response capability to implement a shoreline assessment and clean-up strategy commensurate with the spill events detailed in this EP.
Consultation	Consultation in the event of a spill will ensure that relevant government agencies support the shoreline assessment and clean-up strategy thus minimising potential impacts and risks to sensitivities.
Use of existing tracks and Pathways	Utilising existing tracks and paths where possible will ensure the disturbance footprint associated with the implementation of this response technique is reduced to ALARP.
Impact and Risk Summary	
Residual Impact Consequence	N/A
Residual Risk Consequence	Level 3 - Localised medium-term impacts to species or habitats of recognised conservation value or to local ecosystem function; remedial, recovery over months/year.
Residual Risk Likelihood	The likelihood of a worst-case scenario spill was determined to be Unlikely (D). As such, the likelihood of impacts from shoreline assessment and clean-up activities have been determined to be **Remote (E)**.
Residual Risk Severity	**Low**
Demonstration of Acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to a localised medium-term impact, which is not considered as having the potential to affect biological diversity and ecological integrity. The activities were evaluated as having the potential to result in a **Level 3** consequence thus is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.
Legislative and other requirements	Legislation and other requirements considered as relevant control measures include: • OPGGS Act 2006 (Commonwealth) • OPGGS Act 2010 (Victoria)
Internal context	Relevant management system processes adopted to implement and manage hazards to ALARP include: • Risk Management (MS03) • Technical Management (MS08) • Health Safety and Environment Management (MS09) • Incident and Crisis Management (MS10) • Supply Chain and Procurement Management (MS11) • External Affairs & Stakeholder Management (MS05)
External context	No stakeholder concerns have been raised to date regarding impacts and risks from shoreline assessment and clean-up strategies. As such, Cooper Energy considers that there is broad acceptance of the impacts associated with the activity.
Environmental Performance	
The environmental performance outcomes, standards and measurement criteria for response preparedness and implementation of shoreline clean-up activities are shown in the OPEP.	

7.8. SPILL RESPONSE: Oiled Wildlife Response

7.8.1. Overview

In the event of a Level 2 or 3 hydrocarbon spill, the impacts on wildlife are determined by the types of fauna present, the type of oil spilled and the extent of exposure. A review of the species likely to be present within the EMBA identifies marine birds (albatross, petrels) and shorebirds (hooded plovers) could be affected (refer to Appendix 3). It is noted that given the hydrocarbons present, their low viscosity and rapid evaporation, sea surface thicknesses which support ecological impacts to birds (>10µm) do not remain in the marine environment for a long period of time. Equally, shoreline residues on the available sandy beaches are likely to move into the sand profile and not be present in large quantities in the inter-tidal areas. Due to these factors, it is not expected that significant numbers of birds would be affected by hydrocarbon residues as a result of these spill scenarios.

Spills from IMR survey vessels that work closer to shore and carry smaller MDO inventories may lead to shorter contact times for the MDO to reach shore, however impacts will be much more localised and unlikely to affect significant shoreline areas. Individual birds may be impacted if they are foraging in the foreshore area when oil is present.

- Oiled wildlife response consists of a three-tiered approach involving:
- Primary: Situational understanding of the species/populations potentially affected (ground-truth species presence and distribution by foot, boat or aerial observations);
- Secondary: Deterrence or displacement strategies (e.g., hazing by auditory bird scarers, visual flags or balloons, barricade fences; or pre-emptive capture); and
- Tertiary: Recovery, field stabilisation, transport, veterinary examination, triage, stabilisation, cleaning, rehabilitation, release.

7.8.2. Resources Required and Availability

The Victorian DELWP are the agency responsible for responding to wildlife affected by a marine pollution emergency in Victorian waters. Only trained personnel may interact with oiled fauna species in accordance with the Victorian Wildlife Act 1975. Personnel may be deployed under the direction of DELWP to undertaken wildlife response activities.

Cooper Energy will provide support for the response through the provision of resources. The equipment which Cooper Energy can supply or coordinate through external assistance (such as AMOSC) includes:

- Vessels for transport of wildlife and equipment;
- Oiled Fauna Kits;
- Wildlife intake and triage; and
- Wildlife cleaning and rehabilitation kits.

Response resources would be activated via AMOSC in the first instance, with equipment and resources selected on the basis of the TRP activation and subsequent IAPs as defined in the OPEP.

Cooper Energy identified the estimated waste types associated with an Oily Wildlife response technique to understand the response equipment and personnel required to support waste management activities.

Table 7-18 provides a conservative indication of the level of waste that may be required to be managed by this activity.

Table 7-18 Estimated Waste Types and Volumes from a BMG Vessel Collision Event

Response Technique	Waste Type	Waste Volume (m3)
Shoreline Clean-up –decontamination stations	Wastewater	1 m^3 per unit (1 bird = 1 unit)
	Personal Protective Equipment	5 kg per unit

The feasibility / effectiveness of an oiled wildlife response is provided in *Table 7-19*.

Table 7-19 Feasibility/Effectiveness of Shoreline Assessment and Clean-up Response

Parameter	Oiled Wildlife Response
Suitability/Functionality How does the response strategy perform to achieve its required risk reduction?	The oiled wildlife response may lead to the survival of vulnerable wildlife populations. The level of oiled wildlife response required can be scaled based on the predicted number of animals oiled. It is not expected a large-scale wildlife response, the nature of the worst-case spill scenarios and limited potential for exposure above ecological threshold levels.
Dependencies Does the response strategy rely on other systems to perform its intended function?	Operational effectiveness of the oiled wildlife response relies on supporting monitoring information from aerial, vessel and ground surveys. This supporting information can be gathered during daylight hours only.
Availability and limitations Time the response strategy is available to perform its function?	Time to be operational - Once the oiled wildlife facility has been established 24-hour continuous operations are feasible where it is confirmed safe to do so. Under the direction of DELWP personnel, downtime will be planned and managed to ensure appropriate levels of response personnel are maintained and rotated as required or until the response is terminated.

7.8.1.Oiled Wildlife ALARP Evaluation

OWR ALARP considerations are included in Table 7-20.

Table 7-20 OWR ALARP Evaluation

Additional control measures	Benefit	Cost	Outcome
Training and competencies	Personnel handling oiled wildlife are trained as fauna handlers or are guided by OWR-trained personnel. During an oil spill there is the potential for fauna to come into contact with floating or stranded oil. If this occurs, State response agencies would lead oiled wildlife response, with Cooper energy providing labour and resources as requested by the controlling agency.	State agencies lead the oiled wildlife response, providing trained personnel, technical expertise and instruction to Cooper Energy for support as required, Training additional personnel before an event occurs is not expected to provide any benefit; responders will be given direction from the appropriate agency during an OWR. This option has therefore not been implemented.	Not Selected

7.8.2. Oiled Wildlife Impact and Risk Evaluation

Cause of Aspect:

The activities associated with OWR that have the potential to impact on fauna are:

- hazing of target fauna that may deter non-target species from their normal activities (resting, feeding, breeding, etc.)
- inappropriate handling and treatment that may cause distress, injury or death of target fauna

Aspect Characterisation:

MDO and condensate weather rapidly, with either no, or only a small fraction comprising persistent residuals. The shorelines within the activity EMBA, particularly those close to the activity location and at higher probability of exposure, are predominantly rocky shore platforms backed by sheer rocky cliffs interspersed with sandy beaches, with limited potential for oiling of wildlife, and oiled wildlife response would be targeted.

Potential Impacts and Risks:

- The potential impacts of this activity are disturbance, injury or death of fauna.

Impact and Risk Evaluation:

Risk Event: Disturbance, injury or death of fauna

Untrained resources capturing and handling native fauna may cause distress, injury and death of the fauna. To prevent these impacts, only DELWP-trained oiled wildlife responders will approach and handle fauna. This will eliminate any handling impacts to fauna from untrained personnel and reduce the potential for distress, injury or death of a species.

It is preferable to have oil-affected animals that have no prospect of surviving or being successfully rehabilitated and released to the environment humanely euthanized than to allow prolonged suffering. The removal of these individuals from the environment has additional benefits in so far as they are not consumed by predators/scavengers, avoiding secondary contamination of the food-web.

Hazing and exclusion of wildlife from known congregation, resting, feeding, breeding or nesting areas may have a short- or long-term impact on the survival of that group if cannot access preferred resources. These effects may be experienced by target and non-target species. For example, shoreline booming, or ditches dug to contain oil may prevent penguins from reaching their burrows after they've excited the water and low helicopter passes flown regularly over a beach to deter coastal birds from feeding in an oil-affected area may also deter penguins from leaving their burrows to feed at sea, which may impact on their health.

Due to the potential for localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning, the potential impacts form this activity have been identified as **Level 2**.

7.8.3. Control Measures, ALARP and Acceptability Assessment

Table 7-21 provides the EIA / ERA for OWR activities.

Table 7-21 Shoreline Assessment and Clean-up EIA/ERA

ALARP Decision Context and Justification	**ALARP Decision Context A** The implementation of OWR activities is standard practice for marine oil spills where there is the potential for hydrocarbon exposure to wildlife. There is a good understanding of potential impacts and risks from these techniques, and the control measures required to manage these. There is little uncertainty associated with the potential environmental impacts and risks, which have been evaluated as **Level 2** due to the incidental expected impacts from this response. No objections or concerns were raised during stakeholder consultation regarding this activity or its potential impacts and risks. As such, Cooper Energy believes ALARP Decision Context A should apply.
Control Measure	**Source of good practice control measures**
Maintain Oiled Wildlife Response capability	Cooper Energy will maintain the required level of response capability to implement an OWR strategy commensurate with the spill events detailed in this EP.
Consultation	Consultation in the event of a spill will ensure that relevant government agencies support the OWR thus minimising potential impacts and risks to sensitivities.
Use of existing tracks and Pathways	Utilising existing tracks and paths where possible will ensure the disturbance footprint associated with the implementation of this response technique is reduced to ALARP.
Trained fauna handlers will handle wildlife (unless different direction is received from State agency)	Wildlife is only approached or handled by State agency trained oiled wildlife responders unless formal direction is received from the Government IMT. Cooper Energy response personnel are advised of wildlife interaction restrictions through site safety inductions.
Impact and Risk Summary	
Residual Impact Consequence	N/A
Residual Risk Consequence	Level 2 - Localised short-term impacts to species or habitats of recognised conservation value not affecting local ecosystem function; remedial, recovery work to land, or water systems over days/weeks.

Residual Risk Likelihood	The likelihood of a worst-case scenario spill was determined to be Unlikely (D). As such, the likelihood of impacts from OWR activities have been determined to be **Remote (E)**.
Residual Risk Severity	**Low**
Demonstration of Acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to a localised short-term impact, which is not considered as having the potential to affect biological diversity and ecological integrity. The activities were evaluated as having the potential to result in a **Level 2** consequence thus is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.
Legislative and other requirements	Legislation and other requirements considered as relevant control measures include: • OPGGS Act 2006 (Commonwealth) • OPGGS Act 2010 (Victoria) • EPBC Act 1999 and EPBC Regulations 2000 • Emergency Management Act 2013 (Victoria) • *Wildlife Act 1975 (Victoria)* Oil Spill Response Technical Guidelines: The adopted controls have been guided by the following technical guides: • Wildlife Response Preparedness IPIECA, 2014 • State Maritime Emergencies (non-search and rescue) Subplan (State of Victoria, Department of Transport, 2021)
Internal context	Relevant management system processes adopted to implement and manage hazards to ALARP include: • Risk Management (MS03) • Technical Management (MS08) • Health Safety and Environment Management (MS09) • Incident and Crisis Management (MS10) • Supply Chain and Procurement Management (MS11) • External Affairs & Stakeholder Management (MS05)
External context	No stakeholder concerns have been raised to date regarding impacts and risks from OWR strategies. As such, Cooper Energy considers that there is broad acceptance of the impacts associated with the activity.
Environmental Performance	
The environmental performance outcomes, standards and measurement criteria for response preparedness and implementation of OWR activities are shown in the OPEP.	

8. Environmental Performance Outcomes, Standards and Measurement Criteria

This section summarises the EPOs, standards, and measurement criteria that have been developed as part of a systematic approach to the management of environmental risks as identified in Section 6. The EPOs, standards and criteria related to the Otway Offshore Operations activities are shown in Table 8-1. Also shown are key responsible and accountable personnel who will ensure the EP is implemented and records of implementation retained.

The following legislative and guideline definitions are used in this section:

- EPOs – a measurable level of performance required for the management of the environmental aspects of the activity to ensure the environmental impacts or risks will be of an acceptable level;
- EPSs – a statement of performance required of an adopted control measure; and
- Measurement criteria – defines the measure by which environmental performance will be measured to determine whether the EPO has been met.

Table 8-1: EPOs, Standards and Measurement Criteria

EPO	Control	EPS	Measurement Criteria	Responsible Person	Activity
EPO1: Undertake the activity in a manner that will not interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted.	C1: Marine exclusion and caution zones	Permanent PSZs shall be gazetted.	PSZ gazetted notice	Operations Manager	Operations
		Subsea infrastructure is marked on navigational charts.	Navigational charts	Operations Manager	Operations
		500 m safety exclusion / caution zone to be established via Notice to Mariners around vessels undertaking petroleum activities.	Completed Notice to Marines request	Project Manager	IMR, Drilling, Subsea Installation
	C2: Pre-start notifications	The AHS and / or TSV will be notified no less than four working weeks before operations commence to enable Notices to Mariners to be published.	Email records	Project Manager	IMR, Drilling, Subsea Installation
		AMSA's JRCC will be notified 24–48 hours before operations commence to enable AMSA to distribute an AUSCOAST warning. AMSA JRCC will also be notified if the vessel moves out of the area that the broadcast is issued for.	Email records / Daily report	Vessel Master	IMR, Drilling, Subsea Installation
	C3: Marine Order 27 Safety of navigation and radio equipment	Vessels shall meet the safety of navigation and radio equipment requirements of AMSA MO27.	Vessel inspection records	Vessel Master	IMR, Drilling, Subsea Installation
	C4: Ongoing consultation	Notifications for any on-water activities and ongoing consultations undertaken per Section 10 - Stakeholder Consultation.	Notification records	Project Manager	IMR, Drilling, Subsea Installation
	C5: Fisheries Damage Protocol	Fisheries Damage Protocol in place to provide a compensation mechanism to fishers who damage fishing equipment on Otway assets infrastructure outside of the PSZ.	Fisheries Damages Protocol	General Manager Projects and Operations	Operations, IMR, Drilling, Subsea Installation
	C6: Marine Order 30: Prevention of collision	Navigation, radar equipment, and lighting meets the Marine Order 30 requirements	Vessel inspection records	Vessel Master	IMR, Drilling, Subsea Installation
EPO2: No serious or irreversible harm to a threatened or migratory listed species. **EPO3**: Biologically important behaviours can continue while the activity is being undertaken. **EPO4**: No substantial reduction of air quality within	C7: Planned Maintenance System	Critical equipment on vessels and MODU will be maintained in accordance with preventative maintenance system including: • Combustion Equipment (Vessels) • Thrusters (Vessels) • Equipment used to treat discharges to AMSA standards (Vessel, MODU) • Bunkering equipment (MODU) • Solids control equipment (MODU)	PMS records	Vessel Master / OIM	IMR, Drilling, Subsea Installation
	C8: Selection of high efficiency burner	High efficiency burner will be selected (>99% efficiency) during offshore well testing.	Equipment test records	Project Manager	Drilling

local airshed caused by atmospheric emissions produced during the activity. **EPO5**: No substantial and unrecoverable change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO6**: No substantial and unrecoverable changes to seabed which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO7:** Reduce anthropogenic threats to allow for blue whale and southern right whale conservation status to improve so that they can be removed from the EPBC Act threatened species list, consistent with the objectives and specific actions of the species' recovery plans.	C9: Emissions and Discharge Standards	Prior to commencing the offshore activity, the following will be verified, as relevant to vessel class: • Low-sulphur (<0.5% m/m) marine-grade diesel used. • Valid IAPPC and IEEC • Active Ship Energy Efficiency Management Plan. • Vessel NOx emissions levels meet Reg 13 MARPOL 73/78 Annex VI.	Bunker receipts SEEMP records Certification	Vessel Master / OIM	IMR, Drilling, Subsea Installation
		Bilge water treated via a MARPOL (or equivalent) approved oily water separator and only discharge if oil content less than 15 ppm.	Oil record book	Vessel Master / OIM	IMR, Drilling, Subsea Installation

		• Sewage discharged at sea is treated via a MARPOL (or equivalent) approved sewage treatment system.
		• Food waste only discharged when:
		  ○ vessel is en-route and >12 nm from land, or
		  ○ food waste is communited or ground to <25 mm and vessel is en route and >3 nm from land
		  ○ food waste is communited or ground to <25 mm and platform is >12 nm from land.
			Certification documentation	Vessel Master / OIM	IMR, Drilling, Subsea Installation

	C10: Cooper Energy Offshore Chemical Assessment Procedure	Project chemicals will meet the requirements of the Cooper Energy Offshore Chemical Assessment Procedure.	Completed and approved chemical assessment	Project Manager	Operations, IMR, Drilling, Subsea Installation
	C11: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	Vessels adhere to the distances and vessel management practices of EPBC Regulations (Part 8) with increased caution zone of 500 m between whales and project vessels.	Daily operations report details when whales, dolphins or seals sighted, and the interaction management actions were implemented, if required.	Vessel Master	IMR, Drilling, Subsea Installation
	C12: MODU Material Transfer Procedures	MODU will have a bulk fluid transfer process in place before commencing operations. The process will include: • MODU-to-vessel communication protocols • Transfer hose integrity checks • Continuous visual monitoring while bunkering • Tank volume monitoring while bunkering	Inspection records	OIM	Drilling
	C13: Vessel compliant with MARPOL Annex I, as appropriate to class (i.e., SMPEP or equivalent).	Vessel has a SMPEP (or equivalent appropriate to class) which is: • implemented in the event of a spill to deck or ocean • exercised according to the vessels exercise schedule. Spill response kits are located in high spill risk areas and routinely checked to ensure adequate.	Vessel SMPEP Vessel exercise schedule Vessel inspection	Vessel Master / OIM	IMR, Drilling, Subsea Installation
	C14: Waste Management Practices	• Vessels and MODU implement a garbage management plan. • The waste hierarchy is applied to project wastes. • Waste with potential to be windblown shall be stored in covered containers.	Garbage management plan Waste transfer records	Vessel Master / OIM	IMR, Drilling, Subsea Installation

		• Waste lost overboard is recorded and recovered if possible. • Waste transfers are recorded			
	C15: Installation Procedures	• Installation procedures shall be developed which take into account seabed relief and potentially sensitive seabed features • Equipment will be placed according to pipeline alignment drawings.	Pipeline alignment drawings Equipment installation procedures As-laid drawings	Project Manager	Subsea Installation
	C22: Campaign Risk Review	A pre-campaign risk review will be undertaken and will seek to identify an environmental window where risks to endangered whales (from subsea noise) are avoided, where practicable, and in any case, ensure that risks are continually reduced to levels that are ALARP and acceptable.	Risk review report	Project Manager	IMR, Drilling, Subsea Installation
	C23: Blue whale CMP Action A.2.3 (DAWE 2015) and Adaptive Management	Action A.2.3 (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) will be implemented in accordance with DAWE guidance on key terms (2021), where the action is needed to achieve the objective of the blue whale CMP. This will involve: • Application of precautionary criteria (thresholds) to establish parameters for impact and risk assessment. • Adaptive Management measures will be implemented for vessels on DP operating in, or where noise impact thresholds (displacement) overlap, the defined PBW foraging BIA and season, to reduce the risk of PBW displacement occurring during operations (DAWE 2021).	Noise modelling report Daily report MMO reports	Project Manager	IMR, Drilling, Subsea Installation
	C24: Southern Right Whale CMP – Adaptive Management	Additional mitigation action and an adaptive management plan required; the precautionary principle is applied. This will involve: • Application of precautionary criteria (thresholds) to establish parameters for impact and risk assessment. • Adaptive Management measures will be implemented for vessels on DP operating in, or where noise impact thresholds (displacement) overlap, the defined SRW migration and resting or aggregation BIA and respective season, to reduce the risk of SRW displacement occurring during operations.	Noise modelling report Daily report MMO reports	Project Manager	IMR, Drilling, Subsea Installation
	C25: IMS Risk Management Protocol	Completed risk assessment and management actions in accordance with the IMS Risk Management Protocol.	Completed IMS Risk Assessments.	Project Manager	IMR, Drilling, Subsea Installation
	C26: Marine Order 31: SOLAS and non-SOLAS certification	Vessels will meet survey, maintenance and certification of regulated Australian vessels as per AMSA MO 31.	Vessel certification	Vessel Master	IMR, Drilling, Subsea Installation
	C27: NOPSEMA accepted WOMP	A NOPSEMA-accepted WOMP. The WOMP includes, as applicable to the activity: • Cooper Energy well management standards • A description of well barriers	Records confirm a NOPSEMA-accepted WOMP Implementation records	Well Engineering Manager	Operations, Drilling

		• Performance and testing criteria			
	C28: NOPSEMA accepted safety cases	Activities will be managed in accordance with the accepted safety case revisions.	Accepted Safety Cases in place Implementation records	Accepted Safety Cases in place	Operations, IMR, Drilling, Subsea Installation
EPO8: Australian State and National government GHG commitments and reporting obligations are considered in Cooper Energy strategy development. **EPO9**: Contribute to meeting domestic Energy needs, while also contributing to the transition to a lower carbon emission intensive future.	C9: Emissions and Discharge Standards	Prior to commencing the offshore activity, the following will be verified, as relevant to vessel class: • Low-sulphur (<0.5% m/m) marine-grade diesel used. • Valid IAPPC and IEEC • Active Ship Energy Efficiency Management Plan. • Vessel NOx emissions levels meet Reg 13 MARPOL 73/78 Annex VI.	Bunker receipts SEEMP records Certification	Vessel Master / OIM	IMR, Drilling, Subsea Installation (direct GHG emissions)
	C16: Emissions Reduction Opportunities	Emissions reduction opportunities for Offshore Otway Operations will be assessed within the company's emissions reduction and portfolio selection process.	Emissions reduction opportunities/assessment records.	General Manager HSEC & Technical Services	Operations (direct GHG emissions)
	C17: CEMS MS11 Supply Chain and Procurement management. Supplier Assessments.	Major Offshore Service Tenders include an evaluation of tender emissions management actions and seek lower carbon intensity alternatives.	Service Tender Assessment Records	Project Manager	Drilling, Subsea Installation (direct GHG emissions)
	C18: Corporate Risk Review	Cooper Energy's corporate risk register assesses physical and transition risks associated with climate change including consideration of evolving state and national policy settings.	Corporate risk register	General Manager HSEC & Technical Services	Operations (direct GHG emissions) (indirect GHG emissions)
	C19: Value Chain Opportunities	Low carbon energy technology, opportunities and partnerships are assessed as part of Cooper Energy's emissions reduction and portfolio selection process.	New energy technology screening and assessment records	General Manager HSEC & Technical Services	Operations (indirect GHG emissions)
	C20: NGER Scheme Reporting	Cooper Energy Organisational Emissions associated with the Activity are reported annually.	NGER Reports	General Manager HSEC & Technical Services	Operations, IMR, Drilling, Subsea Installation. (direct GHG emissions)
	C21: Task Force on Climate Related Financial Disclosures (TCFD) principles, future iterations or equivalents	Cooper Energy align to the TCFD (or equivalent) principles for reporting.	Annual sustainability reporting	General Manager HSEC & Technical Services	Operations, IMR, Drilling, Subsea Installation. (direct GHG emissions) (indirect GHG emissions)
EPO10: Impacts to values and sensitivities are minimised in the event of a loss of hydrocarbons.	C29: OPEP	Emergency spill response capability is maintained in accordance with the OPEP. Emergency response activities will be implemented in accordance with the OPEP.	Records confirm that emergency response activities have been implemented in	Incident Management Team (IMT) Incident Controller (IC)	Operations, IMR, Drilling, Subsea Installation.

			accordance with the OPEP		
	C30: OSMP	Operational and scientific monitoring will be implemented in accordance with the OSMP.	Records confirm that operational and scientific monitoring have been implemented in accordance with the OSMP	IMT IC	Operations, IMR, Drilling, Subsea Installation.

9. Implementation

Cooper Energy retains full and ultimate responsibility as the Titleholder of the activity and is responsible for ensuring that the Otway Operations and associated activities are implemented in accordance with the performance outcomes outlined in this EP.

The Commonwealth OPGGS(E)R Regulation 14 and Victorian OPGGSR Regulation 16 require that an implementation strategy must be included in an EP. The Implementation Strategy described in this section provides a summary of the Cooper Energy Management System (CEMS).

9.1. Cooper Energy Management System (CEMS)

The CEMS is Cooper Energy's integrated system which consolidates all of Cooper's business processes into one system of management, to manage every aspect of Cooper Energy's business (such as HSEC, Operations, Well Construction, Engineering and Finance) in accordance with a set of core concepts (Table 9-1).

The CEMS document hierarchy is shown in Figure 9-1: with Cooper Energy's Health, Safety, Environment and Community (HSEC) Policy shown in Figure 9-2 and CEMS standards list in Table 9-2.

Table 9-1: Cooper Energy's Management System Core Concepts

Core Concepts	
People	• How we organise (line and function) • Which roles we need • Which skills we need • How we build and sustain capability
Culture	• Why we exist • What we value • How we work together • How we communicate
Process	• What we do • How we do it • How we learn • How we continuously improve
Technology	• Which tools we use • How we use them • How we support people to perform their role
Governance	• How we manage risk • How we make decisions • How we ensure safety, quality and technical integrity

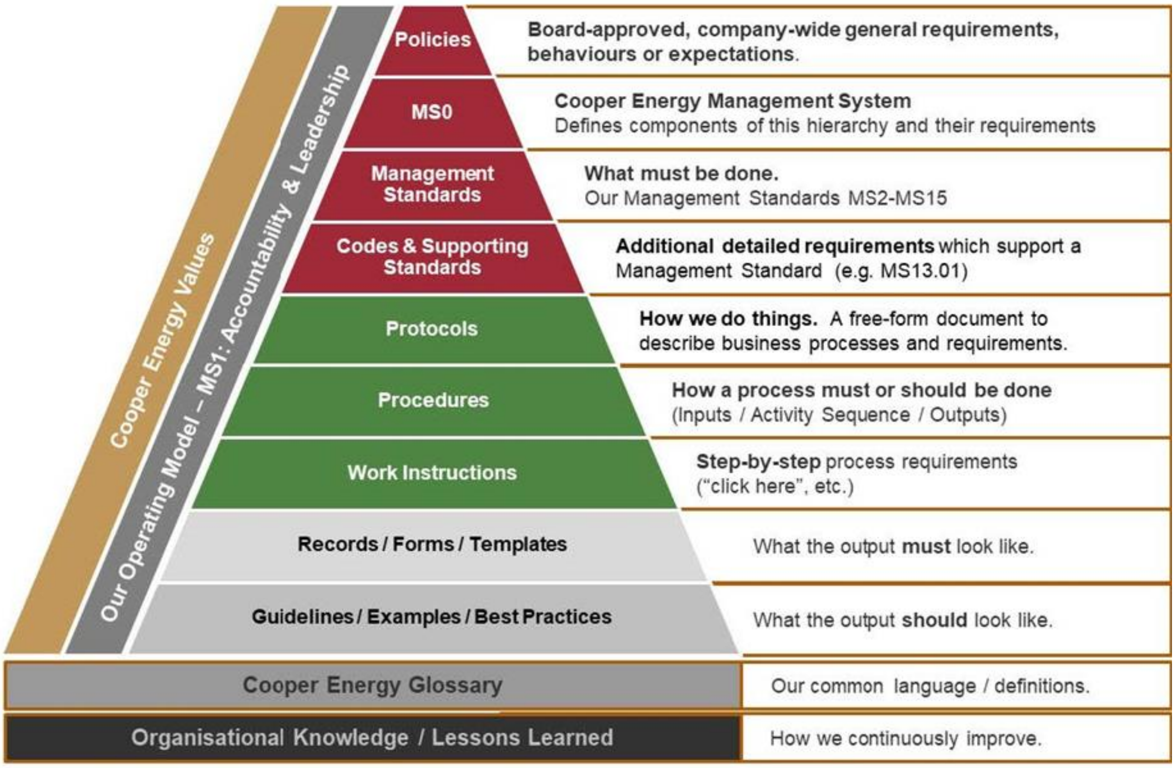


Figure 9-1: CEMS Document Hierarchy

Table 9-2: CEMS Standards

CEMS Standard	Focus Area
MS00	Statement of Intent and Expectations
MS01	Accountability and Leadership
MS02	People Management
MS03	Risk Management
MS04	Strategy and Planning Management
MS05	External Affairs, Investor Relations, Community and Stakeholder Management
MS06	Information Systems
MS07	Operations Management
MS08	Technical Management
MS09	Health, Safety and Environment Management
MS10	Incident and Crisis Management
MS11	Supply Chain and Procurement Management
MS12	Technical Assurance and Compliance Management
MS13	Financial Management
MS14	Commercial Marketing and Economics Management
MS15	Asset Lifecycle Management

Health, Safety and Environment Policy

Cooper Energy | HSE | Policy

Our Commitment

Care is a core value of Cooper Energy.

Cooper Energy is committed to taking all reasonably practicable steps to protect the health and safety of our workers, contractors, partners, and communities in the areas in which we operate. In addition, we will ensure our business is conducted in an environmentally responsible manner.

Our Actions

Wherever we operate we will develop, implement, and maintain HSE protocols that are consistent with recognised standards and practices, which will enable us to:

- Proactively assess and control our health and safety risks and environmental aspects and impacts
- Provide the HSE systems and resources to adequately support organisation in meeting its objectives
- Continually improve HSE systems through periodic consultation and review with the workforce
- Ensure all employees and contractors are appropriately trained and competent and suitably supervised to ensure works are undertaken in a safe and environmentally responsible manner
- Monitor HSE performance through the identification and communication to the workforce of clear, effective HSE objectives and targets
- Encourage participation in promoting improvements in safety, health and environmental practices and supporting a positive and caring culture in all areas of Cooper Energy's business
- Identify and comply with relevant HSE legislation and regulations and other requirements to which we subscribe and incorporating any changes into our HSE systems.

Governance

The HSEC Committee has oversight of this policy. The Managing Director is accountable for communicating this Policy and for ensuring compliance with its undertakings. All Executive Leadership Team members and Managers shall ensure the effective implementation, management, and monitoring of the HSEC Management System and its subsequent outcomes. All Staff are responsible for compliance with our policy, standards, and procedures. This policy will be reviewed at appropriate intervals and revised, as necessary.

David Maxwell

Managing Director

Role	Name	Signature	Document Properties
Document Author:	Ben Edwards	Ben Edwards	Doc No. CMS-HS-POL-0001
CEMS Review:	Sean Brooks		Rev: 5
Document Owner:	Iain MacDougall	Iain MacDougall Digitally signed by Iain MacDougall Date: 2021.12.20 10:30:31 +10'30'	Rev Date: 22 Sept 2021
Document Approver:	David Maxwell		

Figure 9-2: Cooper Energy Health, Safety, Environment and Community Policy

9.2. Asset Integrity Management

The integrity of all Cooper Energy Assets is managed in line with MS08: Technical Management.

The Well Operations Management Plan (CHN-DC-WMP-0001) describes the well integrity management, controls, verification, and maintenance for well activities in the offshore Otway. Well integrity is demonstrated through the maintenance of a primary and a secondary well barrier envelope. The WOMP details the well barrier elements and performance standards and their implementation through the well life cycle.

The Facility Integrity Management Plan (CHN-IR-IMP-0001) describes how Cooper Energy manages integrity of the Otway offshore assets, utilising the Plan-Do-Act-Check cycle. The overall strategy is to maintain the assets as close to their design condition as possible. Accordingly, the integrity of the Otway offshore assets is maintained and monitored in a number of ways, including:

- Design, pressure containment and primary protection functions:
  - Design basis and documentation
  - Protection and support structures
  - External corrosion protection system
  - Internal corrosion control system
  - Restriction and safety zone systems
  - Intervention procedures
  - Pipeline integrity reviews
- Monitoring and inspection:
  - Marine activity monitoring
  - Weather (exceedance) monitoring
  - ROV visual and CP inspection
  - Stakeholder engagement (facility awareness).

This approach is preferred to 'controlled deterioration' as it attempts to maintain enough control effectiveness to prevent 'surprise' deterioration threatening integrity, acknowledges that individual control effectiveness will not always be perfect and provides operational flexibility for decommissioning options.

9.3. Project Planning

Activities such as IMR, new stages and decommissioning are planned and executed in accordance with MS15: Asset Lifecycle Management. Cooper Energy uses a gated process; the process workflow is divided into phases (Figure 9-3). Each phase is subject to assurance processes and a gate review, the outcomes of which include continue, stop, hold, or recycle.

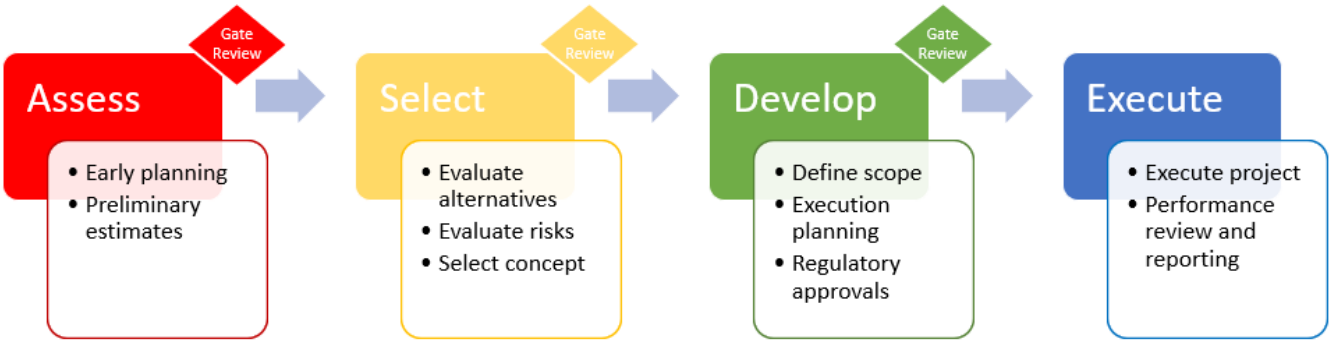


Figure 9-3: Project Workflow

9.3.1. Decommissioning Planning

Decommissioning of an asset involves permanently sealing wells, deconstruction and removal (base case), processing of materials, reagents, waste and infrastructure associated with the operations, and rehabilitation of the area.

Section 572(3) of the OPGGS Act requires titleholders to remove all equipment and other property in their title area that is neither used, nor to be used, in connection with operations. This obligation is ongoing and covers both the removal of equipment and property at the end of production and the removal of disused infrastructure at appropriate points throughout the life of an asset.

Cooper Energy's Decommissioning Protocol acknowledges legislative requirements and illustrates the company's management system for integrating decommissioning planning across operations. The Protocol outlines roles and responsibilities, along with requirements for decommissioning planning for onshore and offshore assets and associated financial provisions.

The objectives of this protocol are to:

- Define the requirement for decommissioning as part of the lifecycle of assets
- Define the requirement for a decommissioning plan to be developed and maintained for each asset, or group of assets within an operational area. The decommissioning plan must consider, where practical, progressive decommissioning of assets when equipment is not intended to be returned to operation
- Define the requirements for financial provisions to ensure decommissioning is completed in accordance with the decommissioning plan and that appropriate provisions are allocated for non-operated assets.

Options for other than the complete removal of all property may be considered, in which case the decommissioning plan must demonstrate that the alternative delivers equal or better environmental outcomes compared to complete removal, and that the approach complies with all other legislative and regulatory requirements. Therefore, for the purposes of planning, full removal must be the base case until an alternative end-state is accepted by the regulator.

Where onshore treatment and disposal of wastes is to be undertaken as a component of decommissioning, management of this waste must be in accordance with the respective legislation of the States or Territory. Depending on the remaining operational life, this may require specific plans for:

- waste management; and
- licensing and regulation of waste transport, storage, treatment, resource recovery and disposal.

9.4. Contractor Management

The Supply Chain and Procurement Management Standard (MS11) details Cooper Energy's contractor management system which provides a systematic approach for the selection and management of contractors to ensure any third party has the appropriate safety and environment management system and structures in place to achieve HSEC performance in accordance with Cooper Energy's expectations.

MS11 applies to sub-contractors, Third Party Contractors (TPCs) and suppliers conducting work at Cooper Energy sites or providing services to Cooper Energy. The Standard addresses operational HSEC performance of all contractors while working under a Cooper Energy contract or in an area of Cooper Energy responsibility or which may be covered under the HSEC Management System. The key HSEC steps in MS11 include:

- Planning – HSEC assessment of potential contractors, suppliers and / or TPCs
- Selection – submission and review of contractors and/or TPCs HSEC management data
- Implementation – onsite contractors and/or TPCs HSEC requirements including induction and training requirements
- Monitoring, review and closeout – ongoing review of contractors and/or TPCs HSEC performance including evaluation at work handover.

Prior to Contractor commencement of operations, contractors must have in place a Cooper Energy approved HSE Management System that meets minimal regulatory requirements and ensures compliance with this EP.

Cooper Energy will undertake an on-hire inspection of the relevant vessel against EP requirements. Cooper Energy shall also provide primary contractors with this EP and EP commitments register, inclusive of the

EPOs and EPSs established in this plan. This is one of a number of means to ensure contractors are aware of, and comply with, EP requirements.

9.5. Organisational Structure, Roles and Responsibilities

As required by Regulation 14(4) of the OPGGS(E)R, and the Victorian OPGGSR Regulation 16(4), this section outlines the chain of command (Figure 9 3) and roles and responsibilities (Figure 9-4) of personnel in relation to the implementation, management and review of this EP. The emergency response structure for the activity is detailed in the Offshore Victoria OPEP (VIC-ER-ERP-0001).

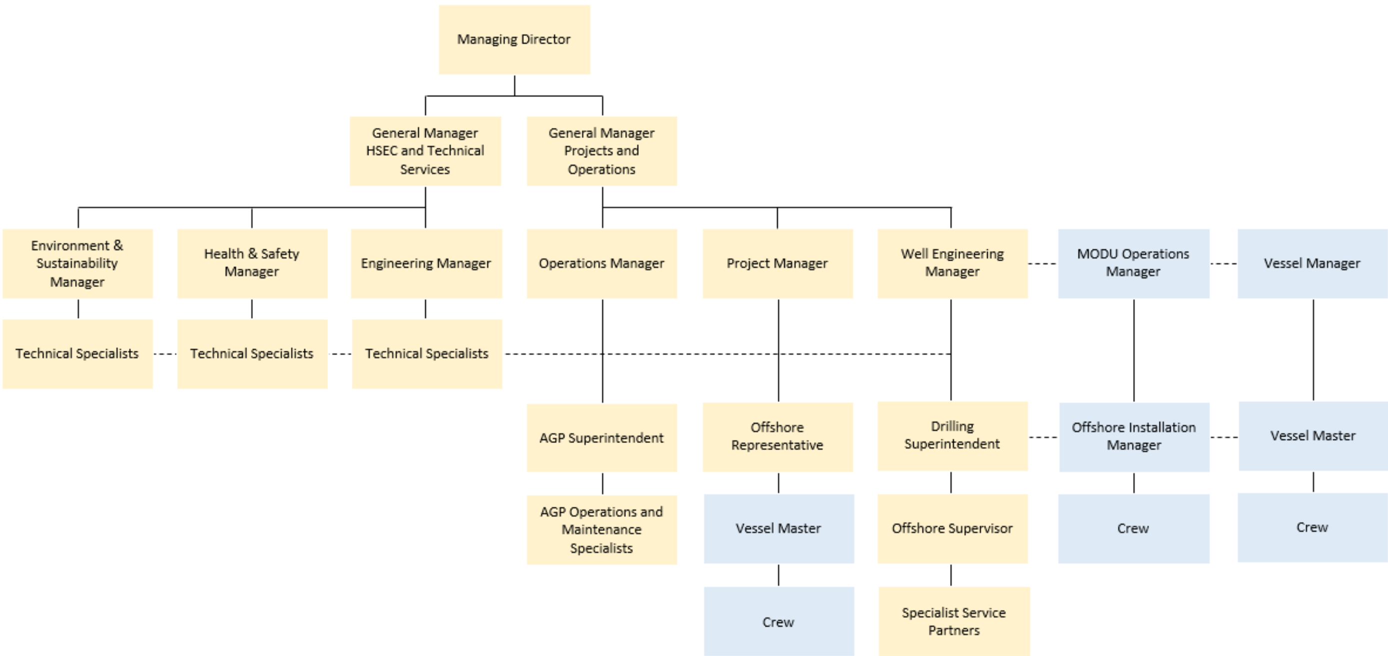


Figure 9-4: Cooper Energy Otway Offshore Operations Organisational Structure

Table 9-3: Cooper Energy Environmental Roles and Responsibilities

Role	Responsibilities
Cooper Energy	
Managing Director	The Managing Director is accountable for ensuring a framework has been established through which the Management System requirements will be met.
General Manager Projects and Operations	Ensures: • Compliance with the Cooper Energy HSEC Policy and Management System. • Audits and inspections to verify HSEC and integrity performance are scheduled and undertaken. • Adequate resources are in place to meet the requirements within the EP and OPEP. • Adequate emergency response capability is in place. • Incidents and non-conformances are recorded, reported and investigated.
Operations Manager / Project Manager / Well Engineering Manager	Ensures in relation to respective area of responsibility (Operations / offshore IMR and install / well activity): • Compliance with the Cooper Energy HSEC Policy and Management System components applicable to the activity. • Compliance with this EP and controls implemented. • Contractor prequalification and qualification processes are undertaken. • Personnel are inducted with EP requirements and are aware of their environmental responsibilities.

Role	Responsibilities
	• Response arrangements in the OPEP are in place and tested commensurate to the risks associated with the current offshore activity. • Environmentally relevant changes are assessed and approved by Cooper Energy. • Environmental incidents are reported internally and externally, and investigations undertaken. • Inspections and audits undertaken. • Actions from environmental audits and incidents are tracked to completion. • Stakeholder engagement is undertaken.
Engineering Manager	Ensures: • Compliance with relevant statutory and CEMS requirements. • Facility Integrity Management Plans are developed and maintained. • Integrity monitoring systems are maintained.
Environment & Sustainability Manager	Ensures: • Compliance with relevant statutory and CEMS requirements. • Specialist environment input and support is provided to implement the EP during the activity, Management and Board as required. • Environmental incidents are investigated in accordance with Cooper Energy requirements and learnings are disseminated appropriately • An in-depth and up to date knowledge of the legal and statutory Environmental obligations for is maintained. • Environmental performance is monitored, evaluated and reported as appropriate at all levels in the organisation.
Health and Safety Manager	Coordinates: • Cooper Energy's approach to Emergency Response and Preparedness. • Emergency Response Training, Competency and Testing commensurate to the risks associated with the current offshore activity.
Activity Superintendent	Ensures: • Compliance with EP commitments (EPOs/EPSs) for the offshore activity. • Implementation of risk assessment processes and management of change for the offshore activity. • Environmentally relevant changes are assessed and approved by Cooper Energy. • Appropriate source control resources are available and maintained, relevant to the activity. • Relevant plans are implemented.
Offshore Representative	Ensures: • Compliance with relevant environmental legislative requirements, performance outcomes, control measures, performance standards, measurement criteria and requirements in the implementation strategy in this EP. • Inductions completed, and record of attendance maintained. • Chemicals that have the potential to be discharged to the marine environment are assessed and approved using the Cooper Energy's Offshore Chemical Assessment Procedure. • Environmentally relevant changes are assessed and approved by Cooper Energy. • Incidents reported to the Cooper Energy Project Manager. • Monitoring and other records are collated and provided to the Cooper Energy Project Manager on completion of the program. • HSEC inspections undertaken throughout the offshore activity to ensure ongoing compliance with the EP requirements. • Corrective actions identified from incidents or inspections are implemented.
Contractors	

Role	Responsibilities
Offshore Installation Manager Vessel Master	Ensure compliance with relevant environmental legislative requirements, performance outcomes, control measures, performance standards, measurement criteria and requirements in the implementation strategy in this EP where relevant to their role.
Offshore Crews	Ensure compliance with relevant environmental legislative requirements, performance outcomes, control measures, performance standards, measurement criteria and requirements in the implementation strategy in this EP where relevant to their role.

9.6. Training and Awareness

OPGGS(E)R Regulation 14(5) and OPGGSR Regulation 16(5) require that the implementation strategy detail measures to ensure each employee or contractor working on, or in connection with, the activity is aware of their responsibilities in relation to this EP, including during emergencies or potential emergencies.

9.6.1. Cooper Energy Personnel

Cooper Energy personnel competency and training requirements are outlined in position descriptions and reviewed during the recruitment process. Competencies and training are initiated as defined in the Training and Development Procedure (CMS-HR-PCD-0004).

Personnel training records are maintained internally in accordance with MS06 Information and Systems Management.

9.6.2. Contractor personnel

Contractors engaged to work on the activity are assessed and engaged in accordance with the requirements of the MS11 Supply Chain and Procurement Management.

Competency of contractors is assessed as part of the pre-qualification and qualification process and requires contractors to define the competency and training requirements necessary to ensure that contractor personnel have the relevant knowledge and skills relevant to their role.

9.6.3. Environmental Induction

Cooper Energy and contractor personnel who work on the activity will complete an induction.

The environmental component of the induction will include information as detailed in Table 9-4. Records of personnel that complete the induction will be maintained internally in accordance with MS06 Information and Systems Management.

Table 9-4: Environmental components to be included in Environmental Inductions

Component	Onshore	Offshore
	Gas Plant / Operations	Vessel / MODU
Description of the environmental sensitivities and conservation values of the operations area and surrounding waters.	✓	✓
Controls to be implemented to ensure impacts and risks are ALARP and of an acceptable level.	✓	✓
Requirement to follow procedures and use risk assessments/job hazard assessments to identify environmental impacts and risks and appropriate controls.	✓	✓
Procedures for responding to and reporting environmental hazards or incidents.	✓	✓
Overview of emergency response and spill management procedures.	✓	✓
Megafauna sighting and vessel interaction procedures.	X	✓

9.7. Emergency Response

9.7.1. General Response

Cooper Energy manages emergencies from offshore Victoria activities in accordance with its Incident Management Plan (IMP) (COE-ER-ERP-0001). The purpose of the IMP is to provide the Cooper Energy Incident Management Team (IMT) with the necessary information to respond to an emergency affecting operations or business interruptions. The IMP:

- Describes the Emergency Management Process;
- Details the response process; and
- Lists the roles and responsibilities for the IMT members.

9.7.2. Oil Pollution Emergency Plan

In accordance Commonwealth OPGGS(E)R Regulation 14(8)(8AA)(8A) and the Victorian OPGGSR Regulation 17, the implementation strategy must include an Oil Pollution Emergency Plan (OPEP)/Emergency Response Plan (ERP) and arrangements for testing the response arrangements within these plans.

The Cooper Energy Offshore Victoria OPEP (VIC-ER-EMP-0001) and Offshore Victoria Operational and Scientific Monitoring Plan (OSMP) (VIC-ER-EMP-0002) provide for oil spill response and monitoring arrangements for this activity. These documents are submitted with this EP.

Roles and responsibilities for maintaining oil spill response capability and preparedness, testing and review arrangements and oil spill response competency and training requirements are detailed in the OPEP.

Vessels will operate under the vessel's SMPEP (or equivalent appropriate to class) or spill clean-up procedures to ensure timely response and effective management of any vessel-sourced oil spills to the marine environment. The SMPEP (or equivalent) is routinely tested. The SMPEP (or equivalent) is designed to ensure a rapid and appropriate response to any vessel oil spill and provides guidance on practical information that is required to undertake a rapid and effective response; and reporting procedures in the event of a spill.

9.7.3. Source Control Emergency Response Plan

A Source Control Emergency Response Plan (SCERP) provides for source control emergency response arrangements and preparedness for the activities. The SCERP aligns with industry and regulatory guidelines and provide for each of the key source control response strategies outlined in this EP.

Roles and responsibilities for maintaining source control response capability and preparedness, testing and review arrangements and source control response competency and training requirements are detailed in the SCERP and summarised in Table 9-5.

Table 9-5: SCERP Content

<table>
<tr><th>Response options</th><th>Topics addressed</th></tr>
<tr><td>Site Survey</td><td rowspan="6">Arrangements for the provision of the Source Control IMT personnel (numbers, competency, capability for the duration of the response)
Arrangements for the provision of equipment and material supplies
Arrangements for equipment and personnel monitoring and tracking
Activation and mobilisation plans, including activation and expenditure authority and regulatory approval processes
Logistics plans and providers
SIMOPS planning process
Deployment and installation plans
Well kill and shut-in plans.</td></tr>
<tr><td>Debris Removal</td></tr>
<tr><td>Intervention Pressure Control Equipment</td></tr>
<tr><td>Capping</td></tr>
<tr><td>Dispersant Application</td></tr>
<tr><td>Relief Well Drilling</td></tr>
</table>

9.8. Chemical Assessment and Selection

Cooper Energy's Offshore Chemical Assessment Procedure (CMS-EN-PCD-0004) requires that chemicals used offshore for a project and operations that will be or have the potential to be discharged to the environment are assessed and approved prior to use. This process is used to ensure the lowest toxicity, most biodegradable and least bioaccumulative chemicals are selected which meet the technical requirements.

A summary of the evaluation process is detailed in Table 9-6.

Table 9-6 Cooper Energy Offshore Chemical Assessment Procedure Summary

<table>
<tr><th>Step</th><th>Evaluation</th><th>Input</th><th>Outcomes</th></tr>
<tr><td>1</td><td>Characterise proposed chemical.</td><td>Confirm the following:
Chemical name & supplier
Chemical Function/purpose
Formulation, where available
CAS number, where available
Eco toxicity, where available
Estimated use, dosage and discharge.</td><td>Proceed to Step 2</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Determine whether the chemical proposed is to be discharged to the marine environment.</td><td rowspan="2">Refer to EP to determine proximity to priority sensitivities.</td><td>Where chemical is to be used in an entirely closed loop system no further action is required.</td></tr>
<tr><td>Where chemical is to be discharged - proceed to Step 3.</td></tr>
<tr><td>3</td><td>Determine whether the chemical proposed is on the OSPAR PLONOR List.</td><td>Refer to OSPAR PLONOR List</td><td>Where the chemical is listed the chemical is approved at Step 3.

Where the chemical Is not listed go to Step 4.</td></tr>
</table>

Step	Evaluation	Input	Outcomes
4	Use the OCNS Definitive Ranked Lists of Registered Substances to determine the risk banding.	Search the OCNS Definitive Ranked Lists of Registered Substances for the product name or equivalent branding. Always use the latest version.	Is the HQ Band "Gold" or "Silver," or OCNS Group "E" or "D"? If yes go to **Step 5**. Where the chemical is not listed go to **Step 6**.
5	Determine whether the chemical has a substitution or product warning.	OCNS Definitive Ranked Lists of Registered Substances or obtain from the current CEFAS template. Always use the latest version.	Where the chemical does not have a product or substitution warning no further action is required and chemical is approved. Where the chemical has a product or substitution warning go to **Step 7**.
6	Assess the Ecotoxicity.	LC50 or EC50 concentrations for representative species; Octanol-water partition coefficient (Log Pow); and Biodegradation information (% biodegradation in 28 days).	Requires a Hazard Assessment and ALARP justification where: Toxicity = LC50 <100 mg/L or EC50 <100mg/L Bioaccumulation = Log Pow >3 Biodegradability <20%
7	Consider an alternative or complete ALARP justification.	Technical justification required to proceed with selected chemical.	Where there is no technical justification for the chemical it is not accepted for use. Where there is a technical justification an ALARP Justification must be approved by the Project Manager.

9.9. Invasive Marine Species Risk Assessment

Cooper Energy's Invasive Marine Species Protocol (CMS-EN-PCD-0006) was developed to integrate Australian IMS prevention efforts into Cooper Energy's offshore operations. The procedure details the actions to be undertaken during the contracting phase for a vessel, MOU and submersible equipment (e.g. ROVs) for a project within a Cooper Energy operational area (as defined under the EP for the activity). The procedure incorporates key considerations from IMO (2011) and Australian Government (2009) biofouling guidelines; the inputs, decision points and general flow of the of IMS risk management actions are shown in Figure 9-4.

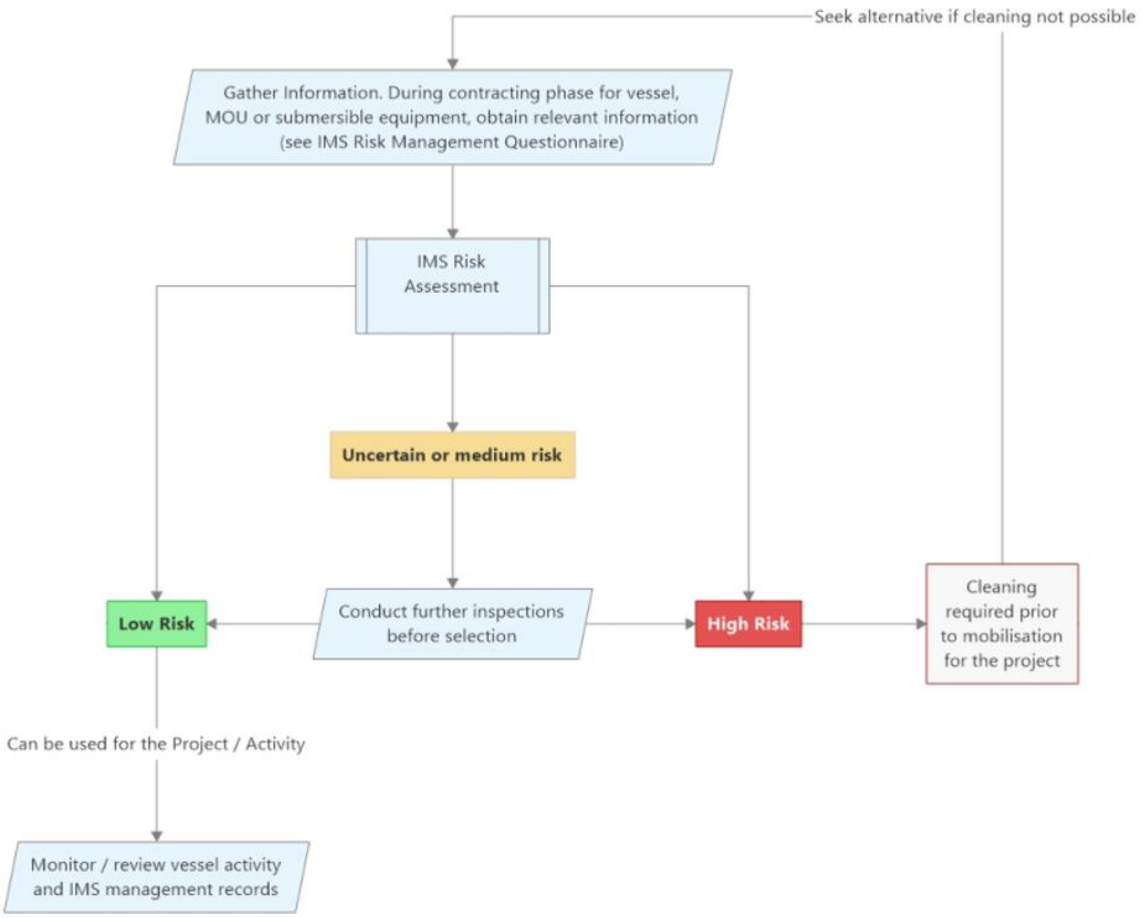


Figure 9-5: Cooper Energy IMS Risk Management Flow

9.10. Marine Mammal Risk Review and Management

Cooper Energy implements risk reviews prior to undertaking offshore campaigns. A risk review framework addressing campaign timing in relation to seasonal sensitivities (pygmy blue whale and southern right whale important behaviours) is shown in Figure 9-6.

Figure 9-6 and Figure 9-8 outline the adaptive measures to be implemented in relation to pygmy blue whales and southern right whales in order to manage the impacts and risks of subsea noise from vessels during offshore campaigns both inside and outside defined seasons for the respective species.

Pre-campaign risk review		
Purpose:	The review will seek to identify an environmental window where risks to endangered whales (from subsea noise) are avoided, where practicable, and in any case, ensure that risks are continually reduced to levels that are ALARP and acceptable.	
Timing:	Prior to campaign activity commencing at the Otway offshore facilities	
Personnel:	This process will involve personnel who can supply relevant information to the activity and/or are the key decision makers for the project. This includes the Project Manager, Lead Engineer and Environment Specialist.	
Risk Review Considerations		
Facility drivers	• Integrity management drivers, such as upcoming risk-based inspection, planned or urgent repairs. • Market operator drivers, such as mandated shutdown windows.	
Campaign drivers	• Availability of vessel / offshore unit and services. • Work duration and schedule, • Safe operating limits (weather).	
Seasonal environmental sensitivities	• Current conservation advice and actions • Current legislated exclusion zones and associated timing • Seasonal sensitivity of the species across the broader region utilising the Cooper energy Existing Environment, contemporary literature and available sightings databases such as the Atlas of Living Australia and SWIFFT;	
Campaign risk events (subsea noise)	• Sound / source level of DP vessels selected for the campaign will be characterised. • Location of the campaign DP vessel activity and predicted noise contours against the expected location of these sensitivities. • Campaign timing relative to seasonal sensitivity of both pygmy blue whales and southern right whales.	
Campaign risk controls	• Suitability of current control measures in the context of the campaign risk event review. • Previously discounted control measures • New techniques and technologies (e.g. for monitoring).	

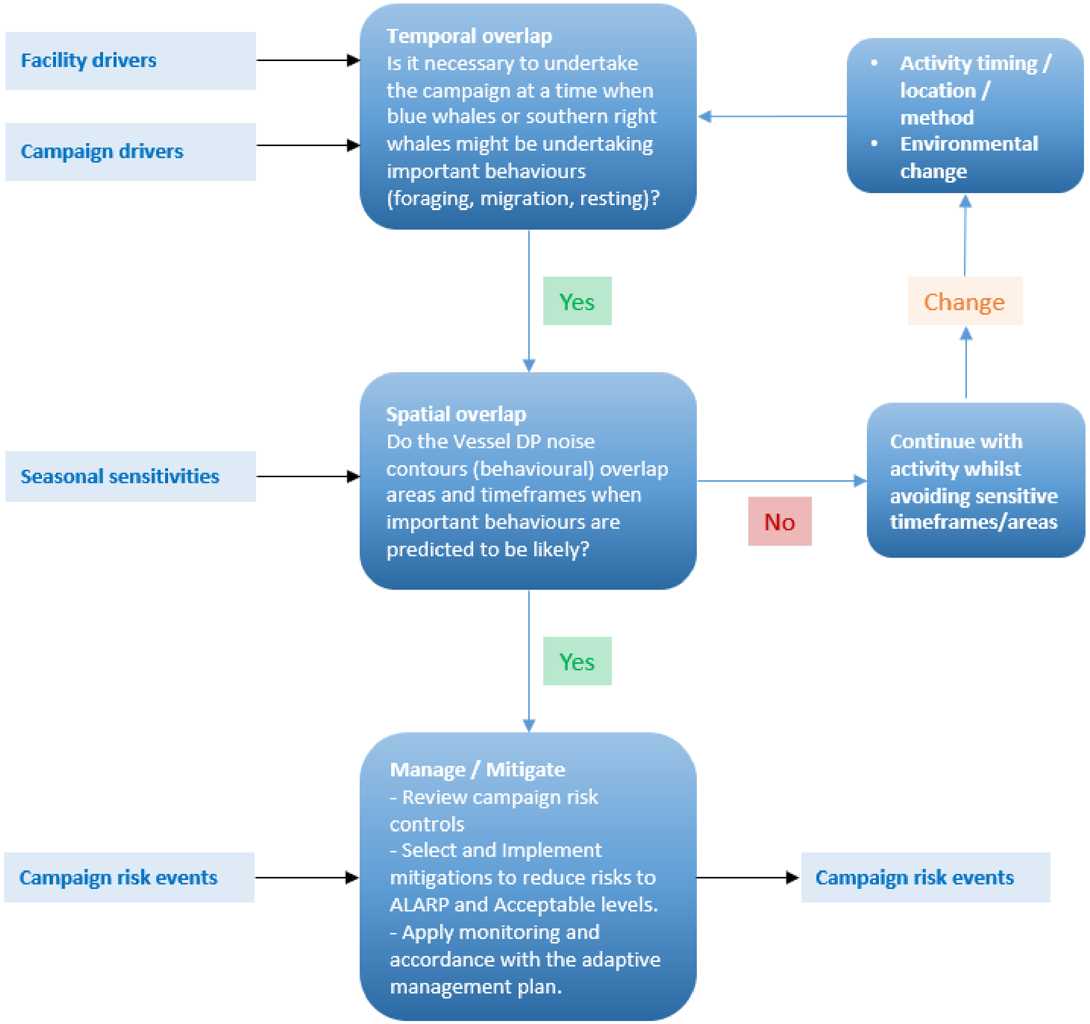


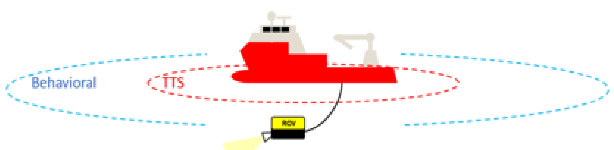
Figure 9-6: Pre-campaign Risk Review Framework

Inside pygmy blue whale season and foraging area

Pygmy blue whales

Outside pygmy blue whale season or outside foraging area

Timing | **Control Measure**



Potential effect contours are described in Section 6 of the EP

Monitoring
Dedicated MMO supported by trained crew (during breaks).

Prestart observation
MMO 30-minute pre-start watch before commencing DP. Commence if no BW seen in observation zone (A.3.1, DEWHA 2008).

Initial pre-activity survey**
undertaken by appropriate means to cover behavioral disturbance contour before DP start.

Observation Zone
Out to behavioral contour.

Action
Modify vessel activity if foraging blue whale observed inside Observation zone.

Nighttime Ops
No nighttime DP ops if ≥3 whale instigated power-downs during preceding daylight hours, where one of the power-downs is within the hour before darkness (A.3.6, DEWHA 2008).

Risk Review
Undertake if 3 consecutive days of whale instigated power-downs. Consider:
- Aerial survey
- Increased duration pre-start observation
- Increased no nighttime ops trigger

Process notes

*Limits of detection are expected to be 3-7km for an observer depending on height of observation platform (DEWHA 2008, Beach Energy 2021).

**for the initial pre-activity survey, where visibility precludes observations out to the behavioral contour the project will undertake:
- an aerial survey with coverage of the area inside the behavioral contour. The survey will occur within the 24 hours preceding DP commencement, or
- extended prestart observation from the vessel for a duration of at least 2 hours prior to DP commencement (A.3.6, DEWHA 2008).

Monitoring
Routine monitoring and reporting by trained crew.

Risk review
If ≥ 3 whales are observed from the MOU for 3 consecutive days – review risk assessment and management measures to ensure performance outcomes are achieved.

Training levels

Trained Crew
This will include bridge watch crews and helicopter crews. Observations reported daily when in field and in transit. Crew will be inducted in whale ID, binocular use, range finding, reporting.

Dedicated MMO
A trained Marine Mammal Observer with prior experience in observing and identifying whales in field environment, whale behaviour, recording, reporting, project induction. The MMO has discretion over species and behaviour observed.

Actions

Activity modifications may include:
- Modify vessel progress inside 30 minutes of whale sighting if heading in the direction of the whale.
- Power-down DP once subsea equipment is safely on deck, and
- Slowly move away from whale, to beyond displacement distance if possible.

References

DEWHA 2008 EPBC Policy 2.1 Interaction between offshore seismic exploration and whales.
Beach Energy 2021. Geograph Subsea Installation & Commissioning EP (accepted November 2021).

Figure 9-7: Pygmy Blue Whale Marine Mammal Adaptive Management Measures

Inside southern right whale season and activity behavioral noise contour overlap with migration and resting corridor, or aggregation area.

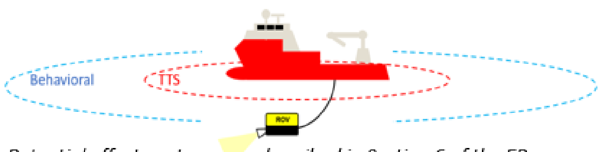
Southern right whales

Outside southern right whale season or no activity behavioral noise contour overlap with migration and resting corridor

Timing

Control Measure

Monitoring
Dedicated MMO supported by trained crew (during breaks).



Potential effect contours are described in Section 6 of the EP

Prestart observation
MMO 30-minute pre-start watch before commencing DP. Commence if no SRW seen in observation zone (A.3.1, DEWHA 2008).

Initial pre-activity survey**
undertaken by appropriate means to cover behavioral disturbance contour before DP start.

Observation Zone
Area of overlap between behavioral disturbance corridor and SRW migration and resting corridor, or aggregation area.

Action
Modify vessel activity if SRW observed inside Observation zone.

Nighttime Ops
No nighttime DP ops if ≥3 whale instigated power-downs during preceding daylight hours, where one of the power-downs is within the hour before darkness (A.3.6, DEWHA 2008).

Risk Review
Undertake if 3 consecutive days of whale instigated power-downs. Consider:
- Aerial survey
- Increased duration pre-start observation
- Increased no nighttime ops trigger

Process notes

*Limits of detection are expected to be 3-7km for an observer depending on height of observation platform (DEWHA 2008, Beach Energy 2021).

**for the initial pre-activity survey, where visibility precludes observations out to the behavioral contour the project will undertake:
- an aerial survey with coverage of the area inside the behavioral contour. The survey will occur within the 24 hours preceding DP commencement, or
- extended prestart observation from the vessel or shore for a duration of at least 2 hours prior to DP commencement (A.3.6, DEWHA 2008).

Monitoring
Routine monitoring and reporting by trained crew.

Risk review
If ≥ 3 whales are observed from the MOU for 3 consecutive days – review risk assessment and management measures to ensure performance outcomes are achieved.

Training levels

Trained Crew
This will include bridge watch crews and helicopter crews. Observations reported daily when in field and in transit. Crew will be inducted in whale ID, binocular use, range finding, reporting.

Dedicated MMO
A trained Marine Mammal Observer with prior experience in observing and identifying whales in field environment, whale behaviour, recording, reporting, project induction. The MMO has discretion over species and behaviour observed.

Actions

Activity modifications may include:
- Modify vessel progress inside 30 minutes of whale sighting if heading in the direction of the whale.
- Power-down DP once subsea equipment is safely on deck, and
- Slowly move away from whale, to beyond displacement distance if possible.

References

DEWHA 2008 EPBC Policy 2.1 Interaction between offshore seismic exploration and whales.
Beach Energy 2021. Geograph Subsea Installation & Commissioning EP (accepted November 2021).

Figure 9-8: Southern Right Whale Marine Mammal Adaptive Management Measures

9.11. Management of Change

MS08 Technical Management and Management of Change (MoC) General Protocol (CMS-TS-PRO-0002) describes the requirements for dealing with change management. The objective of the MoC process is to ensure that changes do not increase the risk of harm to people, assets or the environment. This includes:

- Deviation from established corporate processes
- Changes to offshore operations and/or status of infrastructure
- Deviation from specified safe working practice or work instructions/procedures
- Implementation of new systems
- Significant change of HSEC-critical personnel.

Environmentally relevant changes include:

- New activities, assets, equipment, processes or procedures proposed to be undertaken or implemented that have the potential to impact on the environment and have not been:
  - assessed for environmental impact previously, in accordance with the relevant standard
  - authorised in the existing management plans, procedures, work instructions or maintenance plans
- Proposed changes to activities, assets, equipment (including change of well or infrastructure status that may be undertaken under another EP), processes or procedures that have the potential to impact on the environment or interface with the environmental receptor
- Changes to the existing environment including (but not limited to) fisheries, tourism and other commercial and recreational uses, and any changes to protective matter requirements
- Changes to the requirements of an existing external approval (e.g., changes to conditions of environmental licences)
- New information or changes in information from research, stakeholders, legal and other requirements, and any other sources used to inform the EP
- Changes or updates identified from incident investigations, emergency response activities or emergency response exercises.

For any MoC with identified environmental impacts or risks, an impact/risk assessment will be undertaken to ensure that impacts and risks from the change can be managed to meet the nominated EPOs set out in the accepted EP as well as be ALARP and of an acceptable level.

9.11.1. Changes to Titleholders and Nominated Liaison Person

Section 0 details the titleholders and nominated liaison person and contact details. Any change in these details is required to be notified to NOPSEMA and the DJPR as soon as possible.

9.11.2. Revisions to the EP

In the event that the proposed change introduces a significant new environmental impact or risk, results in a significant increase to an existing risk, or through a cumulative effect of a series of changes there is a significant increase in environmental impact or risk, this EP will be revised for re-submission to NOPSEMA and DJPR.

Where a change results in the EP being updated, the change/s are to be logged in the EP Change Register (Appendix 1).

In addition, the titleholder is obligated to ensure that all specific activities, tasks or actions required to complete the activity are provided for in the EP. Regulation 17(5) of the OPGGS(E)R and Regulation 20(2) of the OPGGS Regulations (Vic) require that where there is a significant modification or new stage of the activity (that is, change to the spatial or temporal extent of the activity) a proposed revision of the EP will be submitted to NOPSEMA and DJPR.

9.12. Incident Reporting and Recording

MS10 Incident and Crisis Management, Incident and Crisis Management Protocol (CMS-ER-PRO-0002) and Incident Investigation and Reporting Protocol (CMS-ER-PRO-0001) provide for a systematic method of incident reporting and investigation and a process for monitoring close out of preventative actions.

The incident reporting and investigation documentation defines the:

- Method to record, report, investigate and analyse accidents and incidents;
- Legal reporting requirements to the regulators within mandatory reporting timeframes;
- Process for escalating reports to Cooper Energy senior management and the Cooper Energy Board;
- Methodology for determining root cause;
- Responsible persons to undertake investigation; and
- Classification and analysis of incidents.

Notification and reporting requirements for environmental incidents to external agencies are listed in Table 9-7. Notification and reporting requirements for oil spills (Level 2/3) are detailed in the OPEP.

Table 9-7: External Incident Reporting Requirements

Incident Type	Description	Requirement	Timing	Contact
Recordable Incident	OPGGS(E)R: An incident arising from the activity that breaches an EPO or EPS in the EP that applies to the activity that is not a reportable incident.	As a minimum, the written monthly recordable report must include a description of: • all recordable incidents occurred during the calendar month • all material facts and circumstances concerning the incidents that the operator knows or is able to reasonably find out • corrective actions taken to avoid or mitigate any adverse environmental impacts of the incident • corrective actions that have been taken, or maybe taken, to prevent a repeat of similar incidents occurring.	Before the 15th day of the following calendar month.	**Written Notification:** NOPSEMA - submissions@nopsema.gov.au DJPR -reports@ecodev.vic.gov.au
Reportable Incident	OPGGS(E)R: An incident arising from the activity that has caused, or has the potential to cause, moderate to significant environmental damage. OPGGSR (Victoria): An incident arising from the activity that has caused, or has the potential to cause: • moderate to catastrophic environmental consequences • a breach of, or noncompliance with the Victorian OPGGS Act 2010; Victorian OPGGSR 2011 (Chapter 2–Environment); or EPOs set out in the EP. For Cooper Energy, reportable incidents include, but are not limited to, those that have been identified through the risk assessment process as having an inherent impact consequence of 'moderate', 'major' or 'critical'; or at a minimum, the following incidents: • A level 2/3 spill incident; and • IMS Introduction.	**Verbal Notification:** The notification must contain: • all material fact and circumstances concerning the incident • any action taken to avoid or mitigate the adverse environmental impact of the incident • the corrective action that has been taken or is proposed to be taken to stop control or remedy the portable incident. This must be followed by a written record of notification as soon as possible after notification.	**State Waters** Within 2 hours of becoming aware of the incident	**Verbal:** DJPR - Phone 0409 858 715 **Written Notification:** DJPR - marine.pollution@ecodev.vic.gov.au
			Commonwealth Waters Within 3 days of notification of the incident	**Verbal:** NOPSEMA – Phone 1300 674 472 **Written Notification:** NOPSEMA - submissions@nopsema.gov.au NOPTA – reporting @nopta.gov.au
		Written Notification: Verbal notification of a reportable incident to the regulator must be followed by a written report. As a minimum, the written incident report will include: • the incident and all material facts and circumstances concerning the incident • actions taken to avoid or mitigate any adverse environmental impacts • the corrective actions that have been taken, or may be taken, to prevent a recurrence of the incident • the action that has been taken or is proposed to be taken to prevent a similar incident occurring in the future.	**State Waters** Within 3 days of notification of the incident	DJPR - marine.pollution@ecodev.vic.gov.au
			Commonwealth Waters Within 3 days of notification of the incident	NOPSEMA - submissions@nopsema.gov.au
		Written reports to be submitted to National Offshore Petroleum Titles Administrator (NOPTA) and DJPR (for incidents in Commonwealth waters).	Within 7 days of written report submission to NOPSEMA	NOPTA – reporting @nopta.gov.au

Reportable incident - in the event an AMP may be exposed to hydrocarbons		Notification must be provided to the Director of National Parks and include: • titleholder details • time and location of the incident (including name of marine park likely to be affected) • proposed response arrangement • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator.	As soon as possible	Marine Park Compliance Duty Officer – 0419 293 465
Reportable Incident – Invasive Marine Species		Suspected or confirmed Invasive Marine Species Introduction.	As soon as possible	DJPR on 136 186 or marine.pests@ecodev.vic.gov.au.
Reportable Incident - Injury or Death to Fauna		Incidents of injury or death to native fauna including whales and dolphins. https://www.wildlife.vic.gov.au/wildlife-emergencies/whale-and-dolphin-emergencies https://www.zoo.org.au/fighting-extinction/marine-response-unit/	As soon as possible	DELWP Whale & Dolphin Emergency Hotline - 1300 136 017. Seals, Penguins or Marine Turtles Zoo Victoria Marine Response Unit – 1300 245 678.
		Impacts to MNES, specifically injury to or death of EPBC Act-listed species. https://www.environment.gov.au/biodiversity/threatened/listed-species-and-ecological-communities-notification	Within 7 days	DAWE Phone: +61 2 6274 1111 Email: EPBC.Permits@environment.gov.au
		Vessel strike with cetacean.	Within 72 hours of incident.	DAWE – National Ship Strike Database https://data.marinemammals.gov.au/report/shipstrike

9.13. Environmental Performance Monitoring and Reporting

This section details the specific measures Cooper Energy will implement to ensure that, for the duration of the activity:

- The environmental impacts and risks of the activity continue to be identified and reduced to a level that is ALARP;
- Control measures detailed in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and an acceptable level; and
- Environmental performance outcomes and standards set out in the EP are being met.

9.13.1. Emissions and Discharges

Emissions and discharge monitoring and records required for operations and vessel-based activities are detailed in Table 9-8. Copies of emission and discharge records will be retained in accordance with Section 9.14.

Table 9-8: Discharge and Emissions Monitoring

Aspect	Monitoring	Frequency	Reporting
Operations			
Routine release of hydraulic fluid	Chemical Type Volume	Daily	Distributed Control System
Offshore Activity			
Treated bilge	Volume Location Vessel Speed	As required	Oil Record Book
Food scraps	Volume Location	As required	Garbage Record Book
Fuel use	Volume	Daily	Daily Report
Ballast water discharge	Volume Location	As required	Ballast Water Record System.
Chemical discharges to marine environment	Chemical name Chemical type Chemical use Chemical volume	Weekly	Daily Report
Drill Fluids Discharge	Fluid type Fluid volume % oil on cuttings	As required	Daily Report
Cementing discharges	Nature of discharge Volume Location	As required	Daily Report
Waste	Volume sent ashore	As required	Garbage Record Book
Spill	Volume Chemical / Oil type	As required	Daily Report Incident Report
Accidental release or losses overboard	Nature of the discharge material Volume / Amount	As required	Daily Report Incident Report

9.13.2. Activity Commencement and Cessation Notifications

Activity notification requirements are detailed in Section 10 (Ongoing Consultation and Notifications).

9.13.3. Annual Performance Report

As required by Regulation 26C OPGGS(E) Regulations (Cwlth) and Regulation 31A OPGGS Regulations (Vic), Cooper Energy will submit an annual EP performance report to the regulator (NOPSEMA and DJPR).

This report will provide sufficient detail to enable the Regulator to determine whether the environmental performance outcomes and standards in the EP have been met.

The report will be submitted annually within 3 months of the EP acceptance date.

9.13.4. Cetacean Reporting

Cetacean observation data will be submitted to the DCCEEW via the National Marine Mammal Data Portal.

https://data.marinemammals.gov.au/report/sighting

Data will be reported within 3 months of the completion of an offshore activity.

9.13.5. Audit and Inspection

Environmental performance of offshore operations and activities will be audited and reviewed in several ways to ensure that:

- Environmental performance standards to achieve the EPOs are being implemented and reviewed;
- Potential non-compliances and opportunities for continuous improvement are identified; and
- Environmental monitoring requirements are being met.

Non-conformance with the environmental performance standards outlined in this EP will be managed as per Section 9.13.6.

Opportunities for improvement or non-compliances noted will be communicated to relevant personnel at the time of the review/inspection/audit to ensure adequate time to implement corrective actions. The findings and recommendations of inspections or audits will be documented and distributed to relevant personnel for comment, and any actions tracked until completion.

9.13.5.1. EP Compliance

The following assurance arrangements will be undertaken:

- Annual Audit of the performance outcomes and performance standards contained in the EP and the requirements detailed in the implementation strategy. This audit will be used to inform the annual EP performance report submitted to NOPSEMA and DJPR.

9.13.5.2. Offshore Vessel Activities

The following arrangements review the environmental performance of offshore vessel and MODU activities:

- A premobilisation inspection will be undertaken for offshore vessels to ensure they will meet the requirements of the EP; and
- HSEC inspections will be undertaken throughout the offshore activity on a weekly basis to ensure ongoing compliance with relevant EP requirements. The scope of the inspections will include (but is not limited to):
  - Vessel spill readiness (i.e. provision spill kits and drills in accordance with vessel SOPEP/SMPEP);
  - Waste management in accordance with EP, EPO and EPSs;
  - Chemical Inventory checks to ensure campaign chemicals are accepted via the Offshore Chemical Assessment Procedure;
  - Maintenance checks for equipment identified within an EP EPS (e.g. oily water separator).

Non-compliance and improvement opportunities will be communicated to COE HSEC onshore for advice, tracking and reporting in accordance with Section 9.13.6.

9.13.6. Management of Non-conformance

In response to any EP and environmental audit and inspection non-compliances, corrective actions will be implemented and tracked to completion as per the Incident management, Non-Conformity and Corrective Action Standard Instruction (COE-MS-STI-0020).

Corrective actions will specify the remedial action required to fix the breach and prevent its reoccurrence and is delegated to the person deemed most appropriate to fulfil the action. The action is closed out only when verified by the appropriate Manager and signed off. This process is maintained through the Cooper Energy corrective action tracking system.

Where more immediacy is required, non-compliances will be communicated to relevant personnel and responded to as soon as possible. Where relevant the results of these actions will be communicated to the offshore crew during daily toolbox meetings or at daily or weekly HSEC meetings.

Cooper Energy will carry forward any non-compliance items for consideration in future operations to assist with continuous improvement in environmental management controls and performance outcomes.

9.14. Records Management

In accordance with the Regulation 27 of the OPGGS(E) Regulations (Cwlth) and Regulation 32 of the OPGGS Regulations (Vic), Cooper Energy will store and maintain documents or records relevant to the EP in accordance with the Document and Records Management Procedure (CMS-IM-PCD-0002).

10. Stakeholder Consultation

The OPGGS(E) Regulations (Cwlth) require that titleholders (and those with access authority):

must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person.

The OPGGS Regulations (Vic) establish that the EP must demonstrate:

- an appropriate level of consultation with authorities, interested persons and organisations.

To meet these requirements, Cooper Energy has and will continue to undertake stakeholder consultation with persons and organisations that operate or have an interest in the area where the Otway Offshore Operations and activities are undertaken. This is done as part of the consultation cycle (Figure 10-1).

Figure 10-1 Consultation Cycle

Key learnings and consultation from previous Cooper Energy campaigns and ongoing activities offshore Victoria have also been considered for the current activities where relevant.

The principal objectives of the Cooper Energy consultation strategy are:

- Confirm existing stakeholders;
- Identify whether there are additional stakeholders to those identified with regard to previously accepted Otway activities and previous consultation undertaken;
- Initiate and maintain open communications between stakeholders and Cooper Energy relevant to their interests;
- Proactively work with stakeholders on recommended strategies to minimise negative impacts and maximise positive impacts of all activities; and
- Provide for ongoing consultation that reflects the requirements of stakeholders and the activity schedule.

Cooper Energy has maintained records of consultation and tracks commitments made through to closure.

10.1. Scoping – Identification of Relevant Stakeholders

Determining the relevant stakeholders for the Otway activities involved the following:

- reviewing the receptors identified in the existing environment section, persons or groups linked to those receptors, and their functions interests and activities
- reviewing existing stakeholders identified as relevant and contained within the Cooper Energy stakeholder register
- reviewing previous Otway asset campaign consultation records

- discussing with existing stakeholders to identify potential new stakeholders or changes to stakeholder contacts or consultation preferences
- reviewing Commonwealth and State fisheries jurisdictions and fishing effort in the region
- reviewing and acting upon NOPSEMA guideline A705589 (03/07/2020) ‘Consultation with Commonwealth agencies with responsibilities in the marine area’.

Cooper Energy has undertaken consultation activities in the Otway region and specifically in relation to the Otway offshore facilities since the facilities were acquired from the previous operators.

Cooper Energy has consulted with stakeholders in the region and established a good working relationship with them. Consequently, Cooper Energy believe they have effectively identified relevant stakeholders and have a good understanding of issues and areas of interest.

During the scoping activity, it was identified that some stakeholders previously engaged are no longer relevant or no longer exist and they have been removed from the stakeholder register. It is also recognised that additional stakeholders may be identified through the life of the activity; consultation with these additional stakeholders will be integrated into the project consultation cycle.

Stakeholders identified and contacted for this activity listed in Table 10-1. These stakeholders include relevant persons under the OPGGS(E)R (Commonwealth) Regulation 11A, where a ‘relevant person’ is:

> *A person or organisation whose functions, interests or activities may be affected by the petroleum activity*

Stakeholders that may only be relevant in the event of an oil spill and these stakeholders are identified in Cooper Energy’s Emergency Contacts register. Cooper Energy also engages and collaborates with other parties including operators and research organisations; these parties are not considered ‘relevant persons’.

Table 10-1: Relevant Stakeholders for the Otway Offshore Activities

Stakeholder	Functions, Interests, Activities	Activity relevance	Reason for inclusion
Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant			
Australian Antarctic Division (AAD)	Marine Mammal research, protection and conservation	Administrators of Australian marine mammal sightings database. Experience and specialism in marine mammal monitoring and risk mitigations.	Targeted consultation in relation to marine mammal sightings, risk management and reporting.
Australian Border Control	National maritime security	Responsible for coordinating and advising on maritime security. Communicates with industry to advise of maritime actions that may impact on their businesses and advising of appropriate preventive security measures. Australian Border Control have a role in the enforcement of Petroleum Safety Zones. PSZs are currently established at the Otway Offshore facilities.	PSZs and relevance to maintaining maritime security.
Australian Fisheries Management Authority (AFMA)	Commonwealth fisheries	Activity is within a Commonwealth fishery area or will impact or potentially impact a Commonwealth fishery area or resource. Via prior consultation, AFMA has recommended engagement with Commonwealth Fisheries Association (CFA) as the peak fishing industry body for Commonwealth and that 'Australian Bureau of Agricultural and Resource Economics and Sciences' reports should be reviewed for fishery status. CFA is included in this table as a relevant stakeholder; the latest 'Australian Bureau of Agricultural and Resource Economics and Sciences' report and study by SETFIA (2020) used to determine which Commonwealth and State fisheries have fishing effort within the activity area.	Commonwealth managed fisheries overlap the activity area, and support vessel movements may be of interest.
Australian Hydrological Service (AHS)	Maritime safety	Interest in identifying and charting potential seabed features and hazard warnings to mariners. Via prior consultation, AHS have requested to provide information at least three weeks prior to commencement of any oil and gas activity to allow for publication of notices to mariners.	Interested in safe navigation of commercial shipping in Australian waters during the activity. Interested in charting changes to infrastructure and exclusion zones.
Australian Maritime Safety Authority (AMSA)	Marine Vessel Safety	Activity focused consultation regarding shipping, emergency response preparedness and offshore activity levels.	Interested in safe navigation of commercial shipping in Australian waters during the activity. Involved in maritime notifications, advice and emergency response.
Department of Agriculture, Water and Environment (DAWE) - Biosecurity	Biosecurity	Responsible for managing biosecurity of incoming goods and conveyances (including biosecurity) in Australia. Responsible for implementation of marine pest and biosecurity within Australian Waters (12nm), including conveyances into Australian Waters. The Otway offshore activities will involve activities both inside and beyond 12nm, provisioned by conveyances within 12 nm.	Potential for biosecurity risk associated with conveyances between Australia and offshore petroleum activities.

Stakeholder	Functions, Interests, Activities	Activity relevance	Reason for inclusion
		The department also provides national leadership in management of established marine pests, and in responding to incursions of exotic marine pests, and is responsible for implementing ballast water requirements under the Biosecurity Act.	
DAWE – Fisheries (now DAFF)	Fisheries	Activity is within a Commonwealth fishery area or will impact or potentially impact a Commonwealth fishery area or resource.	Consultation in relation to potential impacts to other marine users, including commonwealth fisheries.
DAWE – Heritage (now DCCEEW)	Underwater Heritage	Administration of the Underwater Cultural Heritage Act, applicable to any wrecks identified within the Title areas or close to licenced pipelines.	Any actions involving contact with the seabed, or activities in close proximity to the seabed, have the potential to impact underwater heritage.
DAWE – Sea Dumping Section (now DCCEEW)	Administration of the Sea Dumping Act	NOPSEMA guidance N-06800-GL1887 identifies DAWE as a relevant Department or Agency with respect to Sea Dumping. Further to guidelines released in Q4 2019 (Revised specific guidelines for assessment of platforms or other man-made structures at sea), DAWE will now review facility/infrastructure decommissioning scenarios on a case-by-case basis (pers comm. DAWE Sea dumping section).	May be relevant for future decommissioning planning depending on final end-states (base case is full removal). No activities are currently relevant hence no detailed consultation on the activity.
Department of Defence (DoD)	National security	Relevant where the proposed activity may impact DoD operational requirements, where the proposed activity encroaches on known training areas and/or restricted airspace and where there is a risk of unexploded ordnance in the area where the activity is taking place.	Not directly relevant to activities. Consult in relation airspace restrictions pending definition of offshore crew transfer plans.
Director of National Parks (DoNP)	Managing Commonwealth reserves and conservation zones	The DoNP is a relevant person for consultation for this project in relation to potential incidents in Commonwealth waters which could impact on the values of a Commonwealth marine park.	Operational Area does not overlap marine parks however, potential EMBA for unplanned spill scenario (vessel collision) overlap and impact the values within a Commonwealth marine parks. Consult in relation to spill response planning as relevant.
Each Department or agency of a State to which the activities to be carried out under the EP may be relevant			
DJPR – Biosecurity	Victorian biosecurity	DJPR Biosecurity and Agricultural Services manage advice on biosecurity within Victoria including vessels in state waters/calling into ports. The DJPR BAS has provided advice during the development of Cooper Energy IMS risk management processes.	Vessels traversing between offshore installations and mainland, along with potential interest in disposal of subsea infrastructure (bio fouled). Consult on biosecurity concerns and specific requirements or guidance in relation moving structures with biofouling across state waters.
Department of Jobs Precincts and Regions (DJPR) –	Changes in fishery access and/or habitat	Activity is within a Victorian fishery area or will impact or potentially impact a Victorian fishery area or resource. Study by SETFIA (2020) identifies which	Activity Operational Area overlaps with Victorian fishery areas.

Stakeholder	Functions, Interests, Activities	Activity relevance	Reason for inclusion
Victorian Fishery Authority		Victorian fisheries are authorised to fish in the Title areas, and those who do actively fish.	
Department of Transport (DoT) – Victoria	Marine pollution response in Victoria	Responsible for marine pollution response arrangements in Victorian jurisdiction. DoT coordinate advice with other state agencies involved in marine pollution response including DELWP and Port Authorities.	EMBA and Support vessel routes overlaps with Victoria waters as such OPEP sets out arrangements with DoT.
Department of Environment, Land, Water and Planning (DELWP)	Wildlife and habitat protection / conservation	Responsible for State marine protected areas within Victorian jurisdiction, and oiled wildlife response.	Wildlife response control agency in the event of an oil spill. Input into OPEP wildlife response plan where there is shoreline contact in Victoria or impact on Victorian coastal waters.
Parks Victoria	Wildlife and habitat protection/conservation in Victoria	Manages Victoria's marine national parks.	Oil spill EMBA overlap with Victoria waters
A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP			
Commonwealth Fisheries			
Abalone Council Australia	Changes in fishery access and/or habitat	Peak industry body representing the wild-harvest abalone Industry from Tasmania, Victoria, South Australia, Western Australia and New South Wales. Fishing occurs in water depths <30 m.	Activity is within the Victorian Central Abalone Zone. Based on water depths for fishing and habitat, overlap between the project and stakeholder functions, interests, and activities is minimal.
Commonwealth Fisheries Association (CFA)	Changes in fishery access and/or habitat	Peak industry body representing the interests of fishers operating in Commonwealth managed fisheries. AFMA recommended engagement with CFA as the peak fishing industry body for Commonwealth fisheries.	Petroleum Activity and support route overlaps with Commonwealth fisheries areas and may restrict access. Future changes in PSZ of interests to fishers.
South East Fishing Trawl Industry Association (SETFIA)**	Changes in fishery access and/or habitat	Peak industry body representing the interests of fishers operating in the Commonwealth Trawl Sector. Project activities overlap with fisheries which SETFIA represent (Shark Gillnet and Shark Hook Sector).	Cooper Energy has ongoing engagement with SETFIA across all operations offshore Victoria.
Southern Shark Industry Alliance (SSIA)**	Changes in fishery access and/or habitat	Industry body representing interests of its Commonwealth-licenced shark gillnet and shark hook members in the Gillnet Hook and Trap Fishery. Activity is within the Southern and Eastern Scalefish and Shark Fishery management area where there is no fishing effort.	Within fishery area and fishery is active in the area (2010-2019) in area access. Continue to engage. *Noting engagement is via SETFIA.
Southern Squid Jig Fishery**	Changes in fishery access and/or habitat	Individual skippers managed by AFMA South East Management Advisory Committee.	Within fishery area and fishery is active in the area (2010-2019) in area access. Continue to engage.

Stakeholder	Functions, Interests, Activities	Activity relevance	Reason for inclusion
		Activity is within the Southern Squid jig fishery management area, though the fishery is transient and operate at water depths between 60 m and 120 m. SSJF are recorded as fishing within the Title Areas	
Sustainable Shark Fishing Inc. (SSFI)**	Changes in fishery access and/or habitat	Activity is within the Southern and Eastern Scalefish and Shark Fishery management area where there is no fishing effort.	Within fishery area and given fisheries interest in area access. However, no overlap between this aspect of the project and stakeholder functions, interests, and activities expected.
Tuna Australia **Australian Southern Bluefin Tuna Industry Association (Port Lincoln)**	Changes in fishery access and/or habitat	Peak body representing statutory fishing right owners, holders, fish processors and sellers, and associate members of the Eastern and Western tuna and billfish fisheries of Australia.	Operational Area overlaps Eastern Tuna and Billfish Fishery and Southern Bluefin Tuna Fishery area. No active fishing identified at in vicinity the Otway facilities. Continue to provide updates to Tuna Australia as agreed.
State Fisheries			
Abalone Victoria Central Zone (AVCZ)**	Changes in fishery access and/or habitat	Represents the views and interests of its members and to ensure appropriate governance of member resources. However, fishing occurs in water depths <30 m (minimal overlap during normal operations).	Activity is within the Central Zone represented by Abalone Victoria. Note indirectly engaged via representative body (SIV)
Eastern Victoria Sea Urchin Divers Association	Changes in fishery access and/or habitat	Industry body representing views and interests of its members. Activity is within the central zone of the Sea Urchin Fishery. Sea urchin is only harvested out of eastern Victoria. https://vfa.vic.gov.au/commercial-fishing/commercial-fisheries/sea-urchin	Activity overlap fishery zones however sea urchin is only harvested from the eastern zone. Note indirectly engaged via representative body (SIV)
Lakes Entrance Fishermen's Society Cooperative Limited (LEFCOL)	Changes in fishery access and/or habitat	Industry body and fishing services provider based in Lakes Entrance. Represents views and interests of its members. Activity overlaps with State fisheries who may be members of the cooperative, t5hough are expected mostly to operate offshore Gippsland.	Activity overlap of fisheries. *Note indirectly engaged via representative body (SIV).
Seafood Industry Victoria (SIV)**	Changes in fishery access and/or habitat	Peak industry body representing the interests of fishers operating in State (Vic) managed fisheries. SIV primary contact for State fishers. Multiple constructive engagements over the years with SIV to discuss Cooper Energy's activities and ongoing engagement. SIV has expressed interest in overlapping activities with its members. SIV engagement covers following fisheries; every Victorian fishing access licence holders, Victorian Inshore Trawl Fishery, Victorian Wrasse Fishery, Victorian Rock Lobster Fishery including VRLA, Victorian Abalone Fishery including AVCZ, Eastern Victoria Sea Urchin Divers Association.	Activity overlaps with a number of State fisheries. Changes in PSZ, offshore activities and fishing access of interest.

Stakeholder	Functions, Interests, Activities	Activity relevance	Reason for inclusion
Southern Rock Lobster (SRL)**	Changes in fishery access and/or habitat	National peak body working to further the interests of the Australian Southern Rock Lobster Industry. The Victorian Government has jurisdiction over the commercial rock lobster fishery in Commonwealth waters adjacent to Victoria through an Offshore Constitutional Settlement Agreement with the Commonwealth Government. Consultation with Rock Lobster Fishery and Giant Crab Fishery are linked, noting Giant Crab Fishery (Western Zone) Access Licence can only be operated when it is linked to a Rock Lobster Fishery (Western Zone). The fishing grounds for southern rock lobster extend through State and Commonwealth waters; main rock lobster fishing grounds in the region are known to be located around Portland Bay. Studies indicate some Rock lobster fishing in the Title areas.	Activity is within the western zone of the Rock Lobster Fishery. Potential impact stakeholder functions, interests, and activities. Continue to engage.
Victorian Recreational Fishers Association	Changes in fishery access and/or habitat	Peak body representing recreational fishing interests in Victorian waters.	Activity is within an area where there may be only low levels of recreational fishing given the distance to shore. Support vessel activities may overlap within an area where they maybe low levels of recreational fishing as not features other than pipeline.
Victorian Rock Lobster Association (VRLA)**	Changes in fishery access and/or habitat	Activity is within the western zone of the Rock Lobster Fishery. The Victorian Government has jurisdiction over the commercial rock lobster fishery in Commonwealth waters adjacent to Victoria through an Offshore Constitutional Settlement Agreement with the Commonwealth Government. Consultation with Rock Lobster Fishery and Giant Crab Fishery are linked, noting Giant Crab Fishery (Western Zone) Access Licence can only be operated when it is linked to a Rock Lobster Fishery (Western Zone) Access Licence. The fishing grounds for southern rock lobster extend through State and Commonwealth waters; main rock lobster fishing grounds in the region are known to be located around Portland Bay. Studies indicate some Rock lobster fishing in the Title areas.	Activity is within the western zone of the Rock Lobster Fishery. Potential impact stakeholder functions, interests, and activities. Continue to engage. Note requested that consultation be undertaken via SIV as such indirectly engaged via SIV.
Victorian Scallop Fisherman's Association	Changes in fishery access and/or habitat	Representative body of Victorian Scallop Fishers. Most members are based in Lakes Entrance, East Gippsland, Victoria. No active fishing within Otway Titles.	Activity and scallop fishing does not overlap. Via previous consultation are mainly concerned regarding seismic surveys. *Note indirectly engaged via representative body (SIV).

***Actively fish or have members who actively fish within the Otway Title areas. Although multiple fisheries can legally fish in the area, not all of them for various reasons including unsuitability of the area (depth/habitat) and/or the relative lack of target species.*

10.2. Provision of Sufficient Information

The Regulations require titleholders to make sufficient information available to relevant stakeholders.

Cooper Energy integrates consultation into its planning process, ensuring stakeholders are:

- provided with details and milestones of the Project
- advised, where they are or may be directly impacted (e.g., fisheries), of any potential hazards/risks and the mitigation measures to address them and provided the opportunity to raise additional concerns
- involved in the planning process where their functions, interests or activities may be directly impacted by the project.

Consultation methods and media vary with the project phase and level of engagement required (as informed by the stakeholder). Typical means of engagement are provided in Table 10-2.

Table 10-2 Otway offshore activities consultation approach

Communication method	Description
Meetings	Cooper Energy is committed to meeting with relevant stakeholders for the Project in order to enable transparent and direct feedback on the proposed Project. This will include: • Regulator briefings on a semi-regular basis • Meetings with individual stakeholders and / or community information sessions Face-to-face meetings (where possible given COVID-19 otherwise video conference or phone calls) will be conducted with relevant stakeholders. The purpose of briefings is to provide project updates, reinforce key messages, clarify any misconceptions, and build stronger stakeholder relationships.
Letters and emails	Letters and emails will be used as an initial consultation tool to introduce the Project to relevant stakeholders and establish appropriate forms of communication that will be used during the Project. Written communications may include formal correspondence, Project updates regarding developments or upcoming activities, and specific responses to issues, concerns or requests.
Information sheets	Information sheets on the Project will be developed to inform relevant stakeholders. Information sheets will be provided during personal meetings, housed on the Cooper Energy webpage and provided in hard copy upon request by any stakeholder. Note that relevant activity information which may change (such as project timing) will be re-communicated to relevant stakeholders. Further information, such as detailed maps will be tailored to meet the needs of each stakeholders' circumstances and will be provided as part of the consultation process.
Public display of regulatory documentation	Assessment documents (the EP) will be placed on public exhibition on the regulators website following acceptance. To protect the rights of both parties involved in the consultation process, records of all engagements between Cooper Energy and third parties during the Project development will be maintained by Cooper Energy, subject to Information Privacy requirements.
Cooper Energy Web page	The Cooper Energy website will be used to provide information regarding the Project. The website: • contains details on Cooper Energy and the Project • contains any fact sheets or newsletters as they are developed • contain details of any public displays and information sessions • allows documents produced for public display to be downloaded • provides methods for contacting, providing feedback to, or registering complaints with Cooper Energy. https://www.cooperenergy.com.au/
Address, phone and email	Relevant stakeholders may wish to contact the Project team via the details below: Address: Level 8, 70 Franklin Street, Adelaide SA 5000 Phone: (08) 8100 4900

Communication method	Description
	Email: stakeholder@cooperenergy.com.au

10.3. Summary of Stakeholder Engagement

Table 10-4 provides a summary of the stakeholder consultation undertaken as part of revising the EP and were applicable an assessment of any claims or objections. A summary of recent historical consultation and any objections or claims is also noted.

All stakeholder consultation activities along with any actions required and commitments made, are recorded and tracked via a stakeholder engagement register.

10.4. Assessment of Claims and Feedback

Cooper Energy shall assess the merits of any new claims or objections made by a relevant stakeholder whereby they believe the activity may have adverse impacts upon their interest or activities. Cooper Energy shall finalise the assessment of the merit of any claim or objection within two weeks of receipt of all pertinent information and undertake any resulting actions as soon as practicable.

In determining if a claim or objection has merit, evidence must be presented such as literature, scientific data, historical fishing data etc. If the claim has merit, where appropriate, Cooper Energy shall modify management of the activity. The assessment of merit and any resulting actions shall be shared with the stakeholder.

Cooper Energy shall determine through internal risk assessment, whether a risk or impact is considered 'significant' (i.e., has resulted in an increased residual risk ranking) based on information available at that time (e.g., reviewed scientific information, stakeholder claims or concerns). If the outcome of the assessment suggests that impacts and risks are new or significantly increased, then this will trigger a revision to the EP, and stakeholders re-consulted as part of that process.

10.5. Ongoing Stakeholder Consultation

10.5.1. Ongoing Consultation and Notifications

Further to the stakeholder consultation undertaken and documented in Table 10-4, the ongoing notifications and consultation required is detailed in Table 10-3.

Consultation for the Otway offshore activities has spanned a number of decades. The activities and management described within this EP are informed by historical and present consultation and will continue to be shaped by feedback from stakeholders.

Cooper Energy will continue to provide annual updates to stakeholders with up-to-date timeframes. More detailed and more frequent updates will be provided to stakeholders as offshore campaigns approach, in accordance with agreed communications with particular stakeholders.

Table 10-3 Ongoing Stakeholder Consultation and Notification

Ongoing Engagements	Timing	Person or Organisation
Provision of operational and offshore activity plans and Cooper Energy contact person flyer with updates on timing and activity details.	Annual (typically Q1) until this EP is closed or replaced.	Relevant stakeholders
Meetings, calls, enquiries, emails (e.g. interim activity updates).	Ongoing. Stakeholder engagement inbox is monitored throughout the planning and execution phases.	Relevant stakeholders
PSZ applications (new / alterations)	Prior to drilling operations. Prior consultation and consultation report aligned to NOPSEMA Policy A196273 Section 4.2.5.	NOPSEMA
Regulatory notification of start of an activity.	10 days prior to activity commencing	DJPR / NOPSEMA

Ongoing Engagements	Timing	Person or Organisation
Notification of start of activity for publication of AUSCOAST warning and notice to mariners.	3 weeks prior to activity commencing	TSV / AHS
	24-48 hours prior to activity commencing	TSV / AMSA-JRCC
Notification to trawl fisheries of on-water activity. Notification to include: • type of activity • location of activity: coordinates and/or map • timing of activity: start and finish date and duration	4 weeks prior to activity commencing Then, 1 day prior to activity commencing	SETFIA, who will provide SMS to western fleet.
Notification to trawl fisheries of cessation of on-water activity	Within 10 days of activity completion	
Regulatory notification of cessation of an activity	Within 10 days of activity completion	DJPR / NOPSEMA
Notification of cessation of activity to cease warnings for an activity	On vessel demobilisation from field	TSV / AHS / AMSA-JRCC

10.5.2. Consultation in the wider community

Cooper Energy has undertaken activities in the Otway Basin since 2017. Stakeholder consultation has included ‘relevant stakeholders’ and the broader community. Cooper Energy has consulted broadly in relation to its onshore and offshore operations, well construction and maintenance activities. Cooper Energy has hosted Community drop-ins in Peterborough and Port Campbell, published activity details in local newspapers and consulted with local and state government. Across a number of activities, offshore and onshore. Cooper Energy has refined a robust understanding of relevant stakeholders and established open dialogue with a range of stakeholders and organisations. Consequently, Cooper Energy believes it has a comprehensive understanding of relevant stakeholders and their interests.

10.5.2.1. Community Reference Group (formerly the Environmental Review Committee)

The Environmental Review Committee (ERC) is a legacy of the Minerva project and has been retained for the continued operation of the Athena Gas Plant. The ERC is body for consultation with the community, local government and regulators. In 2013, the ERC was transitioned to a Community Reference Group (CRG) to reflect an evolution in focus. Cooper Energy maintains and continues to consult with the CRG for the Athena Gas Plant and related project work.

10.5.2.2. PL228

Cooper Energy consults with a range of onshore stakeholders including traditional owners, local government, landowners and agencies in relation to the onshore pipeline (PL228) which connects to VIC/PL37(V). Consultation is undertaken to maintain awareness of the pipeline, provide an understanding of the petroleum activities, engage on effective environmental management and co-existence with input from landowners so that disruption to stakeholders can be minimised.

Table 10-4 Stakeholder Feedback and Cooper Energy Assessment of Objections and Claims

Stakeholder	Stakeholder ID	Information provided	Summary of Stakeholder Response	Cooper Energy (COE) Assessment of Objection/ Claim	COE Response	Record ID (Stakeholder-ID-Date-Item) (Latest consultation)
Australian Antarctic Division (AAD)	GA-AAD	COE submission of marine mammal sightings forms following offshore activities.	Thanked Cooper Energy for the sightings	No claims or objectives have been raised with the proposed activity.	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagements.	GA-AAD-20220321-email
Australian Border Control	GA-ABC	Cooper Energy Activity Update 2022, including update on Otway onshore and offshore activities and contact details for further queries. Historical: Cooper Energy Activity Update for 2021	No response received.	No claims or objectives have been raised with the proposed activity.	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagements.	GA-ABC-20220331-email
Australian Fisheries Management Authority (AFMA)	GA-AFMA	Cooper Energy Activity Update 2022 Historical: Cooper Energy Activity Update for 2021	No response received. Historical AFMA noted importance of consultation with fishers within proposed activity areas. AFMA provided further details of potentially affected stakeholders.	No claims or objectives have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-AFMA-20220331-email
Australian Hydrographic Service (AHS)	GA-AHS	Cooper Energy Activity Update 2022 Historical: Cooper Energy Activity Update for 2021	AHS acknowledged receipt of information. Historical AHS acknowledged receipt of information.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-AHS-20220404-email
Australian Maritime Safety Authority (AMSA)	GA-AMSA	Cooper Energy Activity Update for 2022. Historical: Cooper Energy Activity Update for 2021 Cooper Energy Offshore Maintenance – 1-month notice activity update provided Weather and progress update provided. Confirmation and acknowledgement of vessel leaving field. Discussion surrounding MOUs Cooper Energy Offshore General Visual Inspection 1-month notice activity update provided Confirmation of completion of activities	Acknowledged receipt and provided update contact details. Confirmation no further information was needed at that time. Historical Acknowledged update Traffic update provided. Contact detail update and NMT confirmation discussion	No claims or objectives have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-AMSA-20210310-email GA-AMSA-20210309-email GA-AMSA-20210422-email GA-AMSA-20210503-email GA-AMSA-20210913-email GA-AMSA-20210913-email-2 GA-AMSA-20210917-email GA-AMSA-20220318-email GA-AMSA-20220331-email-2 GA-AMSA-20220331-email-2

Stakeholder	Stakeholder ID	Information provided	Summary of Stakeholder Response	Cooper Energy (COE) Assessment of Objection/ Claim	COE Response	Record ID (Stakeholder-ID-Date-Item) (Latest consultation)
						GA-AMSA-20220401-email GA-AMSA-20220405-email GA-AMSA-20220406-email GA-AMSA-20220406-email-2 GA-AMSA-AHS-DoD-F-20210308-email.pdf GA-AMSA-DoD-F-20210308-email.pdf
Department of Agriculture, Water and the Environment (DAWE) – Biosecurity	GA-DAWE-B	Cooper Energy Activity Update for 2022 COE acknowledged change in contact details. Historical: Cooper Energy Activity Update for 2021	Department noted change in personnel and that activity update had been forwarded. Historical Acknowledged receipt of information.	No claims or objections have been raised with the proposed activity	COE updated consultation records. COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-DAWE-B-20220331-email.pdf GA-DAWE-B-220401-email.pdf GA-DAWE-B-220405-email.pdf
Department of Agriculture, Water and Environment (DAWE) – Fisheries	GA-DAWE-F	Cooper Energy Activity Update for 2022 Historical: Cooper Energy Activity Update for 2021	No response received. Historical No response received.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-DAWE-F-20220331-email.pdf
Department of Agriculture, Water and Environment (DAWE) – Heritage	GA-DAWE-H	Cooper Energy Activity Update for 2022	No response received.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-DAWE-H-20220331-email.pdf GA-DAWE-H-20220331-email-2.pdf
Department of Agriculture, Water and the Environment – Sea Dumping Section	GA-DAWE-SD	Cooper Energy Activity Update for 2022	No response received.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	DA-DAWE-SD-20220412-email.pdf DA-DAWE-SD-20220412-email-2.pdf DA-DAWE-SD-20220412-email-3.pdf GA-DAWE-SD-20220331-email.pdf
Department of Defence	GA-DoD	Cooper Energy Activity Update for 2022 Historical: Cooper Energy Activity Update for 2021 Cooper Energy Offshore Maintenance - 1 month notice	No response received.	No claim or objections raised with proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-SEFTIA-AMSA-DoT-AHO-DoD-F-20210308-email.pdf GA-AHS-20220404-email.pdf
Director of National Parks	GA-DoNP	Cooper Energy Activity Update for 2022 Historical: Cooper Energy Activity Update for 2021	No response received.	No claim or objections raised with proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-DoNP-20220331-email.pdf

Stakeholder	Stakeholder ID	Information provided	Summary of Stakeholder Response	Cooper Energy (COE) Assessment of Objection/ Claim	COE Response	Record ID (Stakeholder-ID-Date-Item) (Latest consultation)
DJPR - Biosecurity	GA-DJPR-BAS	COE provided COE Activity Update Statement 2022 factsheet. Historical: COE provided COE Activity Update Statement 2021 factsheet.	No response received.	No claims or objections raised with the proposed activity.	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagements described above.	GA-DEWLP-DoT-DJPR-RDV-Parks Victoria-VFA-TMSV-20220405-email GA-DJPR-BAS-20201120-email
DJPR - VFA	GA-VFA	COE provided COE Activity Update Statement 2022 factsheet. Historical: COE provided COE Activity Update Statement 2021 factsheet.	No response received Clarification new contact details	No claims or objections raised with the proposed activity.	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagements described above.	GA-DEWLP-DoT-DJPR-RDV-Parks Victoria-VFA-TMSV-20220405-email GA-VFA-20201120-Email
Department of Environment, Land, Water and Planning (DELWP) – Marine National Parks and Marine Parks	GA-DELWP-NPMP	Cooper Energy Activity Update 2022 Historical: Cooper Energy Activity Update 2021 Cooper Energy have previously consulted with DELWP (see Vic DoT) on the spill scenarios and responses provided for within the OPEP.	No response received. Historical: See DoT below	No claim or objections raised with proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-DELWP-NPMP-20220405-email-1.pdf
Department of Transport (DoT)	GA-DoT	Cooper Energy Activity Update 2022. Cooper noted a desire to engage with DoT on communication protocols and processes. COE acknowledged updated contacts. Historical: Cooper Energy Activity Update 2021 Cooper Energy have previously consulted with Vic DoT on the spill scenarios and responses provided for within the OPEP.	Department acknowledged activity update and nominated additional contacts for consultation. Historical: In 2021 DoT and DEWLP undertook a review of the BMG Closure Project (Well P&A) OPEP (NOPSEMA ID: 6825); advice from this consultation were transferred to the Offshore Victoria OPEP in 2021. In 2019 the Offshore Vic OPEP was updated to include spill scenarios from Otway drilling activities including at WCD locations (Annie (exploration)). The DoT coordinated a whole of government (multiple departments including DELWP) review of the OPEP; comments were addressed in the OPEP, and the EP accepted prior to drilling (NOPSEMA ID: 4702). The Annie scenarios remain the WCD scenarios for the OPEP.	No claims or objections have been raised with the proposed activity	COE updated consultation records. The DoT are consulted following significant changes in spill scenarios and are provided new revisions of Cooper Energy OPEPs. COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-DoT-20220405-email.pdf Other relevant records: Consultation during the BMG Closure Project (P&A) planning: NOPSEMA ID: 6825 Consultation during preparations for 2019 Otway drilling campaign: NOPSEMA ID: 4702
Parks Victoria	GA-PV	Cooper Energy Activity Update 2022	Acknowledged receipt of information.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-PV-20220406-email.pdf GA-PV-20220406-email-2.pdf
Transport Safety Victoria (Maritime Safety)	GA-TSVMS	Cooper Energy Activity Update 2022 Provided additional information on activity outlook.	Department offered to issue notice to mariners as appropriate for activities within Victorian State waters.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	GA-TSVMS-20220406-email.pdf
Australian Border Control	GA-ABC	Cooper Energy Activity Update 2022, including update on Otway onshore and offshore activities and contact details for further queries.	No response received.	No claims or objectives have been raised with the proposed activity.	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement	GA-ABC-20220331-email

Stakeholder	Stakeholder ID	Information provided	Summary of Stakeholder Response	Cooper Energy (COE) Assessment of Objection/ Claim	COE Response	Record ID (Stakeholder-ID-Date-Item) (Latest consultation)
		Historical: Cooper Energy Activity Update for 2021				
Abalone Council Australia	CF-ACA	Cooper Energy Activity Update for 2022 Historical: Cooper Energy Update for 2021	No response received.	No claims or objectives have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-ACA-20220405-email.pdf CF-ACA-20220405-email.pdf
Commonwealth Fisheries Association	CF-CFA	Cooper Energy Activity Update for 2022 Historical: Cooper Energy Activity Update for 2021	No response received.	No claims or objectives have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-CFA-20220405-email.pdf
South East Trawl Fishing Industry Association (SETFIA)	CF-SEFTIA	Cooper Energy Stakeholder Update. Historical: • Communication offshore maintenance scope in 2021 • Cooper Energy Offshore Maintenance - 1 month notice • Maintenance activities and dates discussed and communicated • Weather and activity update with communications discussion • Confirmed end of campaign	Confirmation of publication of update. Historical: • Acknowledged and confirmed communication process • Maintenance activities and dates discussed and communicated • Response to Cooper Energy Offshore Maintenance update and general communications process discussion. • Notifications Acknowledged and communicated	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-SEFTIA-20210309-email.pdf CF-SETFIA-20210412-email.pdf CF-SETFIA-20210412-email 2.pdf CF-SETFIA-20210412-email-3.pdf CF-SETFIA-20210419-email.pdf CF-SETFIA-20210419-email-2.pdf CF-SETFIA-20210422-email.pdf CF-SETFIA-20210427-email.pdf CF-SETFIA-20210427-email-2.pdf CF-SETFIA-20210427-email-3.pdf CF-SETFIA-20210502-email.pdf CF-SETFIA-20210503-email.pdf
Southern Shark Industry Alliance (SSIA)	CF-SSIA	See SETFIA	-	-	-	-
Southern Squid Jig Fishery	CF-SSJF	Cooper Energy Activity Update for 2022 Historical: Cooper Energy Activity Update for 2021	No response received.	No claims or objectives have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-SSJF-20220405-email.pdf
Tuna Australia	CF-TA	Cooper Energy Activity Update for 2022 Historical: Cooper Energy Activity Update for 2021	No response received. Historical Confirmed contact details and would like to receive updates.	No claims or objectives have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-TA-20220405-email.pdf

Stakeholder	Stakeholder ID	Information provided	Summary of Stakeholder Response	Cooper Energy (COE) Assessment of Objection/ Claim	COE Response	Record ID (Stakeholder-ID-Date-Item) (Latest consultation)
Australian Southern Bluefin Tuna Industry Association (Port Lincoln)	CF-ASBTIA	Historical: Cooper Energy Activity Update for 2021	No response received. Historically no responses received tried Tuna Australia as alternate.	No claims or objectives have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-ASBTIA-PL-20201208-email.pdf
Sustainable Shark Fishing Inc.	CF-SSFI	Cooper Energy Activity Update 2022 Historical: Cooper Energy Activity Update for 2021	No response received.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-SSFI-20220405-email.pdf
Lakes Entrance Fishermen's Co-Operative Limited (LEFCOL)	CF-LEFCOL	Cooper Energy Activity Update 2022	No response received.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-LEFCOL-20220408-email.pdf
Seafood Industry Victoria	CF-SIV	Provided Cooper Energy Activity Update 2022. Queried opportunity for publication of consultation material on SIV website. https://www.siv.com.au/offshore-projects.html Historical: Provided Cooper Energy Activity Update 2021.	SIV confirmed publication via SIV website available as a communication option. Update published on SIV website.	No claims or objectives have been raised with the proposed activity	Cooper Energy took account of the opportunity to publish materials on the SIV website.	CF-SIV-2022-0405-email.pdf CF-SIV-2022-0406-email.pdf CF-SIV-2022-0406-email-2.pdf
Southern Rock Lobster Ltd	CF-SRL	Cooper Energy Activity Update 2022 Historical: Cooper Energy Activity Update for 2021	No response received.	No claims or objections have been raised with the proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	CF-SRL-20220405-email.pdf
Victorian Recreational Fishers Association (VRFish)	RI-VRFA	Cooper Energy Activity Update 2022 Historical: Cooper Energy Activity Update for 2021.	No response received.	No claim or objections raised with proposed activity	COE considers that the stakeholder's interests have been adequately addressed; consultation will continue in line with ongoing engagement.	RI-VRFA-20220408-email.pdf

11. References

11.1. Cooper Energy Documents

Document Number	Document Name
Cooper Energy Documents	
CMS-HS-POL-0001	Health, Safety and Environment Policy
CMS-RM-PRO-0001	Risk Management Protocol
CMS-EN-PCD-0001	Environmental Protocol
CMS-TS-PRO-0002	Management of Change (MoC) General Protocol
CMS-EN-PRO-0002	Invasive Marine Species Risk Management Protocol
CMS-ER-PRO-0001	Incident Investigation and Reporting Protocol
CMS-ER-PRO-0002	Crisis Management Protocol
CMS-HR-PCD-0004	Training and Development Procedure
CMS-EN-PCD-0004	Offshore Chemical Assessment Procedure
AGP-EN-EMP-0005	Athena Gas Plant Operations Environment Management Plan
VOB-EN-EMP-0003	Otway Onshore Operations Environmental Management Plan (PL251 and PL228)
CHN-DC-WMP-0001	Casino Henry Netherby Well Operations Management Plan
CHN-HS-SMP-0001	Casino Henry Netherby Safety Case
CHN-IR-IMP-0001	Integrity Management Plan Casino PL37(V), PL37 & PL42 Offshore Pipelines
COE-ER-ERP-0001	Incident Management Plan
VIC-ER-EMP-0001	Offshore Victoria Oil Pollution Emergency Plan
VIC-ER-EMP-0002	Offshore Victoria Operational and Scientific Monitoring Plan
COE-EN-EMP-0001	Description of the Environment

11.2. Guidance

Document Number	Document Name
NOPSEMA Guidance	
N-04300-GN0166	ALARP Guidance Note, June 2020
N04750-GN1344	Guidance Notes for EP Content Requirement September 2020
N-04750-GL1721	Guideline - Environment plan decision making June 2021
N-04750-IP1899	Reducing marine pest biosecurity risks through good practice management Information paper, October 2021
N-00500-PL1903	Section 572 Maintenance and removal of property Policy, November 2020
N-04750-GN1488	Oil Pollution Risk Management, Guidance Note, February 2021
A652993	Environment Bulletin – Oil Spill, April 2019
N-09000-GN1661	Vessels Subject to the Australian Offshore Petroleum Safety Legislation, Guidance Note, October, 2020
A705589	Consultation with Commonwealth agencies with responsibilities in the marine area, July 2020
Other Guidance	
API Standard 53	Well Control Equipment Systems for Drilling Wells
APPEA	Australian Offshore Titleholders Source Control Guideline
Department of Agriculture, Water and the Environment	National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds
Department of Agriculture, Water and the Environment	EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species

Document Number	Document Name
Department of Agriculture, Water and the Environment	EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans
Department of Agriculture, Water and the Environment	National biofouling management guidelines for the petroleum production and exploration industry
Department of Agriculture, Water and the Environment	Anti-fouling and In-water Cleaning Guidelines
Department of the Environment and Energy	Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life
Department of the Environment and Energy	National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna
GOMO 0611-1401	Guidelines for Offshore Marine Operations GOMO 0611-1401 (2013)
HB 203:2012	Environmental Risk Management – Principles and Process
IMO MEPC/Res.207(62)	Guidelines for the control and management of a ships' biofouling to minimise the transfer of invasive aquatic species
IOGP 464	Capping and Containment Global Industry Response Group Recommendations
IOGP 485	Standards and Guidelines for Well Integrity and Well Control
IOGP 516	Wildlife response preparedness
IOGP 533	Dispersants: Subsea Application
IOGP 592	Subsea Capping Response Time Model Toolkit User Guide
IOGP 594	Source Control Emergency Response Planning Guide for Subsea Wells
IOGP 595	Subsea Capping Stack Design and Operability Assessment
ISO 14001	Environmental Management Systems
ISO 31000	Risk management - Guidelines

11.3. Literature

ACCC 2022. ACCC Gas Inquiry 2017-2025 Interim Report (2022). Available at: https://www.accc.gov.au/publications/serial-publications/gas-inquiry-2017-2025/gas-inquiry-january-2022-interim-report.

AEMO 2022. Integrated System Plan – Roadmap for the National Electricity Market. Available at: https://www.energy.gov.au/news-media/news/aemo-report-roadmap-net-zero.

AEMO. 2021. Australian Energy Market Operator. Gas Statement of Opportunities for Eastern and South-Eastern Australia. March 2021. https://aemo.com.au/-/media/files/gas/national_planning_and_forecasting/gsoo/2021/2021-gas-statement-of-opportunities.pdf?la=en

AMSA. 2020. NATPLAN. Australian Maritime Safety Authority. Canberra.

AMSA. 2015a. Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities. Australian Maritime Safety Authority. Canberra.

AMSA. 2015b. The effects of maritime oil spills on wildlife including non-avian marine life. A WWW database accessed at http://www.amsa.gov.au/.

ANZECC and ARMCANZ. 2018. Australian and NZ Guidelines for Fresh and Marine Water Quality. Australian and NZ Environment and Conservation Council and Agriculture and Resource Management Council of Australia and NZ.

Australian Hydrographic Office 2021. Mariner's Handbook for Australian Waters Edition 5.0. Australian Hydrographic Office, Canberra.

Backhouse, G., Jackson, J. and O'Connor, J. 2008. National Recovery Plan for the Australian Grayling Prototroctes maraena. DSE. Melbourne.

Balcazar, N.E., J.S. Tripovich, H. Klinck, S.L. Nieukirk, D.K. Mellinger, R.R. Dziak, and T.L. Rogers. 2015. “Calls reveal population structure of blue whales across the southeast Indian Ocean and the southwest Pacific Ocean.” Journal of Mammalogy 6:1184-1193.

Ball, D. and Blake, S. 2007. Shallow water habitat mapping at Victorian Marine National Parks and Marine Sanctuaries, Volume 1: Western Victoria. Parks Victoria Technical Series No.36. Parks Victoria, Melbourne.

Bannister, J.L. 2001. Status of southern right whales (Eubalaena australis) off southern Australia. Journal of Cetacean Research and Management Special Issue 2: 103-110.

Bannister, J.L., Kemper, C.M. and Warnecke R.M. 1996. The Action Plan for Australian Cetaceans. The Director of National Parks and Wildlife Biodiversity Group, Environment Australia. Canberra.

Barton, J., Pope, A. and Howe, S. 2012. Marine protected areas of the Otway bioregion. Parks Victoria. Melbourne.

Beach Energy. 2020. Environment Plan - Artisan-1 Exploration Well Drilling. Adelaide, Australia: Beach Energy

Bezore, R., Kennedy, D.M., and Ierodiaconou, D., 2016. The Drowned Apostles: The Longevity of Sea Stacks over Eustatic Cycles. In: Vila-Concejo, A.; Bruce, E.; Kennedy, D.M., and McCarroll, R.J. (eds.), Proceedings of the 14th International Coastal Symposium (Sydney, Australia). Journal of Coastal Research Special Issue No. 75:592-596.

Birdlife Australia. 2016. Species fact sheets. A WWW database accessed in 2016 at http://birdlife.org.au/.

Birdlife Australia. 2017. Red-capped Plover. A WWW database accessed on 21st March 2017 at http://www.birdlife.org.au/bird-profile/red-capped-plover.

Birdlife Australia. 2017b. Silver gull. A WWW database accessed on 21st March 2017 at http://birdlife.org.au/bird-profile/Silver-Gull.

BirdLife International (2013b) IBAs factsheet: Port Fairy to Warrnambool. Downloaded from http://www.birdlife.org on 19/06/2013.

Birdlife International. 2016. Species factsheets. A WWW database accessed in 2016 at http://www.birdlife.org.

BP. 2013. Shah Deniz 2 Project. Environmental & Socio-Economic Impact Assessment. BP Development Pty Ltd

Branch, T. A., Matsuoka, K. and Miyashita, T. 2004. Evidence for increases in Antarctic blue whales based on Bayesian modelling. Marine Mammal Science 20(4): 726-754.

Branch, T.A., K.M. Stafford, D.M. Palacios, C. Allison, J.L. Bannister, C.L.K. Burton, E. Cabrera, *et al*. 2007. “Past and present distribution, densities and movements of blue whales Balaenoptera musculus in the Southern Hemisphere and northern Indian Ocean.” Mammal Review 37(2), 116-175.

Brown, P.B. and Wilson, R.I. 1984. Orange-bellied Parrot Recovery Plan. Department of Environment, Water, Heritage and Arts. Canberra.

Brown, P.B. and Wilson, R.I. 1980. A Survey of the Orange-bellied Parrot Neophema chrysogaster in Tasmania, Victoria and South Australia. Tasmanian National Parks & Wildlife Service. Hobart.

Bruce, B., Griffin, D., Bradford, R. (2007) – Laval Transport and Recruitment Processes of Southern Rock Lobster, FRDC 2002/007, Final Report, CSIRO Marine and Atmospheric Research.

Brusati, E.D. and Grosholz, E.D. 2006. Native and introduced eco-system engineers produce contrasting effects on estuarine infaunal communities. Biol Inv 8:683–695.

Butler, A., Althaus, F., Furlani, D. and Ridgway, K. 2002. Assessment of the Conservation Values of the Bass Strait Sponge Beds Area: A component of the Commonwealth Marine Conservation Assessment Program 2002-2004. Report to Environment Australia, CSIRO Marine Research. Hobart.

Campbell, R.A., N.J. Gales, G.M. Lento & C.S. Baker (2008). Islands in the sea: extreme female natal site fidelity in the Australian sea lion, Neophoca cinerea. Biology Letters. 23:139-142.

Charlton, C.M., Guggenheimer, S.N. and Burnell, S.R. 2014. Long term Southern Right Whale population monitoring at the Head of the Great Australian Bight, South Australia (1991-2013). Report to the Department of Environment, Australian Antarctic Division, Australian Marine Mammal Centre.

Childerhouse, S., Double, M. and Gales, N. 2010. Satellite tracking of southern right whales (Eubalaena australis) at the Auckland Islands, NZ. Paper SC/62/BRG19 presented to the Scientific Committee of the International Whaling Commission, Agadir, Morocco.

Clark, R.B. 1984. Impact of oil pollution on seabirds. Environmental Pollution (Series A) 33:1–22.

Coffey, 2008 – Seabed Habitat Report – VIC/P44 Stage 2 Gas Development, A Report for Santos, Report No: CR 1235_3_v1.

Cogger, H.G., Cameron, E.E., Sadlier, R.A., and Eggler, P. 1993. The Action Plan for Australian Reptiles. Canberra. Australian Nature Conservation Agency.

CoA. 2020. Australian Ballast Water Management Requirements. Version 8.

CoA. 2020a. National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds.

CoA. 2018. TAB for the impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Ocean.

CoA. 2017. Recovery Plan for Marine Turtles in Australia.

CoA. 2017a. National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna.

CoA [Commonwealth of Australia]. 2015. Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999. Canberra, ACT: Commonwealth of Australia.

CoA. 2009. National Biofouling Management Guidance for the Petroleum Production and Exploration Industry.

Connell, S.C., M.W. Koessler, and C.R. McPherson. 2021. BMG Wells Plug and Abandonment Activities: Acoustic Modelling for Assessing Marine Fauna Sound Exposures. Document 02381, Version 1.0. Technical report by JASCO Applied Sciences for Cooper Energy.

Connell, S.C., M.W. Koessler, A. M. Muellenmeister and C.R McPherson. 2022. Cooper Energy Otway Subsea Noise Modelling: Acoustic Modelling for Assessing Marine Fauna Sound Exposures. Document 02764, Version 1.0. Technical report by JASCO Applied Sciences for Cooper Energy Limited.

Cooke, J.G., Rowntree, V.J. and Payne, R. 2001. Estimates of demographic parameters for Southern Right Whales (Eubalaena australis) observed off Peninsula Valdes, Argentina. J. Cetacean Res. Manage. Special Issue 2:125-132.

Coyle, K.O., Pinchuk, A.I., Eisner, L.B. and Napp, J.M. 2008. Zooplankton species composition, abundance and biomass on the eastern Bering Sea shelf during summer: the potential role of water column stability and nutrients in structuring the zooplankton community. Deep-Sea Res., 55:1755-1791.

Dalley, DD, McClatchie, S, (1989) – Functional feeding morphology of the euphausiid Nyctiphases Australia, Marine Biology 1010 1950293 (1989).

Davis, J.E. and Anderson S.S. (1976) – Effects of oil pollution on breeding grey seals, Marine Pollution Bulletin, Volume 7, Issue 6, June 1976, Pages 115-118.

Davis, H.K., Moffat, C.F. and Shepherd, N.J. 2002. Experimental Tainting of Marine Fish by Three Chemically Dispersed Petroleum Products, with Comparisons to the Braer Oil Spill. Spill Science & Technology Bulletin. 7(5–6): 257–278.

DAWE 2022, Australian biofouling management requirements (Version 1), Department of Agriculture, Water and the Environment, Canberra, May. CC BY 4.0.

DAWE. 2020a. Draft Conservation Advice for the Karst Springs and Associated Alkaline Fens of the Naracoorte Coastal Plain Bioregion. Department of Agriculture, Water and the Environment, https://www.environment.gov.au/biodiversity/threatened/nominations/comment/karst-springs-alkaline-fens.

DAWE. 2020b. Karst Springs and Associated Alkaline Fens of the Naracoorte Coastal Plain Bioregion Map. Department of Agriculture, Water and the Environment. https://www.environment.gov.au/system/files/consultations/d9132abc-bcbc-43bf-a29c-48848b10e076/files/karst-springs-indicative-distribution-map.pdf.

DAWE. 2020c. Conservation Advice for the Australian Sea Lion (Neophoca cinereal). Department of Agriculture, Water and the Environment. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=22.

DAFF. 2020. Australian Ballast Water Management Requirements. Available at: https://www.agriculture.gov.au/biosecurity-trade/aircraft-vessels-military/vessels/marine-pest-biosecurity/ballast/australian-ballast-water-management-requirements

DAWE. 2022a. Species Profile and Threats (SPRAT) Database. A WWW database accessed in 2022 at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=38. DAWE. Canberra

DAFF. 2022 Managing biofouling in Australia. Australian Government guidance pages. Accessed in 2022 at: https://www.agriculture.gov.au/biosecurity-trade/aircraft-vessels-military/vessels/marine-pest-biosecurity/biofouling

DELWP 2022. Victoria's Gas Substitution Roadmap. Available at: https://engage.vic.gov.au/download/document/27751

DELWP. 2017. Submission on the EPBC Act assessment of the Salt-wedge Estuaries ecological community. Received 10 August 2017. Victorian Government.

DELWP. 2016. Shipwreck protected zones. A WWW database accessed in 2016 at http://www.dtpli.vic.gov.au/heritage/shipwrecks-and-maritime/shipwreck-protected-zones. Department of Environment, Land, Water & Planning. Melbourne.

Dennis, T.E. & P.D. Shaughnessy (1996). Status of the Australian sea lion, Neophoca cinerea, in the Great Australian Bight. Wildlife Research. 23:741-754.

Dernie, K.M., M.J. Kaiser, and R.M. Warwick. 2003. "Recovery rates of benthic communities following physical disturbance." Journal of Animal Ecology 72, 1043-1056.

DEWHA. 2008. EPBC Act Policy Statement 2.1- Interaction between offshore seismic exploration and whales, Department of Environment, Water, Heritage & the Arts, Canberra.

DIISER 2021. Australian Energy Market Update 2021. Available at: https://www.energy.gov.au/sites/default/files/Australian%20Energy%20Statistics%202021%20Energy%20Update%20Report.pdf.

DoE. 2013. EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – MNES. Department of the Environment. Canberra.

DoE. 2015. CMP for the Blue Whale (2015-2025) – A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment. Canberra.

DoE, 2015b – South-east marine region profile. A description of the ecosystems, conservation values and uses of the South-east Marine Region, CoA, 2015.

DSEWPaC. 2013a. Recovery Plan for the White Shark Carcharodon carcharias. Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSWEPaC. 2013b. Recovery Plan for the Australian Sea Lion (Neophoca cinerea). 2013. Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSEWPaC. 2012a. CMP for the Southern Right Whale. Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSEWPaC. 2012b. Giant Kelp Marine Forests of the South East Australia Ecological Community. Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSEWPaC. 2011. National recovery plan for threatened albatrosses and giant petrels 2011-2016, Department of Sustainability, Environment, Water, Population and Communities, Commonwealth of Australia, Canberra.

Duncan, A.J., Gavrilov, A.N., McCauley, R.D., Parnum, I.M. and Collis, J.M (2013). Characteristics of sound propagation in shallow water over an elastic seabed with a thin cap-rock layer. J. Acoust. Soc. Am:134, pp. 207-215.

Finneran, J.J., E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III). Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p.

Fraser, M.W., J. Short, G. Kendrick, D. McLean, J. Keesing, M. Byrne, M.J. Caley, *et al*. 2017. “Effects of dredging on critical ecological processes for marine invertebrates, seagrasses and macroalgae, and the potential for management with environmental windows using Western Australia as a case study.” Ecological Indicators 78:229-242

French-McCay, D.P. 2009. State-of-the-art and research needs for oil spill impact assessment modelling. Proceedings of the 32nd Arctic and Marine Oil Spill Program Technical Seminar, Environment Canada, Ottawa, pp. 601-653.

French-McCay, D.P. 2003. Development and application of damage assessment modelling: example assessment for the North Cape oil spill. Marine Pollution Bulletin 47(9):9-12.

French-McCay, D.P. 2002. Development and application of an oil toxicity and exposure model, OilToxEx. Environmental Toxicology and Chemistry 21:2080-2094.

French, D. Schuttenberg, H. and Isaji, T, (1999) – Probabilities of oil exceeding thresholds of concern: examples from an evaluation for Florida Power and Light In: Proceedings of the 22nd Artic and Marine Oil Spill Program (AMOP), Technical Seminar, June 1999, Alberta, Canada, 243-270pp

Fugro (2020). Survey Results Report. Otway Pipeline / Umbilical Route Survey. VOB-SV-REP-4900-0002.

Geraci, J.R. and St. Aubin, D.J. 1988. Synthesis of Effects of Oil on Marine Mammals. Report to US Department of the Interior, Minerals Management Service, Atlantic OCS Region, OCS Study. Ventura, California.

Gill, P.C., B., Pirzl, R., Morrice, M.G. and Lawton, K. 2015. Cetacean Diversity of the Continental Shelf and Slope off Southern Australia. The Journal of Wildlife Management 79(4):672–681.

Gill, P,C., Morrice, M.G., Page, B., Pirzl, R., Levings, A.H. and Coyne, M. 2011. Blue whale habitat selection and within-season distribution in a regional upwelling system off southern Australia. Marine Ecology Progress Series 421: 243–263.

Gill, P.C., Kemper, C.M., Talbot, M. and Lyons, S.A. 2008. Large group of pygmy right whales seen in a shelf upwelling region off Victoria, Australia. Marine Mammal Science 24(4): 962-968.

Gill, P. and Morrice, M. 2003. Cetacean Observations. Blue Whale Compliance Aerial Surveys. Santos Ltd Seismic Survey Program Vic/P51 and P52. November-December 2002. Report to Santos Ltd.

Gill, P.C., Ross, G.J.B., Dawbin, W.H. and Wapstra, H. 2000. Confirmed sightings of dusky dolphins (Lagenorhynchus obscurus) in southern Australian waters. Marine Mammal Science. 16: 452-459.

Hinwood, Jon & Potts, A.E. & Dennis, L.R. & Carey, Janet & Houridis, H. & Bell, R.J. & Thomson, J.R. & Boudreau, P. & Ayling, A.M. (1994). Environmental implications of offshore oil and gas development in Australia - Drilling activities.

Hook, S., Batley, G., Holloway, M., Irving, P. and Ross, A. 2016. Oil Spill Monitoring Handbook. CSIRO Publishing. Melbourne.

Huang, Z, and Hua X Wang. 2019. “Mapping the spatial and temporal variability of the upwelling systems of the Australian south-eastern coast using 14-year of MODIS data.” Remote Sensing of Environment 90-109

IMCRA Technical Group. 1998. Interim Marine and Coastal Regionalisation for Australia: an ecosystem-based classification for marine and coastal environments. Version 3.3. IMCRA Technical Group. Environment Australia, Commonwealth Department of the Environment. Australia.

IPCC (2022) – IPCC WGII Sixth Assessment Report, Chapter 11 – Australia, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FinalDraft_Chapter11.pdf

IPPC 2022b. IPPC Special Report Global Warming of 1.5°C. Summary for Policy Makers. Available at: https://www.ipcc.ch/sr15/chapter/spm/.

IPIECA (1994) - Report Series No 6: Biological Impacts of Oil Pollution: Saltmarshes. IPIECA

IPIECA. 1995. Biological Impacts of Oil Pollution: Rocky Shores. IPIECA. London.

IPIECA. 1999. Biological Impacts of Oil Pollution: Sedimentary Shores. IPIECA. London.

IPIECA. 2002. Guidelines on Biological Impacts of Oil Pollution. IPIECA. London.

IPIECA. 2014. Wildlife response preparedness. Report 516, International Association of Oil & Gas Producers.

IPIECA/OGP. 2015. Aerial Observations of Oil Spills at Sea. Good practice guidelines for incident management and emergency response personnel. Cedre. London.

ITOPF. 2011a. Effects of Oil Pollution on the Marine Environment. Technical Information Paper 13. The International Tanker Owners Pollution Federation Ltd (ITOPF) London. Available online at: https://www.itopf.org

ITOPF. 2011b. Aerial Observation of Marine Oil Spills. Technical Information Paper 1. The ITOPF London.

ITOPF. 2011c. Use of Booms in Oil Pollution Response. Technical Information Paper 3. The ITOPF London.

ITOPF. 2011d. Use of Skimmers in Oil Pollution Response. Technical Information Paper 5. ITOPF. London.

ITOPF. 2011e. Recognition of Oil on Shorelines. Technical Information Paper 6. The ITOPF London.

JASCO Applied Sciences 2015. Acoustic Characterisation of Subsea Choke Valve. Results from North West Shelf Measurements.

Jenssen, B.M. 1994. Effects of Oil Pollution, Chemically Treated Oil, and Cleaning on the Thermal Balance of Birds. Environmental Pollution, 86:207–215.

Kukert, H. 1991. “In situ experiments on the response of deep sea macrofauna to burial disturbance.” Pacific Science 45:95

Lewis, M. and Pryor, R. 2013. Toxicities of oils, dispersants and dispersed oils to algae and aquatic plants: Review and database value to resource sustainability. Environmental Pollution 180:345–367.

Malme, C.I., B Würsig, J.E Bird, and P.L. Tyack. 1986. Behavioral responses of gray whales to industrial noise: Feeding observations and predictive modelling. Document Number 56, NOAA Outer Continental Shelf Environmental Assessment Program, 393-600.

Malme, C.I., Miles P.R, Clark C.W., Tyack P., and Bird J.E. 1984. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 Migration. No. 5586, Alaska: US. Department of the Interior Minerals Management Service.

Malme, C.I., Miles P.R., Clark C.W., Tyack P, and Bird J.E. 1983. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. No. 5366, U .S. Minerals Manage.

McCauley, R.D., A.N. Gavrilov, C.D. Jolliffe, R. Ward, and P.C. Gill. 2018. “Pygmy blue and Antarctic blue whale presence, distribution and population parameters in southern Australia based on passive acoustics.” Deep-Sea Research Part II 157–58:154-168.

McCauley, R.D. and Duncan, A.J. 2001. Marine Acoustic Effects Study, Blue Whale Feeding Aggregations, Otway Basin, Bass Strait Victoria. Prepared for: Ecos Consulting. Curtin University Centre for Marine Science and Technology.

McCauley, R D, J Fewtrell, A J Duncan, C Jenner, M N Jenner, J D Penrose, R Prince, A Adhitya, and J Murdoch. 2000. Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid. Western Australia: Report Number R99-15. Prepared for Australian Petroleum Production Exploration Association by Centre for Maine Science and Technology.

McCauley, R. D. 1994. Seismic Survey. In: Environmental Implications of Offshore Oil and Gas Developments in Australia – the Findings of an Independent Scientific Review. Swan J.M., Neff J.M. and Young P.C. (eds). Australian Petroleum Exploration Association, Sydney. Pp 19-121.

McPherson, C, and M Koessler. 2021. Empirical estimation of underwater noise and effect from survey equipment. Memo, Capalaba, Queensland, Australia: JASCO Applied Sciences.

Möller, Luciana, Catherine Attard, Kerstin Bilgmann, Virginia Andrews-Goff, Ian Jonsen, David Paton, and Michael Double. 2020. “Movements and behaviour of blue whales satellite tagged in an Australian upwelling system.” Sci Rep 3;10(1):21165. doi:10.1038/s41598-020-78143-2.

Neff, J. Fate and Effects of Water Based Drilling Muds and cuttings in cold water environments. A scientific review. Prepared for Shell E&P Company.

NMFS. 2018. 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. National Marine Fisheries Service (US).

NMFS. 2001. Biological Opinion on the Endangered Species Act 1973 - Section 7 Consultation relating to the minerals management Service's (MMS) proposed approval of a development and production plan for the construction and operation of the Liberty project in the Beaufort Sea, Alaska. Consultation No. F/AKR/2001/00889. National Marine Fisheries Service, Alaska region, Office of protected resources. pp. 1-51.

NOAA. 2002. Environmental Sensitivity Index Guidelines. Version 3. March 2002. National Oceanic and Atmospheric Administration (NOAA). Washington.

NOAA. 2013. Deepwater Horizon Oil Spill: Assessment of Potential Impacts on the Deep Soft-bottom Benthos. Interim data summary report. NOAA Technical Memorandum NOS NCCOS 166. NOAA. Washington.

NOAA, 2017- Automated Data Inquiry for Oil Spills (ADIOS) available at http://response.restoration.noaa.gov/adios.

NOAA. 2018. Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Marine Site Characterization Surveys off of Delaware. Federal Register 83(110): 26416-26432, National Oceanic and Atmospheric Administration.

NOAA 2019. ESA Section 7 Consultation Tools for Marine Mammals on the West Coast. National Oceanic and Atmospheric Administration (US). Accessed May 2022. https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/esa-section-7-consultation-tools-marine-mammals-west.

Noad, M., E. Kniest, and R. Dunlop. 2019. “Boom to bust? Implications for the continued rapid growth of the eastern Australian humpback whale population despite recovery.” Population Ecology 61(2), 198-209.

Noad, M.J., Dunlop, R.A., Paton, D. and Kniest, H. 2011. Abundance estimates of the east Australian humpback whale population: 2010 survey and update. IWC Report SC/63/SH22.

NRC. 2003. Oil in the sea III. Inputs, Fates and Effects. The National Academies Press. Washington, D.C.

National Resource Damage Assessment (NRDA). 2012. April 2012 Status Update for the Deepwater Horizon Oil Spill. A WWW publication accessed at: http://www.gulfspillrestoration.noaa.gov. Natural Resource Damage Assessment

Owen, K, C.S Jenner, and MN.N Jenner. 2016. “A week in the life of a pygmy blue whale: migratory dive depth overlaps with large vessel drafts.” Animal Biotelemetry 4, 17.

Patil, J., Gunasekera, R., McEnnulty, F. and Bax, N. 2004. Development of genetic probes for rapid assessment of the impacts of marine invasive species on native biodiversity – Maoricolpus roseus. CSIRO. Hobart.

Pineda, M.C., A. Duckworth, and N. Webster. 2016. “ Appearance matters: sedimentation effects on different sponge morphologies.” Journal of the Marine Biological Association of the United Kingdom 96, 481-492.

Popper, A.N., A.D. Hawkins, R.R. Fay, D. Mann, S. Bartol, T. Carlson, S. Coombs, *et al*. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report. ASA S3/SC1.4 TR-201.4. Prepared by ANSI Accredited Standards Committee Rationale and Background Information (Chapter 8).

Richardson W.J., Greene Jnr. C.R., Malme C.I. and Thomson D.H., 1995. Marine Mammals and Noise. Academic Press, California.

Richardson, W.J. and Malme, C.I. 1993. ‘Man-made noise and behavioural responses.’ In: The Bowhead Whales Book, Special publication of The Society for Marine Mammology 2. Edited by D. Wartzok and K.S. Lawrence. The Society for Marine Mammology, pp. 631-700.

Roberts, D., A. Davis, and S. Cummins. 2006. “Experimental manipulation of shade, silt, nutrients and salinity on the temperate reef sponge Cymbastela concentrica.” Marine Ecology Progress Series 307:143-154.

RPS-APASA (2014). Reindeer – Devil Creek, Quantitative Oil Spill Risk Assessment. Revision 0, 24 February 2014. Report prepared for Apache Energy Ltd.

RPS. 2019a. Annie-1 Oil Spill Modelling. RPS AUSTRALIA WEST PTY LTD, Bundall, QLD Australia.

RPS. 2019b. BP Developments Australia Ironbark Block WA-569-P Drill Cuttings and Muds Dispersion Modelling. RPS AUSTRALIA WEST PTY LTD, Bundall, QLD Australia.

Santos. 2004. Casino Gas Field Development Environment Report. Prepared by Enesar Consulting Pty Ltd. Hawthorn East, Victoria, for Santos Ltd, Adelaide.

SETFIA. 2020. Commercial fishing catch and value in the Cooper Energy permit areas, Otway Basin, Offshore Victoria.

Shigenaka, G. 2003. Oil and Sea Turtles: Biology, Planning, and Response. National Oceanographic and Atmospheric Administration, United States of America.

Smit, M.G.D., Bechmann, R.K., Hendriks, A.J., Skadsheim, A., Larsen, B.K., Baussant, T., Bamber, S. and Sanni, S. 2009. Relating biomarkers to whole-organism effects using species sensitivity distributions: A pilot study for marine species exposed to oil. Environmental Toxicology and Chemistry 28(5):1104-1109.

Southall, B. L., Finneran, J. J., Reichmuth, C., Nachtigall, P. E., Ketten, D. R., Bowles, A. E., & Tyack, P. L. 2019. Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects. *Aquatic Mammals*, 45(2): 125-232.

Southall, B L, A E Bowles, W T Ellison, J Finneran, R L Gentry, C R Green Jr, D Kastak, D R Ketten, and J H Miller. 2007. "Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations." *Aquatic Mammals,* 33(4): 411-521.

State of Victoria (Department of Transport). 2021. State Maritime Emergencies (non-search and rescue) Subplan. Edition 2, Melbourne: State of Victoria. Accessed 2022. https://files.emv.vic.gov.au/2021-10/SEMP%20Maritime%20Emergencies%20%28Non-search%20and%20Rescue%29%20Sub-Plan.pdf.

Stephenson, L.H. 1991. Orange-bellied Parrot Recovery Plan: Management Phase. Tasmanian Department of Parks, Wildlife & Heritage. Hobart.

SWIFFT. 2022. Southern Right Whale research and monitoring project. State Wide Integrated Flora and Fauna Teams. Available from: https://www.swifft.net.au/cb_pages/team_southern_right_whale_south_eastern_australia_monitoring.php

Threatened Species Scientific Committee (TSSC) (2011) - Commonwealth Conservation Advice on Sternula neris (Fairy Tern). A www publication available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/82950-conservation-advice.pdf

TSSC, (2012). Commonwealth Conservation Advice on Giant Kelp Marine Forests of South East Australia. Department of Sustainability, Environment, Water, Population and Communities. Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/107-conservation-advice.pdf. In effect under the EPBC Act from 29-Aug-2012

TSSC, 2013 Commonwealth Conservation Advice for Subtropical and Temperate Coastal Saltmarsh. Canberra: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/118-conservation-advice.pdf. In effect under the EPBC Act from 10-Aug-2013

TSSC (2013) Conservation advice for Subtropical and Temperate Coastal Saltmarsh. Threatened Species Conservation Committee (TSCC)

TSSC (2014) – Approved Conservation Advice for Thinornic rubicollis (Hooded plover). A www publication available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/66726-conservation-advice.pdf

TSSC. 2015a. Conservation Advice Megaptera novaeangliae humpback whale. TSSC.

TSSC, 2015b Conservation Advice Balaenoptera borealis sei whale. TSSC.

TSSC, 2015c Conservation Advice Balaenoptera physalus fin whale. TSSC.

TSSC (2015d) - Commonwealth Conservation Advice on Halobaena caerulea (Blue Petrel). A www publication available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/1059-conservation-advice-01102015.pdf

TSSC (2015e) - Commonwealth Conservation Advice on Calidris ferruginea (Curlew sandpiper). A www publication available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/856-conservation-advice.pdf

TSSC (2016) Conservation Advice Calidris canutus red knot. A www publication available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/855-conservation-advice-05052016.pdf

TSSC (2016b) Conservation Advice Charadrias mongolus Lesser Sand Plover. A www publication available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/879-conservation-advice-05052016.pdf

Volkman, J.K., Miller, G.J., Revill, A.T. and Connell, D.W. 1994. 'Oil spills.' In Environmental Implications of offshore oil and gas development in Australia - the findings of an independent scientific review. Edited by Swan, J.M., Neff, J.M. and Young, P.C. Australian Petroleum Exploration Association. Sydney.

Wilson, R. and Poore, G. 1987. The Bass Strait survey: biological sampling stations, 1979-1984. Occasional papers from the Museum of Victoria 3, 1-14.

Woodside. 2003. Otway Gas Project Environmental Impact Statement/Environment Effects Statement (EIS/EES). Prepared by Woodside Energy Ltd. Perth.

Woodside. 2008. Browse LNG Development. Torosa South-1 Pilot Appraisal Well Environment Plan. Woodside Energy Ltd. Perth.

Woodside, 2011 – Browse LNG Development, Draft Upstream Environmental Impact Assessment, EPBC Referral 2008/4111, November 2011.

Yaghmour F., Els J., Maio E., Whittington-Jones B., Samara F., El Sayed Y., Ploeg R., Alzaabi A., Philip S., Budd J., Mupandawana M. 2022. Oil spill causes mass mortality of sea snakes in the Gulf of Oman. Science of The Total Environment, Volume 825. Accessed on May 2022 at: https://doi.org/10.1016/j.scitotenv.2022.154072.

Appendix 1. EP Change Register

Date	Rev	Originator	Section Changed	Change	MOC #	Trigger Resubmission
07/2017	2	LC	-	NOPSEMA and DEDJTR accepted versions	-	No
09/2017	3	RL	-	Update – minor internal updates	-	No
13/12/2019	3a	CJ / JM	Refer to MOCs	Administrative Updates Inclusion of further details of sound sources for IMR campaign. Alignment with Offshore Victoria OPEP update (Rev 7c) post exercise and DoT review. Update details APPEA MoU Updates to org structure.	Kanepi MoC No:ADM-19-0011 Kanepi MoC No: OPS-19-0029 Kanepi MoC No: ADM-19-0007 Kanepi MOC No: ADM-18-0011 Kanepi MOC: No: ORG-19-0002	No
27/8/2021	3b	XG / JM	Refer to EP Changes register	Annual update including to: Changeout of the HSEC MS for CEMS Additional information - DAWE National Light Pollution Guidelines 2020. Updated references to DoT guidance notes	Kanepi MOC No: ADM-21-0001 (applicable to CEMS component only) ADM-21-0005 (applicable to general updates)	No
18/07/2022	4	XG / JM	-	5-yr resubmission	-	Yes

Appendix 2. EPBC Database Protected Matters Search Results

Appendix 3. Description of the Environment

Appendix 4. Stakeholder Consultation Report

Please refer to Sensitive Information

Appendix 5. Oil Spill Trajectory Modelling

Appendix 6. Subsea Noise Modelling