# East Coast Supply Project

## Cooper Energy | Otway Basin | OPP

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## Foreword

We are pleased to present the East Coast Supply Project- a strategic project that is critical to helping to meet domestic gas demand in Southeast Australia. Cooper Energy rebranded as Amplitude Energy at our November AGM. Our Otway Basin petroleum title ownership has not changed and remains held by subsidiary companies Cooper Energy (CH) Pty Ltd and Cooper Energy (MGP) Pty Ltd. To remain consistent with stakeholder consultation to date, this document refers to these companies collectively as Cooper Energy. As an Australian company, we recognise the crucial role of natural gas in our country's journey towards a net-zero emissions future. Our project aligns with the Commonwealth Government's Future Gas Strategy, which underscores the importance of gas in ensuring energy security, reliability and affordability and supports the broader economic transition. At Amplitude Energy we are committed to delivering gas to Australian consumers while minimising our environmental impact. The East Coast Supply Project uses our existing offshore and onshore infrastructure in the Otway Basin, a region where industry, the community and the environment have coexisted for decades.

Our project delivers domestic gas to local customers via existing pipeline connections, representing a smaller environmental and emissions footprint compared to greenfield developments or transporting gas by pipeline over long distances. It also offers a cost-effective alternative to liquefied natural gas (LNG) imports, which require more processing and transport, adding to their cost and emissions footprint.

Today in Southeastern Australia around 40% of gas is used by industrial customers to make the products which are the backbone of our economy, for example our construction and food processing and packing sectors. These industries use gas as a feedstock and for high temperature heat for which there is currently no electrification option. We are proud to support these Australian industries which produce dairy products, glass, bricks and paper for the local market.

The East Coast Supply Project represents a step towards fulfilling Australia's future energy needs and reflects our dedication to sustainable practices and community engagement. We believe that through careful planning, rigorous environmental assessments, and active stakeholder consultation, we can achieve a balance that benefits both the economy, the local community and the environment.

Thank you for reviewing our Offshore Project Proposal. We look forward to your feedback and to continuing to provide Australia with the energy security and reliability it needs for a sustainable future.

Sincerely,

Jane Norman

CEO

Amplitude Energy

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## Acronyms and Abbreviations

| Acronym | Definition |
|---|---|
| **µPa** | Micro Pascal |
| **2D** | Two-Dimensional |
| **AAD** | Australian Antarctic Division |
| **ACAP** | Agreement on the Conservation of Albatrosses and Petrels |
| **ACCU** | Australian Carbon Credit Units |
| **ACMA** | Australian Communications and Media Authority |
| **AEMO** | Australian Energy Market Operator |
| **AFMA** | Australian Fisheries Management Authority |
| **AFS** | Anti Fouling Systems |
| **AGP** | Athena Gas Plant |
| **AHO** | Australian Hydrographic Office |
| **AHT** | Anchor Handling Tug |
| **AIATSIS** | Australian Institute of Aboriginal and Torres Strait Islander Studies |
| **ALARP** | As Low as Reasonably Practicable |
| **AMP** | Australian Marine Parks |
| **AMSA** | Australian Maritime Safety Authority |
| **AMSIS** | Australian Marine Spatial Information System |
| **ANZECC** | Australian and New Zealand Environment Conservation Council |
| **ANZG** | Australian and New Zealand Guidelines |
| **API** | American Petroleum Institute |
| **APPEA** | Australian Petroleum Production & Exploration Association |
| **ARS** | Area Restricted Search |
| **AS** | Australian Standard |
| **ASBTIA** | Australian Southern Bluefin Tuna industry association |
| **ATSIHP** | Aboriginal and Torres Strait Islander Heritage Protection |
| **AUV** | Autonomous Underwater Vehicles |
| **BIA** | Biologically Important Area |
| **BMG** | Basker Manta Gummy |
| **BOP** | Blowout Preventer |
| **BP** | British Petroleum |
| **BW** | Blackwatch |
| **BWM** | Blackwatch Manifold |
| **BWMC** | Ballast Water and Sediments Convention |
| **BWS** | Blue Whale Study |
| **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 |

| Acronym | Definition |
|---|---|
| **CGR** | Condensate to-gas Ratio |
| **$CH_4$** | Methane |
| **CHIRP** | Compressed High-Intensity Radar Pulse |
| **CHN** | Casino-Henry-Netherby |
| **CIA** | Cumulative Impact Assessment |
| **CM** | Casino - Matador |
| **CMP** | Conservation Management Plan |
| **CO** | Carbon Monoxide |
| **$CO_2$** | Carbon Dioxide |
| **CoA** | Commonwealth of Australia |
| **COE** | Cooper Energy |
| **COLREGS** | International Regulations for Preventing Collisions at Sea |
| **CRA** | Corrosion Resistant Alloy |
| **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 |
| **DEC** | Department of Environment and Conservation |
| **DECC** | Department of Environment and Climate Change |
| **DEDJTR** | Department of Economic Development Jobs Trade and Resources. Previously Department of Transport Planning and Local Infrastructure (DTPLI). Now Department of Jobs Skills Industry and Regions (DJSIR) and Department of Transport and Planning (DTP). |
| **DEECA** | Department of Energy, Environment and Climate Action (formerly DELWP) |
| **DEH** | Department of the Environment and Heritage |
| **DELWP** | Department of Environment, Land, Water and Planning. Now DEECA |
| **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) |
| **DISR** | Department of Industry, Science and Resources |
| **DITRDC** | Department of Infrastructure, Transport, Regional Development and Communications |
| **DJPR** | Department of Jobs Precincts and Regions (formerly DEDJTR) |
| **DJSIR** | Department of Jobs, Skills, Industry and Regions (formerly DJPR) |

| Acronym | Definition |
|---|---|
| **DMA** | Dead Man Anchor |
| **DNP** | Director of National Parks |
| **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), DEH and Environment Australia) |
| **DoH** | Department of Health |
| **DoHAC** | Department of Health and Aged Care |
| **DP** | Dynamic Positioning |
| **DPC** | Department of Premier and Cabinet |
| **DPI** | Department of Primary Industry |
| **DSE** | Department of Sustainability and Environment |
| **DSEWPaC** | Department of Sustainability, Environment, Water, Population and Communities |
| **DSV** | Dive Support Vessel |
| **DTP** | Department of Transport and Planning (formerly Department of Transport) |
| **DTPLI** | Department of Transport Planning and Local Infrastructure |
| **EAC** | East Australian Current |
| **ECSP** | East Coast Supply Project |
| **EEZ** | Exclusive Economic Zone |
| **EFL** | Electrical Flying Lead |
| **EHU** | Electro-hydraulic umbilical |
| **EIA** | Environmental Impact Assessment |
| **EIAPP** | Engine International Air Pollution Prevention |
| **EMAC** | Eastern Maar Aboriginal Corporation |
| **EMBA** | Environment that may be affected |
| **ENVID** | Environmental Identification |
| **EP** | Environment Plan |
| **EPA** | Environment Protection Authority |
| **EPBC** | Environment Protection Biodiversity Conservation |
| **EPO** | Environmental Performance Outcome |
| **ERP** | Emergency Response Plan |
| **ERR** | Earth Resources Regulation |
| **ESD** | Ecologically Sustainable Development |
| **ETBF** | Eastern Tuna and Billfish |
| **EU** | Electrical Umbilical |
| **FEED** | Front End Engineering and Design |
| **FPSO** | Floating, Production, Storage and Offloading facility |
| **GDA 2020** | Geocentric Datum Of Australia 2020 |
| **GHG** | Greenhouse gases |
| **GMP** | Garbage Management Plan |

| Acronym | Definition |
|---|---|
| **GMTOAC** | Gunditj Mirring Traditional Owners Aboriginal Corporation |
| **GSACUS** | Great Southern Australian Coastal Upwelling System |
| **GSSO** | Gas Statement of Opportunities |
| **HB** | Handbook |
| **HDD** | Horizontal Directional Drill |
| **HF** | high frequency |
| **HFL** | Hydraulic Flying Lead |
| **HFO** | Heavy Fuel Oil |
| **Hg** | Mercury |
| **HLV** | Heavy Lift Vessel |
| **HP** | High Pressure |
| **HPU** | Hydraulic Power Unit |
| **HQ** | Hazard Quotient |
| **HSE** | Health, Safety, Environment |
| **HSEC** | Health Safety Environment and Community |
| **Hz** | Hertz |
| **IAPP** | International Air Pollution Prevention |
| **ICC** | Incident Control Centre |
| **IGP** | Iona Gas Plant |
| **ILI** | Internal Line inspection |
| **ILT** | In-line Tee |
| **ILUA** | Indigenous Land Use Agreements |
| **IMAS** | Institute for Marine and Antarctic Studies |
| **IMCRA** | Interim Marine and Coastal Regionalisation for Australia |
| **IMO** | International Maritime Organisation |
| **IMOS** | Integrated Marine Observing System |
| **IMP** | Integrity Management Plan |
| **IMP** | Incident Management Plan |
| **IMR** | Inspection Maintenance & Repair |
| **IMS** | Invasive Marine Species |
| **IMT** | Incident Management Team |
| **IOGP** | International Association of Oil and Gas Producers |
| **IPA** | Indigenous Protected Areas |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **IPIECA** | International Petroleum Industry Environmental Conservation Association |
| **IR** | Infrared |
| **ISO** | International Standards Organisation |
| **ISV** | Installation Support Vessel |
| **ITOPF** | International Tanker Owners Pollution Federation |
| **IUCN** | International Union for the Conservation of Nature |

| Acronym | Definition |
|---|---|
| **JAMBA** | Japan/Australia Migratory Birds Agreement |
| **JRCC** | Joint Rescue Coordination Centre |
| **KEF** | Key Ecological Feature |
| **Kg** | Kilograms |
| **kHz** | Kilohertz |
| **km** | Kilometre |
| **km$^2$** | Square kilometres |
| **kt** | 1000 tonnes |
| **L** | Litres |
| **LGA** | Local Government Area |
| **LOC** | Loss of Containment |
| **LOWC** | Loss of Well Control |
| **LWD** | Logging Whilst Drilling |
| **m$^2$** | Square Meters |
| **m$^3$** | Cubic Meters |
| **MARPOL** | International Convention for the Prevention of Pollution from Ships |
| **MBES** | Multi-beam echo sounder |
| **MCS** | Master Control System |
| **MDO** | Marine Diesel Oil |
| **MDRT** | Measured Depth Relative to the Rotary Table |
| **MEG** | Mono-ethylene glycol |
| **MEPC** | Marine Environment Protection Committee |
| **MF** | medium frequency |
| **MFO** | Marine Fauna Observer |
| **mg/l** | milligrams per litre |
| **MGA 54** | Map Grid of Australia 54 |
| **MGO** | Marine Gas Oil |
| **MLV** | Mainline valve |
| **MMO** | Marine Mammal Observer |
| **MMscf** | Million standard cubic feet |
| **MNES** | Matters of National Environmental Significance |
| **MO** | Marine Order |
| **MOC** | Management of Change |
| **MODU** | Mobile Offshore Drilling Unit |
| **MOU** | Memorandum of Understanding |
| **MS** | Management System |
| **MT** | Metric Tonne |
| **$N_2$** | Nitrogen |
| **$N_2O$** | Nitrous Oxide |
| **NA** | Not Applicable |

| Acronym | Definition |
|---|---|
| **NADF** | Non-Aqueous Drilling Fluid |
| **NDC** | Nationally Determined Contributions |
| **NEPM** | National Environment Protection Measure |
| **NERA** | National Energy Resources Australia |
| **NGER** | National Greenhouse and Energy Reporting |
| **NIMPIS** | National Introduced Marine Pest Information System |
| **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 |
| **NPI** | National Pollutant Inventory |
| **NORMS** | Naturally Occurring Radioactive Material |
| **NORSOK** | Norsk Sokkels Konkurranseposisjon |
| **NOx** | Nitrogen Oxides |
| **NPI** | National Pollution Index |
| **NRDA** | National Resource Damage Assessment |
| **NSW** | New South Wales |
| **NZ** | New Zealand |
| **°C** | Degrees Celsius |
| **OCNS** | Offshore Chemical Notification System |
| **ODS** | Ozone Depleting Substances |
| **OHS** | Occupational Health & Safety |
| **OPEP** | Oil Pollution Emergency Plan |
| **OPGGS** | Offshore Petroleum and Greenhouse Gas Storage |
| **OPGGSA** | Offshore Petroleum & Greenhouse Gas Storage Act |
| **OPGGS(E)R** | Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Com) |
| **OPP** | Offshore Project Proposal |
| **OPRC** | (Convention on) Oil Pollution Preparedness, Response and Cooperation |
| **ORP** | Oxidation-reduction Potential |
| **OSMP** | Operational & Scientific Monitoring Plan |
| **OSPAR** | Oslo-Paris Convention |
| **OWF** | Offshore Wind Farm |
| **P&A** | Plug and Abandonment |
| **PAH** | Poly-aromatic hydrocarbon |
| **PBW** | Pygmy Blue Whale |
| **PFAS** | Per-and poly-fluoroalkyl substances |
| **PFOS** | Perfluorooctane sulfonic acid |
| **PIG (pig)** | Pipeline Inspection Guage |

| Acronym | Definition |
|---|---|
| **PIMP** | Pipeline Integrity Management Plan |
| **PJ** | Petajoule |
| **PK** | Peak |
| **PLONOR** | Pose Little or No Risk |
| **PM** | Particle Matter |
| **PMB** | Property Management Branch |
| **PMST** | Protected Matters Search Tool |
| **POB** | Persons on Board |
| **ppb** | Parts per billion |
| **ppm** | Parts per million |
| **PSV** | Platform Supply Vessel |
| **PSZ** | Petroleum Safety Zone |
| **PTS** | Permanent threshold shift |
| **PV** | Parks Victoria |
| **PWS** | Parks and Wildlife Services |
| **pXRF** | Portable X-ray Fluorescence |
| **RAP** | Registered Aboriginal Party |
| **ROKAMBA** | The Republic of Korea Migratory Birds Agreement |
| **RO** | Reverse Osmosis |
| **ROV** | Remotely Operated Vehicle |
| **SBP** | Sub-Bottom Profiler |
| **SCERP** | Source Control Emergency Response Plan |
| **SCM** | Subsea Control Module |
| **SEEMP** | Shipboard Energy Efficiency Management Plan |
| **SEI** | Socio-economic impact |
| **SEL** | Sound Exposure Level |
| **SEMR** | South East Marine Region |
| **SESSF** | Southern and Eastern Scale-fish and Shark Fishery |
| **SETFIA** | South East Trawl Fishing Industry Association |
| **$SF_6$** | Sulphur Hexafluoride |
| **SHS** | Scalefish Hook Sector |
| **SIMAP** | Spill Impact Mapping Analysis Program |
| **SIMOPS** | Simultaneous Operations |
| **SIV** | Seafood Industry Victoria |
| **SMPEP** | Shipboard Marine Pollution Emergency Plan |
| **SoE** | State of Environment |
| **SOLAS** | Safety of Life at Sea |
| **SOx** | Sulphur Dioxides |
| **SPL** | Sound Pressure Level |
| **SSF** | Sustainable Shark Fishing Inc. |

| Acronym | Definition |
|---|---|
| **SSJF** | Southern Squid Jig Fishery |
| **SSS** | Side Scan Sonar |
| **SST** | Subsea Tree |
| **ST** | Side Track |
| **SUDU** | Subsea Umbilical Distribution Unit |
| **SUTU** | Subsea Umbilical Termination Unit |
| **SVP** | Sound Velocity Profiler |
| **TA** | Tuna Australia |
| **TACC** | Total Allowable Commercial Catch |
| **TEC** | Threatened Ecological Community |
| **TJ** | Terajoule |
| **TPC** | Third Party Contractors |
| **TPH** | Total Petroleum Hydrocarbons |
| **TOC** | Total organic carbon |
| **TSIC** | Tasmanian Seafood Industry Council |
| **TSSC** | Threatened Species Scientific Committee |
| **TTS** | Temporary Threshold Shift |
| **UCH** | Underwater Cultural Heritage |
| **UK** | United Kingdom |
| **UN** | United Nations |
| **UNCLOS** | United Nations Convention on the Law of the Sea |
| **UNEP** | United Nations Environment Program |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **USBL** | Ultra-Short Baseline |
| **UTA** | Umbilical Terminal Assembly |
| **UXO** | Unexploded Ordinance |
| **VFA** | Victorian Fisheries Authority |
| **VIC** | Victoria |
| **VRFish** | Victorian Recreational Fishing Peak Body |
| **VSP** | Vertical Seismic Profiling |
| **VTIC** | Victorian Tourism Industry Council |
| **WBDF** | Water-Based Drilling Fluids |
| **WCD** | Worst Case Discharge |
| **WMO-GAW** | World Meteorological Organisation-Global Atmosphere Watch |
| **WOMP** | Well Operations Management Plan |
| **WTOAC** | Wadawurrung Traditional Owners Aboriginal Corporation |

# 1 Introduction

## 1.1 Activity Overview

Cooper Energy is the operator of the Casino Henry Netherby (CHN) development, which is in the Otway Basin, off Victoria's southwest coast in the Bass Strait (Figure 1-1). The CHN fields have been developed incrementally since 2004, with gas transported from the offshore fields, via pipeline, for onshore processing. All gas is used to supply the domestic market in south-east Australia.

To meet continued demand as existing fields decline Cooper Energy proposes to continue the incremental development of adjacent fields and utilise existing CHN infrastructure to backfill and maintain supply. This is referred to as the East Coast Supply Project (East Coast Project).

The East Coast Project comprises up to 8 gas development opportunities (7 new prospective resource opportunities and one discovered field, as shown in Figure 1-2) with associated sub-sea wells, manifolds and flowlines that tie in via existing tie in points along the subsea pipeline - all located in Commonwealth waters. The project will be developed in stages, aligned with domestic demand and project approvals.

This Offshore Project Proposal (OPP) has been developed by Cooper Energy to seek primary approval for all phases of the project life of the East Coast Project, including:

- site surveys
- well construction activities
- installation and commissioning
- operations
- decommissioning
- support operations.

### 1.1.1 Activity Location

The East Coast Project is located in, and adjacent to, the existing CHN fields within Commonwealth waters of the Otway Basin in licence areas VIC/P76, VIC/L24, VIC/P44, VIC/L30 and VIC/L33.

Water depths range between ~50 to 90 m across the proposed development options. The closest proposed well to shore is ~9 km offshore (Figure 1-2). All gas wells will tie back to the existing CHN subsea facilities in offshore Commonwealth waters. The existing CHN pipeline will then be utilised to transport gas and condensate to the Athena Gas Plant for processing, which is situated ~5 km inland of Port Campbell, Victoria.

The nearest settlements to the East Coast Project are the towns of Peterborough and Port Campbell which are ~11 km and 16 km away, respectively. The closest significant ports are Portland, situated ~96 km west and Geelong >150 km east.

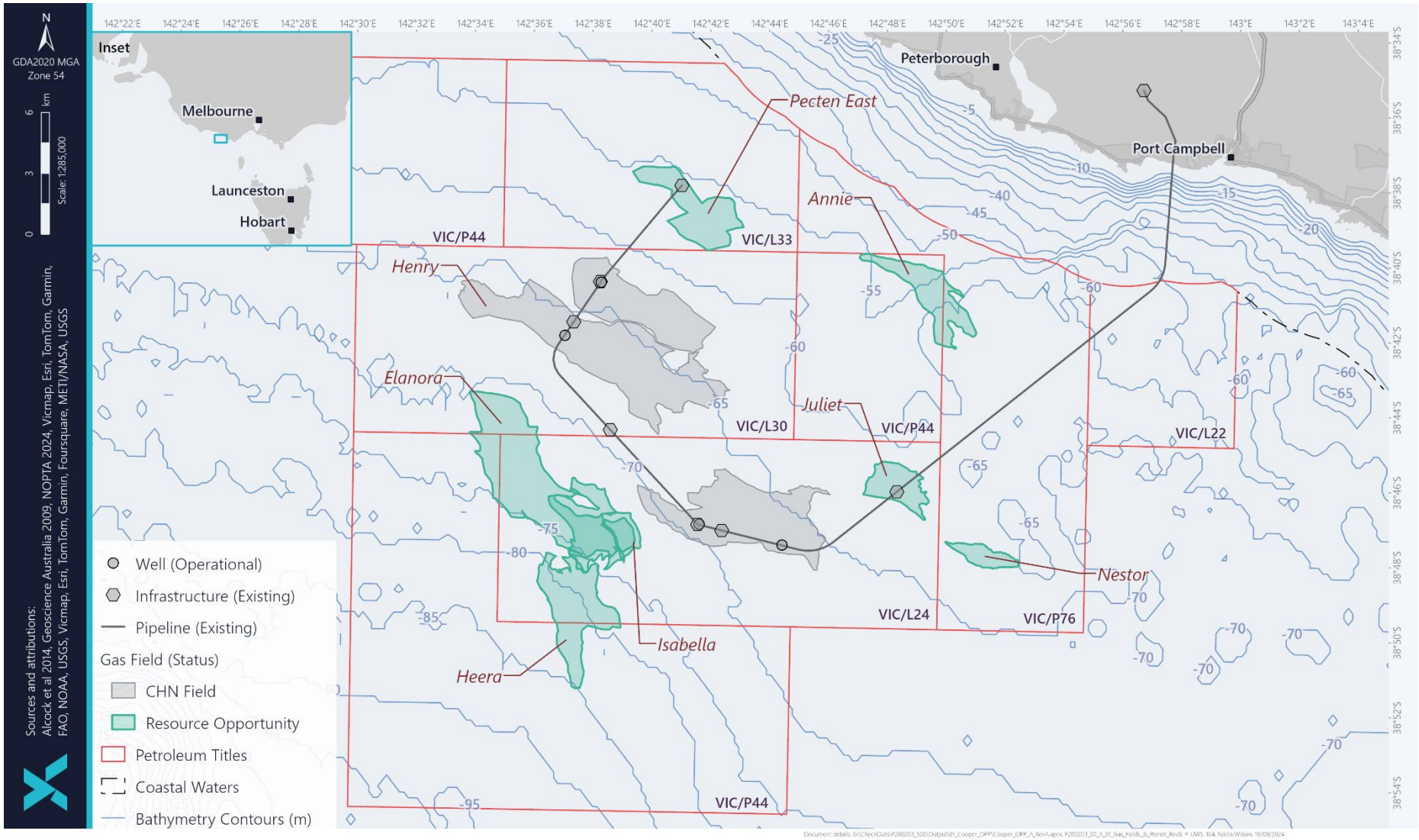



*Figure 1-1: Existing CHN development*

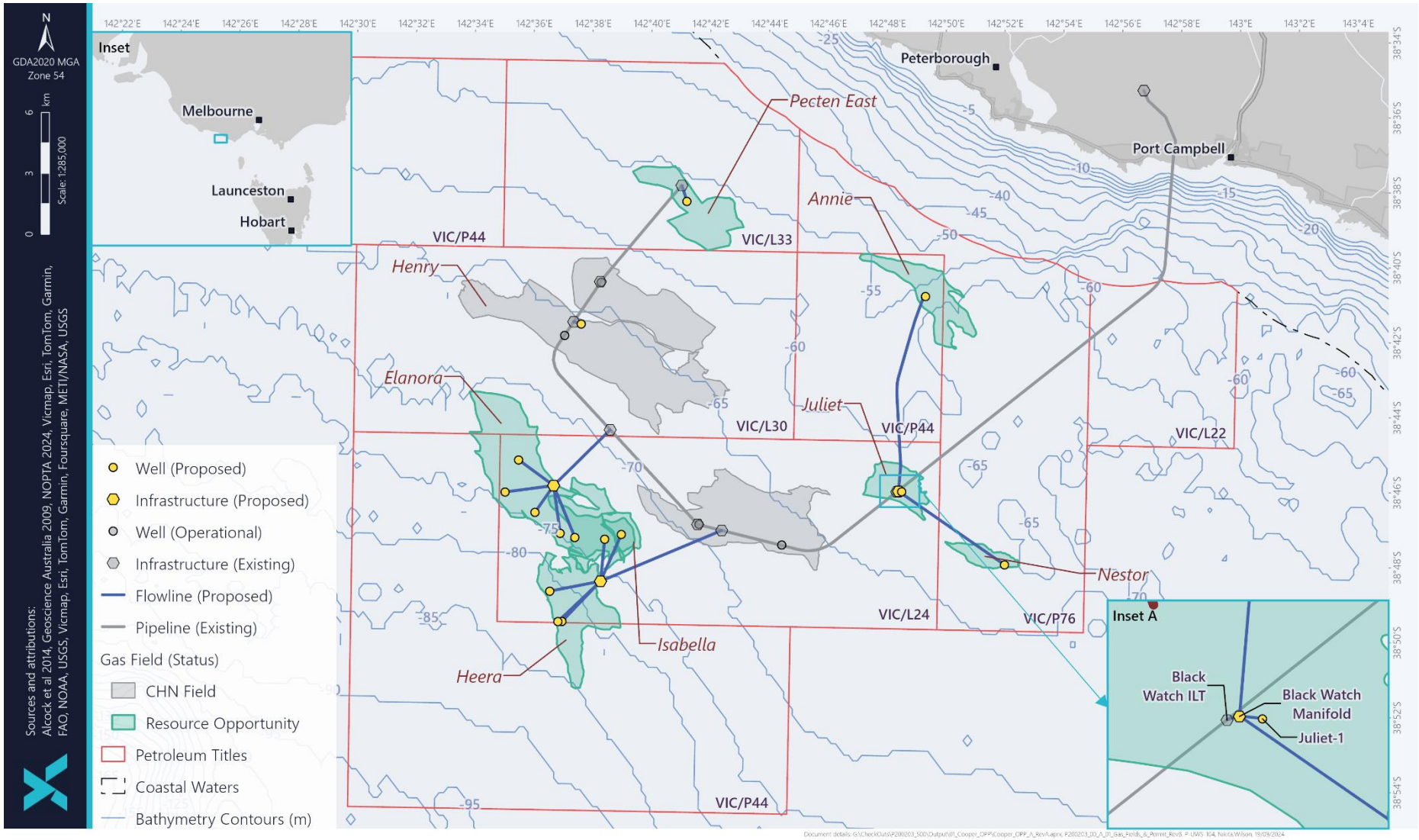



*Figure 1-2: Location and Layout of East Coast Project and potential development scenario*

## 1.2 Background

Exploration in the offshore Otway Basin has been undertaken for over 50 years, with hydrocarbons first discovered via drilling of the Pecten-1A well in 1969. Over the following decades, numerous other hydrocarbon discoveries were made. Gas and condensate have been produced from the Casino-Henry-Netherby (CHN) development assets since the early 2000's; the hydrocarbon resources proximal to the CHN facilities have been incrementally developed to meet south-east Australian gas demand and utilise existing infrastructure.

The existing Otway offshore facilities include the CHN development which produces from Production Licence Areas VIC/L24 (Casino) and VIC/L30 (Netherby and Henry). The CHN development has included the drilling of four wells which have been producing gas for over a decade. Products from these wells are transported through a subsea pipeline to the onshore Athena Gas Plant (AGP) on Victoria's southwest coast for processing. Processed gas is directed to third-party pipelines, where it is transported domestically for use within the southern and eastern states. Exploration undertaken proximal to the CHN development over the last couple of decades includes:

- Casino-1 exploration well was drilled in 2002, followed by two further exploration wells, which were both plugged and abandoned
- the Henry-1 exploration well was drilled in 2005 and was plugged and abandoned the same year
- the first exploration well in the Annie field (Annie-1) was drilled and plugged and abandoned in 2019.

The first production associated with the CHN development occurred in 2006 from two wells located within the Casino field (VIC/L24), later joined in 2010 by two single-well production wells in both the Henry and Netherby fields (VIC/L30).

Stage 1 of the CHN development comprised of the original Casino-2 well development, with gas processing through the nearby Iona Gas Plant (IGP), north of Port Campbell. In 2005, Casino-4 and Casino-5 wells (located in VIC/L24) were installed and have been in production since 2005.

Stage 2 of the development expanded the IGP for lower pressure operation and extended the pipeline to Pecten East. The Henry-2 and Netherby-1 development wells were drilled in 2008 and began producing in 2012. More recently, in late 2021, the Athena Gas Processing Project was completed, allowing CHN gas to be processed through the AGP.

The existing CHN facilities are shown in Figure 1-1 and comprise:

- Stage I, installed 2004:
  - Subsea production wells, including Casino-4 and Casino-5.
  - A 32.6 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 East where a future production well was anticipated.
  - A 22 km EHU cable (extension of the umbilical above to Pecten East) connecting the Henry and Netherby wells to the onshore plant. Sections of this EHU have been repaired in subsequent years via installation of electrical umbilicals that bypass electrical faults within the original EHU.

### 1.2.1 Existing Approvals

The CHN development, including the Otway offshore operations and associated activities described in the Otway Offshore Operations Environment Plan (EP) (Cooper Energy, 2023), has received EPBC Act approval.

Stage I, involving onshore, coastal and offshore construction and operations was approved as a controlled action in 2003 (EPBC 2003/1295). At the time of submission of this OPP, Cooper Energy have requested an extension from DCCEEW to extend the approval expiry date to 31 December 2050 to reflect the continued use of the infrastructure.

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).

The approvals and installed infrastructure provide for the integration of infill gas/ condensate resources via existing tie-in points already installed in the CHN pipeline system. These tie-in points, as shown in Figure 1-2 are anticipated to be utilised for the East Coast Project.

### 1.2.2 Exploration Activities

The Athena Supply Project EP (prepared by Cooper Energy) was accepted on 8 May 2025. The EP includes exploration and well completion activities (in the event sufficient quantities of gas for domestic supply are discovered i.e. a commercially viable resource) at Juliet-1, Nestor-1 and Elanora-1/ST1. If commercially viable resources for potential future in-fill development are discovered, Cooper Energy will complete the wells and suspend them to allow their future use. The completed wells will be left with the SSTs installed with primary and secondary well barriers preventing the flow of hydrocarbons out of the well. In this scenario, Cooper Energy expects to integrate the completed wells into the East Coast Project production infrastructure, subject to acceptance of this OPP and other regulatory approvals and licencing for production activities.

This approach aligns with Cooper Energy's strategy of utilising existing infrastructure where safe and practicable to do so; this also has benefit in reducing the overall project footprint, and associated impacts and risks. If exploration wells are successfully integrated into the East Coast Project, some of the impacts associated with developing a field, such as emissions and disturbances from re-drilling or re-visiting a suspended well for completing are reduced. The integration, production, operation and decommissioning of these wells is provided for in this OPP. Refer to Section 4 for further details.

## 1.3 Purpose

This OPP has been developed in accordance with the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 [OPGGS(E)R].

Under the regulations, an OPP must be submitted for all offshore projects to the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA) for approval. An OPP is the initial assessment phase for an offshore project and must be accepted before the titleholder can submit Environment Plans (EPs) for the proposed phases of activity covered under the OPP. It is not until the regulator accepts an EP, that commencement of the activity covered by the EP can occur. This pre-requisite does not apply to exploration activities such as seismic surveys and exploratory drilling.

The proponent must ensure all environmental impacts and risks associated with the project will be managed to acceptable levels. This OPP will allow NOPSEMA to assess the potential environmental impacts and risks associated with the East Coast Project over the entire project life. Before acceptance, the OPP will be open for a public comment period. This opportunity for review and comment on the proposal by the public is an important part of the assessment process and assists in identifying environmental values and sensitivities and ensuring appropriate management of the impacts and risks across the whole project life of the East Coast Project.

### 1.3.1 Future Gas Strategy

The Commonwealth Government released the Future Gas Strategy in May 2024 (Department of Industry, Science and Resources (DISR), 2024). It maps the Australian Government's plan for how gas will support the Australian economy's transition to net zero. The strategy's objectives are to:

- support decarbonisation of the Australian economy
- safeguard energy security and affordability
- entrench Australia's reputation as an attractive trade and investment destination
- help Australia's trade partners on their own paths to net zero.

The strategy acknowledges that gas remains crucial to the Australian economy and region to support the transition to net zero (DISR 2024). Consistent with the Strategy, the East Coast Project can provide domestic gas supply in response to the AEMO forecast 2028 supply gap. Further, the phased development approach (Section 4.1.3) of the East Coast Project allows the development to respond to customer gas demand, aligning with the Future Gas Strategy principle of new sources of gas supply to meet demand during the economy-wide transition.

The East Coast Project development concept, being a backfill development for an existing gas plant in regional Australia, proximal (and already connected) to the east coast domestic gas market, can serve to reduce construction and transportation costs making the gas more affordable. The concept also avoids environmental impacts and emissions associated with the construction of new processing facilities and helps to reduce the need for (and associated emissions from) gas liquification, shipping and regassification into the eastern states from interstate or overseas.

### 1.3.2 Document Structure

The OPP has been prepared to align with NOPSEMA's guidelines for Offshore project proposal content requirements guidance note (NOPSEMA, 2020) and Offshore project proposal decision-making (NOPSEMA, 2021). The structure of this OPP is summarised in Table 1-1.

*Table 1-1: OPP Structure*

| Section | | Content |
|---|---|---|
| **1** | Introduction | Overview of the East Coast Project, location, background scope and proponent details. |
| **2** | Requirements | Legislation, other regulatory requirements, standards, policies, guidelines and international agreements relevant to the East Coast Project. |
| **3** | Stakeholder Consultation | A summary of Cooper Energy's stakeholder consultation methods which includes the process of stakeholder identification, consultation history and future requirements. |
| **4** | Project Description | A description of all proposed infrastructure and activities, including surveys, installation, commissioning, drilling, operation and decommissioning; and support operations. |
| **5** | Alternatives Analysis | An analysis of the feasible alternatives for the project concept, and design and activities of the selected concept. |
| **6** | Description of the Environment | A description of the values and sensitivities of the existing environment. |
| **7** | Impact and Risk Assessment | A description of the methodology used to identify and evaluate the environmental risks and impacts of the activities associated with the East Coast Project. |
| **8** | Environmental Impact Assessment | Environmental impact assessment for environmental impacts associated with planned aspects generated by the East Coast Project activities. |
| **9** | Environmental Risk Assessment | Environmental risk assessment for potential incident events associated with unplanned aspects generated by the East Coast Project activities. |

| Section | | Content |
|---|---|---|
| **10** | First Nations Cultural Heritage Impact Assessment | Identifies and assess the potential impacts to First Nations cultural heritage generated by the East Coast Project activities. |
| **11** | Cumulative Impact Assessment | Identifies and assesses the potential cumulative impacts associated with the East Coast Project in the context of existing and future activities. |
| **12** | Implementation Strategy | An overview of Cooper Energy's management system and how environmental performance outcomes will be implemented. |
| **13** | References | |

## 1.4 Scope

To address the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R), Cooper Energy has assessed the potential environmental impacts and risks across all phases of the East Coast Project.

Phases and associated activities assessed within the scope of the OPP include:

- site surveys - geophysical and geotechnical
- well construction activities - drilling operations and well testing
- installation and commissioning - installation of subsea infrastructure and testing/start-up evaluations
- operations - maintenance, inspection and repair of infrastructure
- decommissioning - well decommissioning and removal of subsea infrastructure
- support operations - MODU, vessels, helicopters, ROVs.

Activities specifically excluded from the scope of this OPP are:

- exploration drilling[1]
- management and maintenance of existing CHN facilities[2]
- management of onshore activities including the Athena Gas Plant and MLV station.
- vessels transiting to or from the operational area. These vessels are deemed operating under the Commonwealth *Navigation Act 2012* and not performing a petroleum activity.

*[1] Under the OPGGS(E)R, exploration activities such as seismic surveys and exploration drilling require an approved Environment Plan (EP) before an activity can occur but are not required to be assessed within an OPP (see Section 1.2.2).*
*[2] Interactions with existing CHN facilities within the scope of this OPP are those activities required to integrate the East Coast Supply Project (ECSP) facilities; these activities include hot tapping (described in Section 4.2.5), pig launching (described Section 4.2.3 and 4.2.5), and other inspection-maintenance and repair type works as described in Section 4.3.4.3 and 4.3.4.4.*

## 1.5 Proponent Details

Cooper Energy (CH) Pty Ltd and Cooper Energy (MGP) Pty Ltd are the proponent for the East Coast Project. In accordance with the Offshore Petroleum and Greenhouse Gas Storage Act (Environment) Regulations 2023 (OPGGS(E)R), details are provided below.

Contact details of the proponent are:

Cooper Energy (CH) Pty Ltd and Cooper Energy (MGP) Pty Ltd[3]

Level 8, 70 Franklin Street

Adelaide, South Australia, 5000

Phone: +61 8 8100 4900

Email: nathan.childs@amplitudeenergy.com.au

Website: https:/amplitudeenergy.com.au/

[3] The titleholders are subsidiary companies, with the same parent company. The parent company's name has recently changed from Cooper Energy Limited to Amplitude Energy Limited, effective 8 November 2024

# 2 Requirements

This section provides information on the requirements that apply to the activities. 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 East Coast Project is located entirely within Commonwealth waters and therefore falls under Commonwealth jurisdiction. Projects located within Commonwealth jurisdiction must comply with two keys acts: *Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGSS Act)* and *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*

## 2.1 Commonwealth legislation

### 2.1.1 OPGGS Act Requirements

The OPGGS Act provides the regulatory framework for all offshore petroleum activities within Commonwealth waters. The Act ensures that activities are undertaken in a way that is:

- consistent with the principles of ecologically sustainable development as defined in section 3A of the EPBC Act
- reduces environmental impacts and risks of the activity to as low as reasonably practicable (ALARP)
- ensures that environmental impacts and risks of the activity are acceptable.

There are several regulations under the Act including:

- Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009
- Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011
- Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R).

Section 6 of the OPGGS(E)R specifies that prior to beginning an offshore project, a person must submit an OPP to the regulator.

Section 572 of the OPGGS Act places duties on titleholders in relation to the maintenance and removal of structures, equipment and property brought onto the petroleum title. Decommissioning requirements are addressed in Section 4.3.5.

Facilities to meet the requirements of Section 270 and 572 of the OPGGS Act is addressed in Section 4.3.5.6.

The OPGGS(E)R require a titleholder to have an accepted Environment Plan (EP) in place for any petroleum activity or greenhouse gas activity.

EPs related to activities associated with the OPP development can be submitted for assessment after the OPP has been accepted by NOPSEMA. Activities can only commence once the relevant EP has been accepted by NOPSEMA.

An EP is supported by an Oil Pollution Emergency Plan (OPEP) and an Operational and Scientific Monitoring Plan (OSMP), which are required to be included within an EP's implementation strategy.

Table 2-1 specifies the requirements of the OPGGS(E)R in relation to the content of this OPP.

*Table 2-1: Concordance Table for the OPP Requirements of the OPGGS(E)R*

| Regulation Section | Description | Document Section |
|---|---|---|
| **7(2)(a)** | The proposal must:<br>(a) include the proponent's name and contact details; | Section 1.3 |

| Regulation Section | Description | Document Section |
|---|---|---|
| **7(2)(b)** | (b) a summary of the project, including the following:<br>I. a description of each activity that is part of the project;<br>II. the location or locations of each activity;<br>III. a proposed timetable for carrying out the project;<br>IV. a description of the facilities that are proposed to be used to undertake each activity;<br>V. a description of the actions proposed to be taken, following completion of the project, in relation to those facilities; | Section 4 |
| **7(2)(c)** | (c) a description of the existing environment that may be affected by the project; | Section 6 |
| **7(2)(d)** | (d) details of the relevant values and sensitivities (if any) of that environment; | Section 6 |
| **7(2)(e)** | (e) the environmental performance outcomes for each activity that is part of the project; | Section 8 and 9 |
| **7(2)(f)** | (f) a description of any feasible alternative to the project, or an activity that is part of the project, including:<br>I. a comparison of the environmental impacts and risks arising from the project or activity and the alternative; and<br>II. an explanation, in adequate detail, of why the alternative was not preferred. | Section 5 |
| **7(3)** | Without limiting paragraph (2)(d), relevant values and sensitivities may include any of the following:<br>(a) the world heritage values of a declared World Heritage property;<br>(b) the National Heritage values of a National Heritage place;<br>(c) the ecological character of a declared Ramsar wetland;<br>(d) the presence of a listed threatened species or listed threatened ecological community;<br>(e) the presence of a listed migratory species;<br>(f) any values and sensitivities that exist in, or in relation to, part or all of:<br>I. a Commonwealth marine area; or<br>II. Commonwealth land. | Section 6 |
| **7(4)** | The proposal must describe:<br>(a) describe the requirements, including legislative requirements, that apply to the project and are relevant to the environmental management of the project; and<br>(b) describe how those requirements will be met. | Section 2 |
| **7(5)** | The proposal must include:<br>(a) details of the environmental impacts and risks of the activities that are part of the project; and<br>(b) an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk. | Section 8 and 9 |

### 2.1.2 EPBC Act Requirements

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection and enables the management of nationally and internationally important flora, fauna, ecological communities and heritage places.

The EPBC Act refers to the living things (including plants and animals), habitats and places that need protecting as 'matters of national environmental significance' (MNES).

MNES relevant to the OPP include:

- listed threatened species and ecological communities
- listed migratory species (protected under international agreements)
- Commonwealth marine areas
- World Heritage places
- Commonwealth Heritage places
- wetlands of international importance (listed under the Ramsar Convention).

NOPSEMA oversees the assessment process as the delegated authority for petroleum activities under the EPBC Act, after streamlining of regulatory processes under the OPGGS Act and EPBC Act in 2014.

An independent review was conducted on the EPBC Act in 2022 (the Samuel Review), and the Australian Government is in the process of reforming the EPBC Act. Public consultation on the details of the draft legislation will occur in the second half of 2023; however, no draft legislation was available at the time of writing.

#### *2.1.2.1 Protected Areas*

Under the EPBC Act, protected areas (marine and terrestrial) are established to meet objectives consistent with local and national goals (Environment Australia, 2002). Once protected areas are established, an International Union for Conservation of Nature (IUCN) category is assigned, to ensure objectives are met. Any activities occurring within a protected area must be consistent with the Australian IUCN Reserve Management Principles which embody the objectives and values of the area:

- Strict Nature Reserve (IA) – possesses outstanding or representative ecosystems, geological or physical features and/or species. Managed primarily for scientific research or environmental monitoring.
- National Park (II) – designated to protect and manage natural condition and provide a foundation for spiritual, scientific, educational or recreational opportunities.
- Habitat/Species Management Area (IV) – subject to active intervention to ensure the maintenance of habitats and/or meet the requirements of specific species.
- Managed Resource Protected Area (VI) – managed to ensure long-term protection and maintenance of biodiversity while providing a sustainable flow of natural products and service to meet community needs.

The Australian IUCN Reserve Management Principles for each category are within the EPBC Regulations and summarised in Table 2-2.

*Table 2-2: Australian IUCN Reserve Management Principles*

| Category IA: Strict Nature Reserve | Category II: National Park | Category IV: Habitat/Species Management Area | Category VI: Managed Resource Protected Areas |
|---|---|---|---|
| 1.01<br>The reserve or zone should be managed primarily for scientific research or environmental monitoring based on the following principles | 3.01<br>The reserve or zone should be protected and managed to preserve its natural condition according to the following principles. | 5.01<br>The reserve or zone should be managed primarily, including (if necessary) through active intervention, to ensure the maintenance of habitats or to meet the requirements of collections or specific species based on the following principles. | 7.01<br>The reserve or zone should be managed mainly for the sustainable use of natural ecosystems based on the following principles. |

| Category IA: Strict Nature Reserve | Category II: National Park | Category IV: Habitat/Species Management Area | Category VI: Managed Resource Protected Areas |
|---|---|---|---|
| 1.02<br>Habitats, ecosystems and native species should be preserved in as undisturbed state as possible | 3.02<br>Natural and scenic areas of national and international significance should be protected for spiritual, scientific, educational, recreational or tourist purposes. | 5.02<br>Habitat conditions necessary to protect significant species, groups or collections of species, biotic communities or physical features of the environment should be secured and maintained, if necessary, through specific human manipulation. | 7.02<br>The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term. |
| 1.03<br>Genetic resources should be maintained in a dynamic and evolutionary state | 3.03<br>Representative examples of physiographic regions, biotic communities, genetic resources, and native species should be perpetuated in as natural a state as possible to provide ecological stability and diversity. | 5.03<br>Scientific research and environmental monitoring that contribute to reserve management should be facilitated as primary activities associated with sustainable resource management. | 7.03<br>Management practices should be applied to ensure ecologically sustainable use of the reserve or zone. |
| 1.04<br>Established ecological processes should be maintained. | 3.04<br>Visitor use should be managed for inspirational, educational, cultural and recreational purposes at a level that will maintain the reserve or zone in a natural or near natural state. | 5.04<br>The reserve or zone may be developed for public education and appreciation of the characteristics of habitats, species or collections and of the work of wildlife management. | 7.04<br>Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles. |
| 1.05<br>Structural landscape features or rock exposures should be safeguarded | 3.05<br>Management should seek to ensure that exploitation or occupation inconsistent with these principles does not occur. | 5.05<br>Management should seek to ensure that exploitation or occupation inconsistent with these principles does not occur. | |
| 1.06<br>Examples of the natural environment should be secured for scientific studies, environmental monitoring and education, including baseline areas from which all avoidable access is excluded | 3.06<br>Respect should be maintained for the ecological, geomorphologic, sacred and aesthetic attributes for which the reserve or zone was assigned to this category. | 5.06<br>People with rights or interests in the reserve or zone should be entitled to benefits derived from activities in the reserve or zone that are consistent with these principles. | |
| 1.07<br>Disturbance should be minimised by careful planning and execution of research and other approved activities. | 3.07<br>The needs of indigenous people should be taken into account, including subsistence resource | 5.07<br>If the reserve or zone is declared for the purpose of a botanic garden, it should also be managed for the increase of | |

| Category IA: Strict Nature Reserve | Category II: National Park | Category IV: Habitat/Species Management Area | Category VI: Managed Resource Protected Areas |
|---|---|---|---|
| | use, to the extent that they do not conflict with these principles. | knowledge, appreciation and enjoyment of Australia's plant heritage by establishing, as an integrated resource, a collection of living and herbarium specimens of Australian and related plants for study, interpretation, conservation and display. | |
| 1.08<br>Public access should be limited to the extent it is consistent with these principles. | 3.08<br>The aspirations of traditional owners of land within the reserve or zone, their continuing land management practices, the protection and maintenance of cultural heritage and the benefit the traditional owners derive from enterprises, established in the reserve or zone, consistent with these principles should be recognised and taken into account. | | |

#### 2.1.2.2 *Management / Recovery Plans and Conservation Advice for Listed Threatened Species and Ecological Communities*

Relevant requirements and advice associated with the EPBC Act, related policies, guidelines, plans of management, recovery plans, and threat abatement plans issued by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) are detailed in the applicable sections within Section 6 as part of the description of the existing environment.

The requirements and relevant specific actions identified within management/recovery plans and conservation advice have been considered in the development of the OPP and used as guidance in developing the management of proposed activities.

Table 2-3 outlines the management plans, recovery plans and conservation advice of listed species identified in Section 6 and highlights any key threats or conservation actions relevant to the proposed activities. Guidance and advice have been considered when assessing the impacts and risks, acceptability, in developing environmental performance outcomes (EPOs) and management measures.

*Table 2-3: Management/Recovery Plans and Conservation Advice Relevant to the East Coast Project*

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| **Fish** | | | | | |
| **Australian Grayling** | National Recovery Plan for the Australian Grayling (Backhouse et al., 2008) | • Vulnerable | 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.<br>Relevant specific objectives within the lifespan of the recovery plan are:<br>Protect and restore habitat for Australian Grayling<br>Investigate and manage threats to populations and habitats | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| | | | | Poor Water Quality | Manage water quality where Australian Grayling occurs to maintain waters free of significant levels of nutrient, sediment, pesticide and other pollutants, consistent with the ANZECC guidelines for water quality. |
| | Conservation Advice *Prototroctes maraena* Australian Grayling (TSSC, 2021) | | No explicit relevant objectives | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| **Black Rockcod** | Approved Conservation Advice for *Epinephelus daemelii* (Black Rock-cod) (DSEWPaC, 2012e) | • Vulnerable | No explicit relevant objectives | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| **Eastern Dwarf Galaxias** | National recovery plan for the Dwarf Galaxias (*Galaxiella pusilla*) (Saddlier et al., 2010) | • Endangered | No explicit relevant objectives | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| | Conservation Advice for *Galaxiella pusilla* (dwarf galaxias) (DCCEEW 2023a) | | | | |
| **Variegated Pygmy Perch** | National recovery plan for the Variegated Pygmy Perch (*Nannoperca* | • Vulnerable | No explicit relevant objectives | Climate Change | No explicit relevant management actions; climate change identified as a threat. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | *variegate)* (Saddlier and Hammer, 2010b) | | | | |
| **Yarra Pygmy Perch** | National recovery plan for the Yarry Pygmy Perch (*Nannoperca obscura*) (Saddlier and Hammer, 2010a) | • Endangered | No explicit relevant objectives | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| | Approved Conservation advice for *Nannoperca obscura* (Yarra pygmy perch) (DCCEEW, 2023b) | | | | |
| **Handfish** | Recovery Plan for Three Handfish Species: Spotted Handfish (*Brachionichthys hirsutus*), Red Handfish (*Thymichthys politus*), and Ziebell's Handfish (*Branchiopsilus ziebelli*) (CoA, 2015c) | Critically Endangered:<br>• Red Handfish<br>• Spotted Handfish<br>Vulnerable:<br>• Ziebell's Handfish | No explicit relevant objectives | Pollution and siltation of waterways | No explicit relevant management actions; pollution and siltation of waterways identified as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| | Approved Conservation Advice for *Thymichthys politus* (Red Handfish) (DSEWPaC, 2012f) | • Critically Endangered | No explicit relevant objectives | Habitat Degradation | Ensure there is no disturbance to areas where the red handfish occurs, excluding necessary actions to manage the conservation of the species.<br>Manage any known, potential or emerging threats including introduced species |
| **White Shark** | Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013) | • Vulnerable<br>• Migratory | 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:<br>Improving the population status leading to future removal of the white shark from the threatened species list of the EPBC Act | Habitat modification | No explicit relevant management actions; habitat modification identified as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change identified as a threat. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | Ensuring that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future.<br>The specific objectives of the recovery plan (relevant to industry) are:<br>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. | | |
| **Grey Nurse Shark (east coast population)** | Recovery Plan for the Grey Nurse Shark (*Carcharias Taurus*) (DoE, 2014a) | • Critically Endangered | The long-term objective of this recovery plan is to assist the recovery of the grey nurse shark in the wild, throughout its range in Australian waters, with an aim to improve its population status and ensure that anthropological activities do not hinder the recovery of the grey nurse shark.<br>The specific objectives of this recovery plan (relevant to industry) are:<br>Objective 8: Continue to identify and protect critical habitat to the survival of the grey nurse shark and reduce the impact of threatening processes within these areas. | Pollution | Review and assess the potential threats of introduced species, pathogens and pollutants. |
| | | | | Habitat Modification | Review the level and spatial extent of protection measures at key aggregation sites to ensure appropriate levels of protection, and a consistent approach to the designation and implementation of protective measures, are applied.<br>Use Biologically Important Areas (BIA) to help inform the development of appropriate conservation measures, including through the application of advice in the marine bioregional plans on the types of actions which are likely to have a significant impact on the species and updating such conservation measures as new information becomes available. |
| | | | | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| **Whale Shark** | Approved Conservation Advice for *Rhincodon typus* (Whale Shark) (TSSC, 2015k) | • Vulnerable<br>• Migratory | No explicit relevant objectives | Vessel Strike | Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | Pollution | No explicit relevant management actions; pollution (marine debris) identified as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| **Shorebirds and Seabirds** | | | | | |
| **Threatened Albatross and Petrel species** | National Recovery Plan for Albatrosses and Petrels (2022)<br>(DCCEEW, 2022e) | Endangered:<br>• Chatham Albatross<br>• Grey-headed Albatross<br>• Northern Royal Albatross<br>• Shy Albatross<br>• Gould's Petrel<br>• Southern Giant Petrel<br>Vulnerable:<br>• Antipodean Albatross<br>• Black-browed Albatross<br>• Buller's Albatross<br>• Campbell albatross<br>• Indian Yellow-nosed Albatross<br>• Northern Giant Petrel<br>• Salvin's Albatross | Overall objective:<br>To ensure the long-term survival and recovery of albatross and giant petrel populations breeding and foraging in Australian jurisdiction by reducing or eliminating human related threats at sea and on land.<br>Specific objectives:<br>Land-based threats to the survival and breeding success of albatrosses and giant petrels breeding within areas under Australian jurisdiction are quantified and reduced.<br>Marine-based threats to the survival and breeding success of albatrosses and giant petrels foraging in waters under Australian jurisdiction are quantified and reduced. | Marine pollution | Undertake, as feasible, monitoring of breeding colonies for marine debris, plastics and marine pollution impacts including, as a priority:<br>• Incidence of oiled birds at nest<br>• Effect of plastics and marine pollution<br>• Develop baseline measures of levels of heavy metals and persistent organic pollutants.<br>Risk-based response strategies are implemented where appropriate, for marine pollution incidents that have the potential to affect breeding populations. |
| | | | | Marine infrastructure interactions | No explicit relevant management actions; marine infrastructure interactions identified as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change identified as a threat. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | • Sooty Albatross<br>• Southern Royal Albatross<br>• White-capped Albatross | | | |
| **All Migratory Shorebirds** | Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015b) | N/A | 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. |
| | | | | Anthropogenic disturbance | Investigate the significance of cumulative impacts on migratory shorebird habitat and populations in Australia.<br>Ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes (specifically for coastal developments). |
| | | | | Climate Change | Investigate the impacts of climate change on migratory shorebird habitat and populations in Australia. |
| **All Seabirds** | Wildlife Conservation Plan for Seabirds (CoA, 2020) | N/A | 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. |
| | | | | Habitat loss and degradation from pollution | No explicit relevant management actions; identified as a threat. |
| | | | | Anthropogenic disturbance | Ensure all areas of important habitat for seabirds are considered in the development assessment process.<br>Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | Invasive species | Ensure seabirds are protected from the adverse effects of invasive species. |
| | | | | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| **Little Tern** | Conservation Advice for *Sternula albifrons* (little tern) (DCCEEW, 2025a) | • Vulnerable | The primary conservation objectives for the conservation advice are;<br>• Retain breeding colonies across the species' range by managing threats to the extent possible, including by facilitating breeding site re-positioning if needed, and achieve a stable or increasing population trend in both subpopulations.<br>Increase breeding success in existing breeding colonies in all range states through appropriate management of threats. | Climate Change | No explicit relevant management actions; climate change identified as a threat.<br>Disturbance to nesting birds by activities such as use of boats and jet skis close to shore identified as a threat. This is not applicable to the activities in this OPP. |
| **Sooty Shearwater** | Conservation Advice for *Ardenna grisea* (sooty shearwater).<br>(DCCEEW, 2023m) | • Vulnerable<br>• Migratory<br>• Marine | The primary conservation objectives for the conservation advice are;<br>• To increase the trend of Australian breeding population.<br>• The At-sea losses within Australia remain minimal. | Climate Change | No explicit relevant management actions; climate change identified as a threat. |
| **Australasian Bittern** | Approved Conservation Advice for *Botaurus poiciloptilus* (Australasian bittern)<br>(TSSC, 2019) | • Endangered | 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. |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| | National Recovery Plan for the Australasian Bittern (*Botaurus poiciloptilus*) (DCCEEW, 2022h). | | The objective of this recovery plan is to demonstrate, by 2032, an increasing trend (compared to 2020 baseline counts) in the number of mature individuals being recorded in annual surveys at key locations, and | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| | | | | Reduced water quality | No explicit relevant management actions; reduced water quality recognised as a threat. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | to ensure that habitat critical to the survival of the Australasian Bittern is protected and managed to meet the ecological requirements of the species. | | |
| **Red Knot** | Approved Conservation Advice for *Calidris canutus* (Red Knot) (DCCEEW, 2024a) | • Vulnerable<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of red knot throughout Australia (including habitat predicted to become habitat critical in the future because of climate change) | Acute Pollution | No explicit relevant management actions; oil pollution recognised as a threat. |
| | | | | Habitat loss, disturbance and modifications | Ensure that future development projects avoid any activities that disproportionately affect the upper tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies, and site managers |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Great Knot** | Conservation Advice for Calidris tenuirostris (great knot) (DCCEEW, 2024b) | • Vulnerable<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of red knot throughout Australia (including habitat predicted to become habitat critical in the future because of climate change) | Acute Pollution | No explicit relevant management actions; oil pollution recognised as a threat. |
| | | | | Habitat loss, disturbance and modifications | Ensure that future development projects avoid any activities that disproportionately affect the upper tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies, and site managers |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Curlew Sandpiper** | Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (DCCEEW, 2023q) | • Critically Endangered<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of curlew sandpiper throughout Australia (including habitat predicted to become habitat critical in the future because of climate change). | Acute and chronic pollution | No explicit relevant management actions; oil spill is recognised as a threat. |
| | | | | Habitat loss, disturbance and modifications | Ensure that future development projects avoid any activities that disproportionately affect the upper tidal flats and/or areas |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | | providing major foraging opportunities as identified by species experts, local studies, and site managers |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Sharp-tailed Sandpiper** | Approved Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper)<br>(DCCEEW, 2024c) | • Vulnerable<br>• Migratory<br>• Marine | Australian Objective:<br>Minimise further loss of habitat critical to the survival of the sharp-tailed sandpiper throughout Australia. | Habitat loss, degradation and fragmentation | Ensure that future development projects avoid any activities that disproportionately affect the upper-tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies and site managers. |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Terek Sandpiper** | Approved Conservation Advice for *Xenus cinereus* (Terek sandpiper)<br>(DCCEEW, 2024d) | • Vulnerable<br>• Migratory<br>• Marine | Australian Objective:<br>Minimise further loss of habitat critical to the survival of the terek sandpiper throughout Australia. | Habitat loss, degradation and fragmentation | Ensure that future development projects avoid any activities that disproportionately affect the upper-tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies and site managers. |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Greater Sand Plover** | Approved Conservation Advice for *Charadrius leschenaultia* (Greater Sand Plover)<br>(TSSC, 2016b) | • Vulnerable<br>• Migratory<br>• Marine | 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.<br>Protect important habitat in Australia. |
| | | | | Pollution and contamination | No explicit relevant management actions; pollution / contaminants recognised as a threat. |
| | | | | Introduced Species | No explicit relevant management actions; introduced species recognised as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Lesser Sand Plover** | Approved Conservation Advice for *Charadrius* | • Endangered | No explicit relevant objectives | Habitat loss and degradation | No explicit relevant management actions; |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | *mongolus* (Lesser Sand Plover)<br>(TSSC, 2016h) | • Migratory<br>• Marine | | | Habitat loss and degradation is identified as a threat. |
| | | | | Pollution/contamination impacts | No explicit relevant management actions; Climate Change is identified as a threat. |
| | | | | Introduced species | No explicit relevant management actions; Pollution/Contamination identified as a threat. |
| | | | | Direct mortality | No explicit relevant management actions; Disturbance identified as a threat. |
| | | | | Climate Change | No explicit relevant management actions; Direct morality is identified as a threat. |
| **Grey Plover** | Approved Conservation Advice for *Pluvialis squatarola* (grey plover)<br>(DCCEEW, 2024e) | • Vulnerable<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of grey plover throughout Australia (including habitat predicted to become habitat critical to survival in the future because of climate change). | Habitat Loss | Ensure that future development projects avoid any activities that disproportionately affect the upper tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies and site managers. |
| | | | | Climate Change | No explicit relevant management actions; Direct morality is identified as a threat. |
| **Blue Petrel** | Approved Conservation Advice for *Halobaena caerulea* (Blue Petrel)<br>(TSSC 2015b) | • Vulnerable<br>• Marine | No explicit relevant objectives | Habitat Loss, Disturbance and Modification | No explicit relevant management actions; habitat loss, disturbance and modification recognised as a threat. |
| **Nunivak Bar-tailed Godwit** | Conservation Advice for Limosa lapponica baueri (Alaskan bar-tailed godwit)<br>(DCCEEW, 2024j) | • Endangered | Minimise further loss of habitat critical to the survival of grey plover throughout Australia (including habitat predicted to become habitat critical to survival in the future because of climate change). | Habitat loss, degradation and fragmentation | Ensure that future development projects avoid any activities that disproportionately affect the upper-tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies and site managers. |
| | | | | Acute Pollution | No explicit relevant management actions; oil pollution recognised as a threat. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Eastern Curlew** | Approved Conservation Advice for *Numenius madagascariensis* (far eastern curlew) (DCCEEW, 2023r) | • Critically Endangered<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of far eastern curlew throughout Australia (including habitat predicted to become habitat critical in the future because of climate change). | Acute and chronic pollution | No explicit relevant management actions; oil spill is recognised as a threat. |
| | | | | Habitat loss, disturbance and modifications | Ensure that future development projects avoid any activities that disproportionately affect the upper tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies, and site managers |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Fairy Prion (southern)** | Approved Conservation Advice for *Pachyptila subantarctica* (Fairy Prion (southern)) (TSSC, 2015d) | • Vulnerable | No explicit relevant objectives | Habitat Loss, Disturbance and Modification | No explicit management actions; habitat loss, disturbance and modification recognised as a threat. |
| **Australian Painted Snipe** | Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) (DSEWPaC, 2013b) | • Endangered<br>• Marine | No explicit relevant objectives | Habitat loss disturbance and modifications | Habitat recovery actions are a priority. |
| | National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*) (DCCEEW, 2022g) | | By 2032, sustain a positive population trend (compared to 2020 baseline counts) in the number of mature individuals of the Australian Painted Snipe. | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Australian Fairy Tern** | Approved Conservation Advice for *Sternula nereis* (Australian Fairy Tern) (DSEWPaC, 2011) | • Vulnerable | 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. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | National Recovery Plan for *(Sternula nereis nereis)* (Australian Fairy Tern) (DAWE, 2020) | | 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. |
| | | | | Pollution | No explicit management actions; pollution recognised as a threat. |
| | | | | Climate variability and change | No explicit management actions; climate change recognised as a threat. |
| **Grey-headed Albatross** | Approved Conservation Advice for *Thalassarche Chrysostoma,* Greyheaded Albatross) (DEWHA, 2009) | • Endangered<br>• Migratory<br>• Marine | No explicit relevant objectives | Pollution | No explicit management actions; pollution recognised as a threat. |
| | | | | Entanglement in Marine Debris | No explicit management actions; marine debris recognised as a threat. |
| | | | | Climate Change | No explicit management actions; climate change recognised as a threat. |
| **Shy Albatross** | Conservation Advice *Thalassarche cauta* Shy Albatross (TSSC, 2020) | • Endangered<br>• Migratory<br>• Marine | Refer to objectives in the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2022 | Marine Pollution | No explicit management actions; marine pollution recognised as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Hooded Plover (eastern)** | Approved Conservation Advice for *Thinornis rubricollis* (Hooded Plover, Eastern) (TSSC, 2014) | • Vulnerable<br>• Marine | Primary Conservation Objectives:<br>Achieve stable numbers of adults in the population, and maintain a stable number of occupied and active breeding territories<br>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. |
| | | | | Entanglement and Ingestion of Marine Debris | Reduce in-shore marine debris |
| | | | | Invasive Species | No explicit management actions; invasive species recognised as a threat. |
| | | | | Climate Change | No explicit management actions; climate change recognised as a threat. |
| **Gould's Petrel** | Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan | • Endangered | The overall objective of the Gould's Petrel recovery effort is for Gould's | None identified | NA |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | (DEC, 2006) | | Petrel to be down listed from endangered to vulnerable by 2011.<br>Specific recovery objectives are:<br>To identify and manage the threats operating at sites where the subspecies occurs | | |
| **Herald Petrel** | Conservation Advice *Pterodroma heraldica* (Herald petrel)<br>(TSSC, 2015l) | • Critically Endangered | No explicit relevant objectives | None identified | NA |
| **Soft-plumage Petrel** | Approved Conservation Advice for *Pterodroma mollis* (Soft-plumaged Petrel)<br>(TSSC, 2015g) | • Vulnerable<br>• Marine | No explicit relevant objectives | None identified | NA |
| **Kermadec Petrel (western)** | Lord Howe Island Biodiversity Management Plan (Department of Environment and Climate Change (DECC), 2008) | • Vulnerable | No explicit relevant objectives | None identified | NA |
| | Norfolk Island Region Threatened Species Recovery Plan<br>(DEWHA, 2010c) | | No explicit relevant objectives | None identified | NA |
| **White-bellied Storm Petrel (Tasman Sea)** | Lord Howe Island Biodiversity Management Plan (Department of Environment and Climate Change (DECC), 2008) | • Vulnerable | No explicit relevant objectives | None identified | NA |
| **Swift Parrot** | National Recovery Plan for the *Lathamus discolour* (swift parrot)<br>(DCCEEW, 2024m) | • Critically Endangered<br>• Marine | By 2032, anthropogenic threats to Swift Parrot are demonstrably reduced. | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | Conservation Advice *Lathamus discolor* Swift Parrot (TSSC, 2016d) | | No explicit relevant objectives | None identified | NA |
| **Orange-bellied Parrot** | National Recovery Plan for the Orange-bellied Parrot (*Neophema chrysogaster*) (DELWP, 2016) | • Critically Endangered<br>• Marine | 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:<br>Objective 1. To achieve a stable or increasing population in the wild within five years.<br>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.<br>Objective 3. To protect and enhance habitat to maintain, and support growth of, the wild population.<br>Objective 4. To ensure effective adaptive implementation of the plan. | Habitat degradation and modification | • Retain habitat<br>• Manage threats to habitat quality<br>• Monitor the wild population and habitat |
| | | | | Barriers to migration and movement | Assess and manage the risks from development proposals that may represent a barrier to migration or movement. |
| | | | | Climate Change | No explicit relevant management actions; climate change impacts recognised as a threat. |
| **Grey Falcon** | Conservation Advice *Falco hypoleucos* Grey Falcon (TSSC, 2020b) | • Vulnerable | No explicit relevant objectives | Climate Change | No explicit relevant management actions; climate change impacts recognised as a threat. |
| **White-throated Needletail** | Conservation Advice *Hirundapus caudacutus* White-throated Needletail (TSSC, 2019b) | • Vulnerable<br>• Migratory<br>• Marine | No explicit relevant objectives | NA | NA |
| **Common Greenshank** | Conservation Advice for *Tringa nebularia* (common greenshank) | • Endangered<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of common greenshank throughout Australia (including habitat predicted to become habitat critical to | Habitat loss, degradation and fragmentation | Ensure that future development projects avoid any activities that disproportionately affect the upper-tidal flats and/or areas providing major foraging opportunities as |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | (DCCEEW, 2024f) | | the survival of the species in the future because of climate change). | | identified by species experts, local studies and site managers. |
| | | | | Acute Pollution | No explicit relevant management actions; acute pollution recognised as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Black-tailed Godwit** | Conservation Advice for *Limosa limosa* (black-tailed godwit).<br>(DCCEEW, 2024g) | • Endangered<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of common greenshank throughout Australia (including habitat predicted to become habitat critical to the survival of the species in the future because of climate change). | Habitat loss, degradation and fragmentation | Ensure that future development projects avoid any activities that disproportionately affect the upper-tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies and site managers. |
| | | | | Acute Pollution | No explicit relevant management actions; acute recognised as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Latham's Snipe** | Conservation Advice for *Gallinago hardwickii* (Latham's snipe)<br>(DCCEEW, 2024h) | • Vulnerable<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of common greenshank throughout Australia (including habitat predicted to become habitat critical to the survival of the species in the future because of climate change). | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Ruddy Turnstone** | Conservation Advice for *Arenaria interpres* (ruddy turnstone)<br>(DCCEEW, 2024i) | • Vulnerable<br>• Migratory<br>• Marine | Minimise further loss of habitat critical to the survival of common greenshank throughout Australia (including habitat predicted to become habitat critical to the survival of the species in the future because of climate change). | Habitat loss, degradation and fragmentation | Ensure that future development projects avoid any activities that disproportionately affect the upper-tidal flats and/or areas providing major foraging opportunities as identified by species experts, local studies and site managers. |
| | | | | Acute Pollution | No explicit relevant management actions; acute recognised as a threat. |
| | | | | Climate Change | No explicit relevant management actions; climate change recognised as a threat. |
| **Blue-winged Parrot** | Conservation Advice for *Neophema chrysostoma* | • Vulnerable<br>• Marine | No explicit relevant objectives | NA | NA |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | (blue-winged parrot) (DCCEEW, 2023d) | | | | |
| **King Island Brown Thornbill** | Conservation Advice for *Acanthiza pusilla magnirostris* (King Island brown thornbill) (DCCEEW, 2023e) | • Endangered | No explicit relevant objectives | NA | NA |
| | King Island Biodiversity Management Plan (DPIPWE, 2012) | | No explicit relevant objectives | NA | NA |
| **King Island Scrubtit** | Conservation Advice for *Acanthornis magna greeniana* (King Island scrubtit) (DCCEEW, 2023f) | • Critically Endangered | No explicit relevant objectives | NA | NA |
| | King Island Biodiversity Management Plan (DPIPWE, 2012) | | No explicit relevant objectives | NA | NA |
| **Regent Honeyeater** | National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (DoE, 2016) | • Critically Endangered | No explicit relevant objectives | NA | NA |
| | Conservation Advice *Anthochaera phrygia* regent honeyeater (TSSC, 2015h) | | No explicit relevant objectives | NA | NA |
| **Southern Whiteface** | Conservation Advice for *Aphelocephala leucopsis* (southern whiteface) (DCCEEW, 2023g) | • Vulnerable | No explicit relevant objectives | NA | NA |
| **Tasmanian Wedge-tailed Eagle** | Threatened Tasmanian Eagles Recovery Plan 2006-2010 | • Endangered | Minimising both the modification of foraging habitat and the occurrence of human-related mortality with the | Pollution; specifically oiling | No explicit relevant management actions; oiling recognised as a threat. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | (Threatened Species Section, 2006) | | ultimate goal of an increase in the population size and stability | | |
| **Gang-gang Cockatoo** | Conservation Advice for *Callocephalon fimbriatum* (Gang-gang Cockatoo) (DAWE, 2022) | • Endangered | No explicit relevant objectives | NA | NA |
| **South-eastern Red-tailed Black-Cockatoo** | National Recovery Plan for the South-Eastern Red-tailed Black-Cockatoo *Calyptorhynchus banksii graptogyne* (CoA, 2007) | • Endangered | No explicit relevant objectives | NA | NA |
| **South-eastern Glossy Black-Cockatoo** | Conservation Advice for *Calyptorhynchus lathami lathami* (South-eastern Glossy Black Cockatoo) (DCCEEW, 2022d) | • Vulnerable | No explicit relevant objectives | NA | NA |
| **Tasmanian Azure Kingfisher** | Conservation Advice for *Ceyx azureus diemenensis* (Tasmanian Azure Kingfisher) (DEWHA, 2010a) | • Endangered | No explicit relevant objectives | Habitat Loss, Disturbance and modification | Minimise disturbance to terrestrial and aquatic components of the Tasmanian Azure Kingfisher's habitat in areas where the subspecies occurs, including necessary actions to manage the conservation of the subspecies. |
| **Brown Treecreeper (south-eastern)** | Conservation Advice for *Climacteris picumnus victoriae* (brown treecreeper (south-eastern)) (DCCEEW, 2023o) | • Vulnerable | No explicit relevant objectives | NA | NA |
| **Eastern Bristlebird** | National Recovery Plan for Eastern Bristlebird *Dasyornis brachypterus* (CoA, 2022c) | • Endangered | No explicit relevant objectives | NA | NA |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| **Painted Honeyeater** | Conservation Advice *Grantiella picta* painted honeyeater (TSSC, 2015i) | • Vulnerable | No explicit relevant objectives | NA | NA |
| | National Recovery Plan for the Painted Honeyeater (*Grantiella picta*) (DAWE, 2021a) | | No explicit relevant objectives | NA | NA |
| **Malleefowl** | National recovery plan for Malleefowl (*Leipoa ocellata*) (Benshmesh, 2007) | • Vulnerable | No explicit relevant objectives | NA | NA |
| **South-eastern Hooded Robin** | Conservation Advice for *Melanodryas cucullata cucullata* (hooded robin (south-eastern)) (DCCEW, 2023i) | • Endangered | No explicit relevant objectives | NA | NA |
| **Plains-wanderer** | Conservation Advice *Pedionomus torquatus* (plains-wanderer) (TSSC, 2015j) | • Critically Endangered | No explicit relevant objectives | NA | NA |
| | National Recovery Plan for the Plains-wanderer (*Pedionomus torquatus*) (CoA, 2016) | | No explicit relevant objectives | NA | NA |
| **Night Parrot** | Conservation Advice *Pezoporus occidentalis* night parrot (TSSC, 2016i) | • Endangered | No explicit relevant objectives | NA | NA |
| **Green Rosella (King Island)** | Conservation Advice *Platycercus caledonicus brownii* green rosella (King Island) (TSSC, 2015m) | • Vulnerable | No explicit relevant objectives | NA | NA |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| **Pilotbird** | Conservation Advice for *Pycnoptilus floccosus* (Pilotbird)<br>(DAWE, 2022a) | • Vulnerable | No explicit relevant objectives | NA | NA |
| **Diamond Firetail** | Conservation Advice for *Stagonopleura guttata* (diamond firetail)<br>(DCCEEW, 2023j) | • Vulnerable | No explicit relevant objectives | NA | NA |
| **Black Currawong (King Island)** | Conservation Advice *Strepera fuliginosa colei* black currawong (King Island)<br>(TSSC, 2015n) | • Vulnerable | No explicit relevant objectives | NA | NA |
| **Masked Owl (Tasmanian)** | Conservation Advice for *Tyto novaehollandiae castanops* (Tasmanian Masked Owl)<br>(DEWHA, 2010b) | • Vulnerable | No explicit relevant objectives | NA | NA |
| **Marine Turtles** | | | | | |
| **All Marine Turtles** | Recovery Plan for Marine Turtles in Australia, 2017 – 2027<br>(CoA, 2017) | Endangered:<br>• Loggerhead turtle<br>• Leatherback turtle<br>• Vulnerable:<br>• Green turtle<br>• Flatback turtle<br>• Hawksbill turtle | Long-term recovery objective:<br>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.<br>Interim objective 3:<br>Anthropogenic threats are demonstrably minimised. | Chemical and Terrestrial Discharge | Minimise chemical and terrestrial discharge into marine turtle habitat. |
| | | | | Marine debris | Reduce the impacts from marine debris:<br>Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life. |
| | | | | Noise interference | Assess and address anthropogenic noise:<br>Understand the impacts of anthropogenic noise on marine turtle behaviour and biology. |
| | | | | Light interference | Minimise light pollution:<br>Artificial light within or adjacent to habitat critical to the survival of marine turtles will |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | | be managed such that marine turtles are not displaced from these habitats.<br>Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches.<br>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. |
| | | | | Habitat modification | Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival.<br>Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue. |
| | | | | Climate Change and variability | Adaptively manage turtle stocks to reduce risk and build resilience to climate change and variability:<br>Continue to meet Australia's international commitments to address the causes of climate change.<br>Identify, test and implement climate-based adaptation measures. |
| **Leatherback Turtle** | Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle)<br>(DEWHA, 2008) | • Endangered<br>• Migratory<br>• Marine | No explicit relevant objectives | Boat strike | No explicit relevant management actions; vessel strikes identified as a threat. |
| | | | | Habitat degradation (changes to breeding sites and degradation to foraging areas) | Identify and protect migratory corridors between nesting beaches and common foraging areas to facilitate colonization. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | Marine debris | No explicit relevant management actions; marine debris identified as a threat. |
| **Cetaceans** | | | | | |
| **Sei Whale** | Approved Conservation Advice for *Balaenoptera borealis* (Sei Whale)<br>(TSSC, 2015e) | • Vulnerable<br>• Migratory | 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:<br>Develop a national vessel strike strategy that investigates the risk of vessel strikes on Sei Whales and also identifies potential mitigation measures.<br>Ensure all vessel strike incidents are reported in the National Vessel Strike Database. |
| | | | | 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). |
| | | | | Habitat degradation | No explicit relevant management actions; habitat degradation identified as a threat. |
| | | | | Pollution (persistent toxic pollutants) | No explicit relevant management actions; pollution identified as a threat. |
| | | | | Climate and Oceanographic Variability and Change | Understanding impacts of climate variability and change:<br>Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica. |
| **Fin Whale** | Approved Conservation Advice for *Balaenoptera physalus* (Fin Whale) | • Vulnerable<br>• Migratory | Determine population abundance, trends and population structure for fin whales, and establish a long-term | Vessel disturbance | Develop a national vessel strike strategy that investigates the risk of vessel strikes on Fin Whales and identifies potential mitigation measures. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | (TSSC, 2015f) | | monitoring program in Australian waters. | | Ensure all vessel strike incidents are reported in the National Vessel Strike Database. |
| | | | | Noise interference | Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development). |
| | | | | Habitat degradation | No explicit relevant management actions; habitat degradation identified as a threat. |
| | | | | Pollution (persistent toxic pollutants) | No explicit relevant management actions; pollution identified as a threat. |
| | | | | Climate and Oceanographic Variability and Change | Understanding impacts of climate variability and change:<br>Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica |
| **Blue Whale** | Conservation Management Plan for the Blue Whale, 2015-2025<br>(DoE, 2015a) | • Endangered<br>• Migratory | The long-term recovery objective is to minimise anthropogenic threats to allow the conservation status of the Blue Whale to improve so that it can be removed from the threatened species list under the EPBC Act. | Noise interference | Assess and address anthropogenic noise: shipping, industrial and seismic noise. |
| | | | | Vessel disturbance | Minimise vessel collisions:<br>Develop a national vessel strike strategy that investigates the risk of vessel strike on blue whales and also identifies potential mitigation measures.<br>Ensure all vessel strike incidents are reported in the National Ship Strike Database.<br>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, |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | | appropriate mitigation measures are implemented. |
| | | | | Habitat modification | No explicit relevant management actions; habitat modification identified as a threat. |
| | | | | Climate Change | Understanding impacts of climate variability and change:<br>Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica. |
| | | | | Marine Debris | No explicit relevant management actions; marine debris identified as a threat. |
| **Southern Right Whale** | National Recovery Plan for the Southern Right Whale *Eubalaena australis* (DCCEEW, 2024l) | • Endangered<br>• Migratory | Long term recovery objective:<br>The population has increased in size to a level that the conservation status has improved, and the species no longer qualifies for listing as threatened under any of the EPBC Act listing criteria.<br>Interim Recovery Objective 2:<br>Anthropogenic threats are managed consistent with ecologically sustainable development principles to facilitate recovery of southern right whales<br>Target 2.1:<br>Robust and adaptive management principles are implemented to reduce anthropogenic threats to southern right whales in Australian waters and minimise the risk of mortality, injury, auditory impairment, or disturbance to biologically important behaviours from anthropogenic activities.<br>Target 2.2: | Vessel interaction | Manage, minimise, and mitigate the threat of vessel strike:<br>1. Assess the risk of vessel strike to southern right whales in BIAs.<br>3. Ensure environmental impact assessments and associated plans consider and quantify the risk of vessel strike and associated potential cumulative risks in BIAs and habitat critical to the survival (HCTS) of the species.<br>5. Ensure all vessel strike incidents are reported in the National Ship Strike Database managed through the Australian Marine Mammal Centre, Australian Antarctic Division. |
| | | | | Noise interference | Assess, manage, and mitigate impacts from anthropogenic noise:<br>2. Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that it does not prevent any southern right whale from utilising the area or cause auditory impairment. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | Management decisions are supported by high quality information and scientific data, and high priority research areas identified in the Recovery Plan to deliver this information are supported through national and/or state funding programs and conservation planning. | | 3. Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that the risk of behavioural disturbance is minimised.<br>4. Ensure environmental assessments associated with underwater noise generating activities include consideration of national policy (e.g., EPBC Act Policy Statement 2.1) and guidelines related to managing anthropogenic underwater noise and implement appropriate mitigation measures to reduce risks to southern right whales to the lowest possible level<br>5. Quantify risks of anthropogenic underwater noise to southern right whales. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | Habitat modification | Address habitat degradation impacts from coastal and offshore marine infrastructure developments:<br>1.Coastal and offshore development actions are assessed according to principles of ecological sustainable development to ensure the risk of injury, auditory impairment and/or disturbance to southern right whales is minimised.<br>2. Baseline surveys and monitoring undertaken during activity implementation are conducted in accordance with best practice standards and guidelines to ensure standardised datasets are obtained and suitable to inform environmental management decision making that can reduce the risk of threats to southern right whales.<br>3. Current information on species' occurrence, particularly in HCTS, BIAs, and historic high use areas, are used to inform planning, assessment, and decision-making on marine infrastructure development actions. |
| | | | | Entanglement (marine debris) | No explicit relevant management actions; entanglement identified as a threat. |
| | | | | Pollution | No explicit relevant management actions; pollution identified as a threat. |
| | | | | Cumulative effects from threats | No explicit relevant management actions; cumulative effects identified as a threat. |
| | | | | Climate Change | Understand impacts of climate variability and anthropogenic climate change on the species biology and population recovery:<br>1. Continue to meet Australia's international commitments to address |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | | | causes of climate change, including greenhouse gas emissions. |
| **Pinnipeds** | | | | | |
| **Australian Sea Lion** | Conservation Advice for the *Neophoca cinerea* (Australian sea lion)<br>(TSSC, 2020c) | • Endangered<br>• Marine | Primary conservation actions:<br>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.<br>Control access to breeding colonies to minimise the impacts of disturbance on Australian Sea Lions. |
| | | | | Marine debris | Assess the impacts of marine debris on Australian Sea Lion populations and identify the sources of marine debris which have an impact.<br>Develop and implement measures to mitigate the impacts of marine debris on the species (including reducing the amount of these marine debris entering the oceans), noting linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life. |
| | | | | Disease and parasites | Improve human wastewater management to minimise dispersal of bacteria, parasites and pollutants into the marine environment. |
| | | | | Habitat degradation and pollution (oil spills) | Require all vessels to have oil spill mitigation measures in place and implement jurisdictional oil spill response strategies as required. |
| | | | | 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. |
| | | | The overarching objective of this recovery plan is to halt the decline and | Vessel strike | Collect data on direct killings and confirmed vessel strikes. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (CoA, 2013a) | | 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:<br>Improving the population status leading to the future removal of the Australian sea lion from the threatened species list of the EPBC Act<br>Ensuring that anthropogenic activities do not hinder recovery in the near future or impact on the conservation status of the species in the future. | Marine debris | Identify the sources of marine debris having an impact on Australian sea lion populations.<br>Assess the impacts of marine debris on Australian sea lion populations.<br>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. |
| | | | | Pollution and oil spills | Implement jurisdictional oil spill response strategies as required. |
| | | | | Habitat degradation | No explicit management actions; habitat degradation recognised as a threat. |
| | | | | Disease | No explicit management actions; disease and pathogens recognised as a threat. |
| | | | | Climate Change | No explicit management actions; climate change recognised as a threat. |
| **Southern Elephant Seal** | Conservation Advice Mirounga leonina southern elephant seal (TSSC, 2016f) | • Vulnerable<br>• Marine | Continue high levels of protection for the southern elephant seal in important breeding, foraging and haul-out sites.<br>Assess the impacts of disturbance, pollution and associated risks of disease on the health status of southern elephant seals | Climate and oceanographic variability and change | Improve knowledge of climate and oceanographic variability, including El Niño events, that affect southern elephant seal foraging and reproductive success. |
| | | | | Pollution (including marine debris) | Continue, and where necessary adapt, management actions to reduce disturbance and pollution/marine debris impacts on southern elephant seals and their important breeding, foraging and resting habitats |
| | Sub-Antarctic Fur-seal and Southern Elephant Seal Recovery Plan (Department of the Environment and Heritage (DEH), 2003) | | To maintain existing levels of protection for the Sub-antarctic Fur and Southern Elephant seals to enable population growth so that these species may be removed from the threatened species list under the | None identified | NA |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | EPBC Act, and to ensure that any future anthropogenic impacts are not limiting. | | |
| **Threatened Ecological Communities** | | | | | |
| **Giant Kelp Marine Forests of Southeast Australia** | Approved Conservation Advice for Giant Kelp Marine Forests of Southeast Australia (DSEWPaC, 2012b) | • Endangered | No explicit relevant objectives | Invasive species | No explicit management actions; invasive species recognised as a threat. |
| | | | | Climate Change | No explicit management actions; climate change recognised as a threat. |
| **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 (DoE, 2015b) | • Critically Endangered | No explicit relevant objectives | None identified | NA |
| **Subtropical and Temperate Coastal Saltmarsh** | Conservation Advice for Subtropical and Temperate Coastal Saltmarsh (DSEWPaC, 2013c) | • Vulnerable | 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. |
| | | | | Invasive Species | No explicit management actions; invasive species recognised as a threat. |
| | | | | Climate Change | No explicit management actions; climate change recognised as a threat. |
| **Assemblages of species associated with open-coast salt-wedge estuaries** | Approved Conservation Advice (including Listing Advice) for the Assemblages of species associated with open-coast salt-wedge estuaries of | • Endangered | The conservation objective is to mitigate the risk of extinction of the Salt-wedge Estuaries ecological community, assist recovery and maintain its biodiversity and function. | Land use and associated decline in water quality | Apply recommended buffers around the ecological community and avoid activities that could cause significant change to hydrology or water quality. |
| | | | | Invasive species | No relevant management actions; invasive species recognised as a threat. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| **of western and central Victoria** | western and central Victoria ecological community (DoEE, 2018a) | | | Extractive and recreational activities | No explicit management actions; Extractive and recreational activities recognised as a threat. |
| | | | | Climate Change | Enhance the resilience of the ecological community to the impacts of climate change by reducing other pressures. |
| **River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria** | Conservation Advice for the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (DAWE, 2020a) | • Critically Endangered | To mitigate the risk of extinction of the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria. | Climate change | No explicit management actions; climate change recognised as a threat. |
| **Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland** | Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community (DoEE, 2018b) | • Endangered | To mitigate the risk of extinction of Coastal Swamp Oak Forest, and help recover its biodiversity and function | Climate Change | No explicit management actions; climate change recognised as a threat. |
| **Other relevant species** | | | | | |
| **Vertebrate Species** | The Threat Abatement Plan for the impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Ocean (CoA, 2018) | N/A | There are four main objectives:<br>Contribute to the long-term prevention of the incidence of harmful marine debris<br>Remove existing harmful marine debris from the marine environment<br>Mitigate the impacts of harmful marine debris on marine species and ecological communities<br>Monitor the quantities, origins and impacts of marine debris and assess the effectiveness of management | 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. |

| Species | Plan/ Advice | Protection under EPBC Act | Relevant objectives | Threats identified relevant to the activity | Relevant conservation actions |
|---|---|---|---|---|---|
| | | | arrangements over time for the strategic reduction of debris. | | |

*Table 2-4: Guidance on 'Key Terms' within the Blue Whale Conservation Management Plan (CMP) and how it is applied in this OPP*

| Relevant Plan/Advice | Description |
|---|---|
| **Recovery Plans** | The CMP for the Blue Whale (DoE, 2015b) has been treated as a recovery plan (under the EPBC Act) throughout the EP. |
| **Recovery Plan actions** | Actions identified in the CMP for the Blue Whales (DoE, 2015b) have been considered in the assessment of impacts and determination of acceptability of potential impacts to blue whale within this OPP. |
| **Biologically Important Areas (BIAs)** | BIAs for blue whale, CMP for the Blue Whale (DoE, 2015b), are described in this OPP |
| **Legal requirement - Action A.2.3. from the Blue Whale CMP:**<br>"*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*".<br>**Further, the DAWE key terms state:**<br>'*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 this OPP.<br>In the assessment of underwater sound emissions, Cooper Energy has taken a conservative approach by using underwater noise modelling to predict areas of potential disturbance to blue whales to assess the potential impact. These potential impacts will be managed to reduce the risk of blue whale injury and/or displacement within foraging BIA through the implementation of control measures such as work program specific adaptive management approaches based on modelled predictions, EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales: Industry Guidelines, and EPBC Part 8 Division 8.1 interacting with cetaceans. Adaptive management approaches will be designed into the work programs, suitable to the nature and scale, spatial and temporal overlap of each individual activity, such that the risk of injury and displacement are reduced so that the foraging behaviour of any blue whale should not be impacted. |
| **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 in this OPP |
| **Definition of 'injury to Blue Whale'** | Injury has been defined as permanent threshold shift (PTS) and temporary threshold shift (TTS) throughout the assessment of underwater sound emissions in this OPP |

### 2.1.3 Additional Relevant Commonwealth and State Legislation, Policies and Guidelines

In addition to the OPGGS and EPBC Acts there are other Commonwealth and State legislation (Table 2-5) as well as policies and guidelines (Table 2-6) which are relevant to the East Coast Project.

*Table 2-5: Relevant Commonwealth and State Legislation*

| Legislation / Regulation | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* | The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (ATSIHP Act) is Commonwealth legislation that can be used by Aboriginal and Torres Strait Islander people to make applications to protect places and objects from injury or desecration. The places or objects in question must be of particular significance in accordance with Aboriginal tradition. | Areas or objects protected under this Act may be present within the operational area and EMBA. | DCCEEW |
| *Air Navigation Act 1920* | This Act is responsible for managing navigation within the avian environment. | Helicopter and other aircraft activities occurring throughout all phases of the project are required to abide to the requirements of this Act. | Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) |
| *Australian Heritage Council Act 2003* | This Act was formed to establish the Australian Heritage Council and associated functions. The act also classifies areas that have heritage value, including those identified on the Commonwealth Heritage List, World Heritage List and National Heritage List. | The Act applies to any activities that may occur within an area that may have associated heritage values. | DCCEEW |
| *Australian Maritime Safety Authority Act 1990* | The main objects of this Act are:<br>• to promote maritime safety; and to protect the marine environment from:<br>  ○ pollution from ships; and<br>  ○ other environmental damage caused by shipping; and<br>• to provide for a national search and rescue service; and<br>• to promote the efficient provision of services by the Authority.<br>In Commonwealth waters AMSA is the Statutory Agency for vessels and must be notified of all incidents involving a vessel.<br>In Commonwealth waters AMSA is the Control Agency for all ship-sourced marine pollution | The Act is applicable to all incidents that may occur within Commonwealth waters during the East Coast Project which require AMSA to lead or support the response to pollution in the marine environment. | AMSA |

| Legislation / Regulation | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| | incidents and will respond in accordance with the National Plan for Maritime Environmental Emergencies.<br>Under the National Plan AMSA support oil spill response for non-ship sourced pollution incidents on the formal request of the respective incident controller. | | |
| *Australian Radiation Protection and Nuclear Safety Act 1998* | This Act aims to protect the health and safety of people and the environment from radiation effects. | The use of radioactive material (e.g. during formation evaluation) must comply with the Act. | Department of Health and Aged Care (DoHAC) |
| *Biosecurity Act 2015*<br>(& Regulations 2016) | The objects of this Act are:<br>(a) to provide for managing the following:<br>(i) biosecurity risks;<br>(ii) the risk of contagion of a listed human disease;<br>(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;<br>(iv) risks related to ballast water;<br>(v) biosecurity emergencies and human biosecurity emergencies;<br>(b) to give effect to Australia's international rights and obligations, including under the International Health Regulations, the Sanitary and Phytosanitary Agreement and the Biodiversity Convention. | The Biosecurity Act and regulations apply to 'Australian territory' which is the airspace over and the coastal seas out to 12 nm from the coastline.<br>Provides regulations for the vessels used during the East Coast Project regarding ballast water and biofouling. | Department of Agriculture, Fisheries and Forestry (DAFF) |
| *Climate Change Act 2022 (Cwth)* | This Act sets out Australia's greenhouse gas emissions reduction targets.<br>As the Nationally Determined Contribution (NDC) are at the heart of the Paris Agreement, NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. Australia's emissions reduction targets include:<br>• Reduce greenhouse gas emissions to 43% below 2005 levels by 2030.<br>• Reach net zero by 2050 | Activities within this OPP will be conducted in a manner consistent with Australia's GHG emission reduction targets. | Commonwealth Government |
| *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) | The Act aims to:<br>Protect matters of national environmental significance (MNES); | Petroleum activities are excluded from within the boundaries of a World Heritage Area (Sub regulation 10A(f). | DCCEEW |

| Legislation / Regulation | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| *(and Regulations 2000)* | Provides for Commonwealth environmental assessment and approval processes; and<br>Provides an integrated system for biodiversity conservation and management of protected areas.<br>MNES are:<br>• World heritage properties;<br>• RAMSAR wetlands;<br>• Listed threatened species and communities;<br>• Migratory species under international agreements;<br>• Nuclear actions,<br>• Commonwealth marine environment;<br>• Great Barrier Reef Marine Park; and<br>• Water trigger for coal seam gas and coal mining developments.<br>For offshore petroleum activities, the assessment process is overseen by NOPSEMA as the delegated authority under the EPBC Act. | The activity is not within a World Heritage Area.<br>The OPP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these.<br>Section 6 describes matters protected under Part 3 of the EPBC Act.<br>The OPP must assess any actual or potential impacts or risks to MNES from the activity.<br>Part 8 of the regulations establish caution zones and actions to avoid interfering with cetaceans. | |
| *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 remains on the seabed following decommissioning during the East Coast Project. This is not the base case for planning purposes. | DCCEEW |
| *Hazardous Waste (Regulation of Exports and Imports) Act 1989* | To ensure the management of Australia's hazardous waste is exported, imported and transited in and environmentally sound manner. | The Basel Convention is implemented in Australia by the Act. | DCCEEW |
| *Industrial Chemicals (Notification and Assessment Act) 1989* | This Act enforces restrictions on using particular chemicals that may have detrimental and harmful effects on health and the environment and creates a national register if chemicals used in the industry. | Where relevant, chemicals used during the project will be considered under the requirements of this Act prior to use. | DoHAC |
| *Industrial Chemicals Environmental Management (Register) Act 2021 (ICEMR Act)* | The Act establishes the Industrial Chemicals Environmental Management Standard (IChEMS) to manage environmental risks from industrial chemicals, including the IChEMS Register which lists chemicals and assigns risk management measures. | Management measures identified under IChEMS may have implications for the import and use of particular chemicals and products for the petroleum activity (e.g. fire-fighting foams). | DCCEEW |
| *National Greenhouse and Energy Reporting Act 2007* (NGER | A national framework for reporting and disseminating company information about greenhouse gas emissions, energy production and energy | Activities associated with the project will result in the generation of atmospheric emissions and greenhouse gases. Requirements of the Act must be adhered to | The Clean Energy Regulator |

| Legislation / Regulation | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| Act) *(and NGER Regulations 2008)* | consumption. It is administered by the Clean Energy Regulator. | including energy and greenhouse gas reporting. Cooper Energy will report information in accordance with the Regulations. | |
| National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cwth) | Key statutory instruments for regulating Australia's GHG emissions in line with Australia's NDCs under the Paris Agreement | The Safeguard Mechanism was developed to ensure that Australia's largest GHG emitters keep their net emissions below an emission baseline. The Safeguard Mechanism currently applies to facilities that emit more than 100,000 t $CO_2$-e per annum which may be the case of East Coast Project for some years. | Commonwealth Government |
| *Navigation Act 2012* | Regulates international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters including:<br>• vessel survey and certification<br>• construction standards<br>• crewing<br>• seafarers' qualifications and welfare<br>• occupational health and safety<br>• carriage and handling of cargoes<br>• passengers<br>• marine pollution prevention<br>• monitoring and enforcement activities.<br>It gives effect to the relevant international conventions (MARPOL 73/78, COLREGS 1972) relating to maritime issues to which Australia is a signatory.<br>The Act also has subordinate legislation contained in Regulations and Marine Orders. | All ships involved in petroleum activities, such as the East Coast Project, in Australian waters are required to abide to the requirements under this Act.<br>Several Marine Orders (MO) are enacted under this Act which relate to offshore petroleum activities, including:<br>MO 21: Safety and emergency arrangements<br>MO 27: Safety of navigation and radio equipment<br>MO 28: Operations standards and procedures<br>MO 30: Prevention of collisions<br>MO 31: SOLAS and non-SOLAS certification<br>MO 47: Offshore industry units<br>MO 60: Offshore floating facilities<br>MO 71: Masters and deck officers | AMSA |
| *Offshore Petroleum and Greenhouse Gas Storage (OPGGS) Act 2006*<br>Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (OPGGS(E)R 2023 | 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.<br>Part 4 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:<br>• 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). | NOPSEMA |

| Legislation / Regulation | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| | Requirements and regulations are described in Section 2.1.1. | • So that environmental impacts and risks of the activity are reduced to ALARP.<br>• So that environmental impacts and risks of the activity are of an acceptable level. | |
| *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* | This aims to control and reduce the manufacturing, import and export of substances that deplete the ozone layer and synthetic greenhouse gases. | This Act will apply to Cooper Energy as the company manufactures, imports or exports these kinds of substances. | DCCEEW |
| *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.<br>Requires ships greater than 400 gross tonnes to have pollution emergency plans in place and provides for emergency discharges from ships.<br>The Act requires an approved Shipboard Oil Pollution Emergency Plan (SOPEP) and/or Shipboard Marine Pollution Emergency Plan (or equivalent, according to class) that describes emergency response activities. | All ships involved in the East Coast Project are required to abide to the requirements under this Act.<br>Several MOs are enacted under this Act relating to offshore petroleum activities, including:<br>MO Part 91: Marine Pollution Prevention – Oil<br>MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances<br>MO Part 94: Marine Pollution Prevention – Packaged Harmful Substances in Packaged Forms<br>MO Part 95: Marine Pollution Prevention – Garbage<br>MO Part 96: Marine Pollution Prevention – Sewage<br>MO Part 97: Marine Pollution Prevention – Air Pollution<br>MO Part 98: Marine Pollution Prevention – Anti-fouling Systems. | AMSA |
| *Protection of the Sea (Harmful Antifouling Systems) Act 2006* | The Act aims to protect the marine environment from the effects of harmful antifouling systems.<br>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.<br>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.<br>The Marine Order MO 98: Marine Pollution Prevention – Anti-fouling Systems is enacted under this Act. | AMSA |
| *Radiation Act 2005 (Vic)* | The purpose of this Act is to protect the health and safety of persons and the environment from the harmful effects of radiation | Handling of radioactive material (i.e., NORMS) received onshore or encountered through intervention activities or decommissioning will be consistent with the Act. | Department of Health (DoH) |
| *Underwater Cultural Heritage Act 2018* | Protects remains of vessels and aircraft (including Aboriginal and Torres Strait Islander traditional watercraft) that have been | Cooper Energy is responsible for meeting protection requirements of the Act, including: | DCCEEW |

| Legislation / Regulation | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| | wholly or partially submerged in Australian waters for 75 years or longer. Other types of underwater cultural heritage (UCH), including First Nations archaeological heritage associated with dry-land habitation on the submerged Pleistocene landscapes on the Australian continental shelf and remains of shipwrecks or aircraft younger than 75 years, can also be declared by the Minister upon discovery (NOPSEMA, 2024d). | • No adverse impact to UCH without a permit;<br>• Notify the discovery of all suspected UCH exposed through the proposed action within 21 days of discovery.<br>• Adhere to requirements of Protected Zones and obtain a permit to enter a Protected Zone should entry into a Protected Zone be required.<br>An adequate process of UCH assessment, impact mitigation and management is to be undertaken ahead of (and in certain cases concurrent with and/or following) proposed actions (DCCEEW, 2024n). | |

### 2.1.4 Additional Relevant Commonwealth Policy

This OPP has been developed in accordance with the NOPSEMA Offshore project proposal content requirements Guidance Note (N-04790-GN1663, September 2020).

Table 2-6 summarises other relevant government guidelines that have been considered in the preparation of this OPP.

*Table 2-6: Relevant Commonwealth Policies and Guidelines*

| Policy/Guideline | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| Offshore project proposal content requirements Guidance Note<br>(NOPSEMA, 2020a) | Reflects NOPSEMA's interpretation of the content requirements of the OPGGS(E)R to support proponents in the preparation of OPPs. | This OPP has been developed to meet the requirements described. | NOPSEMA |
| Nature Positive Plan: better for the environment, better for business<br>(DCCEEW, 2022) | Sets out the government's commitment to reform Australia's environmental laws to better protect, restore and manage our unique environment.<br>Builds on the recommendations of the Independent Review of the EPBC Act and considers the findings from the 2021 State of the Environment Report. | The Australian Government will introduce legislation to give effect to this response in 2023, and which is anticipated to apply to future activities described within this OPP. | DCCEEW |
| Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 (ANZG, 2018) | Aims to achieve the sustainable use of water resources by protecting and enhancing their quality while maintaining economic and social development. | Provides guideline values on ambient water quality and monitoring assessment which will be used during the East Coast Project. | DCCEEW |
| Future Gas Strategy May 2024<br>(DISR, 2024) | Considers the future role of natural gas in Australia's energy mix and the transition to net zero. Considers the | The development of the East Coast Project is consistent with the | DISR |

| Policy/Guideline | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| | decarbonisation of the production of natural gas. Establishes the Commonwealth Government policy driver for continued investment in natural gas development. | approach outlined in the Future Gas Strategy. | |
| Australian Offshore Petroleum Development Policy (DISR, n.d) | Encourages the ongoing investment in, and the development of, Australia's offshore petroleum (oil and gas) resources. | Cooper Energy has an obligation to explore and develop petroleum reserves within the held title | DISR |
| Acoustic impact evaluation and management (NOPSEMA, 2020c) | Provides advice to titleholders to assist with preparing EPs for marine seismic survey activities, and in particular the components of an EP that relate to detailing, evaluating and managing impacts from acoustic emissions. | Advice regarding noise modelling and impact assessment. | NOPSEMA |
| Australian Ballast Water Management Requirements Version 8 (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 during the East Coast Project to comply with the Biosecurity Act. | DAFF |
| Australian Biofouling Management Requirements (DAFF, 2022) | The Australian biofouling management requirements set out obligations of operators of international commercial vessels for the management of biofouling when operating vessels under biosecurity control within Australian territorial seas. | Provides requirements on how operators of international commercial vessels should manage biofouling during the East Coast Project to comply with the Biosecurity Act. | DAFF |
| Underwater Cultural Heritage Guidance for Offshore Developments (DCCEEW, 2019) | Provides guidance on how proponents should consider the Underwater Heritage Act when applying for any State, Territory or Commonwealth planning approval for actions or developments in all coastal and offshore waters. | Guidance for the evaluation of seabed disturbance and accidental releases of hydrocarbons. | DCCEEW |
| The Guidelines on the application of the *Underwater Cultural Heritage Act 2018* (DCCEEW, 2024n) | Provides guidance to proponents to meet the requirements of the Australian *Underwater Cultural Heritage Act 2018.* | The Guidelines on the application of the *Underwater Cultural Heritage Act 2018* (DCCEEW, 2024n) state that 'All actions involving seabed contact, and most actions undertaken in proximity to the seabed, have potential to cause adverse impact to UCH'.<br>Requirements include:<br>• No adverse impact to UCH without a permit; | DCCEEW |

| Policy/Guideline | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| | | • Notify the discovery of all suspected UCH exposed through the proposed action within 21 days of discovery, and<br>• Adhere to requirements of Protected Zones and obtain a permit to enter a Protected Zone should entry into a Protected Zone be required.<br>An adequate process of UCH assessment, impact mitigation and management is to be undertaken ahead of (and in certain cases concurrent with and/or following) proposed actions (DCCEEW, 2024n). | |
| Marine Pest Plan 2018 – 2023: National Strategic Plan for Marine Pest Biosecurity<br>(DAWR, 2018) | 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<br>(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. | DAFF |
| Antifouling and In-water Cleaning Guidelines<br>(CoA, 2015) | Describes best practice approaches to applying, maintaining, removing and disposing of anti-fouling coatings and managing biofouling and invasive aquatic species on vessels and movable structures in Australia and New Zealand. | Guidance for evaluation of contamination and biosecurity risk of in-water cleaning; and for in-water cleaning, including suitable coatings, coating service life, methods to ensure minimal release of biological material into the water, and appropriate disposal of collected cleaning debris. | DAFF |

| Policy/Guideline | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| National biofouling management guidelines for commercial vessels<br>(CoA, 2009b) | A voluntary biofouling management guidance document which has been developed to assist industry manage biofouling risk for commercial vessels (e.g., construction vessels). | Guidance for evaluation of biofouling risk of types of vessels; and on biofouling. Used as guidance for Cooper Energy's Invasive Marine Species Risk Management Process | DAFF |
| Reducing marine pest biosecurity risks through good practice biofouling management Information Paper (NOPSEMA, 2020d) | Clarifies biosecurity requirements relevant to offshore activities.<br>Supports the industry's contribution to marine pest risk management consistent with Australia's Marine Pest Plan 2018-2023. | Provides guidance that is consistent with the expectations of all jurisdictions responsible for regulating biofouling management within the Australian marine environment. Used as guidance for Cooper Energy's Invasive Marine Species Risk Management Process | DAFF |
| National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k) | The Guidelines outline the process to be followed where there is the potential for artificial lighting to affect wildlife.<br>Applying the recommendations within this document and implementing effective controls can reduce the impact of light to sensitive receptors. | The recommendations within this document have been used to identify effective control measures that will be implemented reduce the potential impacts of light emissions from the East Coast Project. | DCCEEW |
| National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna<br>(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. | The recommendations within this document have been used to ensure effective controls are implemented to reduce the risk of the vessel collisions with megafauna. | DCCEEW |
| EPBC Policy Statement 2.1 Interaction between offshore seismic exploration and whales (DEWHA, 2008) | Provides practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic survey operations and provides a framework that minimises the risk of biological consequences from acoustic disturbance from seismic survey sources to whales in biologically important habitat areas or during critical behaviours. | Provides a framework for minimising acoustic disturbances to whales from seismic activities. | DCCEEW |
| EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species<br>(CoA, 2017) | The purpose of this policy statement is to assist proponents in avoiding, assessing and mitigating significant impacts on migratory shorebirds listed under the EPBC Act. This policy statement is a key action under the Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015b) | Provides guidance for identifying important habitat and significant impacts to migratory shorebirds or their habitat. | DCCEEW |

| Policy/Guideline | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| Marine Bioregional Plans<br>(DCCEEW, 2021e) | Designed to improve decisions made under the EPBC Act, particularly in relation to the protection of marine biodiversity and the sustainable use of our oceans and their resources by our marine-based industries. | The plans provide information on the Australian Government's marine environment protection and biodiversity conservation responsibilities, objectives and priorities in the four marine regions. | DCCEEW |
| Matters of National Environmental Significance – Significant Impact Guidelines 1.1<br>(CoA, 2013b) | Provides overarching guidance on determining whether an action is likely to have a significant impact on a matter protected under national environment law — the EPBC Act. | Impacts and risks of the petroleum activity can be demonstrated to be at an acceptable level if they do not result in a 'significant impact' as described in the Matters of National Environmental Significance – Significant Impact Guidelines. | DCCEEW |
| Guideline for minimizing greenhouse gas emissions<br>(EPA Victoria, 2022). | Explains how the factor Greenhouse Gas Emissions is considered by the Environmental Protection Authority (EPA) in the environmental impact assessment (EIA) process. | Although the East Coast Project is within Commonwealth waters, the guideline has been used in evaluation of greenhouse gas emissions for potential emissions within State jurisdiction. | Environment Protection Authority Victoria (EPA Victoria) |
| NGER (Measurement) Determination 2008 (as amended 2019);<br>API Compendium of GHG Emissions Methodologies<br>(API, 2009) | Provide methods, criteria and measurement standards for calculating greenhouse gas emissions and energy data under the National Greenhouse and Energy Reporting Act 2007 (NGER Act). | Used for reporting related information to the GHG emissions estimates for the East Coast Project. | Clean Energy Regulator |
| National Environment Protection (National Pollutant Inventory) Measure (NPI NEPM) 1998<br>(CoA, 1998) | The national environment protection goals established by this measure are to:<br>• collect a broad base of information on emissions and transfers of substances on the reporting list, and<br>• disseminate the information collected to all sectors of the community in a useful, accessible and understandable form. | Reporting of atmospheric pollutants will occur under NPI NEPM if required to do so. | DCCEEW |
| Offshore Petroleum Decommissioning Guideline<br>(DISR, 2022) | Clarifies the application, operation and interaction between components of the Commonwealth regime for decommissioning offshore petroleum infrastructure in Commonwealth waters under the OPGGS Act, associated regulations and, where applicable, other Commonwealth laws. | Complete removal of infrastructure and the plugging and abandonment of wells is the default decommissioning requirement. Options other than complete removal may be considered, however the alternative decommissioning approach must deliver equal or better environmental, safety and well integrity outcomes | DISR |

| Policy/Guideline | Scope | Application to Activity | Administering Authority |
|---|---|---|---|
| | | compared to complete removal. | |
| Planning for proactive decommissioning Information Paper (NOPSEMA, 2021) | Encourages titleholders to begin planning for decommissioning at the earliest stage of project development. | Provides information on the level of detail required in an OPP. | NOPSEMA |
| Maintenance and removal of property Policy (Section 572) (NOPSEMA, 2020b) | Sets out NOPSEMA's compliance and enforcement of section 572 of the OPGGS Act which requires titleholders to:<br>• Maintain all structures, equipment and property within the title area and ensure they are in good condition and repair<br>• Remove all structures, equipment, and property when it is neither used nor to be used in connection with operations authorised by the title. | Guidance for ongoing maintenance of property and decommissioning of property at end of development life. | NOPSEMA |
| Consent to surrender Title (Section 270) (NOPSEMA, 2022) | Sets out NOPSEMA's compliance of Section 270 of the OPGGS Act which requires titleholders have:<br>• removed all property brought into the area or have made arrangements that are satisfactory to NOPSEMA<br>• plugged or closed off all wells<br>• provided for the conservation and protection of the natural resources in the area<br>• restored any damage to the seabed or subsoil in the area | Assist titleholders in understanding the requirements that must be met for the Joint Authority to consent to the surrender a title. | NOPSEMA |
| PFAS National Environmental Management Plan Version 3.0 (HEPA, 2025) | Provides nationally consistent guidelines and standards for assessment and management of per-and poly-fluoroalkyl substances (PFAS) contamination and waste that should be taken into account. | Provides guidance on the environmental obligations concerning PFAS, including the requirement to transition away from PFAS to safer alternatives where practicable. | DCCEEW |

## 2.2 International Agreements

The United Nations Convention on the Law of the Sea 1982 (UNCLOS) is the principle international agreement which governs petroleum operations in Commonwealth waters. Additionally, Australia is a signatory to several international conventions with relevance to the development which are detail in Table 2-7 below.

*Table 2-7: Relevant International Agreements and Initiatives*

| Agreement/Convention | Scope | Application to Activity |
|---|---|---|
| International Convention for the Prevention of Pollution from ships, London, 1973/1978 (commonly known as MARPOL 73/78 | Provides advice on the prevention and minimisation of accidental pollution and pollution that results from routine operations. | Guidance on the prevention of all potential and planned marine pollution associated with the OPP. The *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and subsidiary Marine Orders give effect to MARPOL 73/78 (described in Table 2-5). |
| International Convention of Civil Liability for Oil Pollution Damage, 1969 and 1992 (CLC 69; CLC 92) | Ensures that in the case of oil pollution damage that results from maritime casualties involving oil-carrying ships that there is adequate compensation made for those affected. | Provides insight into the ship's liability in the case of a maritime casualty.<br>The *Australian Maritime Safety Authority Act 1990* gives effect to this convention. |
| Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) | Designed to create consistent guidelines for vessels operating in the sea and the responsibilities of their staff. Includes the risk of collision, a safe speed of travel and traffic separation schemes in areas of high traffic. | Provides instruction on the rules of operating vessels at sea in order to ensure safe travel. The *Navigation Act 2012* and subsidiary Marine Orders give effect to the regulations (described in Table 2-5) |
| Convention for the Safety of Life at Sea 1974 (SOLAS) | This convention provides internationally agreed minimum standards for the construction, equipment and operation of vessels. It is implemented in Commonwealth law by the *Navigation Act 2012* and a series of Marine Orders made under this Act (described in Table 2-5). | Provides requirements that all vessels operating within Australian waters must comply with.<br>SOLAS Chapter II-2, Part C, Regulation 10 amendments prohibit the use or storage of firefighting foams containing perfluorooctane sulfonic acid (PFOS) in effect in 2026.<br>The *Australian Maritime Safety Authority Act 1990* gives effect to this convention. |
| Convention on the International Maritime Organisation 1948 | Designed to promote efficient and sustainable shipping through international cooperation that focuses on safe, secure, environmentally sound practices. | Advice on how to efficiently and sustainably travel overseas in relation to navigation, maritime safety and marine pollution.<br>The *Australian Maritime Safety Authority Act 1990* gives effect to this convention. |
| London Protocol and Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1996 | Adopted to protect the marine environment from human activities and promote the effective control of all marine pollution. | Guidance on the prevention of marine pollution and the disposal of waste from applicable activities under this OPP.<br>Chemical inventories onboard vessels and MODUs may potentially breach this convention if unpermitted via this OPP and deliberately discharged to the sea.<br>The Environment *Protection (Sea Dumping) Act 1981* gives effect to the London Convention. |
| International Convention on Harmful Anti Fouling Systems 2001 (AFS Convention) | Designed to protect the marine environment from harmful anti-fouling systems used on ships by either prohibiting or restricting their use. | Guidance for evaluation of a vessels condition and the process of applying, maintaining, removing and disposing of anti-fouling coatings as required. The *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* and subsidiary Marine Order give effect to the Convention (described in Table 2-5). |
| International Convention on the Control and | Adopted with aims to prevent the international spread of non-native | Guidance for ballast water management to reduce the risk of |

| Agreement/Convention | Scope | Application to Activity |
|---|---|---|
| Management of Ship's Ballast Water and Sediment (Ballast Water Management Convention) | marine species by creating standards and procedures for the regulation and control of ships ballast water and sediments. | transfer of IMS. The *Biosecurity Act 2015* gives effect to the Convention. |
| International Maritime Organization (IMO) Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) | Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species | Specific requirements that vessels have a biofouling management plan and a biofouling record book. |
| International Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 1989 (Basel Convention) | Regulates the transboundary movements of hazardous waste to ensure that they are managed and disposed of in an environmentally safe manner. There is expectation that parties will also minimise the waste created and transported. | Provides instruction on the appropriate handling, export and disposal of hazardous waste. The *Hazardous Waste (Regulation of Exports and Imports) Act 1989* gives effect to the convention. |
| Kyoto Protocol 1997 | Designed to have industrialised countries commit to implementing policies and measures that reduce and limit their greenhouse gas emissions. | Advice on the impacts and risks associated with greenhouse gases and is used in evaluation of greenhouse gas emissions.<br>The *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* and *Climate Change Act 2022* (Cwth) gives effect to the Protocol. |
| Paris Agreement 2016 under the United Nations Framework Convention on Climate Change | Objective is to limit the global temperature rise to 2 degrees while attempting to limit it even further to 1.5degrees in comparison to pre-industrial levels.<br>Provides financial assistance to developing countries which will help them mitigate and adapt to the impacts of climate change. | Advice for the evaluation of risks and impacts associated with the activity in regard to climate change.<br>The Australian Government is committed to developing legislation to implement the commitments made in the Paris Agreement.<br>The *Climate Change Act 2022* (Cwth) gives effect to the Agreement. |
| UN 2030 Agenda for Sustainable Development (2030 Agenda) | Created 17 sustainable development goals that protect the planet and improve quality of life globally. | Informs acceptability evaluation for potential impacts which extend outside of Australia's jurisdiction. |
| United Nations Framework Convention on Climate Change 1992 | Objective is to stabilise global greenhouse gas concentrations at a level that allows ecosystems to adapt naturally to a changing climate. | Advice on the impacts and risks associated with greenhouse gases, and evaluation of greenhouse gas emissions.<br>The *Ozone Protection and synthetic Greenhouse Gas Management Act 1989* and *Climate Change Act 2022* (Cwth) gives effect to the Agreement. |
| Montreal Protocol on Substances that Deplete the Ozone Layer 1987 | Designed to protect the ozone layer by phasing out the production and consumption of ozone depleting substances. | Guidance on the impacts and risks associated with ozone depleting substances and evaluation of greenhouse gas emissions. The *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* gives effect to the protocol. |
| International Convention on the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention) | An environmental treaty that utilises international coordination in the advocacy of conservation and sustainable use of migratory species, their habitats and migration routes. | Guidance on the conservation responsibilities regarding migratory species. The EPBC Act gives effect to the Bonn Convention through listing |

| Agreement/Convention | Scope | Application to Activity |
|---|---|---|
| | | species as migratory under Part 3 of the Act. |
| Agreement on the Conservation of Albatrosses and Petrels (ACAP) | Multilateral agreement that coordinates international activities with a purpose to conserve albatross and petrel species and mitigate threats to these populations. | Advice on the conservation responsibilities regarding albatross and petrel species.<br>The EPBC Act gives effect to ACAP by listing migratory albatross and petrel species conservation status under the EPBC Act. |
| China Australia Migratory Birds Agreement (CAMBA) | Bilateral agreement between China and Australia to provide protection and conservation of migratory birds that use the East Asian – Australasian Flyway and their important habitats. | Advice on the conservation responsibilities regarding bird species that may use the development as a migratory flyway between China and Australia. The EPBC Act gives effect to CAMBA by listing migratory birds recognised by the agreement as migratory under the EPBC Act. |
| Japan Australia Migratory Birds Agreement (JAMBA) | Bilateral agreement between Japan and Australia to provide protection and conservation of migratory birds that use the East Asian – Australasian Flyway and their important habitats. | Guidance on the conservation responsibilities regarding bird species that may use the development as a migratory flyway between Japan and Australia. The EPBC Act gives effect to JAMBA by listing migratory birds recognised by the agreement as migratory under the EPBC Act. |
| The Republic of Korea Migratory Birds Agreement (ROKAMBA). | Bilateral agreement between the Republic of Korea and Australia to provide protection and conservation of migratory birds that use the East Asian – Australasian Flyway and their important habitats. | Advice on the conservation responsibilities regarding bird species that may use the development as a migratory flyway between the Republic of Korea and Australia. The EPBC Act gives effect to ROKAMBA by listing migratory birds recognised by the agreement as migratory under the EPBC Act. |
| The Minamata Convention on Mercury | The convention calls on signatories to protect human and environmental health from anthropogenic releases of mercury. The Convention came into force on in 2017 and was ratified in Australia in December 2021. | The Convention covers control and reduction of mercury in a range of processes and industries and is relevant to end-of-life aspects such as waste and contaminated sites.<br>Drilling activities can potentially result in mercury compounds being produced from wells as a by-product. Mercury may pose a risk to the environment if not managed appropriately.<br>The convention will consider best available techniques and environmental practices to control releases of components containing mercury in future activity specific EPs. |
| Convention Concerning the Protection of the World Cultural and Natural Heritage 1972 | Designed to acknowledge and protect areas of cultural and natural heritage across the world. | Guidance around recognising protected areas and areas of cultural and natural heritage and mitigating any potential affects that the development may have on them. |
| Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report | The IPCC released four reports relating climate change and anthropogenic influence and deducing the impact that climate change has had on ecosystems, biodiversity, humans, and cities. Convention on Climate Change. | Provides scientific knowledge that relates climate change to human influences and the use of hydrocarbon fuels. |

| Agreement/Convention | Scope | Application to Activity |
|---|---|---|
| | | The *Climate Change Act 2022* (Cwth) gives effect to the Agreement. |

# 3 Stakeholder Consultation

## 3.1 Overview

Consultation during development of the East Coast Project OPP supports the objects of the OPGGS(E) Regulations through potentially:

- aiding in early identification of complex issues
- helping to uncover unknown issues
- building relationships and setting the scene prior to development of component EPs
- gaining an enhanced understanding of the existing environment
- developing a greater understanding of values and sensitivities
- obtaining of improved clarity on acceptability criteria
- understanding whether controls are suitable and result in acceptable outcomes.

## 3.2 Consultation stages

The consultation comprises 2 stages:

1. pre-public comment
2. public comment.

Stage 2 is the only regulatory consultation requirement and stage 1 is considered good practice. Further consultation will follow during the development of component EPs, but that is not within the scope of this OPP.

While Cooper Energy has significant experience in operating offshore gas facilities in the Otway Basin, and has been consulting on these activities for a long period, each stage of consultation has the potential to result in improvements to the OPP.

### 3.2.1 Consultation stage 1 – pre-public comment

The objective of stage 1 consultation was to gain knowledge through consultation with key members of different stakeholder categories that may be affected by the proposed activities, and certain government agencies and authorities to which the activities may be relevant. Having gone through this stage of consultation, the OPP was likely to be better informed when published for public comment. In practice, very few comments were received, most likely due to these being familiar activities proximate to existing production.

It is considered that the stage 1 consultation provided for reasonable representation across a number of categories of stakeholders which had potential to result in an enhanced understanding of values and sensitivities, and potential impacts and risks to the environment, including socio-economic. The OPP has been updated to incorporate comments received.

The list of stakeholders is in Table 3-1.

*Table 3-1: List of stakeholders consulted*

| Stakeholder |
|---|
| **Government-Commonwealth, state, local** |
| Australian Antarctic Division (AAD) (DCCEEW) |
| Australian Communications and Media Authority (ACMA) |
| Australian Fisheries Management Authority (AFMA) |
| Australian Hydrographic Office (AHO) |
| Australian Maritime Safety Authority (AMSA) |

| |
|---|
| Department of Defence – Property Management Branch (DoD-PMB) |
| Maritime Border Command |
| Parks Australia (DNP) (DCCEEW) |
| National Native Title Tribunal (NNTT) |
| Department of Climate Change, Energy, the Environment and Water (DCCEEW) |
| Victorian Department of Energy, Environment and Climate Action – Earth Resources Regulation (DEECA ERR) |
| Victorian Department of Jobs, Skills, Industry and Regions (DJSIR) |
| Victorian Department of Premier and Cabinet (DPC) - First Peoples State Relations |
| Victorian Fisheries Authority (VFA) |
| Corangamite Shire Council |
| Moyne Shire Council |
| Warrnambool City Council |
| **Business, industry and research** |
| Blue Whale Study (BWS) |
| Deakin University - School of Life and Environmental Sciences |
| Institute for Marine and Antarctic Studies (IMAS) - University of Tasmania |
| Victorian Tourism Industry Council (VTIC) |
| **Interest group** |
| Victorian Recreational Fishing Peak Body (VRFish) |
| **First Nations** |
| Eastern Maar Aboriginal Corporation (EMAC) |
| Gunditj Mirring Traditional Owners Aboriginal Corporation (GMTOAC) |
| Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) |
| **Fisheries** |
| Australian Southern Bluefin Tuna industry Association (ASBTIA) |
| Commonwealth Fisheries Association (CFA) |
| Seafood Industry Victoria (SIV) |
| South East Trawl Fishing Industry Association (SETFIA) |
| Tasmanian Seafood Industry Council (TSIC) |
| Tuna Australia (TA) |

### 3.2.2 Consultation stage 2 – public comment

The timing and duration of the public comment period was determined by the NOPSEMA and commenced after the Christmas and New Year holiday period, running from 6 January 2025 to 25 February 2025. The OPP was published on the NOPSEMA website where clear and simple instructions were posted advising the public how they could participate in the process. Interested stakeholders that are subscribed to relevant NOPSEMA notifications would have received notice of the OPP being published, providing ample opportunity to participate.

In addition, numerous advertisements were placed in regional, state and national newspapers, with this effort substantially exceeding the regulatory requirements (Figure 3-1, Figure 3-2).

Notices advising of the public comment period were placed in the following publications:

**Local:**

- Cobden Timboon Coast Times
- Warrnambool Weekly
- Portland Observer
- Casterton News

**Metro-based state-wide:**

- Daily Telegraph – Sydney
- Herald Sun – Melbourne
- Mercury-Hobart
- Advertiser-Adelaide

**National:**

- The Australian

In addition, Cooper Energy directly notified a number of stakeholders representing various interests in the offshore area, including the three most proximate RAPs. A notice was also posted on the Cooper Energy (Amplitude Energy) corporate website.

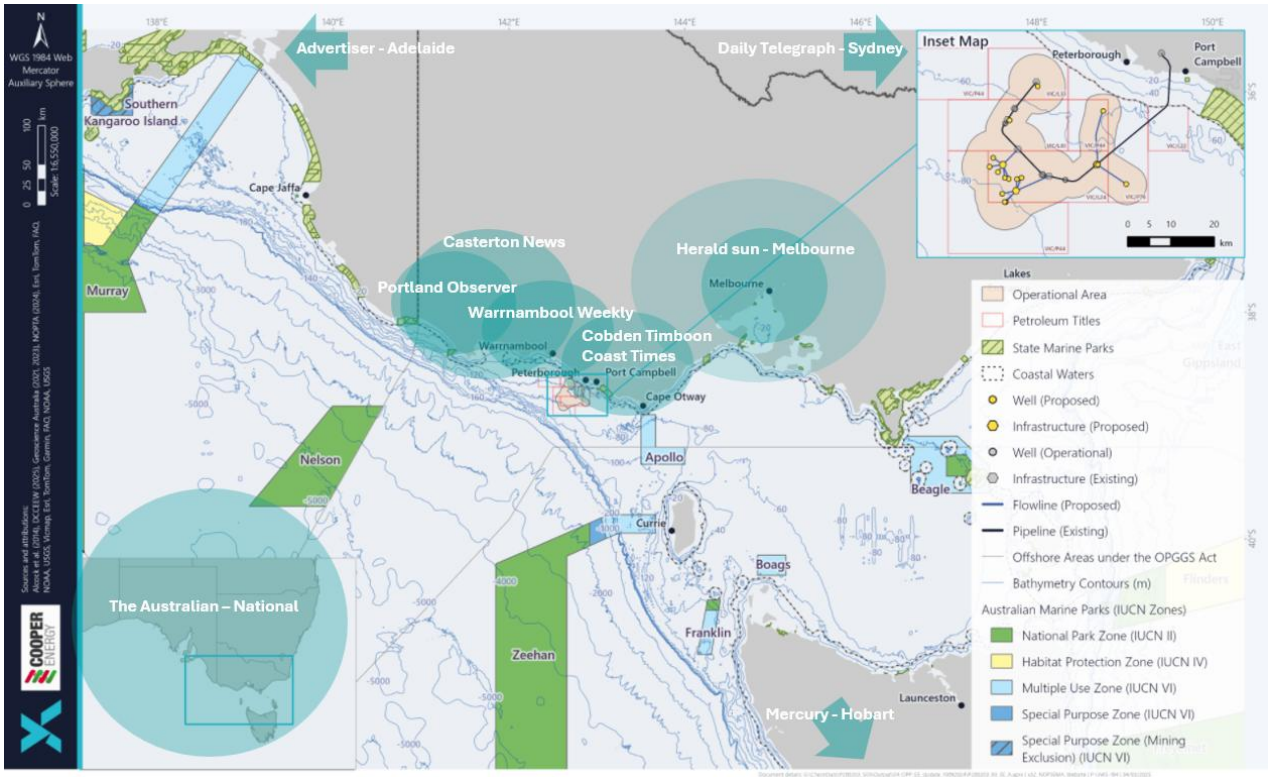



*Figure 3-1: Notices placed advising of public comment period for the OPP*



**Offshore Project Proposal (OPP) now open for public comment**

Amplitude Energy Ltd (formerly Cooper Energy Ltd) operates the Casino gas field which has supplied natural gas to Australians since 2006. As production from this field declines, the activities proposed under our OPP will ensure continued supply of natural gas to southeastern Australia from our existing permit areas. By using our existing infrastructure, we can minimise the environmental footprint of the development while meeting the region's energy needs.

**East Coast Supply Project – Offshore Peterborough Vic, Otway Basin**

The OPP covers a range of activities, including geophysical and geotechnical surveys (excluding seismic), drilling and completing production wells, and connecting these wells into existing pipeline networks. It also provides for ongoing operations, such as inspections, maintenance and repair work, and decommissioning.

**The public comment process**

NOPSEMA has published our draft OPP on its website for public comment. The time available for public comment and details of NOPSEMA's process can be found on the following link or via the QR code.

https://www.nopsema.gov.au/offshore-industry/environmental-management/assessment-process/public-comment

*Figure 3-2: Notice advising of public comment period for the OPP*

#### *3.2.2.1 Titleholder report on public comment*

No comments were received through the public comment process. The low level of interest is consistent with that seen during early engagement on this OPP, and consultation for similar activities in close proximity to existing offshore production by Cooper Energy and other existing operators nearby.

### 3.2.3 Completion of consultation

Consultation was deemed complete for the purpose of preparation of the OPP upon the closing of the public comment period. However, Cooper Energy remains open to ongoing engagement which supports our objectives of continuous improvement and relationship building.

### 3.2.4 Ongoing engagement

Cooper Energy has continued to engage with stakeholders on this OPP. Engagement with VRFish and the Clean Energy Regulator has further informed Sections 6 and 8 of the OPP.

# 4 Description of Project

## 4.1 Project Overview

The East Coast Project comprises up to 8 incremental gas development opportunities with associated wells, flowlines and manifolds, which will tie-in to the existing Otway Casino-Henry-Netherby (CHN) Development (known as the 'existing CHN facilities'). The development opportunities include:

- Confirmed resources at Annie and Henry fields
- Prospective resources at Elanora, Heera, Juliet, Nestor, Isabella, Pecten East.

Hydrocarbons from these fields will be transported to shore via the existing CHN pipeline and processed at the Athena Gas Plant situated ~6 km inland from Port Campbell.

This OPP covers the following phases:

- Surveys – activities include geophysical and geotechnical surveys of the proposed locations (Section 4.3.1).
- Well construction – activities include Mobile Offshore Drilling Unit (MODU) positioning, all drilling operations, blowout preventer (BOP) installation, cementing, subsea trees and completions, clean-up and flowback, well suspension and logging (Section 4.3.2). Only one well is drilled at a time. Multi-well drilling campaigns involve one MODU which drills each well, one well after another.
- Installation of subsea infrastructure – activities include the installation of flowline systems, umbilical control systems, testing of infrastructure and pre and post commissioning the systems (Section 4.3.3).
- Operations – activities include hydrocarbon extraction, inspection, maintenance and repair (Section 4.3.4)
- Decommissioning – activities include well abandonment and the decommissioning of infrastructure (Section 4.3.5)
- Support activities – including MODU operations, vessel operations, remotely operated vehicle (ROV) and helicopter operations (Section 4.3.6). Vessel types include saturation diving support vessel, installation vessels, heavy lift vessels (HLV's) and general support vessels for Inspection, Maintenance and Repair (IMR) type activities or supporting the engineering or execution programs. ROV operations may also include autonomous underwater vehicles (AUVs).

### 4.1.1 Location

The East Coast Project is located entirely within offshore waters of the Otway Basin (Figure 1-2). All gas development opportunities are situated within Commonwealth waters in existing offshore petroleum permits VIC/L24, VIC/L30, VIC/L33, VIC/P44 and VIC/P76.

The Annie gas field is closest to shore, situated ~8 km from the coast in ~55 m water depth. The Heera prospect is the furthest offshore, situated ~35 km from the coast and in the deepest water depths of ~85 m.

The nearest settlements are Peterborough and Port Campbell (Figure 1-2).

#### *4.1.1.1 Operational area*

For the purposes of this OPP, the operational area for the East Coast Project has been defined to include the extent of all petroleum activities, with a sufficient buffer to allow for flexibility in design and location of infrastructure through the project planning process (Figure 4-1).

The extent of the buffer varies depending on the well, infrastructure type and level of project planning and design. Where the project planning and design is more advanced (and therefore locations more certain) for some of the potential gas resources, the buffers have been optimised.

The operational area represents the outer spatial extent of the petroleum activities included within the scope of this OPP. Throughout the phases of the East Coast Project, the footprint of activities will vary in nature and scale within the operational area. Activity footprints and the related potential impacts and risks are described in detail in the impact assessment sections.

The operational area includes:

- 3 km buffer around the proposed well locations and associated flowline routes within the Annie, Juliet, Nestor and Henry fields. This is because the project planning and design for these fields is more advanced, and there is greater confidence on the infrastructure location (being within closer proximity to existing infrastructure).
- 5 km buffer around the proposed well locations and associated flowline routes within Elanora, Heera, Isabella and Pecten East prospects. This is because planning for these prospects is less well advanced.
- Geophysical and geotechnical survey areas. Nominally 5 km x 5 km around proposed well sites, and along nominal pipeline corridors.

Final infrastructure locations will be confirmed in future EPs and will be within the buffers described above.

A range of infrastructure operated under existing CHN approvals currently exist within the operational area. Cooper Energy maintains an infrastructure register within the Asset Integrity Management Plan (IMP) document (CHN-IR-IMP-0001). The proximity of proposed infrastructure to existing infrastructure has been considered in early project planning and design. Impacts and risks resulting from the proximity between East Coast Supply activities and existing CHN assets has been assessed.

Vessels transiting to and from the operational area are not considered a petroleum activity, as they fall under other maritime legislation, including the *Commonwealth Navigation Act 2012*, and therefore are excluded from the scope of this OPP. The operation of onshore facilities required to support the proposed East Coast Project is outside the scope of this OPP (note that indirect greenhouse gas emissions are included in the impact assessment).

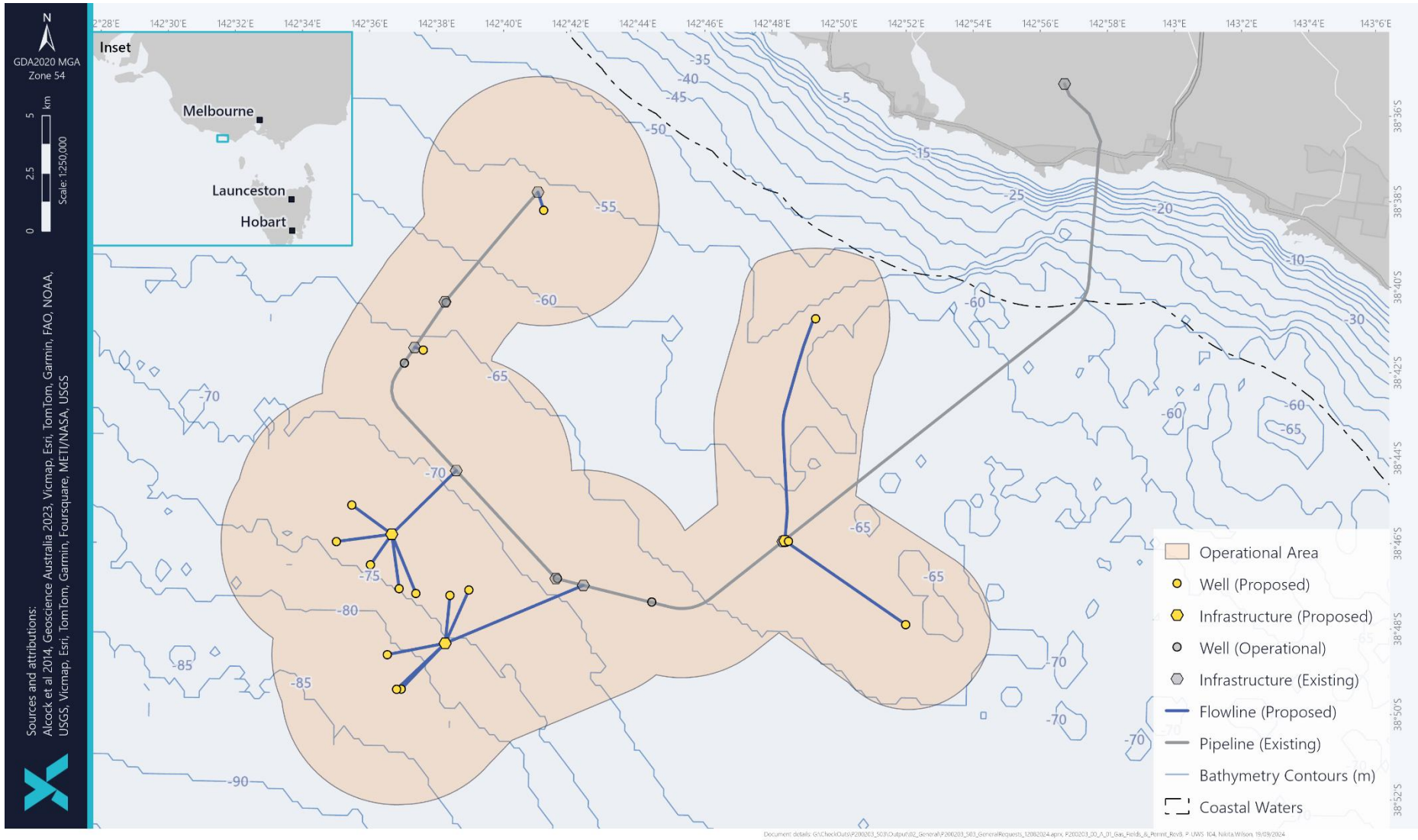



*Figure 4-1: Operational area of the East Coast Project*

#### 4.1.1.2 Direct Disturbance Corridor

The exact footprint of the infrastructure to be installed will be described in detail in future EPs, once development plans are matured. Though equipment alignment and positions within the operational area may change during detailed design, the overall disturbance footprint of the East Coast Project will not increase.

A conservative direct disturbance corridor, termed the long-term disturbance (permanent infrastructure, lasting disturbance) corridor, has been adopted for the purposes of impact assessment, to capture the nominal spatial extent and footprint of all installed infrastructure (i.e. flowlines and subsea structures). Figure 4-1 shows an indicative field layout featuring multiple wells at Elanora, and at Heera, each connected to a manifold with an individual flowline. This layout has been used for evaluation purposes as it is expected to be conservative in terms of overall footprint and the potential duration of aspects associated with construction, maintenance and decommissioning activities for the proposal; the final facility layouts may differ from what is shown but will be within the defined operational area which has been designed at this stage with some flexibility for layout modification during planning. Short term disturbances associated with Project activities for example geotechnical sampling, anchoring of the MODU and temporary wet parking will also occur. These may occur outside of the long-term disturbance corridor but will occur within the operational area proximal to the long-term disturbance corridor.

In the unlikely event that equipment must be stored temporarily on the seabed due to storm or emergency events, the area of disturbance may fall outside of the direct disturbance spatial extents described below in Table 4-1. It is estimated this would have a temporary footprint of ~50 m x 50 m and the equipment will be retrieved within the duration of the campaign (see Figure 4-3).

Table 4-1 provides details of the approximate spatial extent of direct disturbance.

*Table 4-1: Direct disturbance spatial extent*

| Phase | Infrastructure or Purpose | Distance from the activity of potential disturbances* |
|---|---|---|
| **Long-term** | | |
| **Installed Infrastructure** | Flowlines and umbilical systems<br>Well and manifold locations | 100 m corridor (radius) within which seabed disturbance could occur. |
| **Short-term** | | |
| **Well construction** | Temporary moorings for the MODU during well construction. | 2.5 km radius around each well site within which seabed disturbance could occur. |
| **Well maintenance and abandonment** | Temporary moorings for the MODU during well construction. | 2.5 km radius around each well site within which seabed disturbance could occur. |
| **Emergency storage** | Equipment will be temporarily stored on the seabed during well construction, installation or decommissioning activities if required | 2,500 $m^2$ within the operational area. |

**Note: the indicative disturbance corridors presented here do not represent the total predicted area, or exact location to be disturbed, rather a nominal extent from an activity or piece of equipment within which seabed disturbance could occur. The predicted direct disturbance footprints for the activities are described in Section 8.8.*

#### 4.1.1.3 Accommodating design changes during detailed planning

As described throughout Section 4.1, the OPP contains indicative and nominal spatial extents, alignments and positions of equipment. These details may vary in subsequent approvals to

accommodate additional information obtained through survey, detailed design and engineering or consultation. Any necessary contingency designs will occur within the bounds of this OPP including the operational area and overall development footprint described within this OPP.

Where the final designs fit within the parameters of the OPP assessment boundaries, the outcomes of the OPP environmental impact and risk evaluations, acceptability assessment, EPOs and control measures would continue to be appropriate.

### 4.1.2 Project Schedule

The East Coast Project will be staged and developed incrementally, consistent with how the existing CHN fields have been developed. Therefore, not all gas-development opportunities will be developed in a single campaign, which may result in different phases occurring concurrently. For example, Elanora, Juliet and Nestor fields could be drilled sequentially within the same campaign; flowline installation could occur concurrently with the drilling activity.

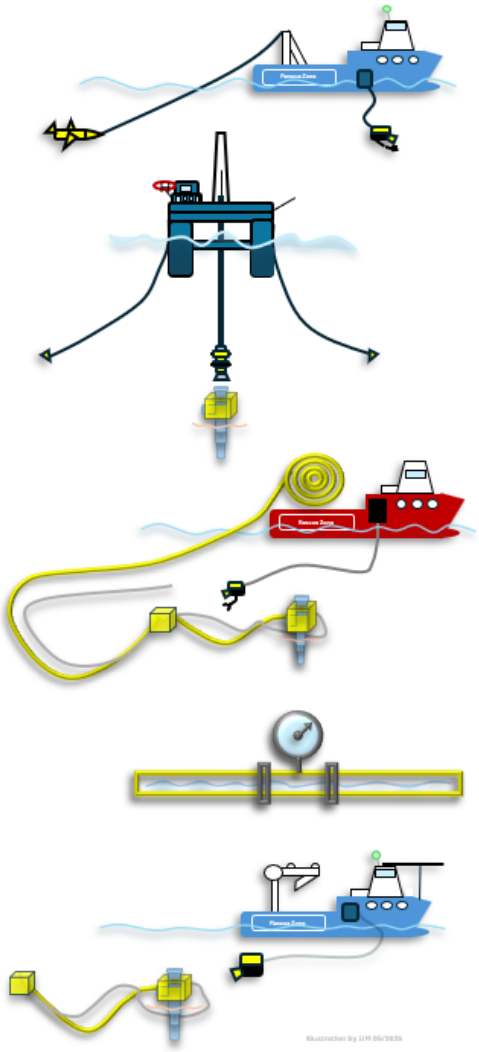
The order in which fields will be developed has not yet been finalised. For the purposes of this assessment, it is assumed that activities associated with well construction, installation and commissioning, and operations phases could all occur within the operational area concurrently, using the 3-well drilling and tie-in example described above. Additionally, pre-decommissioning and decommissioning activities are likely to commence on some fields while others are still operational, meaning there could be an overlap in these later two phases. Potential impacts from concurrent activities are assessed throughout this OPP and will be considered in detail in the subsequent EPs submitted for discreet activities and phases of the East Coast Project.

East Coast Project activities would occur throughout the year. Activity levels associated with production are minimal, with the subsea facilities being operated remotely, there is nothing visible, nor occurring above the sea surface. Higher activity levels are associated with development, maintenance and decommissioning; as these require vessels to deploy / recover equipment to/from the seabed. Figure 4-3 illustrates the individual activities necessary for the East Coast Project, and their approximate durations. Figure 4-3 illustrates the sequence and duration of these activities where combined into offshore vessel campaigns. For conservatism, it is assumed that multiple different activities may occur in direct succession. Figure 4-3 shows activities that may occur concurrently and sequentially across the development, along with the worst likely case scenarios for concurrent and sequential vessel operations for the project concept. A more detailed project schedule would be defined at the Environment Plan development stage.

These timings are indicative as the duration of each phase and activity will vary during the development. This will be due to factors such as final numbers of wells, flowline and umbilical routes, vessel availability and operational windows. Timing influences such as financing, market need, and regulatory change are not allowed for here; but would be built into project schedules where known.

The earliest timing for the pre-operation phase of the first field is 2025. IMR activities may occur during any phase of future developments detailed in this OPP. The production profile provides an indication of the duration of subsea operations, with first gas from 2027, and cessation of production around 2045.

Decommissioning and any post-decommissioning monitoring will occur following end of field life which is estimated to be by the end of 2049. Decommissioning activities could be accelerated in some circumstances (Section 4.3.5).



| Site Survey | |
|---|---|
| Duration | ~7-21 days per survey campaign |
| Required when? | Before development, after decommissioning |

| Well Construction, Maintenance and Deconstruction | |
|---|---|
| Duration | ~60 days to drill and complete a well<br>~30 days for well maintenance or abandonment per well |
| Required when? | During development, during production, during decommissioning |

| Facility Installation and Removal | |
|---|---|
| Duration | ~30-60 days to install, test and commission a new infield flowline and umbilical system<br>~30-60 days to decommission and recover an infield flowline |
| Required when? | During development, during decommissioning |

| Production Operations | |
|---|---|
| Duration | For life of field typically 5-15 years |
| Required when? | For life of field typically 5-15 years |

| Facility Inspection | |
|---|---|
| Duration | ~14-30 days per inspection |
| Required when? | During production, during decommissioning |

*Figure 4-2: Indicative duration and timing of activities required as part of the East Coast Project*

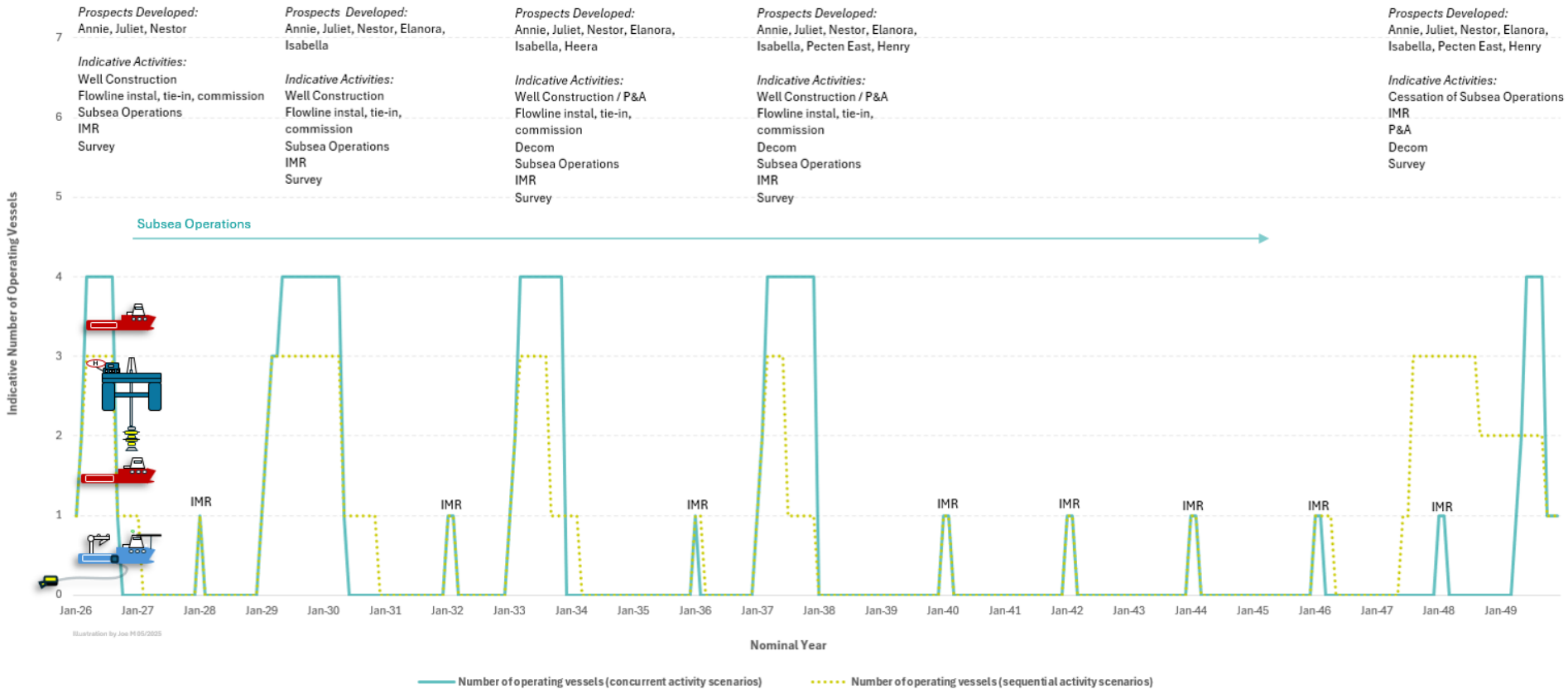



*Figure 4-3: Indicative frequency and duration of vessel-based campaigns across the life cycle of the East Coast Project**

**This chart has been developed to help illustrate the kinds of vessel numbers that could be working to install, maintain and decommission the subsea facilities, as well as give an indication as to the frequency and duration of vessel operations. Typically activities would be planned to occur sequentially from one field to another, but situations can also arise where activities occur concurrently in different fields. In all scenario's shown there are periods where there are multiple vessels operating at the facility. Where the chart shows 3 vessels, this is indicative of a well construction campaign. Where the chart shows 4 vessels, this is indicative of a well construction campaign concurrent with a subsea equipment installation campaign or similar. This chart is not a schedule; it has been developed to assist in characterising the nature and scale of potential impacts of the proposed project, including cumulative impacts from concurrent and sequential vessel activity scenarios.*

### 4.1.3 Reservoir Characteristics

The OPP is based on developing discovered and potential reservoirs. Some of the proposed reservoirs to be tied back do not have well test results to inform the reservoir characteristics. Where these characteristics are used to inform the assessment of environmental impacts and risks, a conservative approach has been taken with regards to defining the reservoir characteristics. This approach is informed by a detailed assessment of the discovered Otway reservoirs and geological models. Given the reservoir targets are clustered around the discovered reservoirs of the CHN development, it is considered likely they will have similar properties, including low reservoir carbon dioxide ($CO_2$; typically <1%).

All 4 production wells of the existing CHN development 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 4-2).

The condensate of wells within the offshore East Coast Project reservoirs are classified as a Group I (non-persistent) oil, except for Annie, which is classified as Group II (light persistent) oil. The classification for the Annie reservoir is based on the most recent analysis from the drilling of Annie-1 exploration well.

Although the Pecten East structure has been drilled, only reservoir pressure and temperature are known. The gas composition of the Pecten East field is assumed to have similar characteristics to the adjacent Netherby field as it is the nearest producing reservoir. Gas development opportunities classified as prospects have not been drilled before and therefore do not have confirmed reservoir characteristics. The remaining East Coast Project wells target the Waarre Formation reservoirs. Hydrocarbon analogues for these prospects have been chosen based on their proximity to the prospect, geological properties (porosity) and expected composition/pressure:

- Casino-4 (Waarre A): analogue for Elanora and Heera
- Casino-5 (Waarre C): analogue for Juliet, Nestor and Isabella.

There is some uncertainty in the Condensate to Gas Ratio (CGR) values even in the discovered fields and a range has been estimated with a conservative average selected of 2 bbl/MMscf for all the exploration prospects.

During the 2021 reporting period, the Athena Gas Plant National Pollution Index (NPI) report did not identify mercury to be present in quantities that required inclusion within the annual NPI report. A Bureau Veritas gas and condensate analysis in 2022 reported total mercury levels of less than 0.1 µg/$m^3$ in the raw gas at Athena Gas Plant, which comprised of Casino, Henry and Netherby gases. Wells associated with the East Coast Project are anticipated to be analogous to their CHN counterparts discussed above, except for Annie, which has known properties. Well testing data of mercury at the previously drilled Annie-1 exploration well found mercury levels of 1-4 µg/$m^3$.

*Table 4-2: East Coast Project Reservoir Conditions*

| Parameter | Field | | | | | Prospect | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Casino-4 (Waarre A)*** | **Casino-5 (Waarre C)*** | **Netherby*** | **Henry** | **Annie** | **Pecten East** | **Elanora** | **Juliet** | **Nestor** | **Isabella** | **Heera** |
| **Analogue condensate** | N/A | N/A | N/A | Henry-3 | Annie-1 | Netherby | Casino-4 | Casino-5 | Casino-5 | Casino-5 | Casino-4 |
| **Gas Specific Gravity** | 0.60 | 0.595 | 0.584 | 0.59 | 0.66 | 0.584 | 0.595-0.65 | 0.595-0.65 | 0.595-0.65 | 0.595-0.65 | 0.595-0.65 |
| **Condensate to Gas Ratio** | Current average: 0.9 bbl/MMscf | | | | Average of 2 bbl/MMscf | Average of 2 bbl/MMscf | | | | | |

**Note: Details on these producing fields are included as they are analogues for prospective fields*

*Table 4-3: East Coast Project Field Gas Compositions*

| Component | Casino | | Netherby | Henry | Annie |
|---|---|---|---|---|---|
| | Casino 4 (Waarre A) | Casino 5 (Waarre C) | Netherby-1 (Waare A) | Henry 2 (Waarre A) | (Waarre C) |
| **Analogue condensate** | Elanora and Heera | Juliet, Nestor and Isabella | Pecten East | Henry-3 | Annie-2 |
| | mole% | | | | |
| **Hydrogen sulphide** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Nitrogen** | 0.66 | 0.74 | 0.06 | 0.07 | 0.88 |
| **Carbon Dioxide** | 3.15 | 2.18 | 1.16 | 1.59 | 7.60 |
| **Methane** | 93.67 | 94.50 | 95.66 | 94.82 | 88.29 |
| **Ethane** | 1.50 | 1.80 | 1.99 | 2.26 | 2.11 |
| **Propane** | 0.43 | 0.44 | 0.55 | 0.60 | 0.64 |
| **i-Butane** | 0.13 | 0.07 | 0.10 | 0.12 | 0.03 |
| **n-Butane** | 0.13 | 0.07 | 0.12 | 0.18 | 0.07 |
| **i-Pentane** | 0.04 | 0.02 | 0.04 | 0.04 | 0.04 |
| **n-Pentane** | 0.03 | 0.02 | 0.04 | 0.04 | 0.04 |
| **Hexane** | 0.05 | 0.02 | 0.05 | 0.07 | 0.11 |
| **Heptane** | 0.09 | 0.06 | 0.08 | 0.10 | 0.08 |
| **Octane** | 0.03 | 0.03 | 0.04 | 0.04 | 0.03 |
| **Nonane** | 0.03 | 0.01 | 0.03 | 0.02 | 0.02 |
| **Decane** | 0.02 | 0.01 | 0.02 | 0.02 | 0.01 |
| **Undecane** | 0.03 | 0.01 | 0.02 | 0.01 | 0.01 |
| **Dodecane+** | 0.01 | 0.02 | 0.04 | 0.02 | 0.03 |
| **TOTAL** | 100 | 100 | 100 | 100 | 100 |
| **Mercury** | 0.1 µg/m$^3$ | | | | 1-4 µg/m$^3$ |
| **Naturally Occurring Radioactive Material (NORMS)** | 240 Bg/m$^3$ (Radon-222) | | | | - |

### 4.1.4 Production Profile

As described in Section 1.1 the East Coast Project development concept is a backfill development for the existing Athena gas plant currently serviced by the CHN field. To meet the continued demand as existing CHN fields decline Cooper Energy proposes to continue the incremental development of adjacent fields and utilise existing CHN infrastructure to maintain supply through the East Coast Project.

This scope allows for a total of 15 sub-sea production wells to be drilled over a ~20-year period. The development of all 15 wells will be subject to reservoir performance and the demand from the south east Australian domestic market. Figure 1-2 presents the gas development opportunities included in the scope of the East Coast Project with proposed well locations.

Figure 4-4 and Figure 4-5 show the production forecast for the East Coast Project.

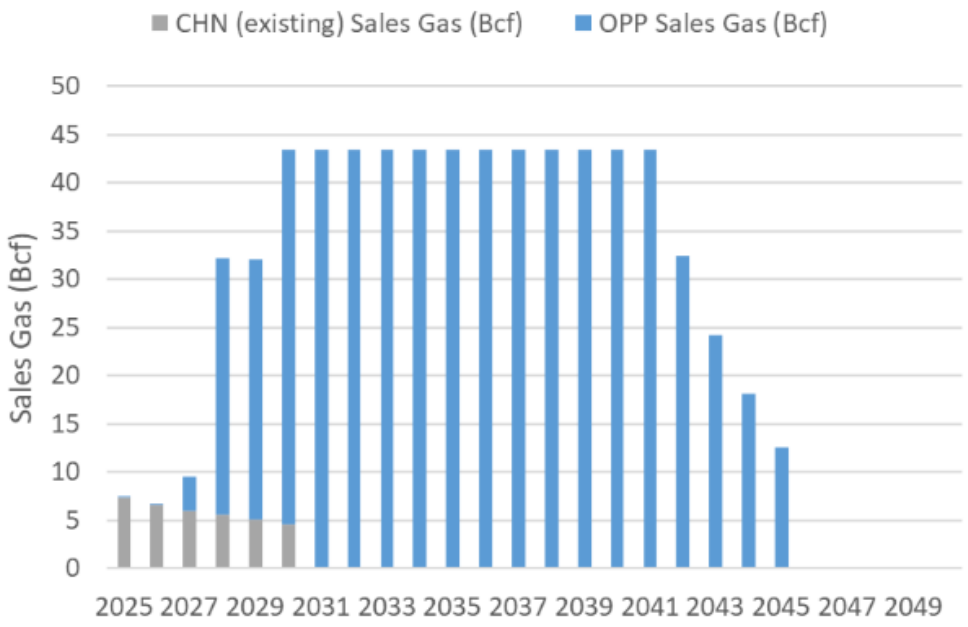



*Figure 4-4: Production forecast of sales gas for Cooper Energy assets within the Otway basin*

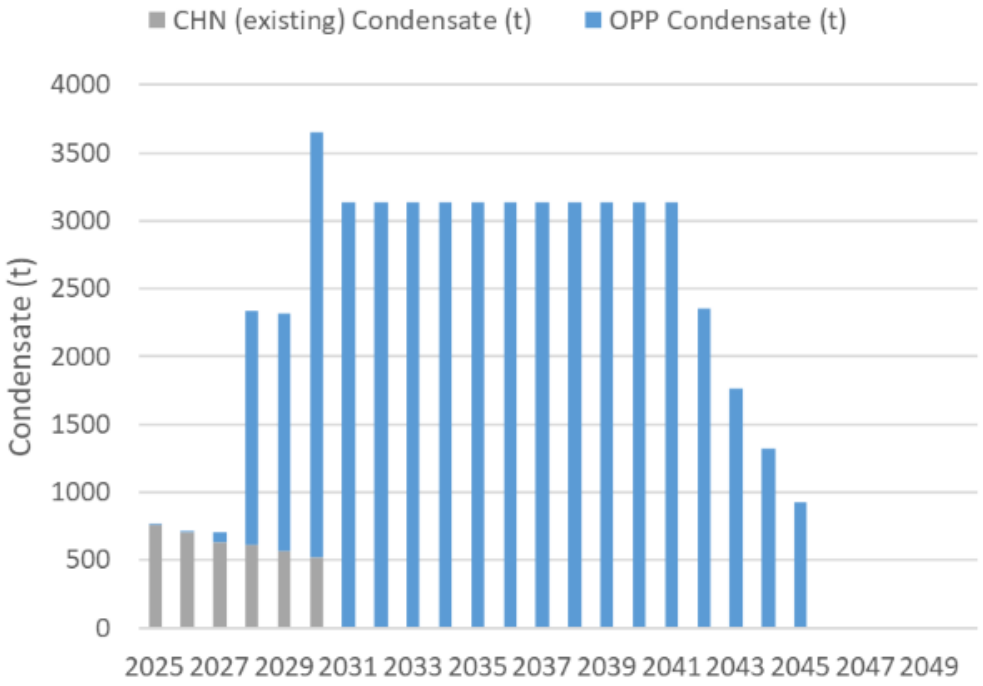



*Figure 4-5: Production forecast of condensate for Cooper Energy assets within the Otway basin*

## 4.2 Description of Hydrocarbon Infrastructure

### 4.2.1 Overview

The East Coast Project proposal includes the following subsea infrastructure which are described in detail in the subsections below:

- production wells
- flowline systems to link new wells to the existing CHN pipeline system

- umbilical system, comprising Electro/Hydraulic Umbilicals, jumpers or flying leads, linked to the existing CHN controls system
- other subsea infrastructure as described in Section 4.2.5.

Diverless structures and diverless trees are intended to be used in the East Coast Project, however, diver-assist manifold structures or trees will be selected where appropriate.

Indicative locations of proposed wells and infrastructure are shown in Figure 4-6. The final locations are likely to be adjusted within the operational area following field surveys and detailed engineering and will be detailed in future EPs.

Note that small structures such as umbilicals and jumpers are not shown in Figure 4-6 due to scale but would be located in close proximity to the infrastructure shown and are accounted for within the long-term direct disturbance footprint for the purposes of assessment as defined in Section 8.8.

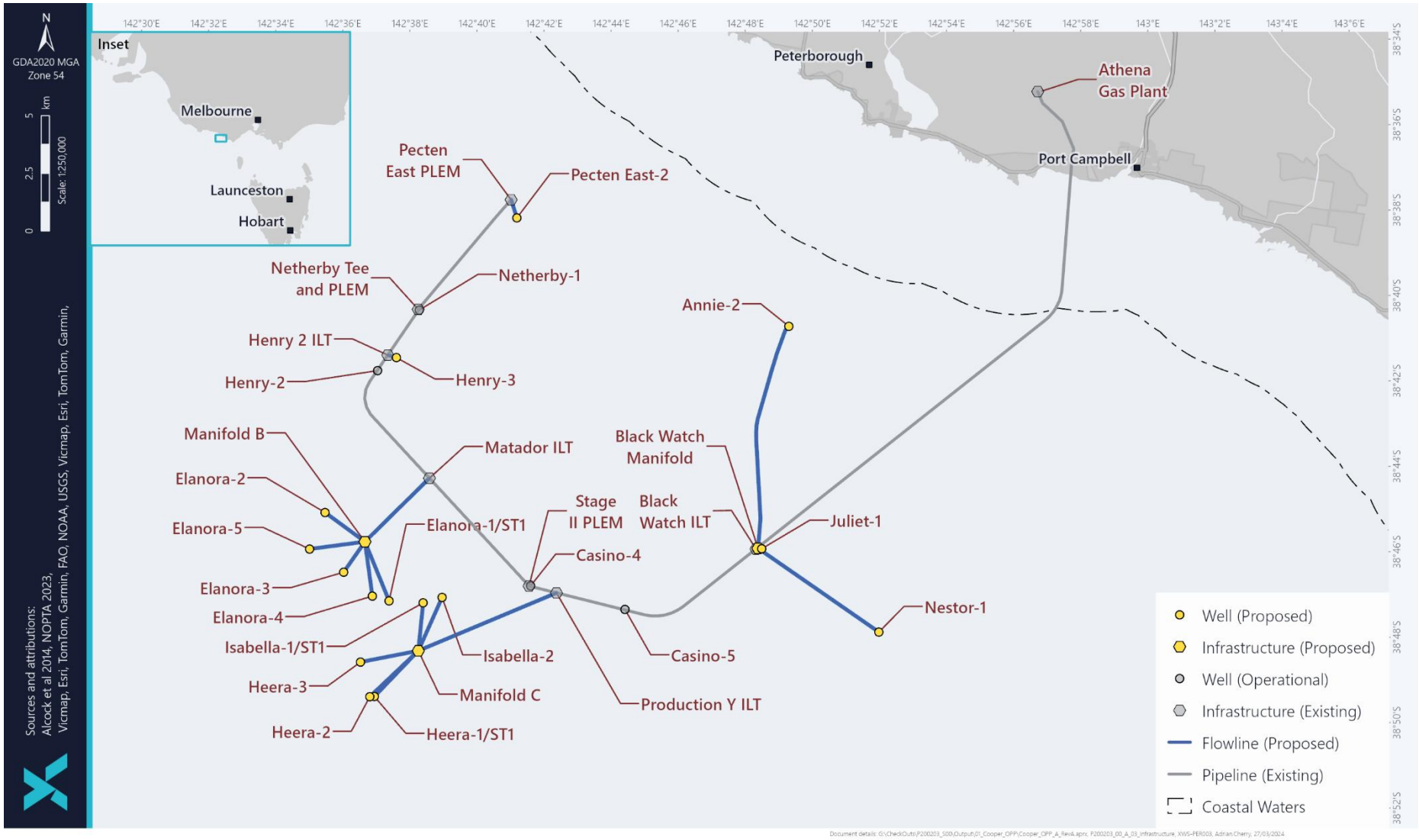



*Figure 4-6: East Coast Project proposed wells and associated infrastructure*

### 4.2.2 Wells

Up to 15 subsea production wells will be drilled over a ~20-year period subject to south east Australian domestic demand. In keeping with the development of the CHN fields to date, it is anticipated that the wells will be drilled incrementally in groups of 1-5 at a time. The OPP nominally assumes there could be up to 7 development well construction campaigns during that ~20-year period (depending on initial drilling outcomes, rig availability and field development planning). Figure 4-3 illustrates a 4-campaign development scenario, where 2-3 fields are developed in each campaign; this provides a conservative view as to the potential duration of the campaigns, which would be longer with more fields included. The direct footprint of the top-hole of each well is ~2 $m^2$.

For every well, there is the possibility of a re-spud at each top-hole location, which would be implemented within an ~10-20 m radius of the original location. In this case, the MODU would be re-positioned (kedged) within the existing mooring configuration, with no anchor movement required. The wells will be drilled either vertically or directionally (at an angle off vertical).

Within the East Coast Project, some wells are likely to be drilled via a sidetrack (ST). A ST uses the same top-hole as the existing well, where the bottom-hole section of the existing well is abandoned before an adjacent bottom-hole section is drilled and completed (or abandoned).

Following completion and well-test activities, commercially viable wells will typically be left with the SSTs installed and the wells shut-in, awaiting connection to the existing CHN facilities. Each production well will be fitted with a subsea tree; this structure includes valves which can be opened and closed to control the flow of hydrocarbons from the wells.

The well design will consider the well barrier envelope during well construction, operations and production to provide two independent verifiable barriers.

The anticipated location of proposed wells and the maximum number of wells at each potential gas development are detailed in Table 4-4.

*Table 4-4: Otway OPP key well characteristics*

| Wells[4, 5] | Eastings (GDA 2020 / MGA 54) | Northings (GDA 2020 / MGA 54) | Approximate water depth (m) |
|---|---|---|---|
| **Annie-2** | 658,700 | 5,716,737 | 57 |
| **Juliet-1** | 657,525 | 5,707,100 | 62 |
| **Nestor-1** | 662,600 | 5,703,490 | 64 |
| **Isabella-1/ST1** | 642,862 | 5,704,756 | 74 |
| **Isabella-2** | 643,682 | 5,704,991 | 73 |
| **Heera-1/ST1** | 640,751 | 5,700,699 | 81 |
| **Heera-2** | 640,553 | 5,700,690 | 81 |
| **Heera-3** | 640,150 | 5,702,188 | 81 |
| **Elanora-1/ST1** | 641,386 | 5,704,839 | 74 |
| **Elanora-2** | 638,613 | 5,708,668 | 73 |
| **Elanora-3** | 639,419 | 5,706,083 | 74 |

*[4]Juliet-1, Nestor-1 and Elanora-1/ST1 are intended to be drilled as exploration wells in the first instance. If exploration wells are successful in accessing commercially viable quantities of gas, then they may be suspended and retained for future production subject to the requisite approvals and licencing. The tie-in, operation and decommissioning of the wells is within the scope of this OPP (refer to Section 1.2.2).*
*[5]Well names and sequencing may change over time.*

| | | | |
|---|---|---|---|
| **Elanora-4** | 640,662 | 5,705,048 | 74 |
| **Elanora-5** | 637,946 | 5,707,085 | 74 |
| **Henry-3** | 641,705 | 5,715,381 | 66 |
| **Pecten East-2** | 646,922 | 5,721,433 | 57 |

### 4.2.3 Flowline systems

It is anticipated that the East Coast Project flowline system will be primarily flexible flowlines to cater for flexibility of lay routes as well as manufacturing and vessel availability. However, the rigid flowline option is also included within the scope of this OPP (see Section 5 for the alternative analysis). Dimensions of both systems are likely to be in the range of 6-8" and will be subject to flow assurance and detailed engineering studies. In the case flexible flowline systems are used, they will tie directly into the new subsea tree (SST). In the event of rigid reeled flowline systems, end terminations will be required with corresponding rigid diverless spools.

Figure 4-1 and Figure 4-6 present a single indicative route for each proposed flowline. These indicative routes present the outermost route and have been created for the purposes of impact assessment (conservative worst case). Final flowline routes will occur within the operational area, within a footprint equivalent in area ($m^2$) to the proposed long-term disturbance corridors for the whole East Coast Project, as described in Section 4.1.1.2. The final flowline routes, and therefore lengths, will be confirmed during detailed design, and will be described within subsequent EPs. The Operational area has been developed to account for potential variations to routes as planning progresses.

The conceptual design uses a 25% increase in route length to estimate a conservative total length of flowlines to be installed for all fields. This includes contingency to account for final route alignment. The conservative total length of flowlines to be installed for all fields is ~65.92 km.

Should alternative engineering designs be identified as the optimal field layout during detailed engineering design, flowline lengths will be reduced. For example, should wells be joined by a common flowline and umbilical prior to connection to a manifold, and tie-in at an existing point within current infrastructure, flowline length would be reduced and located within the operational area.

The new flowline systems included in the East Coast Project will be tied-in to the existing CHN facilities via existing in-line tees (ILTs) or via existing production Y tie-in points.

Currently, the end of the Pecten East line does not have provision for diverless intervention for performing in-line inspections (ILI). To ensure long-term integrity of the existing CHN pipeline, the end of the system will be modified to provide for diverless pig launchers/receivers if required. This would allow cleaning of the line prior to running any internal inspection campaigns.

Final routes for the flowlines have not yet been identified; and multiple route options are being considered and will be confirmed during FEED. Proposed flowlines will not cross currently existing third-party infrastructure, however crossings over the existing CHN pipeline system will occur. If a flexible flowline system is implemented, it will likely require concrete stabilisation mats placed intermittently to limit movement of the flowline system under influence of the prevailing oceanographic conditions.

Further details on the final equipment and design footprint will be provided in future activity-specific EPs. Table 4-5 provides the expected type, number and dimensions of subsea flowline system structures. All structures will be installed within an area equivalent to the proposed long-term disturbance corridor.

*Table 4-5: Estimate dimensions and footprint of infrastructure associated with flowline systems*

| Infrastructure | Estimated number required | Approximate dimensions (m) |
|---|---|---|
| **End termination for flexible flowline system** | Assumed each flexible flowline will have end termination.<br>Assumed there are 18 flowlines. Therefore, 36 end terminations. | 1m x 1m per end termination on each end of the flowline system |
| *Only applicable if rigid flowlines are installed<br>**Jumpers/spools complete with end terminations** | Assumed 2 jumpers/spools per rigid flowline system.<br>Assumed that only four rigid flowlines could be installed given the potential lay routes and distances. Therefore, total number of jumpers / spools is 8. | 15m Long x 1m wide rigid spool with end fittings<br>Rigid spools are installed between ends of rigid flowline and tree or manifold. |

### 4.2.4 Umbilical systems

New electrohydraulic umbilicals (EHUs) will provide hydraulic power, electric power, mono-ethylene glycol (MEG), other chemical inhibitors, and a fibre-optic communication link from existing controls systems to new SSTs and manifolds. EHUs will be installed alongside the flowlines where feasible, and all final umbilical routes will occur within an area equivalent to the proposed long-term disturbance corridors for the whole East Coast Project, as described in Section 4.1.1.2.

The conceptual design uses a 25% increase in route length to estimate a conservative total length of umbilicals to be installed for all fields. The total length of umbilicals associated with the conceptual design across all fields is ~73.79 km, which includes an umbilical from Black Watch Manifold to Casino-5. These lengths and associated operational area are indicative of a conservative engineering design as shown in Figure 4-1, and are also considered conservative for assessment purposes. These layouts may change during detailed design, but any changes would not lead to an exceedance of the acceptable levels of impact defined in this OPP.

In some circumstances the EHUs will incorporate subsea umbilical distribution units (SUDUs) or subsea umbilical termination unit (SUTU) / umbilical termination assembly (UTA) at the ends of the umbilicals. These termination units allow further distribution of the hydraulics or electrics to support the operation of the SSTs. Electrical Flying Leads (EFLs), and hydraulic flying leads (HFLs) may also be used in certain circumstances between the end terminations and the subsea assets. The finalised configuration would be part of the detailed design.

The umbilical system will be designed to be stable on the seabed, however, to prevent movements induced by ocean currents, stabilisation in the form of concrete mattress and/or grout bags will be used if required. Provisions will be made for concrete mattresses near SUDU's for stabilisation. Stabilisation/protection via grout bags may also be required around EFLs to counter the forces of currents at depth.

Further details on the final equipment and design footprint will be provided in future activity-specific EPs. Table 4-6 provides the expected type, number and dimensions of subsea umbilical system structures. All structures will be installed within the proposed operational area.

*Table 4-6: Estimate dimensions and footprint of infrastructure associated with flowline systems*

| Infrastructure | Estimated number required | Approximate dimensions (m) |
|---|---|---|
| **SUDU and SUTU/ UTA** | Each umbilical will have some form of termination. The type of termination is subject to detailed design.<br>Assumed there are 19 umbilicals (including Black Watch Manifold to Casino-5). Therefore, 38 SUDU's, or UTA's at each end of the umbilicals | Each termination could range in size. Assume average size of 2x2 m |

| Infrastructure | Estimated number required | Approximate dimensions (m) |
|---|---|---|
| **EFLs and HFLs** | Each umbilical should terminate direct into the tree. However, if this is not feasible there could be a requirement for 2x EFLs and 1x Hydraulic Flying Lead (HFL) per tree location.<br>Assume 15 trees. Therefore 30 EFLs and 15 HFL's | Each EFL or HFL are circa 50m long with diameter <150 mm |

### 4.2.5 Other Subsea Infrastructure

Other subsea infrastructure that will be installed includes:

- manifolds
- hot tap tie-in structure, as required
- double block and bleed systems and diverless hub
- subsea metering skid will be used, though is subject to future design and fiscal requirements.
- pig launcher/receiving temporary facilities as part of commissioning activities
- over-pressure protection systems.

Three new manifolds are proposed under the East Coast Project which will allow produced hydrocarbons from multiple wells to be co-mingled before entering the in-field production flowlines. Manifolds will incorporate an in-built foundation or require a separate foundation. It is expected that any foundation design would be a skirt-based system without the requirement for piling. Foundation design and final configuration will be subject to detailed design. The proposed manifolds are:

- Black Watch Manifold (BWM) to connect Annie, Juliet and Nestor via the existing Black Watch ILT.
- Additional manifolds to connect Elanora, Isabella and Heera prospects with the Matador ILT or the production Y tie-in.

A 'hot tap' is a contingency method where a flowline system is tied into a live, producing pipeline without disrupting routine operations. Currently there is no intention to hot tap into the existing CHN pipeline, however hot tapping has been included as a contingency activity as it will be undertaken depending on the final design and integrity of existing double block and bleed valve systems.

Over-pressure protection structures provide a means to isolate certain components of the system, where required, to prevent over-pressurisation of the broader production systems above the design parameters. The subsea protection structures are generally a structure that contains isolation valves, operated via the control umbilical system.

All subsea infrastructure is in concept or design phase. Further details on the final equipment and design footprint will be provided in future activity-specific EPs. Table 4-7 provides the expected type, number and dimensions of subsea infrastructure. All structures will be installed within the operational area.

*Table 4-7: Estimated dimensions and footprint of subsea infrastructure*

| Infrastructure | Estimated number required | Approximate dimensions (m) |
|---|---|---|
| **Manifolds** | ~3 | 8 x 12 m for each manifold structure |
| **SSTs (Subsea Trees)** | Up to 15 | 3x3 m for each subsea tree; note – the SST sits on top of the wellhead generally ~1m above seabed. |

| Infrastructure | Estimated number required | Approximate dimensions (m) |
|---|---|---|
| **Skids that house double block and bleed system, diverless hubs or fiscal meters** | ~5 | 5 x 5 m for each skid structure |
| **Hot-tap tie-in structure** | Optionally 1 as contingency | 5 x 5 m for each structure |
| **Pig launcher/receiver** | Optionally 5 as temporary items for commissioning | 6 x 1 m for each temporary facility |
| **Pressure protection system** | Optionally 2 as contingency | 5 x 5 m for each structure |

## 4.3 Description of Activities

The following subsections outline activities associated with each phase of the development.

Support Activities (Section 4.3.6) may apply within all phases of the East Coast Project and refers to those activities associated with contracted vessels/MODU that are common.

### 4.3.1 Surveys

#### *4.3.1.1 Geophysical Survey*

Geophysical surveys are required to understand seabed relief, substrate, anomalies, potential underwater cultural heritage, and hazards on or below the seabed, to inform the planning of activities such as subsea installation and well construction. Surveys will be undertaken at various times during the scope of the East Coast Project, although are subject to final project design. The survey of a proposed well site may take ~7 days to complete and a survey campaign is expected to take up to ~3 weeks where multiple sites are integrated into a single campaign.

Surveys would be expected to occur over approximately 25 $km^2$ area per well (grid dimensions of around 5 km x 5 km) depending on MODU mooring requirements. Any direct disturbance to the seabed will be within operational area, and within an area equivalent to the proposed short-term disturbance corridor. Surveys may employ a variety of techniques including:

- Multi-beam echo sounder (MBES) - detailed measurements of bathymetry in the operational area
- Side Scan Sonar (SSS) - detects hazards such as existing pipelines, lost shipping containers, boulders, debris, unmarked wrecks, reefs and craters. Also used to help detect possible underwater cultural heritage.
- Sub-bottom Profiler (SBP) - used to investigate the layering and thickness of the uppermost seabed sediments to check for shallow hazards and anomalies.
- Magnetometer - 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
- Sound Velocity Profiler (SVP) and Conductivity, Temperature and Depth (CTD) – used to calibrate survey equipment and environmental monitoring.

#### *4.3.1.2 Geotechnical Survey*

Geotechnical survey will be undertaken within the operational area for the purposes of manifold installation or other skid structures or to assist with flowline or umbilical system designs if required. Sampling locations will be identified within the potential development corridor. Each piston / push sample results in a small hole (<1 $m^3$). Approximately ~20 – 40 sample locations are expected within the scope of the OPP subject to detailed engineering requirements

Techniques that may be employed are:

- Penetration testing - The method can detect fine changes in stratigraphy
- Coring - to retrieve samples for geotechnical analysis
- Grab sampling - to retrieve surface sediments along flowline and umbilical routes, and at well sites for further analysis
- Deployment skids – deployment of geotechnical survey equipment.

#### *4.3.1.3 Environmental Surveys*

Environmental Surveys may be undertaken to within and outside of the operational area to collect baseline information where required to inform the development approach, support impact assessment and to verify condition of the environment within the operational area during operations and/or following decommissioning. Techniques that may be used include:

- Seabed sampling with Van Veen Grab or alternative
- Water sampling
- Acoustic monitoring
- Visual data collection with ROV or drop camera

### 4.3.2 Well Construction

Well construction activities will be carried out using a semisubmersible rig referred to as a MODU (as evaluated in Section 5.3.1). The metocean conditions within the offshore Otway region have the potential to preclude setting a jack-up MODU on location for up to 90% of the year and have an increased risk of 'punch through' associated with the region's surficial seabed properties. Therefore, a moored MODU (or DP assist moored MODU) has been selected as the feasible and proven option for drilling of the development wells for the East Coast Project. The MODU would be expected to be temporarily moored to the seabed and will be equipped with dynamic positioning (DP) systems for positioning and stabilisation during extreme weather events if required.

Up to 15 production wells will be drilled under the scope of the East Coast Project, which include up to 3 wells being drilled as geological sidetracks, as detailed in Section 4.2.2. Depending on the site and number of wells, well construction, including drilling, logging and running completions would be 45 days for a single well. This does not include additional time for unexpected delays and extreme weather events. For the purposes of impact assessment, a conservative value of 60 days for well construction (per well) is assumed, ranging up to 300 days for a campaign involving multiple wells (up to 5 wells).

Depending on initial drilling outcomes, rig availability and field development planning that could group multiple fields, a nominal 7 drilling campaigns are expected. Drilling will be undertaken at any time of year, though weather-related interruptions in the Otway region are typically longer and more frequent in Winter and hence could result in longer campaigns overall.

The final well design is subject to detailed engineering. The *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* requires that detailed well design and plans to manage the integrity of the wells throughout the well life cycle, is accepted by NOPSEMA before drilling can commence; this is done through the development and assessment of a detailed Well Operations Management Plan (WOMP).

The following sub-sections provide a description of drilling characteristics for a typical development well.

#### *4.3.2.1 MODU Positioning / Installation*

The MODU will be moored on location with assistance from anchor handler support vessels and/or using the MODU DP-assist, which is subject to final design. The MODU will move into position under its own propulsion or be towed by one anchor handler on bridle. An additional

two anchor handler vessels will be within the operational area (3 km from the MODU) connecting mooring lines from anchors on the seabed, to the MODU if required. The MODU will typically require between 8 and 12 anchors to maintain position during drilling. Anchors are likely to be pre-laid on the seabed a number of weeks in advance of the MODU arriving at each well location if required. These anchors and associated mooring wires/chains are deployed to the seabed by the anchor handler vessels.

Typically, mooring lines extend ~2,000 m – 2,500 m from the MODU, with ~1,200 m of grounded chain. Each anchor typically occupies a total seabed area of ~60 $m^2$.

Equipment to support accurate positioning of the MODU may include transponders. The temporary deployment of any transponders is likely to include skids and /or frames being deployed to the seabed; which are then retrieved. This will result in a temporary disturbance of <2 $m^2$.

The number of anchor handler vessels required is subject to the needs of the selected MODU but typically could be 2 anchor handler vessels with an additional platform support vessel (PSV) or another anchor handler vessel.

A temporary 3.5 km exclusion/ cautionary zone will be requested around the MODU during drilling activities and a permanent (until revoked) 500 m petroleum safety zone (PSZ) around each well will be established where required for equipment integrity management and gazetted by NOPSEMA.

#### *4.3.2.2 Drilling Operations*

Once the MODU is positioned over the well location, drilling equipment is lowered to the seabed and drilling commences with the top-hole section. The top-hole sections of the wells (conductor and surface hole) are drilled without a riser system back to the MODU; which is standard practice prior to BOP installation. The cuttings (rock chips) from the wellbore and drilling fluids from this section are released at the seabed in this initial part of the drilling process. As each section of the well is progressively drilled, steel casing is installed into the hole.

To facilitate the drilling of deeper well sections the nominal sequence of installation includes the installation of a riser and blowout preventor (BOP) once the surface casing has been cemented in place. If the well is intended to be produced in the future, a drill-through SST will be installed and tested on the well in preparation for a well completion on success (ie commercially viable resource discovery). The SST will regulate the flow of gas from the reservoir once the well is tied into the flowline system and production commences. Once the riser and BOP are installed, drilling fluids and cuttings will be returned to the MODU, and the drilling fluids will be separated from the rock cuttings using solids control equipment.

The solids control equipment comprises shale shakers that remove coarse cuttings from drilling fluids. The recovered fluids that have been separated from the cuttings will be directed to centrifuges to remove the finer solids if required. The cuttings are usually discharged back to seabed and the reconditioned fluids are recirculated into the fluid system. The drilling fluids are ultimately discharged once they have reached the end of their operational life.

The direct disturbance footprint of each top-hole is ~2 $m^2$. Volumes of drill cuttings and fluids estimated from the activities are detailed in Section 4.3.2.3.

Occasionally the initial bottom-hole section of a well may require re-drilling within the reservoir. This will be managed by drilling a new bottom-hole section, via a sidetrack from an existing well. In order to drill sidetracks, the bottom-hole section of the existing well section is abandoned and the new bottom-hole section is drilled and completed as per this section, and Section 4.3.2.6. Volumes of drill cuttings and fluids estimated from the activities are detailed in Section 4.3.2.3.

#### *4.3.2.3 Drilling Cuttings and Fluids*

Drilling fluids, sometimes called drilling muds, are a specialist mix of seawater, clay (or gel) and weighting additives such as barite, salt and chalk. Drilling fluids perform several functions,

including cooling and lubricating the drill bit, transporting drill cuttings out of the well, and maintaining hydrostatic pressure greater than formation pressure, thereby preventing the influx of hydrocarbons from the formation into the wellbore. Standard additives to the drilling fluids include polymer and polyamine to control fluid loss, viscosity and stabilise shales during the drilling process. The specific type and mix of drilling fluids will depend on the final proposed design and drilling requirements encountered.

Synthetic based drilling fluids (SBDF) may be used as a contingency drilling fluid. The contingent use of synthetic based fluids is included for well design scenarios which have not currently been worked up in detail but may require the use of SBDF to safely and effectively achieve well execution and ensure integrity of design. This may include scenarios such as extended horizontal step-outs (to subsurface targets), where wellbore stability studies support the use of synthetic based fluids in order to successfully drill the hole section(s).

In the unlikely case that SBDF are required, the potential discharge volumes of drill cuttings and SBDF will be approximately 180m$^3$ per well. Given that there is no planned use of synthetic based fluids, the management of the synthetic base fluids will be detailed in the relevant activity specific Environment Plans should the reservoir characteristics and or well design require these fluids. There will be no bulk discharge of the synthetic based fluids to the marine environment.

During drilling of the conductor and top-hole sections, a combination of seawater and high-viscosity gel sweeps are typically used as drilling fluid. Subsequent intermediate and reservoir hole sections will typically 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. The specific type and mix of drilling fluid will depend on the final proposed design and drilling requirements encountered on site.

Volumes of drill cuttings and fluids discharged at the seabed will be ~150 m$^3$ and 1,500 m$^3$ respectively. Volumes of drill cuttings and fluids discharged at the surface will be ~180 m$^3$ and 2,000 m$^3$ respectively. Fluids at the seabed and surface will typically be discharged in batches of between ~10–100 m$^3$.

#### *4.3.2.4 Cementing Operations*

Cement is used throughout the well construction process during installation of each well section to seal the casing into place. Cement can also be used in the form of a cement plug within the well 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 residual dry cement being discharged from venting pipes located under the MODU.

After a string of casing or liner has been installed into the well, a cementing spacer is pumped to flush drilling fluids from the well. Cement slurry is pumped down the inside of the well, and into the annulus (space between the casing and surrounding rock). Displacement fluid is then pumped into the casing with a wiper plug to displace the cement out of the bottom of the casing. Cement volume excess is required to ensure sufficient cement within the annulus. The volume of excess will depend on multiple factors, ~50 m$^3$ cement excess may be displaced to the seabed. The direct footprint of ‘overflow’ cement on the seabed is estimated to be within a radius of between 10 m and 50 m around the well.

In the event the cement slurry pumped into the well does not place or balance properly, the cement is circulated out of the well and discharged before it sets. The volume of these kind of cement washings can be in the order of 40 m$^3$.

The cementing equipment is tested prior to the commencement of cementing operations, resulting in a discharge of ~2.4 to 8 m$^3$ cement slurry to sea before it can set within the surface equipment. Upon completion of each cementing activity, the cementing equipment is flushed clean which also results in a release of ~1 m$^3$ of cement washings to sea.

#### 4.3.2.5 BOP Installation and Testing

The BOP will be installed onto the SST after completion of the top-hole sections prior to drilling the bottom-hole section, for well control purposes. The BOP is comprised of a series of rams that can be closed above the well. The BOP acts as a secondary barrier and is used to "close in the well" in the event of an unwanted influx of pressure into the wellbore from the reservoir whilst constructing the well. Once well construction is complete, the BOP is replaced by long-term barriers integrated into the well and is recovered to the MODU.

When the BOP is installed, regular function and pressure tests are undertaken to relevant standards, described in the WOMP. Function testing is undertaken regularly and will result in the discharge of ~2.5 $m^3$ of control fluid per well per test which will be discharged to sea.

#### 4.3.2.6 Well Completions

Completions are installed within a well to manage the flow of hydrocarbons from the reservoir into the well. Components of the well completions at reservoir depth (also called lower completions) include pathways to the well bore through the rock, steel casing and cement, as applicable. There are a number of ways these pathways can be established including wire wrap screens (either expandable or standalone), slotted liners, or case and perforate through a cemented liner.

Case and perforate methods, where considered appropriate, include perforating the casing/tubing and cement across the reservoir section using detonation charges. Alternatively sand management equipment (typically screens), where considered appropriate, are utilised to allow production whilst also minimising ingress of sand through the perforations into the well.

Well perforation techniques occur within the closed system of the well. Perforation techniques will create remnants of steel and formation i.e. debris, which will remain within the closed system of the well. This debris is flowed up the well once clean-up/flowback commences (Section 4.3.2.7).

Upper well completions involve running elements such as tubing packers in between the tubing and well casing, downhole gauges, and safety valves. The well bore will be cleaned and displaced to filtered brine when installing completions to minimise solids within the wellbore. Returned fluids will be re-used where they are assessed as suitable for future use. Fluids that are not suitable for reuse are directed overboard to sea.

Prior to setting the packers, the tubing annulus is displaced to corrosion inhibited completion brine (e.g. sodium chloride) which will remain in the well. The tubing contents may be displaced to a base oil (~40 $m^3$) ready for well clean-up and testing. Base oil is only introduced to the well after the well is circulated to completion brine and the completion is installed. The base oil does not form a component of the drilling mud (which is water-based) but is used to initiate flowback and is flared in its entirety during the well clean-up and test.

Completion brines can include sodium chloride (NaCl), or potassium chloride (KCl) treated with biocide and oxygen scavenger components and will be released during this activity. The high side volume is ~500 $m^3$ at the end of each well campaign.

#### 4.3.2.7 Well Clean-up and Flowback

Following completion of each well, well testing and clean-up will be undertaken to ensure the wells are cleared of drilling fluids and brines. This is necessary before eventual production to the onshore production facility, and to also capture well data such as pressure, flowrates, reservoir composition and to characterise non-hydrocarbon constituents. Base oil acts to underbalance the well and initiate flow from the well to the MODU, controlled via valves within the well, SST and BOP stack-up. The base oil and reservoir fluids will be directed to a flare boom, via a surface well test package. Flow from the well continues until the well clean-up criteria are met (e.g. completion fluids have been removed, and residual solids including debris are 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 laboratory analysis. Onsite analysis is also performed for non-hydrocarbon components such as $H_2S$, $CO_2$, radon and mercury).

Flowing of each well and therefore flaring will have a duration of 60 hours and result in a maximum volume of approximately 150 MMscf flared per well. Flaring requires the MODU and associated test package to be connected to the well and hence can only occur from one well at a time.

#### *4.3.2.8 Well Suspension*

In the event the wells do not access commercially viable resources for potential future in-fill development, well abandonment is to be carried out within the well activity duration described within the EP, following drilling and evaluation as described in Section 4.3.5.3. Well equipment above the seabed (i.e. wellhead) will also be recovered where not in use.

Following completion and well-test activities, commercially viable wells will typically be left with the SSTs installed and the wells shut-in, until connection to the existing CHN facilities. For new wells to be brought online, the existing CHN wells would likely be shut-in temporarily whilst backpressure from the new wells reduces. Production from CHN wells would be expected to be reintroduced when pressures and rates from other fields allow.

To be ‘shut-in’ means the well barriers are closed, preventing the flow of hydrocarbons out of the well. Prior to well shut-in, the well and SST barriers will be tested, and fluids flushed to sea (e.g. MEG treated with corrosion inhibitor) if required. Alternatively, should it be required, the wells may have an SST installed at a later date. In this instance, plugs are installed within the wells to prevent flow of hydrocarbons, and a suspension cap installed on the wellhead to prevent debris entering the well during the suspension period, prior to returning to the well to install the SST.

The suspended wells will be monitored 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.

The intention is that a successful discovery, following completion and well-test activities, would be developed as soon as practicable after discovery pending regulatory approvals. An activity specific, approved installation and commissioning EP would be required prior to installation and commissioning activities occurring, and the Operations EP would require revision to account for production associated with the discovery. Installation and commissioning activities are anticipated to occur within approximately 6 to 36 months (depending on planning variables such as vessel availability, equipment delivery timing, timing of onshore processing capacity and obtaining approvals) of the completion and well-test activities of each commercially viable well. During this time the wells will remain shut-in and monitored in accordance with the WOMP. Figure 4-7 illustrates the steps from well planning through to production from the well.

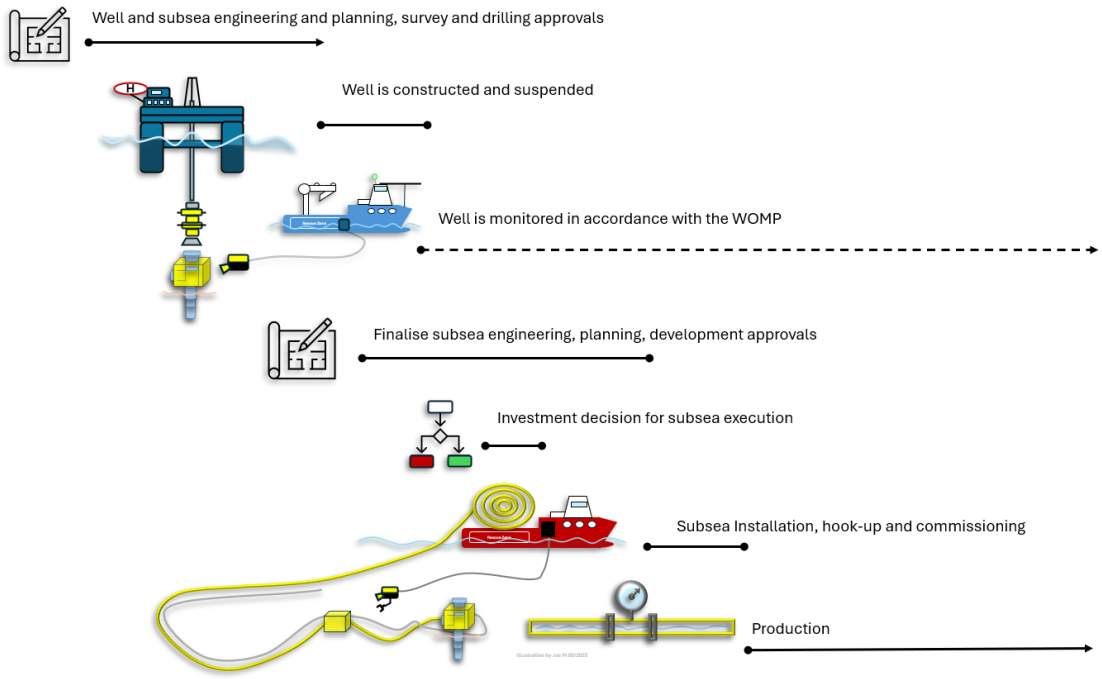



*Figure 4-7 Illustration showing indicative steps between well construction / suspension and production*

#### *4.3.2.9 Logging*

During drilling, it is necessary to gather formation information for ongoing drilling operations or to inform 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 included as an option, avoiding introduction of associated higher intensity impulsive noise.

### 4.3.3 Installation and Commissioning

Installation and commissioning phases will include the installation of flowlines and other subsea infrastructure plus testing activities. During this phase, the development wells will be connected to a commingling manifold or other tie-in point via flexible jumpers or rigid/flexible spools. Jumpers and spools are used to connect manifolds to flowlines and flowlines to ILTs. Existing ILTs are typically integrated into a skid with necessary double block and bleed valves that can be operated by a ROV.

To transition from construction to operation, facilities will go through a process of commissioning prior to start-up. Commissioning activities will ensure components of the East Coast Project are installed, tested and function correctly. Following commissioning activities, start-up activities will introduce hydrocarbons into the rest of the system. Installation and commissioning activities will involve:

- pre-lay works
- flowline system laying
- umbilical system laying (includes SUDU/UTAs)
- installation of subsea structures
- post-lay works including making up connections and adding stabilisation where needed.
- testing, preservation and start-up.

The duration of the above activities will vary for each field based on the numbers of wells, differences in flowline length and type and quantity of additional subsea infrastructure. Section 4.1.2 provides indicative frequencies and durations for activities, however the descriptions

provided do not account for unforeseen events such as delays in vessel availability and extended weather delays.

All activities will occur within the operational area, with direct seabed disturbance from installation and commissioning located within the operational area, within an area equivalent to the proposed short-term disturbance corridor the long-term disturbance corridor (Section 4.1.1.2).

In the unlikely event that equipment is stored temporarily on the seabed due to storm or emergency events (and subsequently removed), the area of disturbance will be additional to the long-term disturbance corridor. It is estimated this would have a temporary footprint of ~50 x 50 $m^2$.

#### *4.3.3.1 Prey-lay works*

If required, pre-lay works within the operational area will involve the installation of concrete mattresses and/or grout bags at pipeline crossings or in locations where pipeline spans may occur. No trenching or excavation is required.

If required, pre-made concrete mattresses and grout bags will be deployed by crane or A-frame and will typically be guided into position on the seabed using an ROV. Grout bags may also be installed by pumping cement slurry/grout through a hose from the vessel to fill grout bags underwater. Some excess cement will be released into the sea during this process when the hose is first filled with cement and then flushed with seawater at the completion of operations.

The total number of concrete mattresses will not be known until the pre-lay survey is performed. Each mattress will have an approximate footprint of 18 $m^2$. The footprint on the seabed of grout bags on the seabed is typically confined to small areas overlapping the flowline footprint. Additional mattresses and grout bags will be used post-lay, to fill in any substantial gaps between the as-laid flowline system and seabed if required; this is also referred to as 'span rectification'(Section 4.3.3.4).The footprint of a grout bag is a consequence of the size of the bag with selection depending on the required stabilisation or the span of rectification but will typically be ~1 $m^2$.

For the purposes of impact assessment, the disturbance footprint for prey-lay works is included within the conservative area estimate for the long-term disturbance corridor.

#### *4.3.3.2 Flowlines and umbilicals*

Both rigid and flexible flowlines will be considered for the East Coast Project (see Section 5 for rationale). Flowlines and umbilicals will be installed within the same campaign through similar methods in respect to seabed disturbance if required. Installation for the flexible flowline / umbilical systems will most likely occur through reels or carousel methods depending on the length and vessel storage capacity. Due to the length of the flowline systems, the flowlines will be transported either on an installation support vessel (ISV) or a Heavy Lift vessel (HLV). In the event flowlines are transported on HLVs, the flowlines will be transferred from a HLV to an ISV via multiple lifts over the course of the installation campaign if required. In the event the flexible flowline system is installed from multiple reels, the inline flange connections will be made up on deck during the lay progress.

Rigid reel lay is also feasible, which installs the rigid flowline system from a single reel but may involve several interim mobilisations to a spool base in order to replenish the reel with more product.

Rigid reel lay is undertaken from an ISV generally referred to as a reel lay vessel. Reel installation involves the welding together of long pipe segments, tested and coated onshore and then spooled onto a large, usually vertically oriented pipe reel. Once the installation vessel is in position, the pipe is unspooled, straightened and lowered to the seabed as the installation vessel moves forward. A dead man anchor (DMA) may need to be temporarily installed on the seabed to facilitate the initial laying of the pipe onto the seabed.

Any free span that exceeds pipeline design parameters will be mitigated via inclusion of a free span support beneath the pipeline. The support may comprise grout injected free span

supports or concrete mattresses / grout bags / log mattresses and would sit within the disturbance corridor for the final pipeline and umbilical alignments within the operational area.

The infrastructure to be installed includes a total length of (including 25% allowance):

- ~65.92 km of flowline system (rigid and/or flexible)
- ~73.79 km of umbilical system.

The long-term direct disturbance footprint of the flowline / umbilical system on the seabed has been conservatively estimated to be equivalent to a 100 m wide corridor (Section 4.1.1.2). The footprint includes any disturbance along the flowline / umbilical routes due to installation. It also takes into consideration other equipment such as, jumpers or spools and stabilisation materials (including those at existing CHN pipeline crossings).

#### *4.3.3.3 Installation of subsea structures*

Subsea infrastructure including manifolds, skids, hot-tap tie-in structures, diverless hub, block and bleed system, spools, SUDUs/ UTAs, flying leads and stabilisation will be installed to connect the new production wells to the existing CHN system (see Table 4-5, Table 4-6 and Table 4-7, for a list of installed subsea structures). As part of the new flowline system in certain circumstances a co-mingling manifold may be required. Flexible jumpers or rigid/ flexible spools will connect the development wells via a commingling manifold or tie directly into the new subsea tree (SST).

Prior to installing subsea structures, a seabed survey may be conducted to confirm no existing obstacles that may hinder installation activities are within the operational area. In the unlikely event of encountering a significant obstruction, the debris/obstruction would be cleared. If a significant obstruction is encountered, the subsea system will be rerouted proximal to the planned layout if required.

Generally, structures / skids will be installed directly onto the seabed; or onto foundations with skirts, which are typically steel skirted mud mats. Subsea infrastructure will be lifted off an ISV by an onboard crane and deployed subsea, with an ROV or diver guiding the structure into place.

The tie-in points on the existing CHN system (ILTs) currently require diver assistance. Conversion of the existing tie-in points to a diverless system (is preferred for safety purposes) which will require the installation of a diverless hub and a block and bleed system. In the unlikely event that a hot-tap is required a hot-tap tie-in structure will be installed.

The development wells transition from a suspended exploration well to a development well on completion of tie-in of the new flowline system between the existing CHN inline Tees (ILT) and the production tree. In order, for the new wells to be development wells, the new umbilical system is also required for both control, monitoring of the trees in lead up to production and operation.

Internal cavities within the structures will be flooded with inhibited water or filled with MEG via inclusion of solid inhibitor sticks placed inside to minimise corrosion risk if required. These fluids and inhibitors are displaced to sea during subsequent activities (see Section 4.3.3.5).

Equipment to support accurate positioning of subsea structures and ROVs may include transponders. The temporary deployment of any transponders is likely to include skids and /or frames being deployed to the seabed which are then retrieved. This will result in a temporary disturbance of <2 $m^2$.

As a part of commissioning operations seawater is typically used for flooding or dewatering of flowlines whereby inhibited seawater passes through filters as part of the seawater winning, or ‘water-winning’ operation.

#### 4.3.3.4 *Post-lay works*

Following installation, the flowlines and umbilicals will be stabilised. This involves placing high-density concrete mattresses at intervals along the flowline / umbilical system to satisfy detailed design requirements.

In addition, small scale 20–40 kg stabilisation grout bags will be situated on jumpers and flying leads to assist with stability and general protection where required.

For the purposes of impact assessment, the disturbance footprint for post-lay works is expected to be equivalent to the estimated long-term disturbance corridor.

#### 4.3.3.5 *Testing, Preservation and Start-up*

Internal cavities within the structures will be flooded with inhibited water or filled with MEG with inclusion of solid inhibitor sticks placed inside to minimise the risk of corrosion if required. These fluids and inhibitors may be displaced to sea during subsequent pre-commissioning activities.

Following subsea infrastructure installation, equipment is inspected and tested via pre-commissioning activities, which will be subject to detailed execution planning:

- Flooding – seawater within the flowlines is displaced to fresh or inhibited seawater via water-winning operations 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 – involves the use of a series of gel pigs 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 may be repeated where required. Once tested, depending on timing to start-up, the subsea system will be left flooded. Preservation fluids are used to preserve infrastructure before commissioning and operations.
- Dewatering – once testing is complete, the flowlines will be in a flooded state filled with preservation fluids (inhibited seawater) via water-winning operations. Prior to start-up of production from the wells, the subsea system is dewatered by displacing the lines with nitrogen gas. Nitrogen gas will be pumped from a surface vessel via a downline into the subsea system. The inhibited water is displaced to sea (at manifold or tie-in locations), until the system is filled with nitrogen gas. Nitrogen is an inert gas that makes up ~78% of the earth's atmosphere; it carries no risk of ignition and is non-corrosive.

Following the above steps, the system is entirely connected, tested and ready for start-up. The subsea equipment is operated by the onshore gas plant via the controls system. Once the gas plant is ready to receive hydrocarbons from any of the new wells, they can be opened and gas will flow through the flowlines per normal operations, pushing the nitrogen gas back to the Athena Gas Plant as part of the commissioning process.

Conservative volume estimates for fluids displaced to the sea from commissioning activities for all flowlines associated with the East Coast Project are compiled in Table 4-8.

*Table 4-8: Estimated maximum discharge volumes from commissioning of the East Coast Project*

| Discharge Type | Key Components | Total Volumes** |
|---|---|---|

| | | |
|---|---|---|
| **Inhibited water** | Seawater with chemical additives including corrosion inhibitor, oxygen scavenger, biocide and dye | 3,232 $m^3$ |
| **MEG*** | MEG c/w water mix. The calculated volume is for the full flexibles. The finalised procedure may result in slugs being used reducing the amount to ~10% of the full volume | 3,232 $m^3$ |
| **Nitrogen gas** | Nitrogen gas | 3,232 $m^3$ |

**10-100% discharged at ~seabed level*
*** An additional conservative 50% has been added*

### 4.3.4 Operations

The principal activity during the operational phase of the East Coast Project will be the flow and transportation of hydrocarbons from the wells to the existing CHN pipelines and then to the Athena Gas Plant onshore.

Section 572(2) of the OPGGS Act requires a titleholder to maintain in good condition and repair all structures, equipment, and other property that is within the title area and is used in connection with the operations authorised by the title. Inspection, maintenance and repair (IMR) of subsea infrastructure is undertaken to ensure that the integrity of the hydrocarbon system is maintained at or above relevant standards. IMR activities may occur at any time during operations, as well as during commissioning and start-up.

Activities associated with operations under the scope of the East Coast Project include:

- hydrocarbon extraction and transport
- inspection (external and internal)
- maintenance and repair
- well intervention.

#### *4.3.4.1 Subsea Operations*

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

Isolation of the pipeline will be able to be performed at the offshore wells, the onshore main line valve 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 facility Integrity Management Plan (IMP).

The hydraulic component of the umbilical is open loop, with small releases to sea (in the order of a few litres) of water-based control fluid at the wells during valve functioning.

Other fluids within the umbilical include MEG and could also include chemicals such as scale and corrosion inhibitor dosed with the MEG or separately via chemical injection cores within the umbilical. Some of the fluid contents of the umbilical may be displaced to sea during maintenance and repair activities, for example during umbilical jumper replacement, or intervention and re-termination of umbilicals in the event of a fault. Additionally, methanol will be used to manage hydrates if they occur within the flowline system.

#### *4.3.4.2 Studies, Surveys and Monitoring*

Studies and surveys that may occur over the operational life of the East Coast Project are listed below:

- peer reviewed scientific research and papers will be used to support the identification of environmental studies, surveys and monitoring required in future EP submissions during the life cycle of the field.

- offshore IMR surveys and ongoing operational monitoring of produced fluids to assess infrastructure integrity
- seabed and water sampling for contaminants of concern (e.g. NORMS, mercury, etc.), where there is a pathway for the contaminant to accumulate in either the seabed or water. Study design types will align with government guidelines for fresh and marine water quality (Australian Government, 2024) or equivalent, such as changeover space whereby disturbances are characterised by spatial patterns*.
- surveys of infrastructure to assess burial status and condition, including structural integrity through to defined end states (removal being base case).
- as-left survey following decommissioning activities
- monitoring surveys, determined on a case-by-case basis, in consideration of the impacts and risks and as described within EPs* accepted by NOPSEMA.

*The project concept is of a subsea development with no ongoing continuous discharges within the operational area. Planned discharges are mainly associated with temporary offshore construction and decommissioning activities; discharges of this nature have been undertaken historically in the region, and have been shown to result in little to no impact on water or sediment quality and associated amenity (Section 6.4.6 and Section 6.4.7).

Further details of surveys will be provided in respective EPs for each phase of the East Coast Project as project and campaign designs are matured.

#### *4.3.4.3 Inspections*

Subsea inspections proactively identify maintenance or repairs required with the aim of maintaining the assets as close to their design condition as possible. Inspection generally involves an IMR vessel travelling along the route of the subsea system with an ROV (and in some cases, divers). Inspections will be undertaken with a frequency determined based on risk and informed by monitoring and previous inspection results. Typically, vessels will be on site for ~2-4 weeks every few years to undertake inspection and/or maintenance works. This frequency is adjusted according to asset integrity risk which is informed both by offshore inspections and ongoing monitoring of asset integrity management measures.

Subsea inspections typically include:

- Cathodic protection measurement – completed using ROVs or AUVs and conductivity probes or by making visual assessments of anode wastage
- General visual inspections – involves ROVs or autonomous underwater vehicles (AUVs) deployed from a vessel; may also involve divers and a dive support vessel
- Marine acoustic surveys – includes the use of side-scan sonar (SSS) and multibeam echo sounders (MBES), and typically completed using towed acoustic instruments, ROVs, or AUVs
- Non-destructive testing – includes ultrasonic testing and electrical resistance testing, which are typically undertaken using an ROV or AUV deployed from a vessel. This type of testing will be performed to validate the results of other inspection techniques if required.
- Inline inspections/pigging (ILI) of the existing pipelines may occur in line with the Pipeline Integrity Management Plan (PIMP) with pigs received onshore at the Athena Gas Plant. Any ILI program will involve minor discharge at Pecten East as part of the execution program.
- Wall thickness/fatigue monitoring/inspection—where required, fatigue monitoring equipment will be installed, inspected, and/or retrieved by an ROV deployed from a vessel.
- Inline inspections are not accommodated in the design for new production systems due to the short design life of the fields and the variation in diameters of the new

system compared to the existing system. This approach will be confirmed as part of detailed design.

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.

#### *4.3.4.4 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
- 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. Activities may include:

- cathodic protection system maintenance
- leak testing
- excavation (e.g. where pipeline has become buried by shifting sands)
- marine growth and hard deposit removal
- removal of debris (e.g. fishing equipment)
- rectification of electrical or hydraulic fault
- flowline repair
- pipeline gauging
- flowline jumper replacement
- service line/hydraulic capping plate removal and reinstallation
- subsea control unit change out
- replacement of equipment on the seafloor
- stabilisation deployment
- servicing of SSTs, flowlines, well maintenance (see Well Intervention), flanges and mechanical connections.

#### *4.3.4.5 Well Intervention*

Well intervention is the action of re-entering a well for purposes other than drilling; usually to:

- evaluate a well's condition or performance
- remove obstructions
- stimulate the well
- repair well casing / tubing.

Well intervention generally occurs within the wellbore and involves specific types of tools that can be delivered down the inside the well itself. It includes activities such as:

- slickline / wireline / coil-tubing operations
- well testing and flowback
- well workovers (mechanical or hydraulic).

The frequency of well intervention activities depends on well performance which is measured through monitoring of production and via integrity tests involving the operation of well tree valves, typically completed by the control room operators within the onshore gas plant.

### 4.3.5 Decommissioning

#### *4.3.5.1 Decommissioning Approach*

Decommissioning of an asset involves sealing the wells and deconstruction and removal of equipment in a safe and environmentally responsible manner. Seabed surveys are used to understand levels of residual seabed disturbance at the end of decommissioning and inform restoration activities.

Decommissioning of offshore assets is required under the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act). 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 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. Options other than the complete removal of all property may be considered if acceptable under the regulations and policies at that time. In the context of current regulations and policy, where alternatives to full removal are proposed, permissioning documents 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 is the base case under current regulatory and policy settings, unless an alternative end-state is accepted by the regulator.

In planning for decommissioning, Cooper Energy also considers the actions and obligations involved in Title relinquishment, under Section 270 of the OPGGS Act (Cth) and Section 266 of the OPGGS Act (Vic). The following principles and conditions apply:

- ecologically sustainable development
- impacts and risks are reduced to ALARP and are of an acceptable level
- wells have been plugged or closed off in accordance with section 569(1) of the OPGGS Act (Cth).
- other international and domestic requirements
- the seabed within the Title Area is cleared of property installed, or authorised to be installed by the Titleholder, except where a deviation has been accepted by the Regulator.

EPs (to be) developed for the decommissioning phases will address these principles and conditions and outline the studies and surveys required to demonstrate compliance with Section 572 and Section 270 of the OPGGS Act.

Cooper Energy acknowledges the targets set in NOPSEMA's Decommissioning Compliance Strategy 2024-2029 for decommissioning planning. Current regulatory expectation is that:

- all facilities, pipelines and flowlines are decommissioned, including remediation of the marine environment and making good any damage to the seabed, within 5 years of permanently ceasing production;
- wells that do not access commercially viable resources will be abandoned within the well activity duration (following drilling and evaluation as described in Section 4.3.5.3);
- the development wells are permanently abandoned within 3 years in the event that wells do not confirm commercially viable resources for future in-fill development or as accepted in the governing WOMP where integrity can be demonstrated as per regular inspection and/ or monitoring activities;
- the development wells are permanently abandoned within 3 years of permanently ceasing production or as accepted in the governing WOMP where integrity can be demonstrated as per regular inspection and/ or monitoring activities.

The final plug and abandonment program for each well will be included in the WOMP which must be accepted by NOPSEMA prior to the commencement of the activity.

Cooper Energy acknowledge these requirements however note the following specific additional aspects in relation to timing:

- Planning for decommissioning should commence in the early stages of project development and be considered in the design of the asset. A decommissioning plan will be developed for each asset, or group of assets within an operational area. For existing assets where decommissioning plans were not undertaken as part of the design process, the development of these decommissioning plans should be prioritised based on the complexity of the asset and the remaining operational life.
- The decommissioning plan must consider, where practical, progressive decommissioning of assets where they are no longer in use or to be used, over the operating life of the project, to the approved end state as soon as practicable or otherwise as agreed by NOPSEMA. Cooper Energy will evaluate the integrity risk to determine if shut-in or redundant equipment or infrastructure needs to be decommissioned out of sequence or during campaign field decommissioning.
- Decommissioning may occur across numerous campaigns, with some elements of the facility decommissioned within interim campaigns, or within the full field decommissioning campaign. When a MODU is undertaking infill drilling or workovers within a field, Cooper Energy will also consider whether the MODU could be used to decommission wells within the field that have ceased production, are shut-in, and which do not have potential for future use.

Additionally, any proposal to permanently leave infrastructure in situ, will require a permit where applicable under the *Environment Protection (Sea Dumping) Act 1981*. Under the Sea Dumping Act, 'dumping' includes abandonment or toppling at site of platforms or other man-made structures at sea.

Key activities associated with decommissioning of infrastructure discussed within this OPP are summarised in the following sections.

#### *4.3.5.2 Surveys*

Surveys within the operational area will be undertaken before and following decommissioning using ROV deployed from a vessel. Survey's aid understanding of the integrity of infrastructure, and aid retrieval planning. Techniques used are similar to that described in Section 4.3.1.

Additional monitoring will be undertaken following decommissioning if required and would be planned in further detail closer to the time of decommissioning, accounting for information gathered during surveys. Surveys that may apply to operational and decommissioning phases are described in Section 4.3.4.2.

#### *4.3.5.3 Well Abandonment*

Wells will be abandoned after the cessation of production, or in the event that wells do not confirm commercially viable resources for future in-fill development. Well abandonment activities are undertaken to isolate the reservoir section of the well and mitigate the risk of a potential release of reservoir fluids to sea. Interim well suspension activities prior to well abandonment are not expected based on current development concepts, however, should they be required, well suspensions would be undertaken as described in Section 4.3.2.8.

Residual gas in the well fluids will be bled off or flared during well abandonment if required. Levels of flaring would depend on pressures within the well, however at end of well life the gas within the wells would be expected to be significantly depleted. If flaring is required, it would be expected to be low levels, in the order of 1 day per well at a rate of ~18 MMscf/well/day and would only occur from one well at a time.

Activities during the well abandonment process may include:

- remove tree cap

- install pressure control equipment
- flowline flushing
- kill and suspend well
- disconnect equipment and remove SST
- installation and removal of pressure control equipment
- remove tubing and control lines
- install permanent reservoir barriers.

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

Cutting and removal of wellheads is common in areas where their presence presents a navigational hazard. The base case plan will be to remove the wellheads, however if a wellhead is cemented beyond the cutting tool limits, the wellhead will be left in-situ if required, subject to regulatory approval.

The method for installation and appraisal of the barriers for abandonment will be the same regardless of whether the wellhead remains in place or not.

Well abandonment operations will be assisted by a moored, or DP assisted moored MODU, and are expected to last ~25 days and result in cement discharge of ~8 $m^3$ per well.

All plug and abandon operations will be conducted in accordance with relevant standards, as detailed within a NOPSEMA-accepted WOMP.

#### *4.3.5.4 Flowline and Umbilical Decommissioning*

Prior to removal of flowline systems, best endeavours will be made to clean and flush the flowline systems via pushing the production fluids back into the production wells, or alternatives such as flushing to shore facilities where fluids will be recovered and treated according to local requirements. The recovery method for flowlines will depend on whether they are rigid or flexible. In general terms there are two viable options for recovering flowlines and umbilicals which are dependent on their material composition:

- Option 1: Recovery via ‘reverse reel or carousel’. This method is likely only suitable for flexible flowlines and umbilicals. It involves the recovery of materials onto a reel or carousel located on the deck of a vessel using a hub drive and tensioner system. If the flowlines are rigid and installed via reel lay method, then a reverse reeling scenario will be a feasible solution.
- Option 2: Recovery via ‘recover and cut’. This retrieval method is only suitable for flexible flowlines and umbilicals. It involves the recovery of materials to the vessel deck, secured through tensioners and cut into manageable pieces on the vessel deck.
- Option 3: Recovery via ‘cut and recover’. This retrieval method is only suitable for rigid flowlines. It involves the subsea cutting of infrastructure using an ROV and cutting tool prior to recovering the materials to the vessel.

Either option, a combination or all, will be used as part of decommissioning, but is subject to final project design (Section 5). Further, it should be noted that over the course of operational life, technology advancements and opportunities for different approaches will be continually investigated and evaluated.

Flushing and cleaning of flowlines may result in discharge to sea. Preference is typically to discharge volumes downhole to the production wells before they are abandonment. Following well abandonment, the remaining contents of the flowline will be released to sea post-disconnection of the flowlines from the wells. See Table 4-9 for estimated maximum discharges from flushing and cleaning of all flowlines associated with the East Coast Project.

*Table 4-9: Estimated maximum discharge from flushing and cleaning of flowlines*

| Discharge Type | Key Components | Total Volumes* |
|---|---|---|
| **Inhibited water** | Seawater with chemical additives including corrosion inhibitor, oxygen scavenger, biocide and dye. | 3,232 $m^3$ |
| **MEG/Water** | MEG and water mix.<br>The finalised method may result in slugs being used which would reduce the volume by ~90%. | 3,232 $m^3$ |
| **Nitrogen gas** | Nitrogen gas for decommissioning is unlikely to be used for dewatering of the flowline system as part of recovery but will be subject to engineering as part of execution phase.<br>The finalised method may result in reduction of this volume to zero | 3,232 $m^3$ |

** An additional conservative 50% has been added*

#### *4.3.5.5 Removal of Remaining Subsea Infrastructure*

The remaining subsea infrastructure will also require decommissioning; this includes spools and jumpers, subsea structures, controls structures, stabilisation equipment and so on. Prior to removal the condition of subsea infrastructure at the time will be assessed. Structures may need to be modified subsea to facilitate removal. The seabed around structure foundations may need to be excavated if they have become buried, or structures may need to be toppled to break sediment suction and cutting may also be required. Equipment such as well heads will be cut at or below seabed level and recovered to a vessel.

A vessel with suitable crane capacity and deck space for marine spread and recovered equipment will be used for the above activities. It should be noted that over the course of operational life, technology advancements and opportunities for different approaches will be continually investigated and evaluated.

All decommissioning activities will occur within the operational area, within an area equivalent to the long-term disturbance corridor (Section 4.1.1.1). However, in the unlikely event that equipment is stored temporarily on the seabed due to storm or emergency events the area of temporary disturbance will be additional to the long-term disturbance corridor. It is estimated this would have a temporary footprint of ~50 x 50 m.

#### *4.3.5.6 Title Relinquishment*

Section 270(3)(c) to (f) of the OPGGS Act requires titleholders to meet obligations with respect to property and the environment to the satisfaction of NOPSEMA in support of consent to surrender title. This includes the requirement to:

- plug all wells
- remove property or implement accepted alternative arrangements
- make good any damage to the seabed or subsoil
- make provisions for conserving and protecting natural resources.

Accordingly, Cooper Energy undertakes decommissioning planning and decision-making with due consideration to obligations related to title relinquishment and understand that in addition to well P&A and property removal, seabed remediation may also be required.

NOPSEMA Policy document on Section 270 Consent to surrender title (2022) describes the EP as the key permissioning document under which arrangements in relation to property, conservation and protection of natural resources, and making good any damage to the seabed or subsoil prior to surrender of the title can be addressed by a titleholder and accepted by NOPSEMA. The well operations management plan (WOMP) is the key permissioning document under which arrangements in relation to permanently abandoning a well or wells prior to the surrender of the title can be addressed by a titleholder and accepted by NOPSEMA.

As such, it is these regulatory plans, EPs and WOMPs, and the regulatory acceptance of these plans, that would demonstrate how Cooper Energy will meet the permit surrender requirements. EP performance reporting and well abandonment reporting to the regulator provides a means of confirming permit surrender requirements are met.

### 4.3.6 Support Activities

Support activities associated with the scope of the East Coast Project are likely to include a MODU, vessels, helicopters and ROVs or AUVs, and are specific to each phase (Table 4-10).

*Table 4-10: Support activities for each development phase*

| Support Activity | | Development Phase | | | | |
|---|---|---|---|---|---|---|
| | | Surveys | Drilling | Installation and Commissioning | Operations | Decom |
| **MODU** | | | ✓ | | ✓* | ✓* |
| **Support vessels** | Survey vessels | ✓ | | ✓ | ✓ | ✓ |
| | Heavy lift vessel (HLV) | | | ✓ | | ✓* |
| | Installation vessel (ISV) | | | ✓ | ✓ | ✓ |
| | Reel lay vessel | | | ✓ | | ✓ |
| | IMR vessel | | ✓* | | ✓ | ✓* |
| | Anchor handler vessels | | ✓ | | ✓* | ✓ |
| | Platform Supply vessel (PSV) | | ✓ | | ✓* | ✓ |
| | General supply vessel | | ✓ | ✓ | ✓ | ✓ |
| | Diver support vessel (DSV) | | | ✓ | ✓ | ✓ |
| **Helicopter** | | | ✓ | ✓ | ✓ | ✓ |
| **ROV / AUV** | | ✓ | ✓ | ✓ | ✓ | ✓ |

**if required*

Indicative duration and frequencies of support activities across the life cycle of the East Coast Project are shown in Figure 4-3.

#### *4.3.6.1 MODU Operations*

Cooper Energy will contract a MODU for drilling, well abandonment and (if required) intervention/workover activities during the operations phase. The market for MODUs is global, hence MODU's will be brought in from overseas or from within Australian waters depending on the levels of well activity elsewhere within the Australian offshore industry. To best suit the conditions of the Otway region and the depth of the East Coast Project, the MODU will be either be a moored MODU or a DP-assist moored MODU (see Section 5 for further rationale).

The MODU is moored to the seabed with ~8-12 anchors, which are tethered to the MODU with mooring lines.

The MODU may use DP systems for initial positioning at site 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(s)
- 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).

Non-drilling activities occurring on the MODU include:

- bunkering / bulk transfer of fuel, chemicals, and supplies
- transfer of waste to supply vessels
- discharge of:
  - sewage, greywater and food waste
  - cooling water and reverse osmosis (RO) brine
  - deck drainage and bilge
- helicopter operations (expected to be ~5–8 round trips per week from the mainland to the MODU).

Refuelling of the MODU and bunkering will be required during the activity and is managed under the MODU's control of work systems.

A MODU will be in the operational area throughout the drilling phase, during well abandonment and will be used as needed for well intervention during the operations phase. There are typically up to ~140 to 200 personnel on board (POB) the MODU.

#### 4.3.6.2 *Vessel Operations*

Vessels will be contracted from international or Australian suppliers and will vary depending on the proposed activity, phase and vessel availability. The expected vessel types include:

- survey vessels
- HLV
- ISV
- reel lay vessel
- IMR vessel will be dependent on the work scope.
- anchor handler vessel
- general supply vessel / platform supply vessel
- DSV.

Activities associated with these vessels include:

- bunkering and bulk transfer of fuel, chemicals and supplies to the MODU
- collection and treatment of waste from the MODU
- discharge / management of:
  - sewage, greywater and food waste
  - cooling water and brine
  - deck drainage and bilge
- vessel positioning
- towing the MODU
- conduct IMR activities
- perform installation and decommissioning activities
- support diver operations
- mooring installation.

Vessels will use light marine fuel such as marine diesel oil (MDO) or marine gas oil (MGO), instead of heavy fuel oil (HFO).

All vessels will initially mobilise and demobilise at ports outside of the operational area. Crew changes for smaller vessels (anchor handler vessels) will typically be conducted at local ports outside of the operational area.

The MV Silver Star has been used as an analogue to inform the potential specifications of the smallest vessel to complete service activities between phase specific vessels or a MODU if available. This type of vessel has been used for survey work within the Otway region around the East Coast Project Fields. This vessel has a length overall of <40 m and can accommodate around 20 POB.

The Siem VS491 CD (AHTS) has been used as an analogue to inform the potential specifications of the AHTSs to support MODU activities. This vessel has a length overall of 91 m and can accommodate a total of 60 POB (Siem Offshore, n.d). AHTS vessels are expected to occur within the operational area more consistently during drilling, installation, IMR and decommissioning activities when phase specific vessels or a MODU are required. Supply vessels undertaking resupply could be expected to remain on station using DP for ~6 hours per day.

The Skandi Acergy (an ISV) has been used as an analogue to inform the potential specifications of the largest vessel to complete installation activities as described in the Section 4.3.3. This vessel has a length of 157m and can accommodate a total of 140 POB (Subsea 7,

2024). During installation the ISV is expected to occur within the operational area for ~45 days per campaign.

Fuel tank volumes vary from vessel to vessel and are generally in the range of 30m$^3$ to 250m$^3$, though could be outside of this range. Vessels and fuel tank volumes are defined in detail at the EP stage, closer to the time of vessel selection for a particular activity. At this stage, activity specific modelling is also completed where parameters may differ from those described in the OPP.

Larger vessels (i.e. reel-lay) will be serviced by helicopters. Outside of drilling, a maximum of one ISV and 2 support vessels will be in the operational area at a given time.

Vessels will typically use main or multiple thrusters on DP to maintain position, but in an emergency, anchoring may be required. A vessel anchored within water depths greater than 70 m with a single anchor could result in a total disturbance area of up to 1,300 m$^2$ (NERA, 2018).

All vessels contracted under the East Coast Project will comply with relevant legislative requirements such as MARPOL. An assessment of the accidental release of MDO from project vessels is assessed in Section 9.5.

Vessels transiting to and from the operational area are managed under the *Commonwealth Navigation Act 2012* and therefore this activity is excluded from the scope of the OPP.

#### *4.3.6.3 Helicopter Operations*

Helicopters will be used during the drilling and installation activities, primarily for crew change and medevac, and occasionally equipment and material transfers. Helicopter flights will peak during drilling, decommissioning and installation and commissioning phases and are expected to occur ~5 -8 times per week.

Frequency will depend on the progress of the drilling program, subsea installation and logistical constraints.

#### *4.3.6.4 ROV Operations*

Inspection and / or work-class ROVs are required for IMR activities (AUVs may also be used). 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. An AUV is an untethered underwater vehicle operated in a similar manner to an ROV.

ROVs are equipped with a video camera and lights. Additional equipment may include positioning[6] 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. ROVs will park or moor on the seabed and may temporarily sit on the seabed as part of execution activities if required. Any such temporary parking would be expected to occur within the spatial extent of direct disturbance.

#### *4.3.6.5 Diver Operations*

Diving operations will occur during installation or maintenance activities if required. A saturation DSV would be utilised to support diving and would have a diving bell to transport divers to and from the surface to the work area.

[6] *Ultra-Short Baseline (USBL) positioning systems use high frequency-short-range acoustic signals. The signals are produced by a small battery-operated beacon which may be attached to ROVs, deployed by ROVs to subsea equipment and the seabed. The USBL system sends / receives and interprets signals in real time to establish precise locations of equipment and vessels.*

# 5 Alternatives Analysis

Section 7(2)(f) of the OPGGS(E)R, requires the proponent of an OPP to provide:

*'a description of any feasible alternative to the project, or an activity that is part of the project, including:*

*(i) a comparison of the environmental impacts and risks arising from the project or activity and the alternative; and*

*(ii) an explanation, in adequate detail, of why the alternative was not preferred.'*

Consideration of alternatives for the East Coast Project has been conducted in accordance with NOPSEMA's current OPP content requirements (N-04790-GN1663 A473026, January 2024).

This section addresses this requirement by undertaking an analysis of the feasible alternatives for the:

- project concept (Section 5.2)
- design and activities of the selected concept (Section 5.3).

## 5.1 Methodology

The comparative assessment which influenced Cooper Energy's selection of feasible alternatives considered the following focus areas:

- environmental
- technical feasibility
- safety
- commercial
- social
- cultural.

In some cases, whereby one of the options posed integrity risk, or constrained by existing infrastructure parameters, no further comparative assessment was undertaken, for example management of hydrotest discharges, and well cleanup discharges (refer Section 5.3.4 and 5.3.5 respectively).

The alternatives assessment was conducted utilising a two-step process:

(1) Comparison of alternatives against environmental criteria to identify the option(s) with the least environmental impact

(2) Further comparison of alternatives against other criteria (technical, safety, commercial, social and cultural).

Each focus area was broken down further into specific assessment criteria (Table 5-1) which allowed for a qualitative assessment of identified options.

Because the development concept alternatives include some onshore impacts and risks, there are additional criteria for Section 5.2.1, shown in Table 5-1 with an asterisk.

*Table 5-1: Assessment Criteria used in Alternatives Analysis*

| Focus Area | | Criteria |
|---|---|---|
| **Environment** | Impacts | Seabed disturbance<br>Ground disturbance*<br>Underwater sound emissions<br>Atmospheric emissions / GHG<br>Light emissions<br>Planned liquid and solid discharges |

| Focus Area | | Criteria |
|---|---|---|
| | | Life-of-field |
| | Risks | Accidental releases<br>Interaction with marine fauna<br>Interaction with terrestrial fauna*<br>Introduction of invasive marine species (IMS)<br>Introduction of terrestrial non-indigenous species*<br>Fire* |
| **Technical Feasibility** | Operability and feasibility risk | Technical feasibility and ability to operate and maintain |
| | Technical readiness | Acceptable technology readiness level |
| | Constructability | Feasibility to construct<br>Reusability<br>Feasibility of decommissioning |
| **Safety** | Safety and risk | OHS & risk exposure<br>Process safety |
| **Commercial** | Schedule risk | Ability to meet the development timeline |
| | Cost risk | Economic viability |
| | Future flexibility risk | Ability to accommodate future developments |
| **Social** | Socioeconomic impacts | Impact to landholders* and marine and coastal users |
| | Reputation | Social licence to operate |
| **Cultural** | Cultural heritage | Impact to cultural heritage sites<br>Impact to First Nations people's cultural heritage |

**Only relevant for development concepts 2 and 3*

Identified options are assessed against the criteria and assigned a score between 1 and 5 to allow for differentiation between them. Table 5-2 shows the qualitative ranking scale developed for the alternative assessment. Where there is no material differentiation between options, they are each given a score of 3.

If criteria are not relevant for an option, they are given N/A (not applicable) – in particular 'life-of-field' is only relevant for the development concept alternatives (Section 5.2).

Subtotals of the scores are provided for environmental criteria and "other" criteria. This results in a qualitative total which represents all potential project drivers; with the lowest score giving the best outcome.

*Table 5-2: Qualitative Ranking Scale for Alternative Options*

| Score | Guidance |
|---|---|
| 1 | Substantially better compared to other options |
| 2 | Marginally better compared to other options |
| 3 | Options are equal when compared to each other |
| 4 | Marginally worse compared to other options |
| 5 | Substantially worse compared to other options |

## 5.2 Analysis of Concept Alternatives

Cooper Energy has considered 6 different development options during the alternative analysis comparative assessment process. This assessment identifies the benefits, impacts and potential risks that correspond with each development concept. A brief overview of each concept is provided in Table 5-3.

*Table 5-3: Overview of Development Concept Alternatives*

| Development Concept | Overview |
|---|---|
| **Option 1 – Subsea tie-back to existing subsea facilities** | Selected concept (described in detail in Section 4).<br>Uses a MODU and vessels to drill and install subsea production wells, control system and production gathering system.<br>New subsea infrastructure tied-in to the existing infrastructure in CHN fields.<br>Well fluids gathered via flowline which ties into existing CHN pipeline and are transported for processing onshore at the Athena Gas Plant. |
| **Option 2 – Subsea tie-back via new trunkline to onshore facility** | Uses a MODU and vessels to drill and install subsea production wells, control system and production gathering system.<br>Well fluids gathered via flowline and tied into a new pipeline.<br>Installation of new subsea pipeline to the Athena Gas Plant onshore. Requires a new shore crossing and onshore pipeline. |
| **Option 3 – Subsea tie-back to onshore facility via third-party infrastructure** | Uses a MODU and vessels to drill and install subsea production wells, control system and production gathering system.<br>Well fluids gathered via flowline and tie into a new pipeline, using existing local shore crossing infrastructure (owned by a third-party).<br>Requires a new onshore pipeline to transport fluids to Athena Gas Plant for processing. |
| **Option 4 – Offshore fixed facility** | Uses an offshore fixed structure.<br>Well fluids produced are transported through flowlines and risers to the fixed facility.<br>From the fixed facility, well fluids will be transported via flowline and tied into the existing CHN pipeline for processing onshore at the Athena Gas Plant. |
| **Option 5 – Floating, production, storage and offloading facility (FPSO)** | Uses an FPSO facility.<br>Well fluids produced are transported through flowlines and risers to the FPSO facility where they are stored, separated and treated.<br>From the FPSO well fluids will be transported via flowline and tied into the existing CHN pipeline for distribution via the onshore Athena Gas Plant. |
| **Option 6 – No development** | No development. |

*Development concept 4 – Offshore fixed facility* was discounted during early screening and was determined to not be commercially or economically viable. Development of a new offshore fixed facility is avoidable due to the close proximity of the East Coast project to existing onshore processing (AGP) with a readily available distribution pipeline present. Introducing a permanent offshore fixed facility not being used for processing, would duplicate the nearby plant processing functionality. The shallow water depth, variable metocean conditions and configuration of fields and prospects within the East Coast Project make the use of a fixed facility commercially unfeasible to design and execute. Additionally, the incremental volumes of gas (and hence project life) expected from the East Coast Project are not sufficient to justify the cost or level of activity required to install and operate a fixed offshore facility. Therefore, this concept was de-selected at an early stage and has not been assessed further.

*Development concept 5 – FPSO* was discounted early during screening and determined to not be commercially or economically viable. FPSOs are most suited to deep / ultradeep waters distant from processing facilities, with hydrocarbons being processed and offloaded onto a tanker for transportation ashore to negate the need to build permanent structures. The East Coast Project is located in close proximity to existing onshore processing (AGP) with a readily available distribution pipeline present. Introducing a FPSO would needlessly duplicate plant processing functionality. Similar to *development concept 4*, the incremental volumes of gas (and hence project life) expected from the East Coast Project do not justify the establishment of an FPSO as the cost and level of activity required to operate the facility are not considered proportionate. Therefore, this concept was de-selected at an early stage and has not been assessed further.

*Development concept 6 – No development* was de-selected at an early stage. Developing the petroleum resources aligns with the Australian Government's offshore development policy to explore and develop offshore petroleum resources, which provides benefits to the community including royalties, taxation revenue, employment, national energy security and regional development. The base case concept aligns with the DSIR Future Gas Strategy (2024), by continuing to provide energy via existing supply networks, from sources close to the domestic energy market, thereby minimising emissions associated with shipping and import of interstate or international sources of gas (Section 1.3.1).

In order to satisfy offshore title and permit requirements, as the titleholder, Cooper Energy has an obligation to pursue the development of commercially viable hydrocarbon reserves. In this context, selection of the 'no development' alternative at this stage of planning, is not consistent with the legal obligations placed on a Titleholder, or the commercial objectives of Cooper Energy. As demonstrated in this OPP, Cooper Energy considers that the environmental impact and risks can be managed to an acceptable level. Therefore, this concept was not considered further.

### 5.2.1 Comparative Assessment of Development Concepts

The layout of the project proposed is shown within the Activity description in Figure 1-2. The layout of alternative concepts 2 and 3 is shown below in Figure 5-1 and Figure 5-2 (respectively) for the readers context and to help hypothetical comparison of proposed project and alternative concept footprints, Typical activities associated with each concept were identified, grouped and assessed against environmental criteria, as displayed in Table 5-4.

Table 5-5 provides a comparative assessment of the development concept alternatives against the criteria explained in Table 5-1.

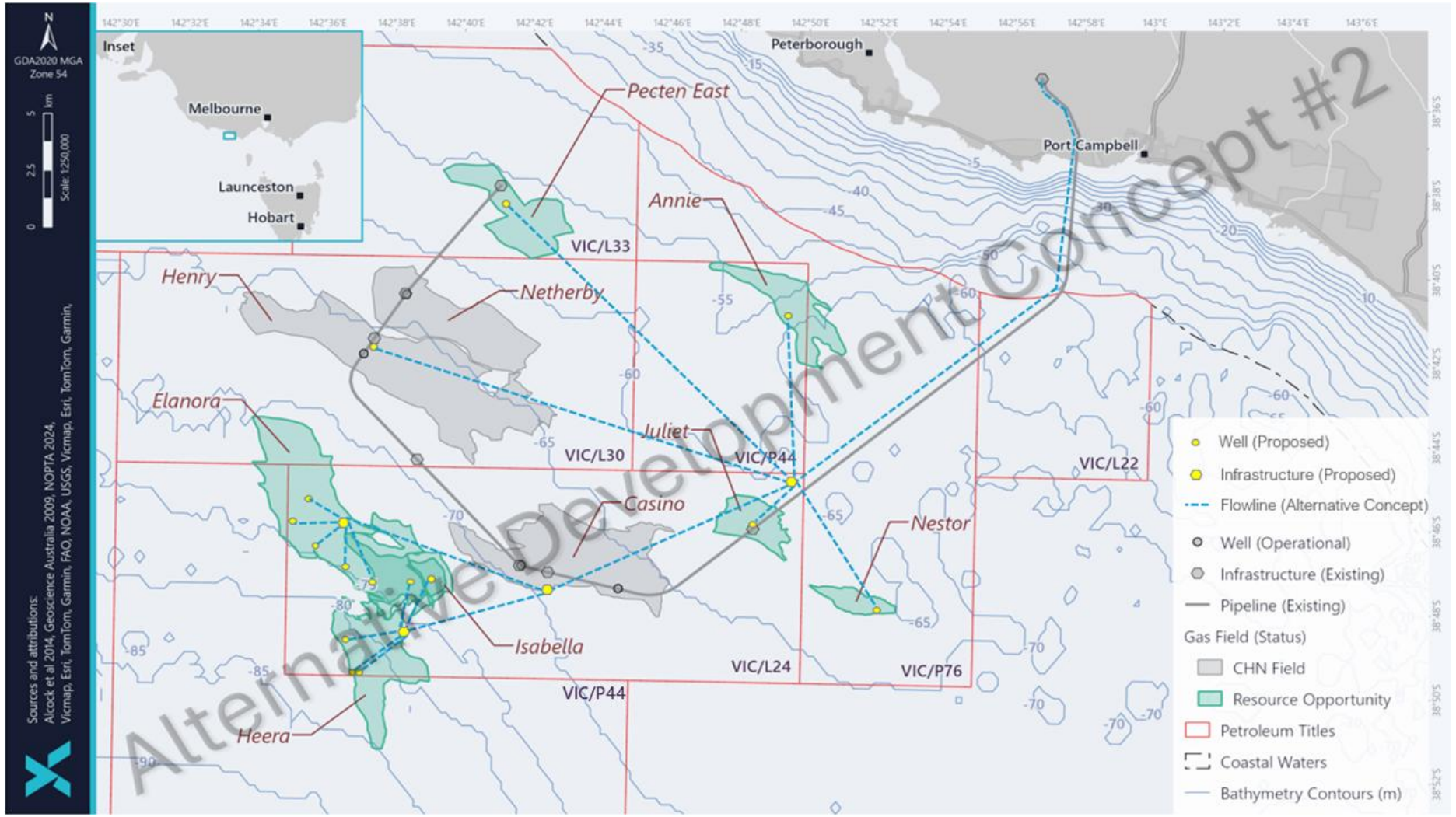



*Figure 5-1: Location and Layout of Alternative Development Concept #2*

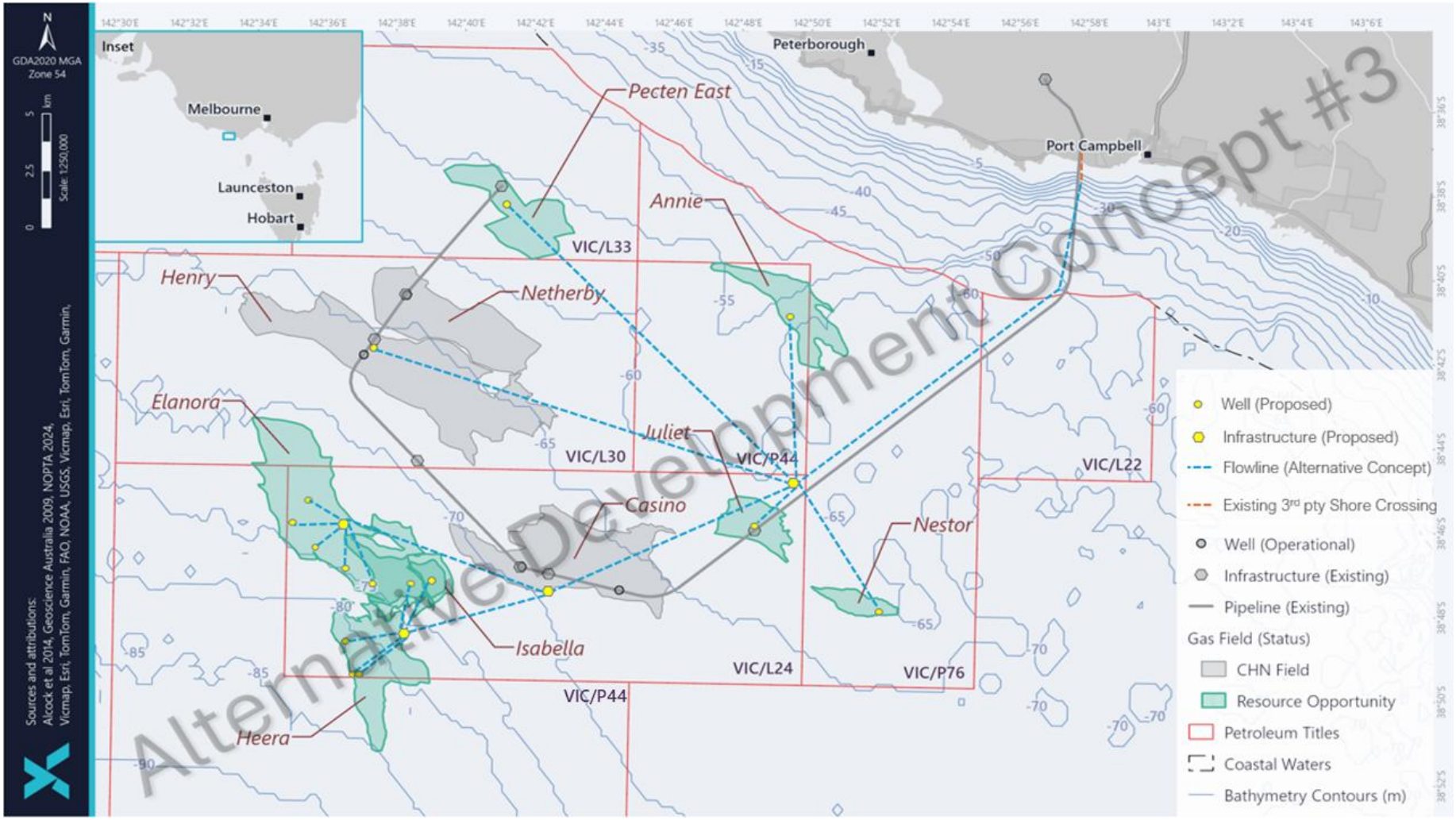



*Figure 5-2: Location and Layout of Alternative Development Concept #3*

*Table 5-4: Environmental Criteria Related to Activities Associated with each Development Concept*

| Activity | Related Concept | Impacts | | | | | Risks | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Seabed Disturbance | Ground Disturbance | Underwater Sound Emissions | GHG and Atmospheric Emissions | Light Emissions | Planned Discharges | Interaction with Marine Fauna | Interaction with Terrestrial Fauna | Introduction of IMS | Introduction of terrestrial Non-indigenous Species | Fire | Accidental Releases |
| **Site Surveys** | | | | | | | | | | | | | |
| **Geophysical survey** | 1,2,3 | | | ✓ | | | ✓ | | | | | | |
| **Geotechnical survey** | 1,2,3 | ✓ | | ✓ | | | ✓ | | | | | | |
| **Onshore survey** | 2,3 | | ✓ | | | | | | ✓ | | | ✓ | |
| **Well Construction Activities** | | | | | | | | | | | | | |
| **Mobilisation / demobilisation of MODU** | 1,2,3 | ✓ | | | | | ✓ | ✓ | | ✓ | | | ✓ |
| **Drilling of wells** | 1,2,3 | ✓ | | ✓ | | | ✓ | | | | | | ✓ |
| **Well clean-up** | 1,2,3 | | | | ✓ | ✓ | ✓ | | | | | | ✓ |
| **Installation, hook-up and commissioning** | | | | | | | | | | | | | |
| **Installation and commissioning of flowlines** | 1,2,3 | ✓ | | | | | ✓ | ✓ | | | | | ✓ |
| **Onshore construction and commissioning** | | | | | | | | | | | | | |
| **Clearing and site preparation** | 2,3 | | ✓ | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| **Shore crossing** | 2,3 | | ✓ | | | | | | ✓ | | ✓ | | ✓ |
| **Installation of onshore pipeline** | 2,3 | | ✓ | | | | | | ✓ | | ✓ | ✓ | ✓ |
| **Operations** | | | | | | | | | | | | | |
| **Inspection, Maintenance and Repair** | 1,2,3 | ✓ | | | | | ✓ | | | ✓ | | | ✓ |
| **Well Intervention** | 1,2,3 | | | | ✓ | ✓ | ✓ | | | | | | ✓ |
| **Decommissioning** | | | | | | | | | | | | | |
| **Plug and abandon wells** | 1,2,3 | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ |
| **Removal of infrastructure** | 1,2,3 | ✓ | | ✓ | | | ✓ | ✓ | | ✓ | | | ✓ |
| **Decommissioning and closure** | 2,3 | | ✓ | | | | ✓ | | ✓ | | | | ✓ |
| **Rehabilitation** | 2,3 | ✓ | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| **Support Operations** | | | | | | | | | | | | | |
| **Onshore equipment operation** | 2,3 | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ |
| **Vessel operations** | 1,2,3 | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ |
| **ROV operations** | 1,2,3 | ✓ | | | | | | ✓ | | | | | ✓ |
| **Aircraft operations** | 1,2,3 | | | ✓ | ✓ | | | ✓ | | | | | ✓ |

*Table 5-5: Comparative Assessment of Development Concepts*

| | Criteria | Evaluated Concepts | | | | | |
|---|---|---|---|---|---|---|---|
| | | (1) Subsea tie-back to existing subsea facilities | | (2) Subsea tie-back via new pipeline to onshore facility | | (3) Subsea tie-back to onshore facility via third-party infrastructure | |
| | | Score | Rationale | Score | Rationale | Score | Rationale |
| Environmental Impacts | Seabed disturbance | 1 | Minor disturbance due to subsea development extension and flowline installation to existing CHN pipeline. | 5 | Largest disturbance footprint of all options due to additional footprint of new pipeline to shore, and shore crossing | 4 | Moderate disturbance footprint resulting from new pipeline. Less coastal disturbance than Option 2 due to use of existing shore crossing infrastructure. |
| | Ground disturbance | 1 | No onshore component. | 5 | Largest footprint of ground disturbance onshore from a new shore crossing and new onshore pipeline to Athena Gas Plant. | 4 | Requires some ground disturbance from a new onshore pipeline to Athena Gas Plant; however existing shore crossing infrastructure can be used. |
| | Underwater sound | 1 | No permanent surface facilities. Noise generated primarily during temporary vessel and MODU-based activities offshore. | 3 | No permanent surface facilities. Noise generated primarily during temporary vessel and MODU-based activities offshore.<br>Additional noise emissions due to extended pipelay campaign, particularly nearshore in shallow water where marine mammal sensitivities are known to occur (i.e., southern right whale reproduction BIA) | 3 | No permanent surface facilities. Noise generated primarily during temporary vessel and MODU-based activities offshore. Additional noise emissions due to extended pipelay campaign. |
| | Atmospheric and GHG | 1 | Minor fugitive emissions, with processing undertaken at the existing Athena Gas Plant.<br>Less emissions from construction and decommissioning activities due to shorter tie-ins and shorter durations compared to other options. | 5 | Additional emissions from construction and decommissioning activities due to longer pipeline, and extended installation and decommissioning periods.<br>Additional emissions generated from clearing and onshore works. | 4 | Additional emissions from construction and decommissioning activities due to extended installation and decommissioning periods.<br>Some clearing and onshore works required. |
| | Light | 1 | Minor temporary impact due to use of artificial light during drilling, | 4 | Additional emissions from construction and decommissioning activities due to | 4 | Additional emissions from construction and decommissioning activities due to extended installation and decommissioning periods. |

| | Criteria | Evaluated Concepts | | | | | |
|---|---|---|---|---|---|---|---|
| | | (1) Subsea tie-back to existing subsea facilities | | (2) Subsea tie-back via new pipeline to onshore facility | | (3) Subsea tie-back to onshore facility via third-party infrastructure | |
| | | Score | Rationale | Score | Rationale | Score | Rationale |
| | | | construction and decommissioning. | | extended installation and decommissioning periods.<br>Works required nearshore. | | Works required nearshore. |
| | Planned discharges | 1 | Typical discharges from development, operational and decommissioning activities. | 4 | Additional discharge volumes from operational activities due to extended development and decommissioning campaigns of additional infrastructure. | 4 | Additional discharge volumes from operational activities due to extended development and decommissioning campaigns of additional infrastructure. |
| | Life-of-field | 1 | Minor source of environmental risk and impact, with smallest physical offshore footprint. | 5 | Larger physical onshore and offshore footprint.<br>Additional resources consumed for extra installation and decommissioning. | 2 | Moderate physical nearshore and offshore footprint. |
| Environmental Risks | Accidental releases | 3 | No material difference in risk of subsea well or flowline loss of containment | 3 | No material difference in risk of subsea well or flowline loss of containment | 3 | No material difference in risk of subsea well or flowline loss of containment. |
| | Interaction with marine fauna | 1 | No surface facilities. Potential fauna interaction during construction and decommissioning. | 5 | No surface facilities. Higher potential for fauna interaction during extended construction and decommissioning.<br>Additional risk for coastal species. | 4 | No surface facilities. Higher potential for fauna interaction during minor extension for construction and decommissioning.<br>Additional risk for coastal species. |
| | Interaction with terrestrial fauna | 1 | No onshore component. | 5 | Risk of injury/mortality to terrestrial fauna due to onshore equipment and excavations. | 4 | Risk of injury/mortality to terrestrial fauna due to onshore equipment and excavations. |
| | Introduction of IMS | 3 | Risks associated with construction, decommissioning and IMR fleets. | 3 | Risks associated with construction, decommissioning and IMR fleets. | 3 | Risks associated with construction, decommissioning and IMR fleets. |
| | Introduction of NIS | 1 | No onshore component. | 5 | Risk of introduction of NIS from onshore equipment and ground-disturbing works.<br>Including coastal area to construct a new shore crossing. | 4 | Risk of introduction of NIS from onshore equipment and ground-disturbing works. |
| | Fire | 1 | No onshore component. | 5 | Fire risk on from onshore equipment and hot works. | 4 | Fire risk on from onshore equipment and hot works. |

| | Criteria | Evaluated Concepts | | | | | |
|---|---|---|---|---|---|---|---|
| | | (1) Subsea tie-back to existing subsea facilities | | (2) Subsea tie-back via new pipeline to onshore facility | | (3) Subsea tie-back to onshore facility via third-party infrastructure | |
| | | Score | Rationale | Score | Rationale | Score | Rationale |
| | | | | | Including coastal area to construct a new shore crossing. | | |
| Subtotal - Environment | | 17 | | 57 | | 47 | |
| Technical feasibility | Technical feasibility | 1 | Feasible and least complex option. | 4 | Feasible, however significant challenges associated with approvals and HDD construction. | 4 | Feasible, depending on HDD integrity and procurement of title. |
| | Technology readiness | 3 | Subsea tiebacks are deployable ubiquitously worldwide. | 3 | Subsea tiebacks are deployable ubiquitously worldwide. | 3 | Subsea tiebacks are deployable ubiquitously worldwide. |
| | Feasibility to construct | 1 | Least complex option for installation. | 5 | High complexity associated with HDD installation. | 4 | Moderate complexity associated with tying into existing HDD. |
| | Reusability | 3 | Reusability within the development is feasible. | 3 | Reusability within the development is feasible. | 3 | Reusability within the development is feasible. |
| | Feasibility of decommissioning | 1 | Least infrastructure to be decommissioned. | 5 | Most infrastructure to be decommissioned. | 4 | Additional infrastructure to be decommissioned. |
| Safety | OHS and risk exposure | 1 | No additional offshore crewed facilities however, there are personnel hours offshore to develop, maintain and decommission the new equipment. | 2 | No additional offshore crewed facilities however, there are additional personnel hours to install additional flowlines, trunkline and shore crossing compared to Option 1. | 4 | Additional personnel hours to install additional flowlines, trunkline and shore crossing.<br>Increased potential for diver operations to be required. |
| | Process safety | 1 | Subsea infrastructure only – no topside facilities to be crewed.<br>Network isolations are manual. Therefore, any major leaks from the network would result in the full flowline inventory being impacted. | 1 | Subsea infrastructure only – no topside facilities to be crewed. | 2 | Integrity verification of the third-party shore crossing infrastructure is required. |
| Commercial | Ability to meet development timeline | 1 | Lowest risk of delays due to a small equipment inventory requirement and minimal commercial complexities | 5 | Pipeline/shore crossing in State waters requires State approval, which adds to approvals complexity and potentially extends project lead times. | 5 | Title and infrastructure are owned by a third party. Time and cost associated with transfer of title. |

| | Criteria | Evaluated Concepts | | | | | |
|---|---|---|---|---|---|---|---|
| | | (1) Subsea tie-back to existing subsea facilities | | (2) Subsea tie-back via new pipeline to onshore facility | | (3) Subsea tie-back to onshore facility via third-party infrastructure | |
| | | Score | Rationale | Score | Rationale | Score | Rationale |
| | | | | | | | Construction in State waters which adds to approvals complexity and potentially extends project lead times. |
| | Economic viability | 1 | Lower costs associated with development as backfill would occur to an existing facility and utilise existing infrastructure. | 5 | Higher cost associated with additional installation and decommissioning activities. | 4 | Additional costs associated with construction required to connect to HDD. |
| | Future development accommodation | 3 | No difference identified between options. | 3 | No difference identified between options. | 3 | No difference identified between options. |
| Social | Impact to land owners and marine and coastal users | 1 | Restrictions on marine activities relatively small around wells and temporarily around vessels and MODU in Cwth waters only. | 5 | Additional potential disruption to coastal water users depending on shore crossing location. | 5 | Additional potential disruption to coastal water users at crossing location. |
| Social | Social license to operate | 1 | Consistent with existing project with modest additional infrastructure. | 4 | Consistent with existing project however requires construction activities nearshore which are more visible to communities. | 4 | Consistent with existing project however requires construction activities nearshore which are more visible to communities. |
| Cultural | Cultural heritage | 1 | Consistent with existing project with modest additional infrastructure and associated footprint. | 5 | Higher potential impact due to higher seabed/shore disturbance and additional noise associated with extended pipelay and decommissioning campaigns. | 4 | Additional potential impacts due to higher seabed/shore disturbance and additional noise associated with extended pipelay and decommissioning campaigns. |
| Subtotal – Other | | 19 | | 50 | | 48 | |
| Total – All Project Drivers | | 36 | | 107 | | 96 | |

The comparison of environmental criteria shows that there is a large range between scores, particularly between Option 2 and Option 1. The assessment shows that the most favourable concept, environmentally, is *Option 1 – Subsea tie-back to existing subsea facilities*.

The comparison of "other" criteria is similar, as there is a large range between the scores of Option 2 and Option 1. The assessment shows *Option 1 – Subsea tie-back to existing subsea facilities* to be the most favourable option.

Across all criteria *Option 1 - Subsea tie-back to existing subsea facilities* was deemed the most favourable development concept. The use of existing infrastructure within the area minimises environmental disturbance. Environmental impacts and risks are less than other options due to the smaller scale of activities required to develop the new fields and subsequent decommissioning of associated infrastructure at the end of the facility life. Additionally, the costs associated with Option 1 are also expected to be less compared to the alternative options, again related to the development scale. Feasibility is expected to be highest for option 1, with options 2 and 3 being technically and commercially more challenging, and with higher approval complexity.

In summary, development concepts listed below were not selected for these primary reasons:

- *Option 2 – Subsea tie-back via new trunkline to onshore facility* was deemed unfavourable given the incremental volumes of gas and project life do not support the cost or impact of additional offshore infrastructure. Option 2 results in comparatively high disturbance onshore and offshore with substantially higher commercial costs associated with installation and decommissioning.
- *Option 3 – Subsea tie-back to onshore facility via third-party infrastructure* was deemed unfavourable due to the commercial feasibility associated with the transfer of title and the risks associated with verifying third-party infrastructure integrity for the proposed mode of use. Additionally, Option 3 results in higher disturbance offshore and within the coastal environment.

Table 5-6 provides a summary of the key reasons which have impacted the evaluation outcomes of rejection or adoption for the development concept alternatives.

*Table 5-6: Summary of Assessment of Alternative Development Concepts*

| Development Concept | | Summary of Assessment | |
|---|---|---|---|
| **1** | Subsea tie-back to existing subsea facilities | Does not require the deployment of any emerging or new technology and is technically feasible due to the use of existing infrastructure with tie-back to the existing CHN pipeline.<br>Utilisation of existing infrastructure avoids the environmental and commercial impacts associated with a new trunkline or shore crossing. | ✓ |
| **2** | Subsea tie-back to onshore facility | The size of the development field and field life are not sufficient to support the associated costs.<br>A larger development footprint is associated with the trunkline and new shore crossing to onshore facilities. | X |
| **3** | Subsea tie-back to third party facility | The size of the development field and field life are not sufficient to support the associated costs.<br>A larger development footprint associated with the trunkline in the offshore environment and nearshore environment.<br>Schedule and commercial risks associated with the need for agreements/contracts between Cooper Energy and the third-party owner. | X |

## 5.3 Analysis of Design/ Activity Alternatives

Once the overall development concept was selected (*Option 1 – Subsea tie-back to existing subsea facilities*), alternatives were considered for the design and activities associated with the chosen concept.

This section describes the key alternative options that were considered and compared for the selected concept.

Design and activity elements of the East Coast Project include:

- MODU type
- flowline material
- hydrotest discharge
- new well functionality
- gas treatment.

Within the following subsections each element and their associated alternatives are evaluated via a comparative assessment.

### 5.3.1 MODU Type

Cooper Energy will contract a MODU for drilling, well abandonment and intervention/workover activities (if required). Three options were considered, and two alternatives were assessed within Table 5-7. Alternatives assessed are applicable for all activities.

- Option 1 – **Moored MODU** (or DP assist Moored MODU): The MODU is towed into position and moored to the seabed with anchors. Approximately 8-12 anchors are required, which are tethered to the MODU with mooring lines. Each location has a total estimated footprint of approximately 6.06 $m^2$.
- Option 2 – **Jack up MODU:** The MODU is towed into position and legs are lowered to the seabed, jacking up MODU hull above sea level. Typically, 3 legs are used, each with an estimated footprint of approximately 1,500 $m^2$.
- Options 3 – **DP MODU**: A DP positioned MODU uses thrusters to maintain position. In order to safely conduct operations, when connected to the seabed (via wellhead/XT and a marine riser above the BOPs), a “watch circle” is implemented, which dictates the amount off offset from well centre (at seabed) is allowable before a risk to well operations and safety (riser angle exceeding a limit off vertical which may induce component failure) is to occur. In deeper water and more benign metocean conditions, the effective distance off centre can be greater before riser angle exceeds said limits, however, in shallow water, even a small movement off centre can lead to a significant increase in riser angle (off vertical) and require a disconnect from the well. Given the shallow water depths and variable metocean conditions in the East Coast Project, utilising a DP vessel to maintain such a small watch circle (needed to safely conduct operations when connected to bottom) is not feasible and as such is discounted as an option for the full well execution. DP positioning may be utilised in an emergency station keeping scenario (i.e. mooring failure) or during approach to location and mooring hook-up, where watch circle criticality is lessened. Therefore, this option will not be carried through the comparative assessment process.

Project drivers were assessed using the method and criteria described in Section 5.2.1. Table 5-7 provides a comparison of criteria for each option.

*Table 5-7: Comparative Assessment of Criteria for MODU Options*

| | Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|---|
| | | Moored (or DP assist) MODU | | | Jack up MODU |
| | | Score | Justification | Score | Justification |
| Environmental | Seabed disturbance | 2 | There will be seabed disturbance associated with anchors of ~720 $m^2$ per well. | 4 | Disturbance associated with jack up feet totalling ~1,500 $m^2$ each time the facility positions on the seabed. |

| | Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|---|
| | | Moored (or DP assist) MODU | | | Jack up MODU |
| | Underwater sound | 4 | Additional noise from limited use of DP system (if a DP MODU case) to maintain station keeping in adverse weather scenarios or during move onto location. | 2 | Noise emissions will be generated by onboard machinery. |
| | Atmospheric and GHG | 4 | Additional impact due to extra support vessel requirement.<br>Limited use of DP system (if a DP assist MODU case) to maintain station keeping in adverse weather scenarios or during move onto location will generate more emissions from diesel use. | 2 | One less support vessel required in the field than option 1; resulting in slightly lower impacts. |
| | Light | 4 | Additional impact due to extra support vessel requirement. | 2 | One less support vessel required in the field than option 1; resulting in slightly lower impacts. |
| | Planned discharges | 4 | Additional impact due to extra support vessel requirement. | 2 | One less support vessel required in the field than option 1; resulting in slightly lower impacts. |
| | Life-of-field | - | N/A | - | N/A |
| Environmental Risks | Accidental releases | 4 | Additional risk due to extra support vessel requirement. | 2 | One less support vessel required in the field than option 1; resulting in slightly lower risk. |
| | Interaction with marine fauna | 4 | Additional risk due to extra support vessel requirement. | 2 | One less support vessel required in the field than option 1; resulting in slightly lower risk. |
| | IMS | 3 | Risk relates to mooring chains and anchor spread on seabed.<br>No difference identified between options. | 3 | Risk relates to spud can contact with the seabed.<br>No difference identified between options. |
| Subtotal - Environment | | 29 | | | 19 |
| Technical feasibility | Technical feasibility | 1 | No concerns identified. Considered common practice within the region and industry. | 5 | Higher risk associated with potential “punch through” of jack-up legs through the thin calcarenite substrate, destabilizing the MODU. Instances where punch through have occurred within the region. |
| | Technology readiness | 3 | No difference identified between options. | 3 | No difference identified between options. |
| | Feasibility to construct | 1 | No concerns identified. Considered common practice within the region and industry. | 5 | Metocean conditions may preclude jack-up/jack down operations for approximately 60-90% of the year. |
| | Reusability | 3 | No difference identified between options. | 3 | No difference identified between options. |
| | Feasibility of decommissioning | 3 | No difference identified between options. | 3 | No difference identified between options. |

| | Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|---|
| | | Moored (or DP assist) MODU | | | Jack up MODU |
| Safety | OHS and risk exposure | 2 | Requirement of anchor handler vessels increase the occupational exposure from anchor handling and winching activities. | 5 | Significant concerns if punch through occurs. Worst case credible scenario where jack-up topples or is inundated. |
| Safety | Process safety | 1 | No concerns identified. Considered common practice within the region and industry. | 5 | Significant concerns if punch through occurs. Worst case credible scenario where jack-up topples or is inundated. |
| Commercial | Ability to meet development timeline | 2 | No concerns identified. Considered common practice within the region and industry. | 4 | Typically, must be able to withstand >2.5m Hs – suitability limited to "ultra-harsh environment" Jack-Up rigs (limited rigs have this capability) and are less available in Australian waters.<br>Additionally, typically a geotechnical survey, coring and CPT testing is required before mobilisation of the Jack-up MODU. |
| Commercial | Economic viability | 4 | Higher costs associated with this option. | 2 | Slightly lower costs associated with this option due to lower jack-up spread rates and reduced support vessel quantity. |
| Commercial | Future development accommodation | 3 | No difference identified between options. | 3 | No difference identified between options. |
| Social | Impact to marine and coastal users | 3 | No differential impact identified between options. | 3 | No differential impact identified between options. |
| Social | Social license to operate | 3 | No differential impact identified between options. | 3 | No differential impact identified between options. |
| Cultural | Cultural heritage | 3 | Higher impact associated with underwater noise emissions.<br>No difference identified between options. | 3 | Higher impact associated with seabed disturbance.<br>No difference identified between options. |
| Subtotal - Other | | 32 | | | 47 |
| Total – All Project Drivers | | 61 | | | 66 |

The comparison of environmental criteria shows that *Option 1 – Moored MODU* is expected to have slightly higher environmental impacts than *Option 2 – Jack up MODU*. This is solely due to slight environmental impacts and risks associated with Option 1's requirement for an additional vessel than is required for Option 2.

The comparison of "other" criteria shows that *Option 1 – Moored MODU* is ranked substantially better than *Option 2 – Jack up MODU*. This is largely due to the technical feasibility and safety risks associated with Option 2, in particular the risk of punch through of Jack-up legs through the relatively thin hard calcarenite substrate, which can destabilise the Jack-up MODU. This has occurred in the region previously, and the substrate within the Cooper Energy Title Areas are known to comprise a hard (and relatively thin) calcarenite layer; hence Jack-up MODU's are typically avoided. Additionally, the metocean conditions typical of the region preclude the jacking up/down of the facility for a significant portion of the year due to wave height. This issue could be mitigated via use of a harsh environment Jack-up, but procurement of such a facility is considered unlikely. Given these factors, moored semi-submersible MODUs are generally selected for drilling in this particular region.

The total qualitative ranking score for each concept against all assessment drivers and criteria (including environmental criteria) shows that Option 1 is ranked slightly better than Option 2.

A moored MODU is the base case option and has been selected over the Jack-up based on historical wells drilled in the region, the local seabed and metocean conditions. Therefore, although Option 1 results in slightly higher environmental impacts and risks associated with the use of an additional vessel, Option 2 is essentially ruled out for technical and safety reasons.

### 5.3.2 Flowline Material

Cooper Energy will install subsea flowlines to transport gas (and associated condensate) to the onshore Athena Gas Plant. Two types of flowlines were considered and are assessed within Table 5-8.

- Option 1 – **Rigid Flowline**: Flowlines are made of stiff materials that have limited capacity to bend. There is no requirement for stabilisation materials to hold the flowline in place.
  - Installation: Due to weather constraints associated with the Otway region installation of rigid flowline would occur through a reel lay method.
  - Retrieval: Due to cost and weather constraints associated with the Otway region, retrieval of rigid flowlines will occur through a subsea cut and recover method.
- Option 2 – **Flexible Flowline:** Flowline is made of malleable materials that can bend. There is a requirement for stabilisation materials (i.e. concrete mattresses) to be installed to hold the flowline in place.
  - Installation: Will occur by either reel or carousel lay.
  - Retrieval: Will occur by either reverse reel or carousel or recover and cut on deck.

Due to the similarities between installation and retrieval methods for each option over both criteria categories (environmental and other) they have not been taken through individual comparative assessments. Therefore, consideration of installation and retrieval methods for each option have been acknowledged and incorporated into this design alternative assessment.

During the life of the project, flowline integrity will be maintained through inspection, maintenance and repair activities. Although the activity specifics differ slightly between flexible and rigid flowlines, such as the type of inspections that can be conducted, the environmental impacts associated with IMR activities resulting from integrity maintenance for flowlines are the same, regardless of the option selection.

Similarly, the risk a loss of containment from the flowline is not dissimilar between each option. Rigid flowlines are steel welded sections and generally have a higher resistance to mechanical damage but are difficult to repair in the event of damage. Flexible flowlines have layers of interlocking steel layers with tension wires to provide a level of mechanical protection, but have the added advantage that repairs are more simplistic with a replacement of the damage section. Comparatively, flexible flowlines may have a lower tolerance to mechanical damage but are an industry accepted product for subsea applications for short static flowlines. Because of this, the comparative assessment for accidental releases focuses on loss of containment from construction vessels. Project drivers were assessed using the method and criteria described in Section 5.2.1. Table 5-8 provides a comparison of criteria for each option.

*Table 5-8: Comparative Assessment of Criteria for Pipeline Options*

| | Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|---|
| | | Rigid Flowline | | Flexible Flowline | |
| | | Score | Justification | Score | Justification |
| Environmental | Seabed disturbance | 3 | No material differentiation between options for installation. | 3 | Requirement to install mattresses for stabilisation results in greater seabed disturbance. However, there |

| | Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|---|
| | | Rigid Flowline | | Flexible Flowline | |
| | | Score | Justification | Score | Justification |
| | | | Cut and recover during decommissioning will require significantly more seabed disturbance at each cut location.<br>Disturbance expected to be broadly similar between options. | | is less seabed disturbance during retrieval if reverse reel or carousel methods can be used.<br>Disturbance expected to be broadly similar between options. |
| | Underwater sound | 3 | Overall vessel time in field likely to be broadly similar across life of the project. | 3 | No differential impact identified between options. |
| | Atmospheric and GHG | 3 | Overall vessel time in field likely to be broadly similar across life of the project. | 3 | No differential impact identified between options. |
| | Light | 3 | Overall vessel time in field likely to be broadly similar across life of the project. | 3 | No differential impact identified between options. |
| | Planned discharges | 3 | Overall vessel time in field likely to be broadly similar across life of the project. | 3 | No differential impact identified between options. |
| | Life-of-field | - | N/A | - | N/A |
| Environmental Risks | Accidental releases | 3 | Overall vessel time in field likely to be broadly similar across life of the project.<br>The risk of loss of containment of flowline content is comparable across each option. | 3 | No differential impact identified between options. |
| | Interaction with marine fauna | 3 | Overall vessel time in field likely to be broadly similar across life of the project. | 3 | No differential impact identified between options. |
| | IMS | 3 | Overall vessel time in field likely to be broadly similar across life of the project. | 3 | No differential impact identified between options. |
| Subtotal - Environment | | 24 | | 24 | |
| Technical feasibility | Technical feasibility | 4 | Design is suited to longer lengths. | 1 | Design is suited to shorter tie-back lengths; more suitable for the requirements of the development. |
| | Technology readiness | 3 | No difference identified between options. General design principles are common within the industry. | 3 | No difference identified between options. General design principles are common within the industry. |

| | Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|---|
| | | Rigid Flowline | | Flexible Flowline | |
| | | Score | Justification | Score | Justification |
| | Feasibility to construct | 3 | Duration of vessel in the field is similar between both options. | 3 | Duration of vessel in the field is similar between both options. |
| | Reusability | 4 | Reelable flowline can't be re-used. | 1 | It is feasible that the flowlines could be recovered and re-used in the field. |
| | Feasibility of decommissioning | 3 | Duration of vessel in the field may be shorter, as recovery of stabilization materials is not required. However, in the event of cut and recover the overall duration in the field may be longer.<br>Therefore, the duration in the field is expected to be similar. | 3 | Recovery of mattresses will increase duration of vessel/s in the field. However, the recovery of the flexibles will be quicker. Overall, the duration in the field is expected to be similar. |
| Safety | OHS and risk exposure | 3 | No difference identified between options as overall time in field likely to be similar across project lifecycle. | 3 | No difference identified between options as overall time in field likely to be similar across project lifecycle. |
| Safety | Process safety | 3 | No difference identified between options. | 3 | No difference identified between options. |
| Commercial | Ability to meet development timeline | 4 | Bespoke requirements for reel lay vessels resulting in potential availability/access constraints. | 2 | Less vessel access constraints to option 1. |
| Commercial | Economic viability | 4 | Generally higher costs associated with installation and requirement for a larger more costly vessel.<br>Neutral decommissioning costs. | 2 | Flexible flowlines are generally more expensive to procure; but are generally quicker to install<br>Neutral decommissioning costs. |
| Commercial | Future development accommodation | 3 | No difference identified between options. | 3 | No difference identified between options. |
| Social | Impact to marine and coastal users | 3 | No difference identified between options. | 3 | No difference identified between options. |
| Social | Social license to operate | 3 | No difference identified between options. | 3 | No difference identified between options. |
| Cultural | Cultural heritage | 3 | No differential impact identified between options. Similar seabed/Sea Country disturbance.<br>No differential impact on ability to continue cultural practices identified between options. | 3 | No differential impact identified between options. Similar seabed/Sea Country disturbance.<br>No differential impact on ability to continue cultural practices identified between options. |
| Subtotal - Other | | 43 | | 33 | |

| Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|
| | Rigid Flowline | | Flexible Flowline | |
| | Score | Justification | Score | Justification |
| Total – All Project Drivers | 67 | | 57 | |

The comparison of environmental criteria shows that both *Option 1– Rigid flowline* and Option 2 – Flexible flowline ranked very similarly when considering environmental impacts due to the overall duration in the field of vessels over the project lifecycle being broadly similar.

The comparison of "other" criteria shows that *Option 1 – Rigid flowline* is ranked slightly worse than *Option 2 – Flexible flowline*. This is largely due to the comparison between costs associated with the materials and method of installation. Additionally, the layout of the fields and current design of the CHN development which the East Coast Project will be tied into is suited to shorter tie-back lengths and Option 2 is therefore more suitable.

The total qualitative ranking score for each concept against all assessment drivers and criteria (including environmental criteria) shows that both options are ranked relatively similar with *Option 2 – Flexible* flowline having a slight edge.

Further design and engineering work are required to understand the benefits and cost of each option, particularly in relation to the stabilisation requirements of *Option 2 - Flexible flowline*. The final decision for selection of flowline type will be based on technical feasibility, safety and cost; and a combination of both may be used.

As *Option 2 - Flexible flowline* presents the slightly greater environmental risk it has been used as the base case for impact assessment in Section 8.

### 5.3.3 New Well Functionality

Umbilicals provide electrical power and hydraulic control to the subsea equipment, and chemical injection capacity at the production wells. Currently Cooper Energy's CHN facilities are serviced by an umbilical which connects the existing subsea wells to the onshore Athena Gas Plant. The main umbilical is run from an onshore HDD to the Casino-4 well offshore. This includes approximately 1.6 km of umbilical onshore (to HDD exit) and 28.6km offshore, 6.34 km of which is located in Victorian state waters. The current umbilical system can support up to 10 wells at a given time. Considering the scope of the project (up to 15 wells) in addition to the current 4 wells producing in the CHN development an alternative has been considered.

The controls system configurations considered are:

- Option 1 – **Existing umbilical**: Utilise the existing main umbilical which would limit production up to 10 wells at a given time.
- Option 2 – **New umbilical**: Allow for the addition of a secondary main umbilical which would provide sufficient terminals for all wells within the development concurrently.

For either option, additional in-field umbilicals would be installed to connect up new wells and manifolds. These have been excluded from the assessment of options as they would be expected to be the same or very similar layout and footprint.

Project drivers were assessed using the method and criteria described in Section 5.2.1. Table 5-9 provides a comparison of criteria for each option.

*Table 5-9: Comparative Assessment of Criteria of New Well Functionality Concepts*

| | Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|---|
| | | Utilise Existing Main Umbilical | | Install New Secondary Umbilical | |
| | | Score | Justification | Score | Justification |
| Environmental Impacts | Seabed disturbance | 1 | No associated disturbance footprint. | 5 | Additional disturbance (~5.72 km$^2$ offshore and ~1.6 km onshore) due to installation of new umbilical and HDD. |
| | Underwater sound | 1 | No impact identified. | 4 | Additional noise emissions associated with the operation of a vessel to install and retrieve. |
| | Atmospheric and GHG | 1 | No impact identified. | 4 | Additional noise emissions associated with the operation of a vessel to install and retrieve. |
| | Light | 1 | No impact identified. | 4 | Additional noise emissions associated with the operation of a vessel to install and retrieve. |
| | Planned discharges | 1 | No impact identified. | 4 | Additional planned discharges associated with the operation of a vessel to install and retrieve. |
| | Life-of-field | - | N/A | - | N/A |
| Environmental Risks | Accidental releases | 1 | No risk identified. | 4 | Additional risk of accidental release consistent with the operation of a vessel. |
| | Interaction with marine fauna | 1 | No risk identified. | 4 | Additional risk of interacting with marine fauna consistent with the operation of a vessel. |
| | IMS | 1 | No risk identified. | 4 | Additional risk of introducing and IMS consistent with the operation of a vessel. |
| Subtotal - Environment | | 8 | | 33 | |
| Technical feasibility | Technical feasibility | 3 | Feasible. | 3 | Feasible. |
| | Technology readiness | 3 | Utilisation of umbilicals is considered common practice. | 3 | Utilisation of umbilicals is considered common practice. |
| | Feasibility to construct | 3 | No associated risk/impact identified | 3 | Installation of umbilicals is considered common practice. |
| | Reusability | 3 | Expected to be similar between options. | 3 | Expected to be similar between options. |
| | Feasibility of decommissioning | 1 | No additional risks/impacts identified. | 4 | Additional safety concerns associated with added decommissioning. |
| Safety | OHS and risk exposure | 1 | No risks/impacts identified. | 4 | Additional safety concerns associated with installation and decommissioning. |
| | Process safety | 3 | No additional risks were identified. | 3 | No additional risks were identified. |
| Commercial | Ability to meet development timeline | 1 | No risk identified. | 4 | Minor risk as it requires the procurement of long lead items. |
| | Economic viability | 1 | No additional cost. | 5 | High costs associated with installation and decommissioning of new umbilical. |

| | Criteria | Evaluated Concepts | | | |
|---|---|---|---|---|---|
| | | Utilise Existing Main Umbilical | | Install New Secondary Umbilical | |
| | | Score | Justification | Score | Justification |
| | Future development accommodation | 5 | Limitations to production (up to 10 wells at a given time). | 1 | Allow for more than 10 wells to be producing at one time. Would accommodate all potential wells within the project description at once. |
| Social | Impact to marine and coastal users | 3 | Expected to be similar between options. | 3 | Expected to be similar between options. |
| Social | Social license to operate | 1 | No associated concerns. | 4 | Requires a state accepted EP which would include an onshore crossing and new HDD. |
| Cultural | Cultural heritage | 1 | No associated disturbance footprint. | 5 | Substantial additional disturbance (5.72 $km^2$) offshore and (~1.6 $km^2$) onshore, mainly in the coastal environment leading to greater risk of impacting cultural heritage. |
| Subtotal - Other | | 29 | | 45 | |
| Total – All Project Drivers | | 37 | | 78 | |

The comparison of environmental criteria shows that *Option 1 – Utilising the existing umbilical* is ranked substantially better than *Option 2 – installing a new umbilical*. This is largely due to onshore and offshore disturbance that would result from the installation of a new umbilical. Additionally, installation of a new umbilical would require the use of a vessel. Although this would likely be grouped with other installation activities, alternatives are assessed exclusively, and the use of a vessel increases environmental impacts and risks across all criteria.

The comparison of "other" criteria shows that *Option 1 – Utilising the existing umbilical* is again ranked substantially better than *Option 2 – installing a new umbilical*. This is largely due to the substantial costs associated with the installation and subsequent additional decommissioning of a new umbilical. Further, as highlighted in the paragraph above, Option 2 would result in disturbance to the ground both onshore and offshore and carries an increased risk of disturbance to cultural heritage.

The total qualitative ranking score for each concept against all assessment drivers and criteria (including environmental criteria) shows that Option 1 is ranked significantly better than Option 2.

Option 1 does not allow for the concurrent production of future fields to the same extent as Option 2 due to the limitations of the existing umbilical. In an event where the umbilical is at capacity it will limit the production of the development. Cooper Energy has factored in this limitation and recognises that this can be managed in line with developing the wells in stages. Wells are generally required to stay connected to the umbilical termination assembly post cessation to allow for control and monitoring of the well until well abandonment occurs; though there may be alternate remote monitoring solutions which could be considered in future. Cooper Energy's decommissioning strategy, which follows NOPSEMAs planning for proactive decommissioning guideline (NOPSEMA, 2021), plans for wells to be abandoned within 3 years of production cessation. Ideally, dual purpose campaigns for drilling and well abandonment will occur. This will allow for wells to be disconnected from the umbilical during the well abandonment process, and the umbilical subsequently reconnected to new wells. This concept of staged development will avoid the need to install a new main umbilical, minimising environmental impact and risk, while meeting internal production targets and decommissioning requirements. Therefore, *Option 1 - Utilising the existing umbilical* was selected over *Option 2 – Installing a new umbilical*.

Note: umbilicals are installed and retrieved by similar methods as flexible flowlines. Assessment of installation and decommissioning methods has been included in Section 4.3.5.4.

### 5.3.4 Hydrotest Discharge

Hydrostatic testing is completed to determine the integrity of subsea infrastructure prior to authorising production to occur, using water inhibited with chemical additives. Once testing is complete, these fluids require removal from the flowline system. Two options have been considered for the removal of hydrotest fluids for the East Coast Project.

- Option 1 – Displace hydrotest fluids to sea
- Option 2 – Displace hydrotest fluids to shoreside facilities

During the consideration of *Option 2 – Displace hydrotest fluids to shoreside facilities* it was determined that this would be an unfeasible alternative due to the inability to direct pigs through the flowline and the existing CHN system to shore due to variations in pipeline diameter and overall layout with the flowlines branching into various tie-in points on the main CHN trunkline, therefore, the inhibited seawater is unable to be displaced to shoreside facilities. Given that Option 2 was considered not technically feasible given the existing infrastructure design and layout, Cooper Energy did not undertake further comparative assessment of these options.

In addition to this technical complication, there are currently no onshore treatment or disposal facilities that can treat large amounts of water as part of the production system or within proximity of the Athena Gas Plant. In this regard it is further noted that if displacing the hydrotest fluid to sea, new infrastructure design is such that only the recently added seawater and inhibitor in the new flowlines will need to be displaced (~590$m^3$ in all flowlines), whereas if a method of fully displacing to shoreside facilities was possible, production fluid and chemicals internal to the pipeline as part of production in the existing CHN trunkline will also need to be displaced to shoreside facilities, which means displacing and disposing of a significantly larger volume of mixed fluid (~790$m^3$ in CHN trunkline => totalling ~1,380$m^3$) which will all need to be transported to a suitable facility and disposed of. On this basis this option will not be carried through the comparative assessment process.

Although discharge to sea will cause temporary and localised changes to water quality, the impacts and risks can be managed to ALARP and acceptable levels. It is considered common practice within the industry and is a feasible alternative to attempting to transfer the fluids to shore. Therefore, although Option 1 results in a higher planned environmental impact within the marine environment, the technical complications associated with Option 2 make Option 2 an unfeasible alternative and no further assessment has been undertaken.

### 5.3.5 Gas Recovery

During well construction activities, the wellbore must be displaced to remove residual well construction and wellbore fluids; the well must be flowed to ensure the well is appropriately displaced. In addition to residual well construction fluids, reservoir fluids, including gas are recovered from the wellbore. Two options have been considered for the processing of gas from well clean-up activities associated with the East Coast Project:

- **Option 1** – **Gas is flared:** volumes of gas from well clean-up activities would be released via flaring offshore at the MODU.
- **Option 2** – **Gas is processed onshore via AGP**: gas from well clean-up activities is recovered and processed at AGP for flaring and/or possibly for domestic export.

During the consideration of *Option 2 –Gas is processed onshore via AGP* it was determined that if gas resulting from well clean-up was sent onshore through the subsea system to AGP, the subsea system would be contaminated by liquids such as brine and base oil. This poses a flow assurance and integrity risk to the onshore process system and there is a higher risk of the initial flowback of fluids impacting production equipment at the gas plant. The gas plant is designed for dry gas (minimal liquid), so influx of liquids can cause damage to the process systems. Rather than risk damaging equipment, the gas would be directed to the flare system at the gas plant. This scenario would have the effect of transferring the aspects associated with flaring in an offshore area, to an onshore coastal area in the same region, it would not eliminate the aspects. It is also the case that MODU's do not have capability to compress and store gas and therefore could not substantially export the gas from the MODU to AGP. Given that Option 2 was considered not technically feasible

and posed integrity risk to the process system, Cooper Energy did not undertake further comparative assessment of these options.

Flaring of gas would result in temporary and localised changes in air quality at the flaring location, which would be either offshore (*Option 1 – Gas is flared*) or onshore (*Option 2 –Gas is processed onshore via AGP*). Winds are typically higher offshore, resulting in emissions being quickly dissipated within the marine environment at a faster rate than would be expected onshore. Sensitivity of the receiving environment is also likely to be higher onshore, with increased proximity to environments and habitats relied upon by fauna and fauna.

Although gas emissions could cause temporary and localised changes to air quality, the impacts and risks can be managed to ALARP and acceptable levels. Flaring is considered common practice within the industry and is feasible. Therefore, although Option 1 results in a slightly higher environmental impact within the marine environment, the technical complications associated with Option 2 make Option 2 an unfeasible alternative and no further assessment has been undertaken.

# 6 Existing Environment

This section provides a detailed description of the environment that may be affected (EMBA), regional setting and a summary of the key ecological, social and cultural receptors.

## 6.1 Regional Context

The OPGGS(E) Regulations 2023 define 'environment' as *'ecosystems and their constituent parts, natural and physical resources, the qualities and characteristics of locations, places and areas, and the heritage value of places; and includes the social, economic and cultural features of those matters'*. In accordance with Section 7(2)(c) and (d) of the OPGGS(E) Regulations, this document describes relevant physical (Section 6.3), ecological (Section 6.4), social (Section 6.5 and 6.6) and cultural (Section 6.7) values and sensitivities of the environment.

A greater level of detail is provided for those particular values and sensitivities as defined by Section 7 (3) of the OPGGS(E) Regulations, which states that relevant values and sensitivities may include any of the following:

(a) the world heritage values of a declared World Heritage property;

(b) the National Heritage values of a National Heritage place;

(c) the ecological character of a declared Ramsar wetland;

(d) the presence of a listed threatened species or listed threatened ecological community;

(e) the presence of a listed migratory species;

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

  i. a Commonwealth marine area; or

  ii. Commonwealth land.

With regards to Section 7(3)(d) and (e) more detail has been provided where threatened or migratory species have a spatially defined biologically important area (BIA), habitat critical to survival or identified biologically important behaviour such as breeding, foraging, resting or migration.

BIAs are areas and times used by protected marine species for carrying out critical life functions as listed above (DCCEEW, 2024o). BIAs can be located anywhere within the Australian marine environment and may also be designated over terrestrial areas (i.e., turtle nesting beaches). BIAs are:

- Designed to inform decision making about actions which may impact protected species
- Described in conservation plans for protected marine species including statutory recovery plans, wildlife conservation plans, and conservation advice documents (DCCEEW, 2024o).

It is important to note that BIAs do not represent the species full range and that areas without BIAs may still support biologically important behaviours (DCCEEW, 2024o).

BIAs within this document have been described and defined by using the downloadable DCCEEW BIA shapefile dataset (DCCEEW, 2024p), this includes data for the updated BIAs for the southern right whale as per the recently released National Recovery Plan (DCCEEW, 2024l).

With regards to Section 7(3)(f) more detail has been provided for:

- Key Ecological Features (KEFs) as they are considered as conservation values under a Commonwealth Marine Area
- Australian Marine Parks (AMPs) as they are enacted under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Important habitat for migratory species is defined within the Matters of National Environmental Significance Significant Impact Guidelines 1.1 (CoA, 2013b) as:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or

- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining.

## 6.2 Environment that may be affected

The environment that may be affected (EMBA) 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. 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 6-1 and Figure 6-1 detail the project areas associated with the activity that are used to describe the environmental context relevant to the activity and support the impact and risk assessments.

Consistent with existing operations, the largest spatial extent of potential impact associated with the East Coast Project is from an accidental release. Spill modelling was conducted for an accidental release of hydrocarbons; for both MDO and condensate. The worst-case spatial extent from an accidental release is associated with condensate – therefore, for the purpose of the description of environment, the EMBA described in Section 6 is based on an accidental release of condensate and is termed the Monitoring Area. The EMBA and extent of potential socio-economic impact (SEI) have been defined for both types of hydrocarbon and release scenarios and are used to inform Section 9.5 and 9.6.

Light and underwater sound emissions also have specific EMBAs for specific potential impacts; these are characterised and assessed in relevant impact assessment section (Sections 8.1, 8.2 and 8.3).

*Table 6-1: East Coast Project operational area and EMBA descriptions*

| Project Area | Description |
|---|---|
| **Operational Area** | The operational area includes:<br>• 3 km buffer around the outermost proposed well locations and associated flowline routes within the Annie, Juliet, Nestor and Henry fields.<br>• 5 km buffer around the outermost proposed well locations and associated flowline routes within Elanora, Heera, Isabella and Pecten East prospects. |
| **EMBA*** | The EMBA is the largest spatial extent where unplanned events could have an environmental consequence on the surrounding environment.<br>The boundary of the EMBA has been defined by an accidental release of condensate. A moderate threshold exposure value for each oil type was used to define the spatial extent.<br>• Floating (10 g/m$^2$)<br>• Shoreline (100 g/m$^2$)<br>• In-water: Dissolved (50 ppb) and Entrained (100 ppb)*<br>*Entrained oil does not have a moderate threshold; therefore, the high threshold is used.<br>The EMBA does not represent the predicted coverage of any one hydrocarbon spill or no does it depict a single plume at any given point in time. Rather, the EMBA is a composite of multiple spill scenarios over a large number of theoretical scenarios with differing metocean conditions. Relevant ecological receptors are detailed in Section 6.5. Potential risks within the EMBA are assessed in Section 9.5 and Section 9.6 and are not homogenous; they vary in consequence. Generally, the potential consequences would diminish with distance from the spill, and the probability of an impact, which is highly unlikely in the first instance, becomes less likely still, with distance from the spill out to the edge of the EMBA |
| **Extent of potential SEI** | The extent of potential SEI is used to identify receptors which have the potential to be subject to visual or economic impacts associated with an accidental release of hydrocarbons. Social receptors are assessed based on the hydrocarbon exposure threshold that could result in a visual sheen or exceedance of water quality guidelines |

| Project Area | Description |
|---|---|
| | and are considered an indicator of possible socio-economic impacts within the marine and coastal environment.<br>The boundary of the extent of potential SEI has been defined by an accidental release of condensate. A low threshold exposure value for visible oil types (floating and shoreline) and a moderate threshold exposure value for in-water oil types were used to define the spatial extent.<br>• Floating (1 g/m$^2$)<br>• Shoreline (10 g/m$^2$)<br>• In-water: Dissolved (50 ppb) and Entrained (100 ppb)*<br>Relevant social receptors are detailed between Section 6.6 and Section 6.8. Impacts to social receptors within the extent of potential SEI are assessed in Section 9.5 and Section 9.6. |
| **Monitoring area** | The monitoring area characterises the geospatial extent where hydrocarbons may potentially be detectable, however impacts are not expected to be detectable to these extents. Applying this conservative threshold enables the identification of physical, biological, conservation values and sensitivities, social and cultural receptors which may fall within spill response monitoring programs and are described in the sections below.<br>The boundary of the monitoring area has been defined by an accidental release of condensate. A low threshold exposure value for each oil type was used to define the spatial extent.<br>• Floating (1 g/m$^2$)<br>• Shoreline (10 g/m$^2$)<br>• In-water: Dissolved (10 ppb) and Entrained (10 ppb) |

**Note: Ecological and extent of potential SEI have also been defined by an accidental release of MDO which fall within the contours of the condensate EMBA's. The MDO EMBA's are referred to for the MDO impact assessment (Section 9.5).*

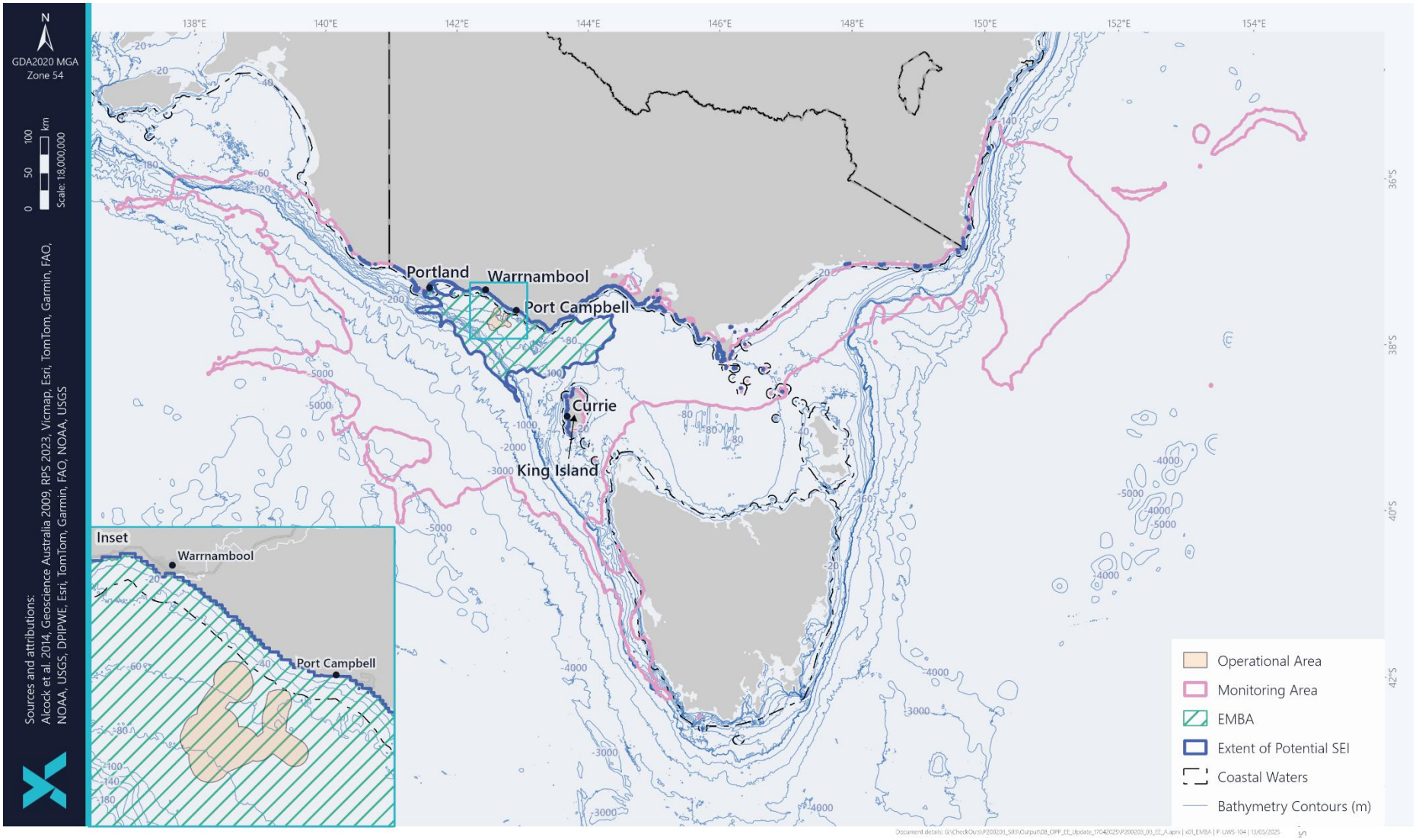



Figure 6-1: East Coast Project operational area and EMBAs to inform hydrocarbon spill risk

## 6.3 Regional Setting

Six marine regions have been identified in Commonwealth waters around Australia. Two of these regions intersect with the monitoring area, one of which, the south-east marine region, is intersected by the operational area.

### 6.3.1 South-east Marine Region

As its name suggests, the south-east marine region spans the south-east commonwealth waters of Australia, including state waters of South Australia, Victoria, Tasmania and NSW. The south-east marine region is further divided into 11 provincial bioregions and is representative of 17 different seafloor types (CoA, 2015a). The region is relatively low in nutrients however, features such as the east Tasmania subtropical convergence zone, Upwelling east of Eden, Seamounts south and east of Tasmania and the Bonney coast upwelling result in localised areas of relatively high productivity and biodiversity. These areas support biologically important behaviours, such as foraging, for a variety of EPBC Listed species like the Australian sea-lion, white shark, Australasian gannet, fairy prion, black-faced cormorant, little penguin, crested tern, and several species of albatross, petrel and shearwater (CoA, 2015a). The region is also a known migration route and foraging area for the pygmy blue whale and supports reproductive and migration areas for the southern right whale.

In addition, the south-east marine region features cultural sites of significance including historic shipwrecks, First Nations heritage sites and places of spiritual connection and built European heritage are discussed in Section 6.8.

#### *6.3.1.1 Otway Marine Bioregion*

The East Coast Project is located within the Otway marine bioregion which extends from Cape Otway (Vic) to Cape Jaffa (South Australia) and includes the western islands of the Bass Strait.

The Otway basin is well mixed given it is a higher-energy environment exposed to frequent storms and significant waves. The region is characterised by 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, >100 km west of the East Coast Project, therefore upwelling around the operational area is considered to be unlikely or occasional (Huang and Wang, 2019).

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; Ramboll, 2020b).

The coastline is generally rocky, with tall cliffs and rock outcrops, some sandy beaches, inlets and settlements. Shoreline habitats of the Otway coastline, including offshore islands, provide for a range of fauna including penguin colonies, fur-seal colonies and bird nesting sites. Offshore islands identified within the monitoring area including, but not limited to, Deen Maar, Griffiths Island, Middle Island and Lawrence Rocks provide important nesting habitat for EPBC listed seabird and shorebird species (Harris and Norman, 1981).

- Deen Maar, previously known as Lady Julia Percy Island, is a particularly important rookeries for shearwater species and the little penguin (Dann and Norman, 2006) which are known to breed extensively over the island (Pescott, 1976).
- Griffiths Island has been identified as an important rookery for the short-tailed shearwater which arrives to the island to breed in September each year (Bowker, 1980). Historically the island was also known to support a population of little penguins however they have since disappeared presumably due to predation (Dann and Norman, 2006).
- Middle Island has been identified as a breeding colony for the black-faced cormorant and possible breeding location of silver and pacific gulls (Tingay and Tingay, 1982). The island

also supports a small population of little penguins whose breeding numbers have increased following the implementation of the Maremma dog project which protects the species from predation (Wallis et al., 2017).

- Lawrence Rocks is classified as an important bird area by BirdLife International and contains > 10% of the global population of the Australasian Gannet (2024). Historically Lawrence Rocks was also known to support small populations of breeding little penguins and fairy prions (Pescott, 1980).

**Shipwreck Coast Biogeographical Unit**

A further regional classification down from IMCRA bioregions are called biogeographical units or biounits. Biounits are defined by their physiographical setting including oceanography, geomorphology and the ecosystem types present (Young et al., 2022). In Victoria biounits have been classified in state waters. The biounit adjacent to the East Coast Project runs from the east of Port Fairy to the west of Cape Otway and is termed Shipwreck Coast. The physiographic features of Shipwreck Coast include:

- cliff dominated coastlines with stacks, islands and small bays
- extreme to very high exposure to the prevailing weather with strong winds and swells
- deep reefs with terraces, scarps and pinnacles as well as low complexity and veneer reef systems (Edmunds and Flynn, 2018).

### 6.3.2 Temperate-east Marine Region

The temperate-east marine region spans from the southern boundary of the Great Barrier Reef Marine Park south to Bermagui, NSW and includes the eastern waters surrounding Lord Howe and Norfolk Islands (CoA, 2012). Defining physical features associated with the marine region include the East Australian Current, the Tasman Front and significant benthic features such as seamount chains and the canyons of the eastern continental slope (CoA, 2012). The East Australian Current is the dominant oceanographic influence within the region, bringing warm waters from the Coral Sea down the continental shelf, extending the range of tropical species into subtropical and temperate waters which supports high species richness and diversity (Director of National Parks (DNP), 2018). This region supports biologically important behaviours, such as foraging, for a variety of EPBC Listed species like the sooty tern and several species of albatross, petrel and shearwater (CoA, 2012). The region is also a known migration route for the grey nurse shark and humpback whale and supports reproductive and migration areas for the southern right whale.

The temperate-east marine region supports established industries such as commercial fishing, shipping and a range of recreational and tourism-based activities such as fishing, snorkelling, diving and boating. Further, Traditional Owners have used Sea Country within the marine region for thousands of years and continue to manage the coastal and marine environments of the region as a resource and to maintain cultural identity, health and wellbeing. Fishing, hunting and the maintenance of culture and heritage through ritual, stories and traditional knowledge continue as important uses of near shore and adjacent areas (DNP, 2018).

## 6.4 Physical Environment

### 6.4.1 Air Quality

Historical air quality data is available from the Environment Protection Authority (EPA) Victoria air quality monitoring stations, and Cape Grim Baseline Air Pollution Station on Tasmania's west coast. Cape Grim is one of the three premier baseline air pollution stations in the World Meteorological Organisation-Global Atmosphere Watch (WMO-GAW) network, measuring greenhouse and ozone depleting gases and aerosols in clean air environments.

The Victorian air quality data is collected at 15 performance monitoring stations representing predominantly urban and industrial environments in the Port Phillip and Latrobe Valley regions of Victoria. Results are assessed against the requirements of the National Environment Protection (Ambient Air Quality) Measure for the pollutants carbon monoxide (CO), nitrogen dioxide ($NO_2$), ozone ($O_3$), sulphur dioxide ($SO_2$), lead (Pb), particles less than 10 micrometres in diameter ($PM_{10}$)

and particles less than 2.5 micrometres in diameter ($PM_{2.5}$). The most recent annual air monitoring report shows Victoria's air quality in 2020 was generally good with AAQ NEPM (Ambient Air Quality National Environmental Protection Measure) goals and standards being met for carbon monoxide (CO), nitrogen dioxide ($NO_2$) and sulphur dioxide ($SO_2$) (EPA Victoria, 2021). There were some exceedances for pollutants such as Ozone ($O_3$) and ($PM_{2.5}$).

The Cape Grim Baseline Air Pollution Station analyses air masses between 190°S - 280°W when they arrive at the station. As there are no intervening landmasses, the air is free from recent human and terrestrial influences and allows samples to be representative of a 'baseline' atmospheric composition for the mid-latitudes of the Southern Hemisphere (CSIRO, 2022). The most recent report from CSIRO in 2022 showed that the levels of greenhouse gases at Cape Grim to be 415.3 ppm carbon dioxide ($CO_2$), 1877.2 ppb methane ($CH_4$) and 335 ppb nitrous oxide ($N_2O$).

The Victorian Air Quality monitoring stations are located closer to the Operational Area; however, majority are located in an urban environment and are not representative of the clean air environment over the Operational and Planning Areas. While the Cape Grim Baseline Air Pollution Station is ~270km away from the Otway, it is likely a more reliable point of reference for the air quality for the Operational and Planning areas. That air that is sampled at Cape Grim travels long trajectories over the Southern Ocean and is representative of a large area that is unaffected by regional pollution sources (cities or industry) (CSIRO, 2017). The Operational Area is 38km away and may be subject too high degrees of vessel traffic (Section 6.7.3.1), which will affect the air quality in the vicinity of the Project.

### 6.4.2 Bathymetry

The geomorphology of Australia's continental margin is varied, with a number of different geomorphic features present, including basins, canyons, terraces, seamounts and plateaus. In the south-east, the continental shelf is broad, extending offshore to approximately 200 m water depth (Figure 6-3) (Harris et al., 2005). Some of the notable seabed features of the continental shelf in the south-east marine region include the Otway Depression and Otway Shelf, King Island Rise and the Bass Basin. Geomorphic features on the continental slope and abyssal plain include: Bass Canyon, East Tasman Saddle and East Tasman Plateau, South Tasman Rise, Stradbroke Seamount and Moreton Seamount.

Bass Basin, a seaway separating the mainland and Tasmania, is a shallow depression approximately 120 km by 400 km, with water depths up to approximately 90 m (average water depth of approximately 60 m). Within the Bass Basin, the Bassian Rise (eastern margin) separates Bass Basin from the Gippsland Basin and is associated with the Furneaux Islands and the King Island Rise (western margin) includes the shallow (<40 m water depth) Tail Bank, and King Island itself; and separates Bass Basin from Otway Basin. To the southwest, there is a relatively narrow, 60 m-deep channel between King Island and Tasmania. Sandwaves and tidal current ridges occur on the seabed of both Bassian and King Island Rises. The largest of the tidal sand ridges, Moriarty Bank, lies east of Clarke Island and is approximately 20 km long and 4 km wide, orientated east-west, sub-parallel to the flow of tidal currents (Harris et al., 2005).

In the locale of the East Coast Project, bathymetry is characterised by overall gradual increase in depth with distance from shore, and localised variability around ridges, channels, escarpments and some areas of sand. megaripples and rubble. Figure 6-2 shows the bathymetry around the 2018 planned Annie-1 well location and planned Elanora well site.

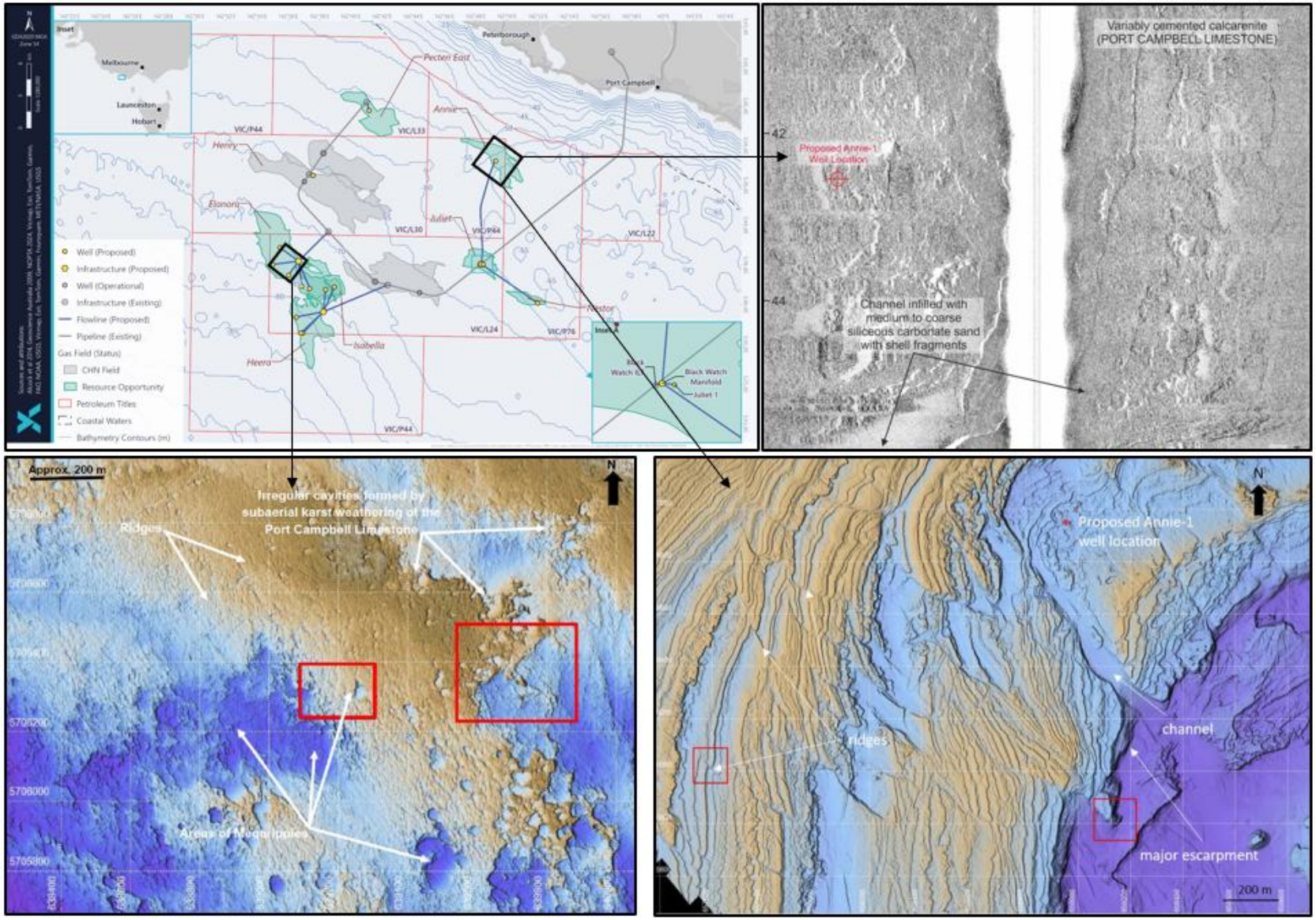



*Figure 6-2: Bathymetry within the East Coast Project Operational Area – 2018 planned Annie-1 and Elanora-1 well locations*

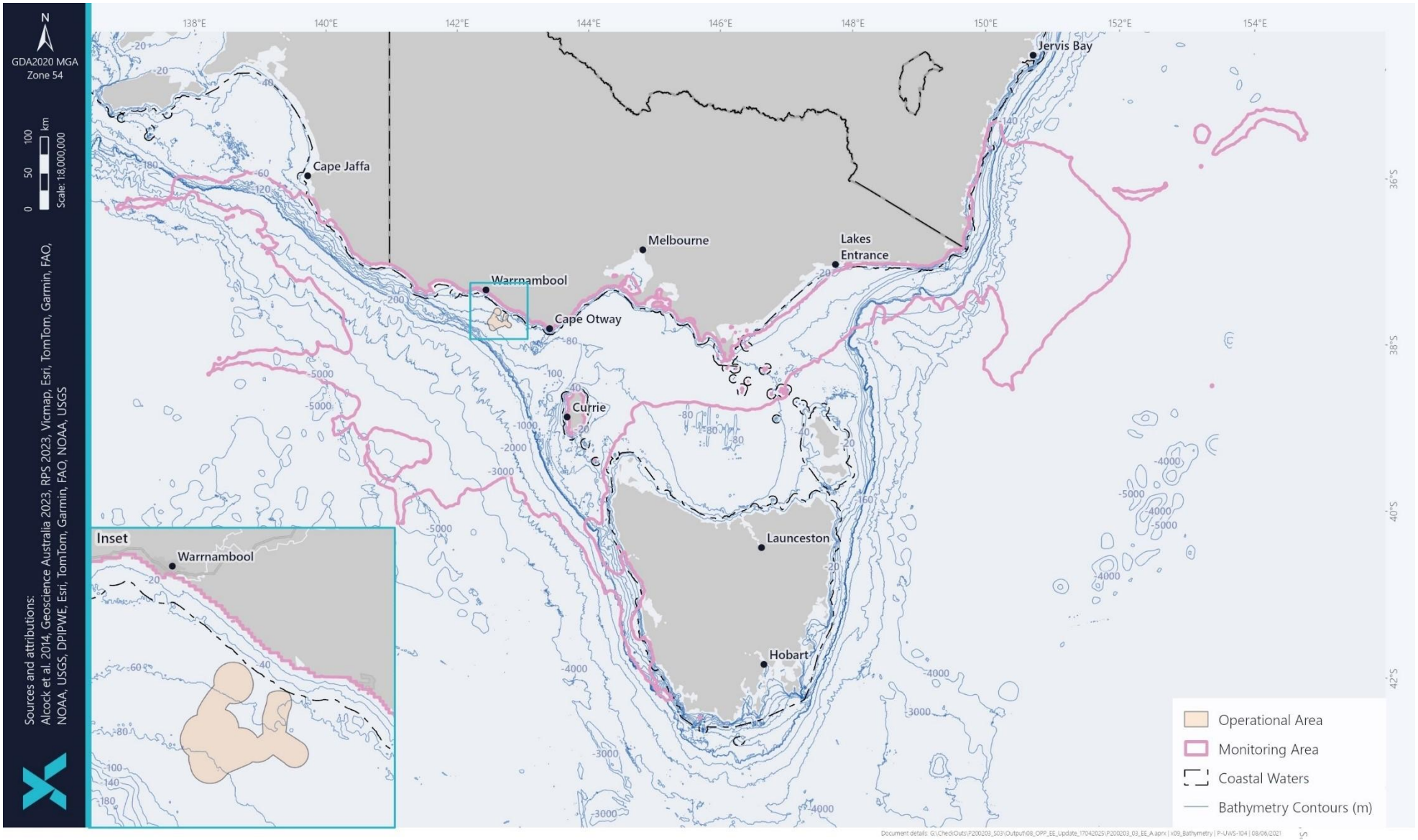



*Figure 6-3: Bathymetry of Bass Strait*

### 6.4.3 Climate

Australia's size and geography gives rise to a diverse range of climate patterns across the continent and offshore islands. The south-eastern coast (Victoria, Tasmania, New South Wales) is primarily described as being 'temperate'. There are seasonal variations in mean temperatures and rainfall with southern Australia having high winter rainfall in comparison to summer.

Victoria's climate in particular can be characterised as cool temperate, with cool wet winters and cool summers. The conditions are primarily influenced by weather patterns originating in the Southern Ocean. It 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 west to east across the region.

### 6.4.4 Winds

Bass Strait is located on the northern edge of the westerly wind belt known as the Roaring Forties. Hindcast modelled wind data from the National Centres for Environmental Predictions Climate Forecast System Reanalysis for the period 2008 to 2012 (inclusive), showed winds were typically from a westerly (west-southwest to west-northwest) direction, with average monthly wind speeds ranging from 14.1–16.5 knots. In winter, when the subtropical ridge moves northwards over the Australian continent, cold fronts generally create sustained west to south-westerly winds and frequent rainfall in the region (McInnes and Hubbert, 2003). In summer, frontal systems are often shallower and occur between two ridges of high pressure, bringing more variable winds and rainfall.

Occasionally, intense mesoscale low-pressure systems occur in the region, bringing very strong winds, heavy rain, and high seas. These events are unpredictable in occurrence, intensity, and behaviour, but are most common between September and February (McInnes and Hubbert, 2003). Wind speeds in the area are typically in the range of 10–30 km/hr, with maximum gusts reaching 100 km/hr.

RPS (2024) acquired high-resolution wind data across their modelling domain from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR). Monthly wind rose distributions from 2010 to 2019 (inclusive) derived from CFSR data for selected nodes nearby each release location are shown in Figure 6-4 to Figure 6-6.

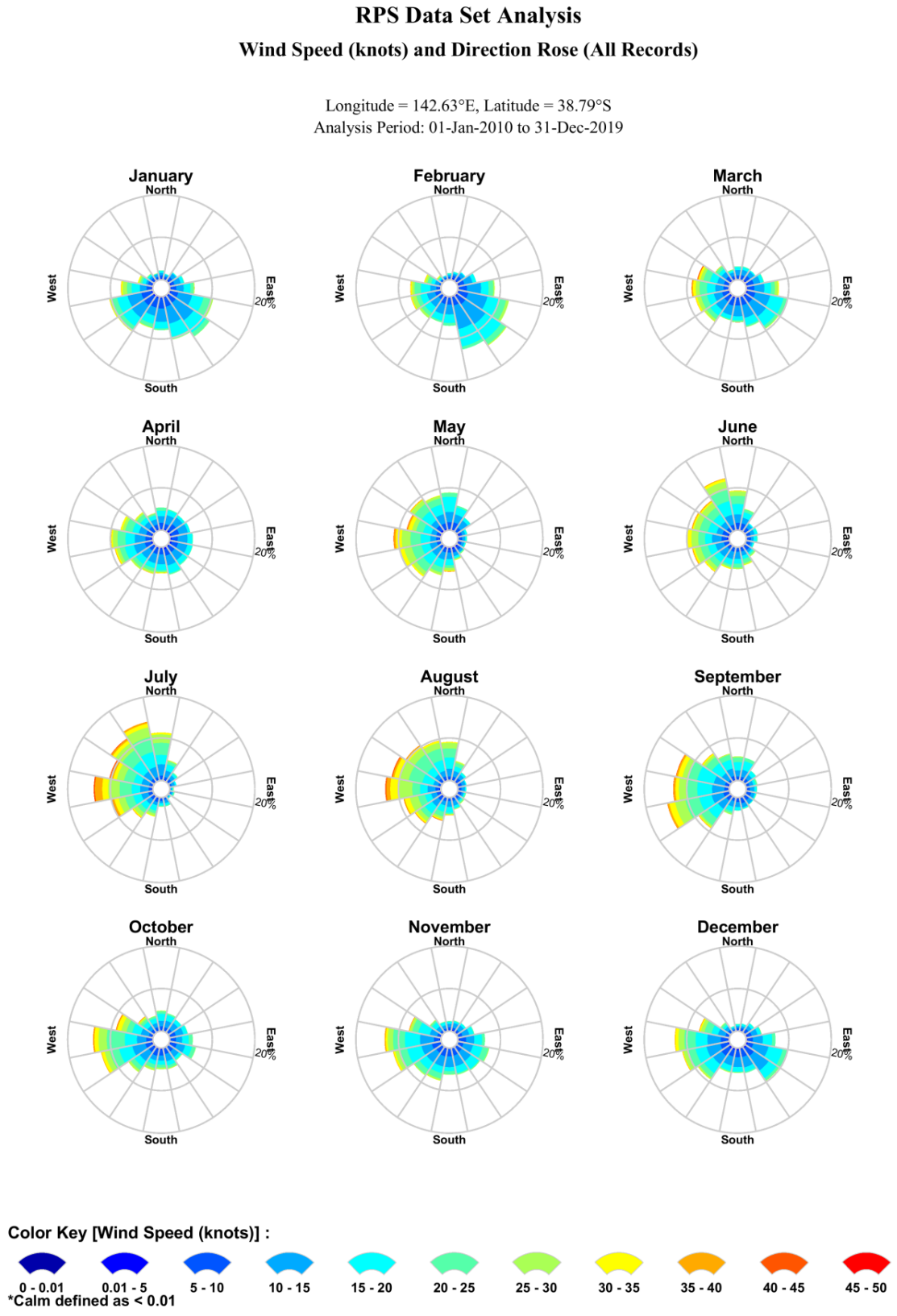



*Figure 6-4: Modelled monthly wind rose distributions from 2010–2019 (inclusive) for the node nearby the Elanora-ST1 (Isabella) well*

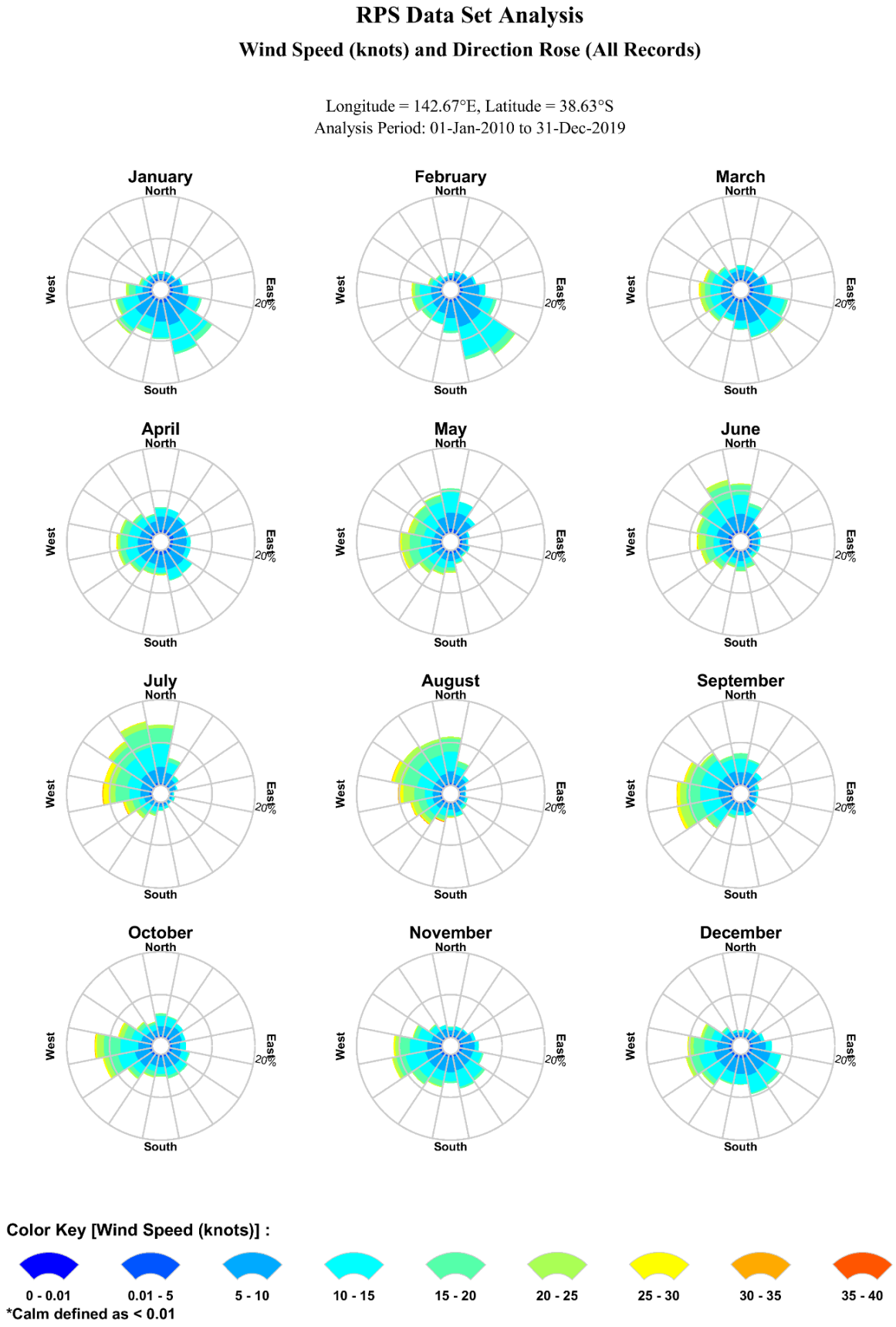



*Figure 6-5: Modelled monthly wind rose distributions from 2010–2019 (inclusive) for the node nearby the Pecten East-2 well*

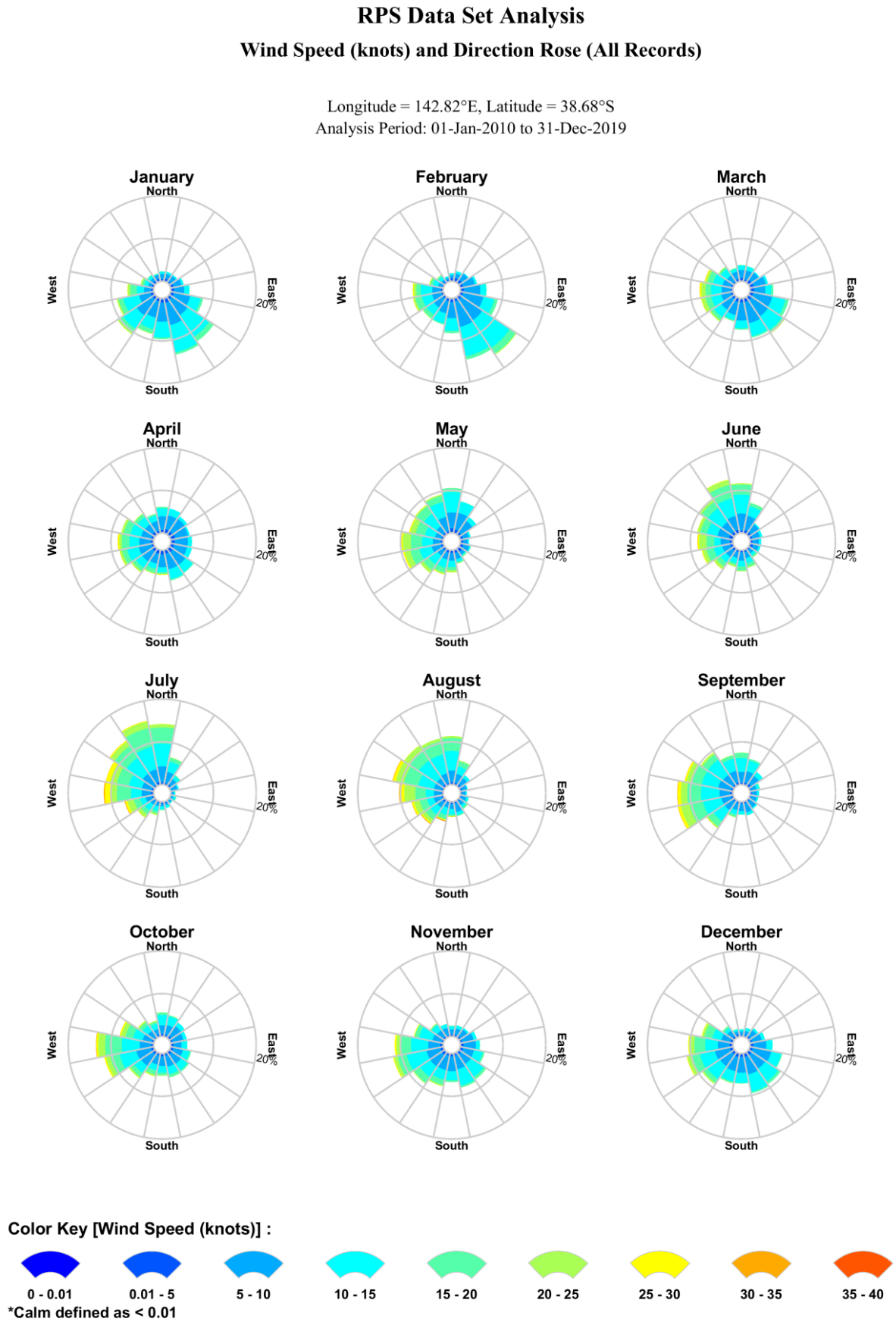



*Figure 6-6: Modelled monthly wind rose distributions from 2010–2019 (inclusive) for the node nearby the Annie-2 well*

### 6.4.5 Oceanography

#### *6.4.5.1 Currents*

Australia is heavily influenced by four major currents: East Australian Current, Leeuwin Current, Indonesian Throughflow, and the Antarctic Circumpolar Current. These currents have a driving influence on the conditions and biodiversity in Australian oceans and coastal environments. There are also a number of smaller and more complex current systems (Figure 6-7). All these ocean features can change from season to season, and may be more or less extensive and energetic, depending on climate factors.

The Bass Strait region has a reputation for high winds and strong tidal currents (Jones, 1980). Currents within the Strait are primarily driven by tides, winds and density driven flows. Tides are semi-diurnal with some diurnal inequalities, generating tidal movements with a predominantly north-east to south-west orientation; with speeds ranging 0.1–2.5 m/s (Fandry, 1983). Tidal flows in Bass Strait come from the east and west during a rising (flood) tide, and flow out to the east and west during a falling (ebb) tide. During winter there is a strong eastward water flow in the Bass Strait due to the strengthening of the South Australian Current (fed by the Leeuwin Current in the Northwest Shelf), which bifurcates with one extension moving though the Bass Strait, and another forming the Zeehan Current off western Tasmania (Sandery and Kämpf, 2007). During summer, water flow reverses off Tasmania, King Island and the Otway Basin travelling eastward, as the coastal current develops due to south-easterly winds. Average current speeds in the area range between 0.15 m/s to 0.24 m/s, with maximum current speeds in a range between 0.66 m/s (Feb) to 1.10 m/s (Sept) (RPS, 2024). 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 (RPS, 2017). Average and maximum ocean current speed were taken from nearby Elanora-1 ST1 (Isabella), Pecten East-2 and Annie-2 wells by combining the ocean and tidal currents (RPS, 2024).

The Tidal current data was generated using RPS's ocean/coastal model, HYDROMAP. The HYDROMAP model has been thoroughly tested and verified through field measurements throughout the world for more than 30 years (Isaji & Spaulding, 1984; Isaji, et al., 2001; Zigic, et al., 2003). HYDROMAP's data has been used as input to forecast and hindcast pollutant spills in Australian waters and forms part of the Australian National Oil Spill Emergency Response System operated by AMSA (RPS, 2024).

Bass Strait is a high-energy environment exposed to frequent storms and significant wave heights. The Otway coast has a predominantly south-westerly aspect and is highly exposed to swell from the Southern Ocean. Storms in Bass Strait can generate wave heights of 5 m or more (Cooper Energy 2019). In-situ wave measurements in the northern portion of the Casino pipeline, showed 2.0–3.5 m waves occur for 50% of the time, and waves over 7.6 m can occur during winter (Santos, 2004).

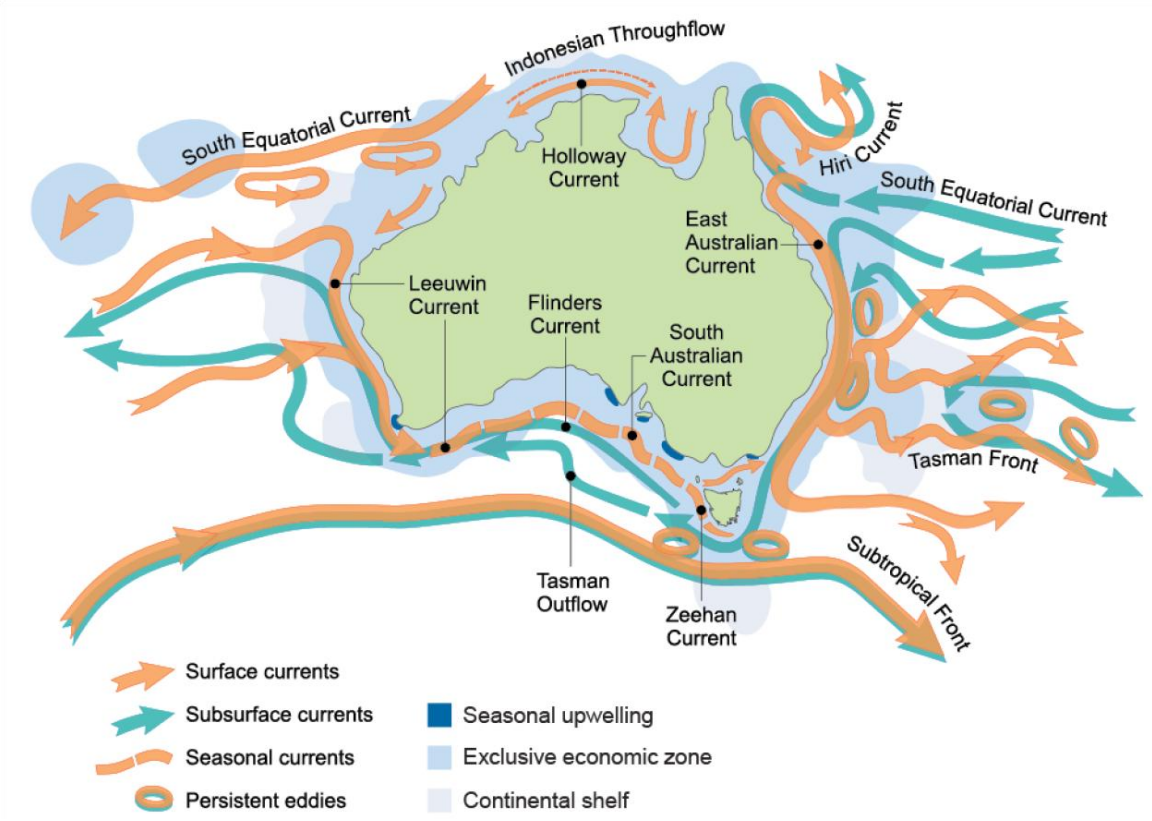



*Figure 6-7: Major Ocean Currents and Features of Australia's Marine Environment*

### *6.4.5.2 Sea Temperature and Salinity*

Sea-surface water temperatures vary seasonally from ~13.3°C (Sept) to ~18.6°C (Jan/Feb/Mar) (RPS, 2024).

Typically, seawater temperature decreases with depth, particularly in the summer months, while during the winter months the shallower continental shelf waters of the Otway Basin become well mixed due to the strong winds and high waves which results in a small temperature variation between the surface and seabed (RPS, 2023a). Variation in temperature and salinity seasonally and over depth at the modelled locations is shown in Figure 6-8, Figure 6-9 and Figure 6-10.

The southwest region of Victorian area has significant upwelling of colder, nutrient rich deep-water during summer (i.e. the Bonney Coast Upwelling KEF) that can cause sea surface temperatures to decrease by 3°C compared with offshore waters (Butler et al., 2002).

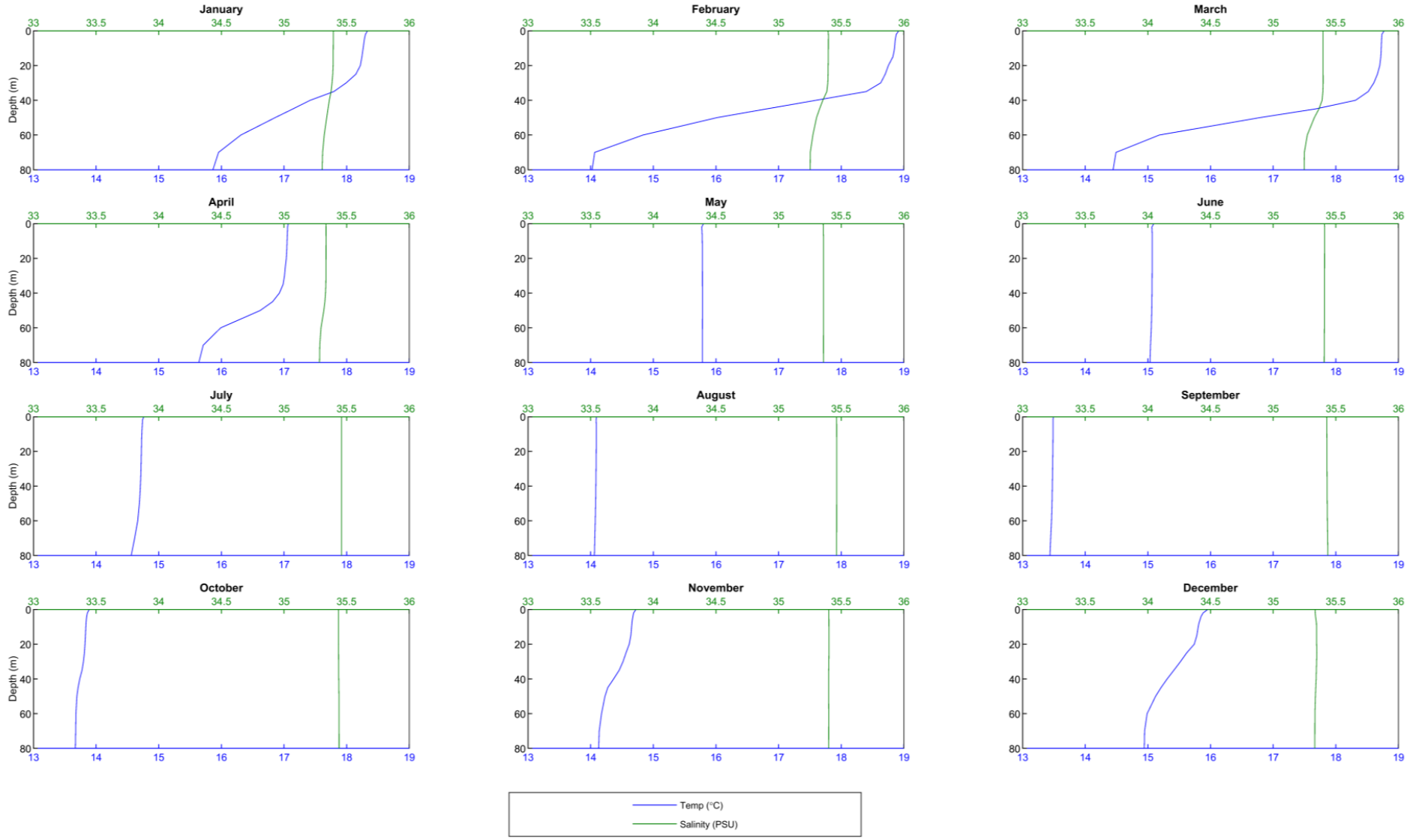



*Figure 6-8: Temperature and salinity profiles nearby the Elanora-1 ST1 well*

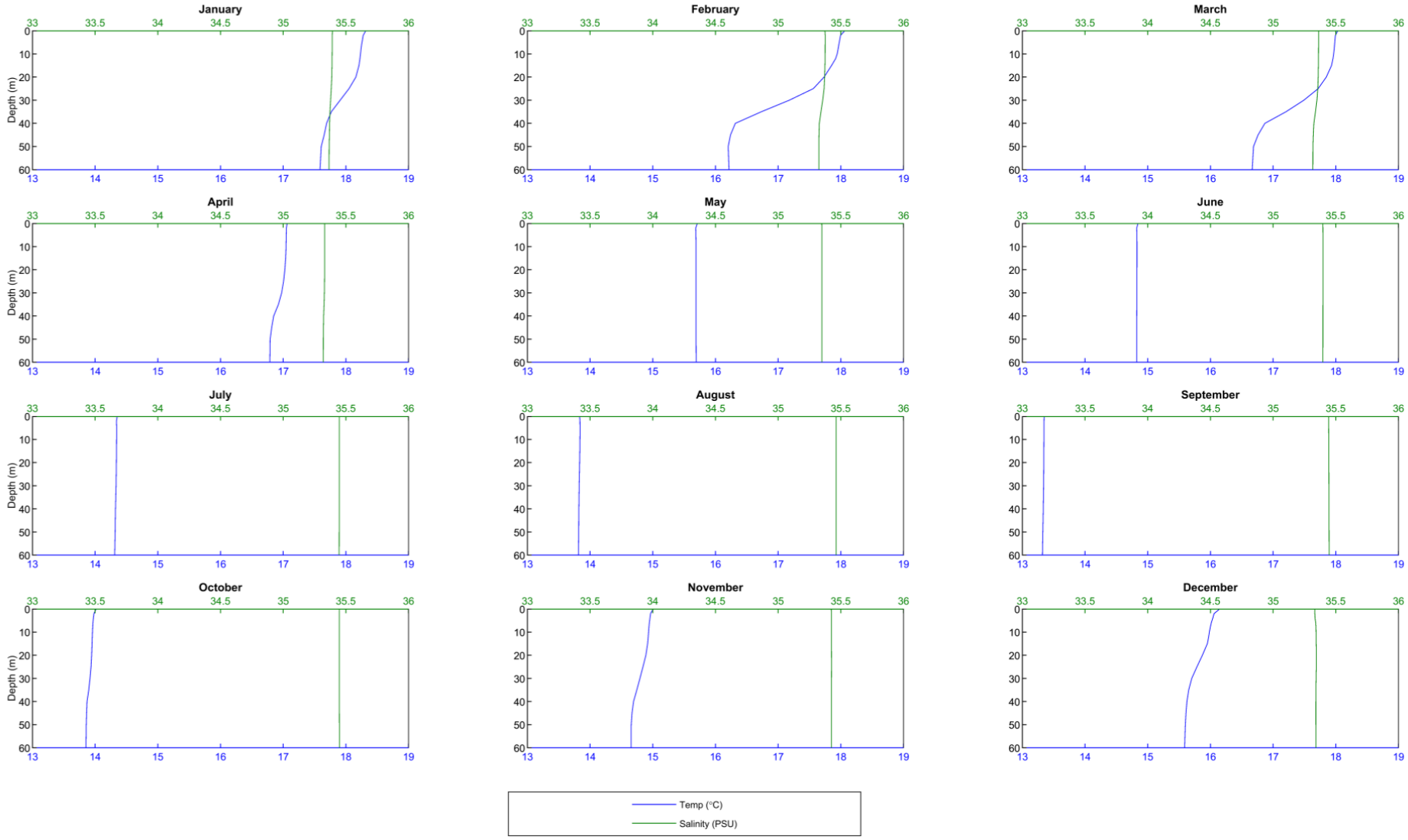



*Figure 6-9: Temperature and salinity profiles nearby the Pecten East-2 well*

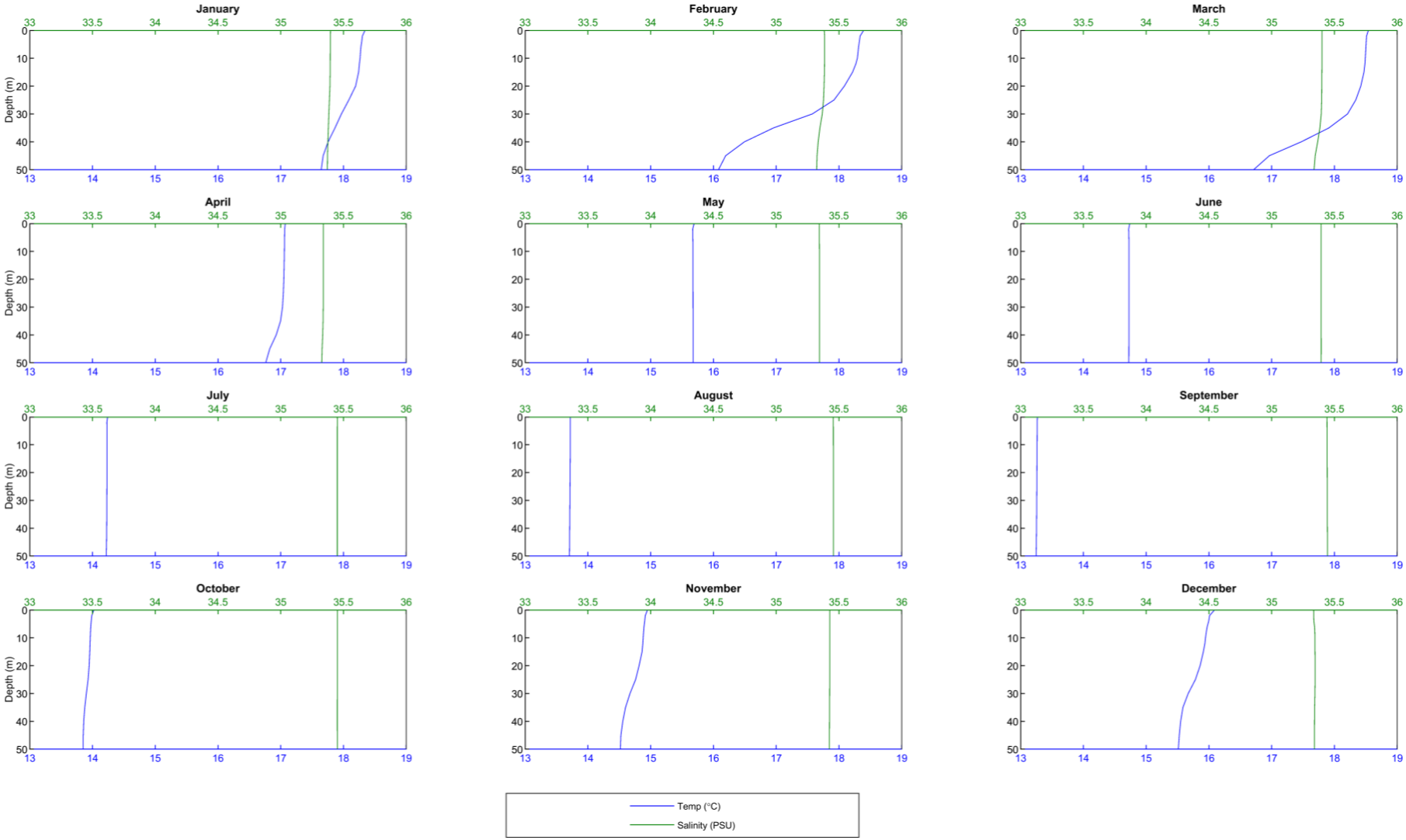



*Figure 6-10: Temperature and salinity profiles nearby the Annie-2 well*

### 6.4.6 Water Quality

Water quality within the monitoring area is expected to be consistent with the waters of the Otway Basin which is characterised by high water quality with low background concentrations of trace metals and organic chemicals (Ramboll, 2020a). The greater Bass Strait is 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 Fairy are known to influence offshore hydrodynamic conditions and are a driver of sediment dynamics, impacting benthic and pelagic habitats and changing water column turbidity. Wave-driven sediment resuspension generates high turbidity levels within coastal zones, commonly exceeding 50 mg/L. Further, water quality may be influenced (sometimes episodically) in nearshore areas through anthropogenic input of nutrients, chemicals and oils from coastal/port towns or rivers, which drain catchments dominated by stock grazing and small settlements (EPA Victoria, 2024).

In late 2019 and early 2020, water sampling was conducted within a neighbouring Title Area in the Otway offshore region <20 km from the CHN offshore facilities. Sampling locations included the Artisan field (inactive at the time of survey) and the Thylacine field (active at the time of survey). Samples were collected at water depths of 33 m and 52 m from fields in water depths of 66 m and 105 m and were analysed for the presence and/or concentration of TSS, chlorophyll a, metals, hydrocarbons and nutrients such as nitrates, ammonia and phosphorus (Ramboll, 2020a). It was found that no water samples exceeded the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) trigger values (Ramboll, 2020a) indicating an undisturbed mid-depth environment. Dissolved oxygen and pH were between their respective lower and upper limits for marine waters in all samples and the range of oxidation-reduction potential (ORP) measurements indicated a well oxygenated, ecologically healthy environment (Ramboll, 2020a). One nutrient Zinc (Zn) had concentrations that variously exceeded the 95 or 99% ANZECC protection level, but never exceeded the 90% protection level (Ramboll, 2020a). These findings are consistent with a slightly disturbed marine system, described in (ANZECC, 2000) as an ecosystem in which biodiversity may have been affected to a small degree by human activity.

It is considered that the findings of water quality sampling from this survey (Ramboll, 2020a) are comparable to the quality which would be expected to be found within the East Coast Project operational area and surrounds considering the proximity to sampling locations, similarity in water depths and the similarity of activities previously conducted within the fields.

### 6.4.7 Sediment Quality and Characteristics

Substrate across the broader Bass Strait (inclusive of the monitoring area) comprises a variety of sediment types (Figure 6-13), with the sediment particle size associated with the region's tidal currents and wave energy. Boreen et al. (1993) examined 259 sediment samples collected over the Otway Basin and the Sorell Basin of the west Tasmanian margin during two research cruises (January / February 1987 and March / April 1988). Based on assessment of the sampled sediments it was concluded the Otway continental margin is a swell-dominated, open, cool-water, carbonate platform. A conceptual model was developed that divided the Otway continental margin into five depth-related zones – shallow shelf, middle shelf, deep-shelf, shelf edge and upper slope (Figure 6-11).

Within Victorian State waters substrate was classified (see Figure 6-12) to identify habitat representation across Victorian marine parks. Seafloor mapping of the Shipwreck Coast biounit (as described in section 6.3) is at approximately 91% (Young et al., 2022). Utilising existing data sources the percentage of reef and sediment coverage across the coastline was identified. The percentage of reef cover for Shipwreck coast was found to be highest in water depths of 30 – 40 m and 40 – 50 m while the percentage of sediment cover was found to be the higher in water depths of 50 – 60 m (Young et al., 2022).

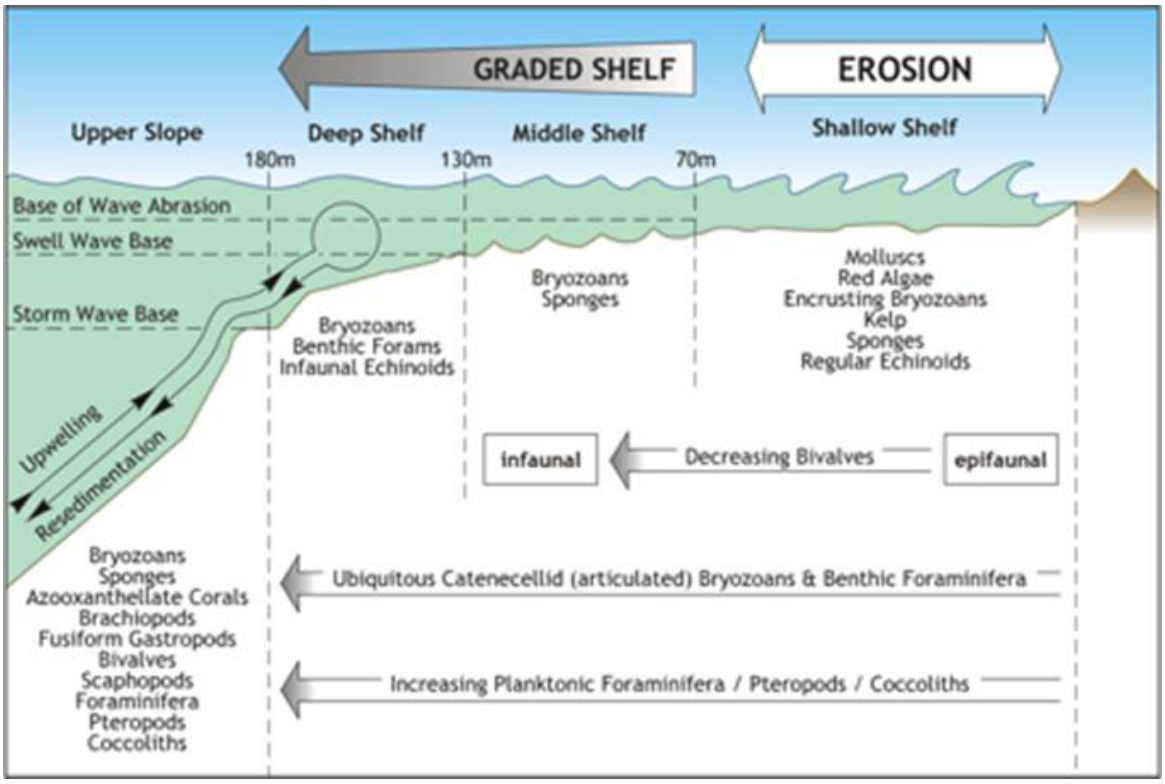



*Figure 6-11: Model of the geomorphology of the Otway Shelf*

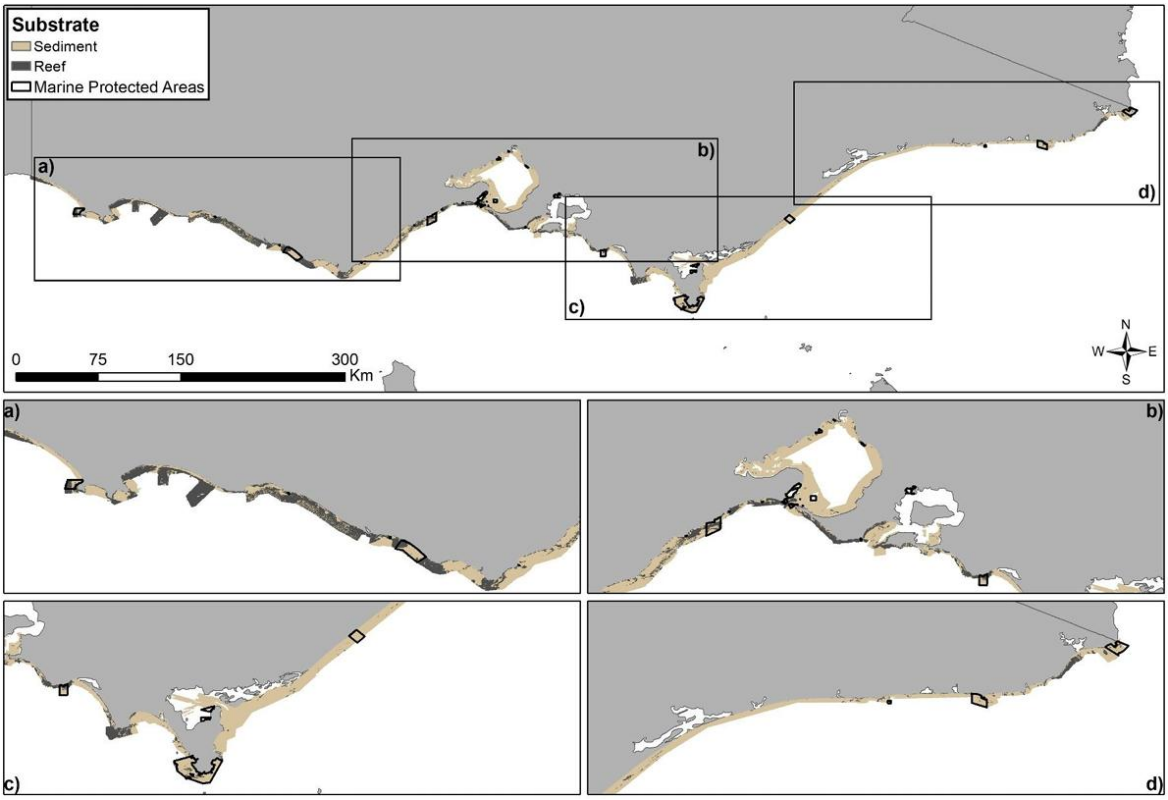



*Figure 6-12: Sediment and reef classification of the seafloor mapping data in the state waters of Victoria. Inset A includes the Shipwreck Coast biounit (Young et al., 2022)*

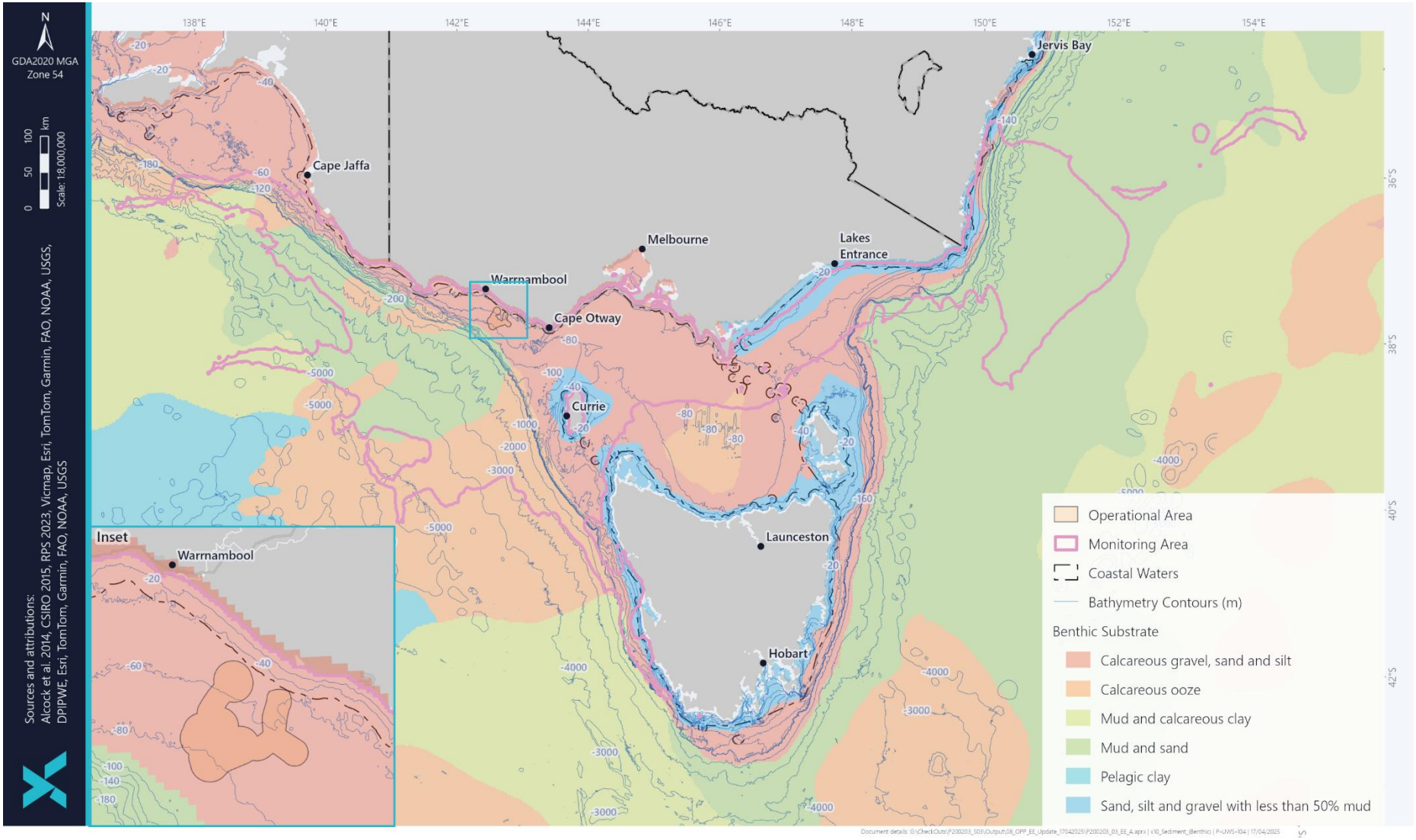



*Figure 6-13: Benthic substrate characterisation across south-east Australia*

In late 2019 and early 2020, sediment sampling was conducted within a neighbouring Title Area in the Otway offshore region <20 km from the CHN offshore facilities (see Figure 6-14). Sampling locations included the Artisan field (inactive at the time of survey) and the Thylacine field (active at the time of survey). Samples were collected at water depths of 72 – 75 m and 104 –105 m and were analysed for the presence and/or concentration of total organic carbon (TOC), metals (including cadmium, chromium, cooper, lead, mercury, nickel, tin and zinc), hydrocarbons and nutrients such as silicon, nitrate and phosphorus (Ramboll, 2020a). Particle size was also identified. The composition of sediment samples was predominately sand across both locations with very little silt and clay. Sediments samples were analysed and were found to have a high ORP and low or undetectable levels of toxicants (listed above) indicating an unmodified seabed environment (Ramboll, 2020a). It is considered that the findings of sediment quality sampling from this survey are comparable to the quality which would be expected to be found within the East Coast Project operational area and surrounds considering the proximity to sampling locations, similarity of water depths and the similarity of activities previously conducted within the fields.

Further, seabed characteristics of the East Coast Project operational area is predicted to be comparable to that of the existing CHN facilities. Particularly between water depths of 60 to 70 m where grab samples were taken as part of an environmental sampling survey conducted in association with the existing CHN infrastructure (Ramboll, 2020b; Appendix 2). A number of these grab samples happen to have been taken within and around the operational area of the East Coast Project (see Figure 6-14). A summary of the sediment composition at each grab sample, including visual representations of samples are detailed in Table 6-2. General observations of the survey included:

- large tracts of exposed caprock (hard calcarenite), some fine to coarse grained sand with variable density
- beyond 60 m water depth, the seabed comprises outcrops of hard substrate with very low relief and structural complexity separated by gullies of sand or fine gravel.
- low relief rock outcrop with no significant sediment cover in water depths varying from 65 to 70 m
- diversity of epifauna and infauna communities (see section 6.5.1).

No significant items of debris or major sediment obstruction were identified during historical video, acoustic (multibeam, sidescan) and seabed sampling surveys in the Title areas (Ramboll, 2020b; Appendix 2). Figure 6-2 provides an SSS image of the sediment characteristics at the historical Annie-1 well located within the vicinity of the East Coast Project.

The description of sediment type and quality from these surveys (Ramboll, 2020a; Ramboll, 2020b) are consistent with other reports for the wider Bass Strait region. It is expected that the sediment type and quality within the operational area and EMBA will be typical of the offshore marine environment in the wider Otway Basin area. Dominant substrate, sand and gravel, cover the shelf except for areas of silty sand in central Bass Strait with the sediment tending to become coarser with increasing distance from shore (Ramboll, 2020b; Barton et al., 2012; Murray-Wallace and Woodroffe, 2014; Jones and Davies, 1983).

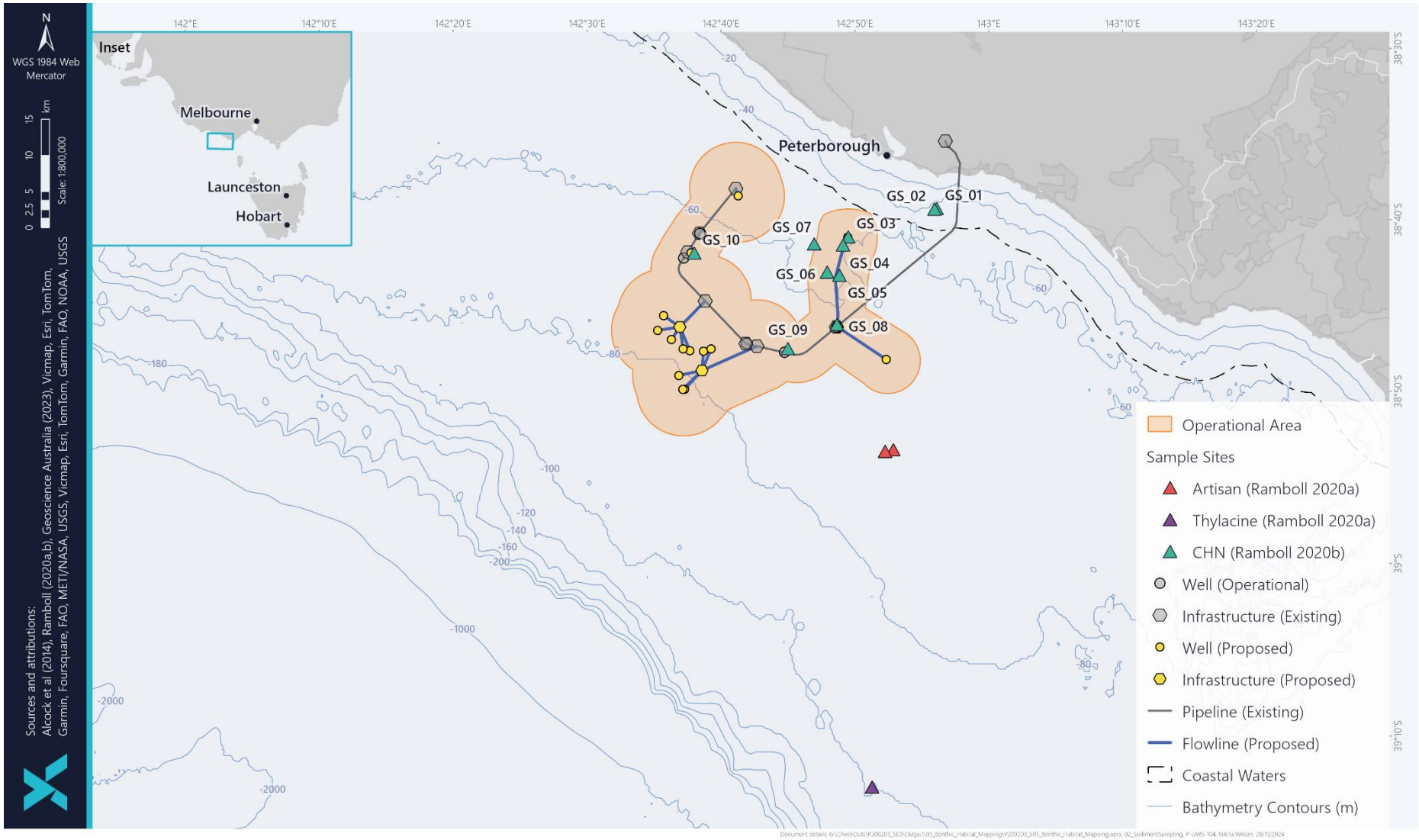
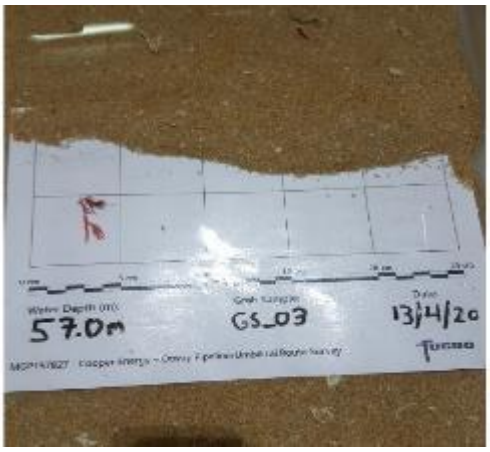
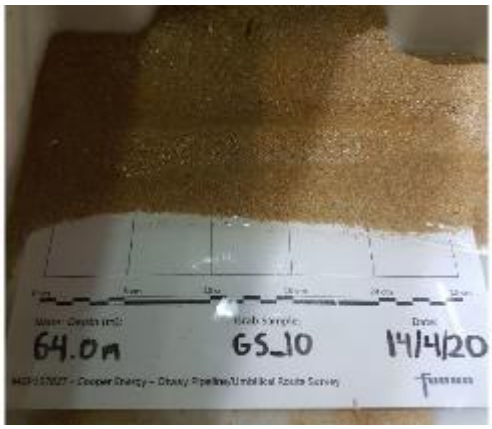



*Figure 6-14: Grab sample locations from the Ramboll 2020a and Ramboll 2020b environmental surveys relevant to the operational area*

*Table 6-2: Sediment types observed in grab samples within and/or adjacent to the operational area*

| Grab Sample Location | Sediment Description | Sediment Sample |
|---|---|---|
| **GS_01** | Fine-grained carbonate sand with silt. Sand is pale yellowish orange, well sorted, fine grained and composed primarily of mixed carbonates. |  |
| **GS_02** | Cobble-sized limestone fragments. |   |
| **GS_03** | Fine-medium carbonate sand. Sand is dark yellowish orange, well sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces. |   |

| Grab Sample Location | Sediment Description | Sediment Sample |
|---|---|---|
| **GS_04** | Coarse gravelly carbonate sand. Sand fraction varies from white to reddish olive-brown, poorly sorted, medium to coarse grained and composed primarily of mixed carbonates. Major fraction shell fragments. |  |
| **GS_05** | Fine-medium carbonate sand. Sand is light yellowish orange, moderately sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces. |  |
| **GS_06** | Carbonate sand and gravels. Sand is light yellowish orange, fine to coarse grained and composed primarily of mixed carbonates. Gravels are reddish brown and poorly sorted with sand and shell fragments. Minor fraction of shell pieces. |  |
| **GS_07** | Four attempts were made; however, no sample was recovered. Small limestone rock was caught in grab on first attempt, prohibiting the grab from closing and it was not retained. | N/A |

| Grab Sample Location | Sediment Description | Sediment Sample |
|---|---|---|
| **GS_08** | Carbonate sand and gravels. Sand is light yellowish orange, fine to medium grained and composed primarily of mixed carbonates. Moderately sorted with shell fragments. Fraction of shell pieces and lacy bryozoan fragments (*Phidoloporidae*). |  |
| **GS_09** | Carbonate gravels and sand. Gravels are light gray to grayish orange in color, very poorly sorted amongst fine to coarse grained sands composed primarily of mixed carbonates. Large fraction of shells, shell pieces and lacy bryozoan fragments (*Phidoloporidae*). |  |
| **GS_10** | Fine-medium carbonate sand. Sand is dark yellowish orange, well sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces. |  |

*Source: Ramboll, 2020b*

### 6.4.8 Ambient Light

Ambient light is classified as light currently present within an environment. Ambient light is predominantly from solar or lunar luminescence. Anthropogenic light sources associated with offshore activities exist in the Otway region, including both permanent (e.g., onshore/offshore developments and nearby townships) and temporary (e.g., vessels, road traffic) light sources. Moderate levels of commercial vessel traffic are expected within the Planning Area (Section 6.7.3.1) and light emissions from navigation and working lighting comply with Australian Maritime Safety Authority (AMSA) Marine Orders Part 30 (Prevention of Collisions).

Within the operational area, sources of artificial light are present from vessel activities for existing offshore activities (Section 6.7.3). These sources of artificial light are temporary and occur infrequently from offshore campaigns including intermittent vessel and MODU activity, and occasional flaring during historical development campaigns. Major population centres and popular tourist associated areas and their presence within the planning and operational area are detailed in Sections 6.7.1 and 6.7.4. Artificial light sensitive species such as shorebirds, seabirds, and turtles may be attracted to anthropogenic light sources which is discussed in Section 6.5.

### 6.4.9 Underwater Noise

Physical and biological processes contribute to natural background sound. Physical processes include that of wind and waves whilst biological noise sources include vocalisations of marine mammals and other marine species.

Iceberg calving, shoaling and disintegration has recently been identified as a dominant source of low frequency (<100 Hz) noise in the Southern Ocean. Wind is also a major contributor to noise between 30–100 Hz and can reach 85-95 dB re 1µPa$^2$/Hz under extreme conditions (WDCS, 2004). Rain may produce short periods of high underwater sound with a flat frequency spectrum to levels of 80 dB re 1µPa$^2$/Hz and magnitude four earthquakes have been reported to have spectral levels reaching 119 dB re 1µPa$^2$/Hz at frequency ranges 5-15 Hz. It is noted that earthquakes of this magnitude are relatively frequent along Australia's continental shelf in the southern margin (i.e. tens of small earthquakes per year) (McCauley and Duncan, 2001). Figure 6-15 provides generalised ambient noise spectra attributable to varies sources completed by Wenz (1962; cited in Richardson et al. 1995).

The South-east Marine Region is one of the busiest shipping regions in Australia and the Bass Strait is one of Australia's busiest shipping routes (see Section 6.7.3.1 for further detail on shipping activities within the monitoring area). Typical predominant frequencies of commercial shipping occur within the range of 10 Hz to 1 kHz with some frequencies reaching the tens of kHz (Southall et al., 2017). A study of multiple vessel classes commissioned by the Vancouver Fraser Port Authority (2018) measured and was able to attribute source levels to those different classes of vessels. The quietest vessel class were naval vessels, with a lowest radiated noise level of 160.9 dB re: 1 µPa$^2$m$^2$.s. The loudest class was container ships over 200 m in length. The highest mean (average) radiated noise level at 189.7 dB re: 1 µPa$^2$m$^2$.s and loudest recorded ship in class of 204.2 dB re: 1 µPa$^2$m$^2$.s The typical vessel types used for the East Coast Project are expected to have monopole source levels around 187.6 dB re: 1 µPa$^2$m$^2$.s (for an ISV) associated with vessel broadband acoustic energy (Jasco, 2022) which is comparable to other ships within the extensive merchant fleet[7].

Since 2009 (paused 2017-2018 due to funding gap), the Integrated Marine Observing System (IMOS) has been recording underwater sound south of Portland, Victoria (38° 32.5' S, 115° 0.1' E). Prominent sound sources identified in recordings include blue and fin whales at frequencies below 100 Hz, ship noise at 20 to 200 Hz and fish at 1 to 2 kHz (Erbe et al. 2016).

Within the operational area existing sources of anthropogenic noise will include passing ships commercial and recreational fishing boats, as well as vessels used intermittently for IMR during

[7] *Radiated noise levels for vessel can be slightly louder than monopole source levels due to less consideration of the environment in the calculation process. Although radiated noise level and source levels (i.e. monopole source levels) are not fully equivalent, for comparison purposes it is reasonable to do so.*

ongoing production operations. Vessel-based seismic survey, scientific surveys and geophysical surveys have also been undertaken in the region and temporarily contribute to background noise levels.

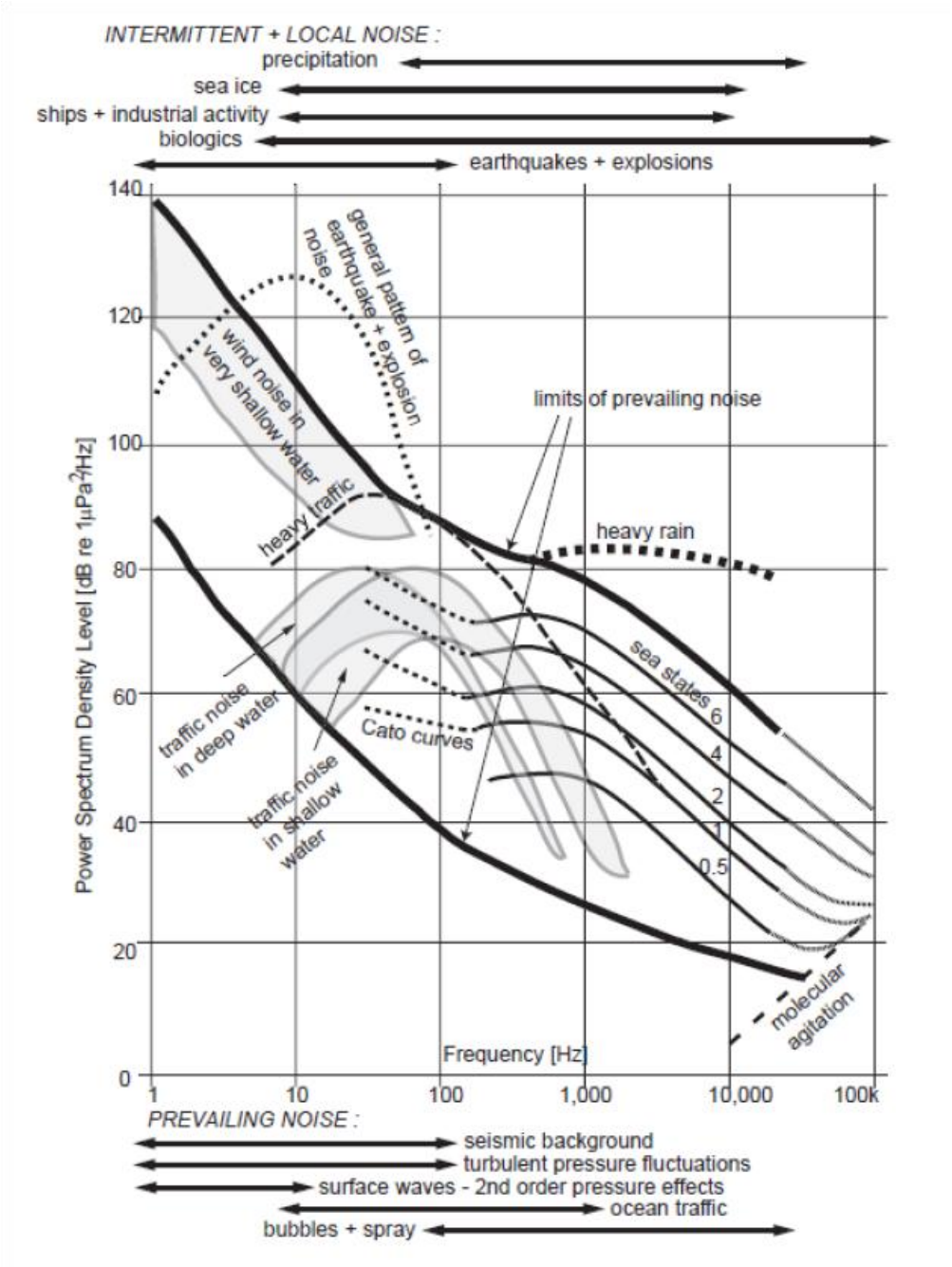



*Figure 6-15: Generalised ambient noise spectra*

## 6.5 Ecological Environment

### 6.5.1 Benthic Assemblages

Benthic assemblages are biological communities which inhabit the seabed; their composition is influenced by the physical properties of the seabed and overlying waters, as well as inputs such as sunlight and nutrients. Seabed substrates can range from unconsolidated sand to hard substrates such as limestone. Typically, within the euphotic zone, benthic communities are composed of a combination of light-dependent taxa and consumer taxa. Species such as algae, seagrass or mangroves which obtain their energy primarily from photosynthesis are consumed by species such

as molluscs, sponges and worms. Benthic assemblages are an important component of marine ecosystems and the ecological services they provide (Rife, 2018).

Between 1979 and 1984 a series of benthic surveys were conducted by the Victorian Museum on the continental shelf of the Bass Strait (Poore et al., 1985; Wilson and Poore, 1987). The surveys involved sediment sampling and recovery of marine benthic organisms across hundreds of sites from the western to eastern Bass Strait. Within those sites there were examples of diverse benthic communities comprising infauna and epifauna such as sponges, octocorals, ascidians and bryozoans. Sediment types ranged across the Bass Strait with generally more and finer sediment in the east and with depth, and generally higher proportion of bare calcarenite in the west.

Surveyed benthic environments of the existing CHN facilities are expected to be representative to those found within the East Coast Project operational area and surrounds considering the proximity to sampling locations, similarity of water depths and the similarity of activities previously conducted within the fields. These studies are described in more detail below.

ROV surveys conducted in 2004 to assist the development of the Casino project found that the following benthic environments occur between the shore and the existing CHN facilities (Santos, 2004):

- Intertidal environment (0 to 2 m):
  - rock platform
  - cliff face
  - sandy beach

  See Section 6.5.2 for detail.
- Shallow environments (2 to 8 m):
  - contiguous kelp reefs
  - patch sandy reefs
  - sand

  See Section 6.5.1.1 for detail.
- Mid-depth environment (8 to 20 m):
  - *Ecklonia*-dominated reef
  - sand

  See Section 6.5.1.2 for detail.
- Deep environment (20 to 70 m):
  - sponge-dominated reef
  - sand

  See Section 6.5.1.3 for detail.

Table 6-3 identifies and illustrates the types of benthos identified in the title areas. Figure 6-16 shows the locations of the seabed sampling sites relative to the existing CHN facilities in Cwth waters, and historical Annie-1 well location. The images depicted within Table 6-3 show colonisation of the existing facilities and natural burial of some sections of the main pipeline since the installation of the CHN facilities in the early-mid 2000's.

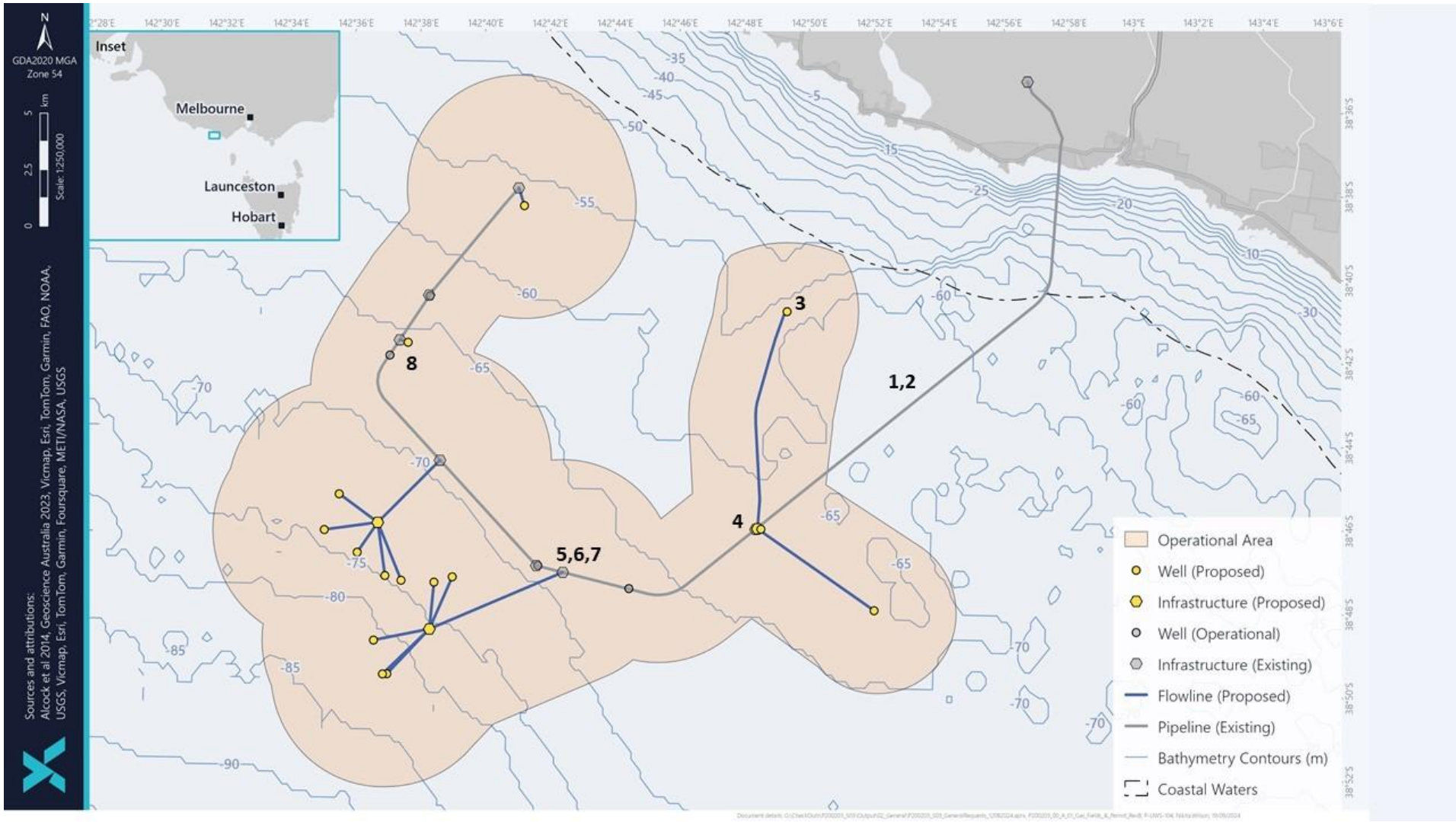



*Figure 6-16: Locations of seabed sample locations in the East Coast Project operational area*

*Table 6-3: Benthos observed in images of existing infrastructure within and/or adjacent to the operational area*

| Image Reference Number | Description | Image |
|---|---|---|
| **1** | Stage I: Pipeline under shifting sand. Vicinity of KP19, Cwth waters |  |
| **2** | Stage I: Pipeline overlaying shifting sand. Vicinity of KP19, Cwth waters |  |
| **3** | Seabed: Cwth waters<br>Vicinity of Annie |  |
| **4** | Seabed: Cwth waters<br>Vicinity Black Watch T |  |
| **5** | Stage I: 12-inch pipeline.<br>Vicinity of Casino-4 |  |
| **6** | Stage I: 12-inch pipeline.<br>Vicinity of Casino-4 |  |

| Image Reference Number | Description | Image |
|---|---|---|
| **7** | Stage II: umbilical repair (2019 install) Vicinity of Casino-4 |  |
| **8** | Stage II: 12-inch pipeline<br>Vicinity of Netherby |  |

*Image #3 collected by ROV during 2019 Annie-1 drilling campaign. All other images collected in 2020 during facility inspection.*

#### *6.5.1.1 Shallow Environment (2-8m)*

Surveys found that the areas extending from the shoreline are comprised of contiguous kelp reef consisting of large areas of hard substrate dominated by large brown algae (bubble weed, *Phyllospora comosa* and bull kelp, *Durvillaea potatorum*). In some areas, kelp reef rises close to the surface and waves may break on these features. Epifauna such as sponges, ascidians and molluscs, including abalone, are also associated with this habitat. Fishes such as wrasse, leatherjacket, scalyfin and morwong are also likely to inhabit contiguous kelp reef (Santos, 2004).

Small patches of non-contiguous reef dominated by large brown algae (bubble weed, *Phyllospora comosa* and bull kelp, *Durvillaea potatorum*) or a turf of red and brown algae interspersed with the green algae *Caulerpa* sp. and *Codium* sp. also occurs in the shallow environment. Tracts of open sand separate these small patch reefs and similar species of epifauna and fish to those occurring on contiguous reef are likely to occur here (Santos, 2004).

Shallow reefs give way to open sand further offshore. The sand areas in the shallow environment are characteristically devoid of significant epifauna but may contain significant infaunal communities including bivalves, crustaceans and polychaetes. The infauna provides food resources for some foraging fish such as bream and flounder and cephalopods such as octopus that may inhabit these areas. Shallow sand areas typically have coarse-grained sand forming sand waves caused by wave action. This environment is likely to be similar for sandy shores that are interspersed among the rocky shorelines of this part of the southwest Victorian coast (Santos, 2004).

The operational area of the East Coast Project does not overlap with the shallow environment as it is located wholly within commonwealth waters in depths ranging from ~55 – 85 m. Overlap does occur within the monitoring area.

#### *6.5.1.2 Mid-depth Environment (8-20m)*

The mid-depth environment is the most extensive and is relatively uniform throughout the region and is dominated by sand. Open sand in this environment comprises a range of grain sizes although sand is usually finer and sand waves of lower crest height and inter-crest distance than in the shallower environment. BHP–Santos (1999) identified intermittent patch reefs dominated by the brown alga, *Ecklonia* sp. Red algae and coralline algae were also identified on these reefs, in addition to epifauna including echinoderms, ascidians, bryozoans and sponges. These isolated reefs probably represent centres of high species diversity and abundance of epifauna, and fish compared to the open sand (Santos, 2004).

The operational area of the East Coast Project does not overlap with the mid-depth environment as it is located wholly within commonwealth waters in depths ranging from ~55 – 85 m. Overlap does occur within the monitoring area.

#### *6.5.1.3 Deep Environment (20-70m)*

As discussed in Section 6.4.6 the seabed in this deep environment is characterised by sand or gravelly / rubble and hard platform substrates (Ramboll, 2020b). In addition to sediment sampling the Ramboll (2020b) environmental survey also investigated the benthic and epibenthic ecology associated with existing CHN infrastructure (Ramboll, 2020b; Appendix 2). Grab samples were analysed for both sediment characteristics (Table 6-2) and benthic fauna (Table 6-4), a number of which were taken within and around the operational area of the East Coast Project (see Figure 6-14). A summary of the benthic fauna found at each grab sample site are detailed in Table 6-4. General observations of the survey were that there was very little conspicuous fauna found in the sediment grab samples, which is likely to reflect the relatively course nature of the sediment collected, characteristic of the wider region (Ramboll, 2020b).

*Table 6-4: Benthic fauna observed in grab samples within and/or adjacent to the operational area*

| Grab Sample Site Code | Benthic Fauna Description |
|---|---|
| **GS_01b** | Polychaete tubes visible. |
| **GS_02** | Limestone fragments covered with crustose coralline algae (Rhodophyta). Also, colonial tunicates (ascidians) visible (Botryllinae, possibly *Botryllus stewardensis*). Presence of calcified tube worm casings (Serpulidae, possibly *Galeolaria caespitosa*) and colonial hydroids (possibly *Leptothecata*). |
| **GS_03d** | Few pieces of red algae (Rhodophyta, possibly *Hemineura frondosa*). |
| **GS_04** | No fauna present. |
| **GS_05** | No fauna present. |
| **GS_06** | Single live Brittle star (Ophiuridae, Genus *Ophionereis*, possibly *Ophionereis schayeri*). |
| **GS_07** | Four attempts were made; however, no sample was recovered. |
| **GS_08** | No fauna present. |
| **GS_09a** | No fauna present. |
| **GS_10** | No fauna present. |

*Source: Ramboll, 2020b*

In addition to grab samples the epibenthic ecology of the surrounds was investigated from seabed video footage taken along 4 routes, covering approximately 1.8 to 2.8 km of seabed associated with the existing CHN infrastructure. A number of these video transect routes were taken within and around the operational area of the East Coast Project (see Figure 6-17). A summary of the benthic features observed along each video transect route is detailed in Table 6-5 with visual representations of drop camera footage represented in Figure 6-18 to Figure 6-24. General observations of the video transects included:

- Scattered areas of hard ground supporting patchy areas of abundant epibiota, typically bryozoans, gorgonian, cnidarians and sponges.
- Various epibenthic organisms such as crustaceans and molluscs are likely to be associated with this habitat.
- No species or ecological communities listed as threatened under the EPBC Act were observed and no areas of high relief, reefs, sponge beds or shipwrecks were noted
- While sponges were present, they were not so highly abundant or morphologically diverse as a taxonomic group to be considered as a sponge bed, rather sponges were interspersed throughout the patchy epifaunal covering.

- The patchy epifauna and the presence of hard platform is consistent with the description of a key ecological feature (KEF) of the South-East bioregion, that is, shelf rocky reefs and hard substrates. However, epifauna was also noted to occur in sand, gravel and rubble substrates (Ramboll, 2020b).

It is important to note that although the sediment sample results were notably different to the observations of abundant epibiota during the video transects, the difference is likely due to the sampling method of the grabber that is unable to penetrate hard substrate which is the preferred habitat of the epifauna located within survey location (Ramboll, 2020b).

Overall findings based on the assessment of epifauna using seabed video transects and photographs, found the seafloor to be an unmodified marine environment that supports a patchy complex of prostrate and branching or erect epibiota (i.e., bryozoans, gorgonian cnidarians and sponges) (Ramboll, 2020b). These findings are consistent with the environmental survey report conducted within a neighbouring Title Area in the Otway offshore region <20 km from the CHN offshore facilities (Ramboll, 2020a) which also found the seafloor to be an unmodified marine environment that supports a patchy complex of branching epibiota based on grab samples for benthic fauna and drop camera images. For example, drop camera images at Hercules (H), located in a similar water depth to the proposed Elanora, Isabella and Heera prospects, showed epibiota coverage of ~24% (Ramboll 2020a). Locations of these sample sites have been provided in Figure 6-14 and Figure 6-17 for context.

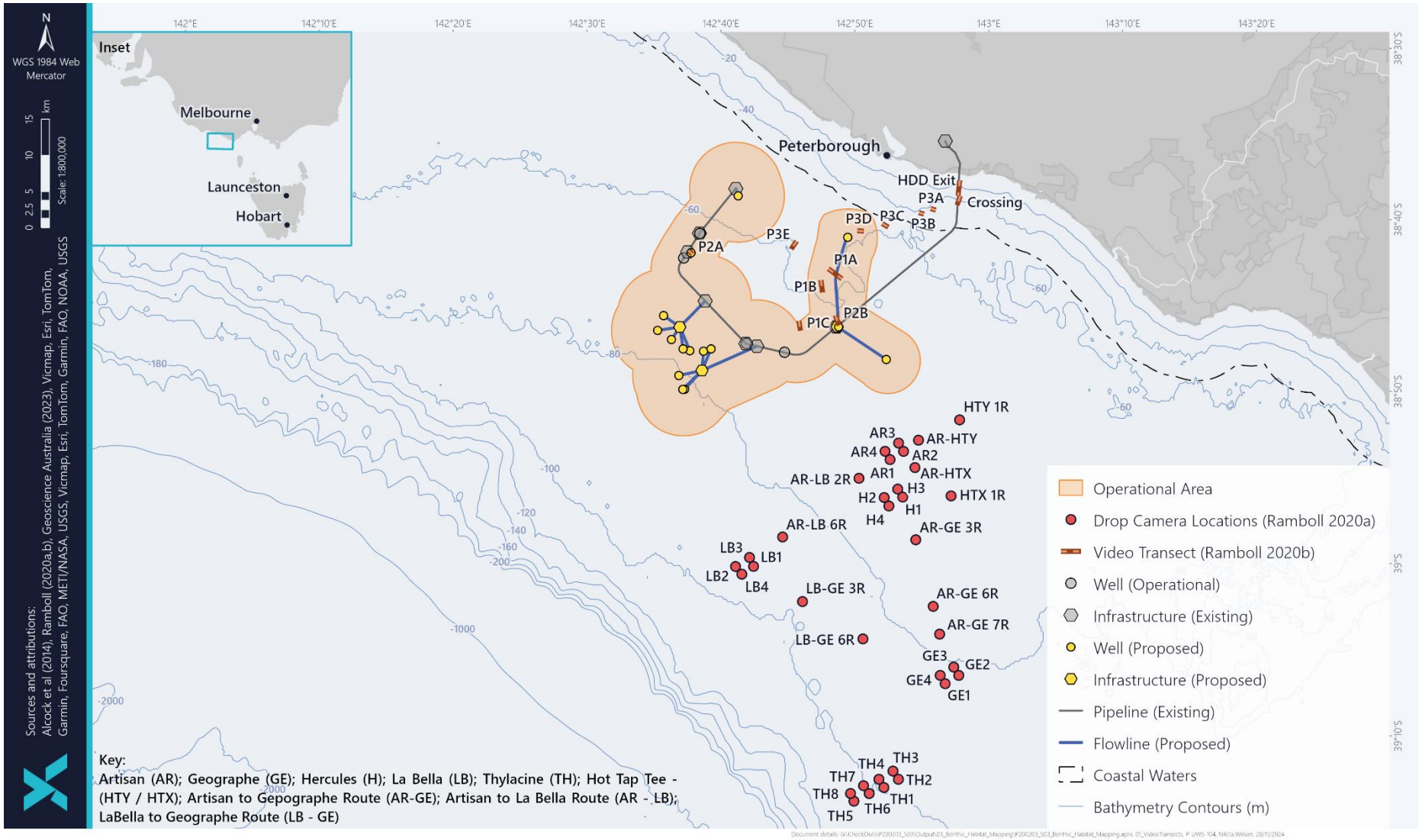



*Figure 6-17: Video transect (Ramboll, 2020b) and drop camera (Ramboll, 2020a) locations from environmental surveys relevant to the operational area*

*Table 6-5: Benthic features observed in video transects within and/or adjacent to the operational area*

| Video Transect Location | Description | Figure reference |
|---|---|---|
| **P2A –** Located near existing Henry well within the operational area | Starting at the beginning of Route 1 in the vicinity of the "Henry" well sites, the epifauna was generally prostrate epifauna with some occasional patches of erect epifauna throughout the entire transect P2A. The abundance of epifauna ranged from occasional to frequent coverage with three instances of highly abundant fauna. Two crinoids (feather stars) and one teleost fish were noted. | Figure 6-18 |
| **P2B –** Located near existing black watch ILT within the operational area | The epifauna type, abundance and patchiness of transect P2B, between the 'Henry' well sites and "Annie 2", was largely similar to that described for transect P2A, with the exception that no hard platform was present. Observations included several snapper, file fish, other teleost fish and starfish. Man-made pipes were observed on the seabed surface, covered in epifauna. | Figure 6-19 |
| **P3C and P3D –** Located near Annie prospect within operational area (P3D only) | The epifauna in closest proximity to "Annie 2", at transect P3D, was less abundant covering <25% of the seabed and was only present as prostrate epifauna. Occasional teleost fish were observed. The epifauna at transect P3C, between "Annie 2" and "HDD/Iona", was very similar. | No drop camera footage presented in Ramboll report for transect (2020b) |
| **P3A and P3B –** Located in state waters outside of the operational area | A greater abundance of erect epifauna was noted along transects P3B and P3A, between "Annie 2" and "HDD/Iona", but generally epifauna remained patchy as for other transects. Rubble substrate was often associated with erect epifauna, which would be providing attachment opportunities for such fauna. | No drop camera footage presented in Ramboll report for transect (2020b) |
| **P3E –** Located between Annie and Henry outside of the operational area | Between "Annie 2" and "Henry" well sites the epifauna was generally prostrate epifauna with some occasional patches of erect epifauna. But generally, epifauna remained patchy aligning with the other transects. Occasional teleost fish were observed in hard platform areas and gravelly (shelly) sand.<br>The sediment composed mostly of gravelly (shelly) sand, with occasional patches of sand with rubble and areas of hard platform/sand and hard platform with gravel. | Figure 6-20 |
| **P1A, P1B and P1C –** Located between Annie and Casino fields within the operational area | Between "Casino" and "Annie 2" well sites, in transects P1A, P1B (Figure 10) and P1C, the epifauna was present for most of each transect with only small patches (1-2 m length) where epifauna was absent. Epifauna was various prostrate and erect with no specific pattern or relationship to the sediment. The sediment was more varied along these transects than those described above, including hard platform (usually with a covering of sand), rubble, and gravel or shell gravel. | Figure 6-21<br>Figure 6-22<br>Figure 6-23 |
| **P1B –** Located between Annie and Casino fields within the operational area | Epifauna in the vicinity of the "Black Watch" tee site, in transect P1B, was highly to frequently abundant and was both prostrate and erect, over a sediment bed consisting largely of sand with some hard platform. | Figure 6-22 |
| **"Crossing" and "HDD Exit" –** Located in near shore state waters (outside the operational area) where the existing CHN pipeline enters the seabed before crossing beneath the shoreline. | At the end of this route, near "HDD/Iona", within transects labelled as "Crossing" and "HDD Exit", there was a notable lack of epifauna compared to other transects described along this route. No epifauna was observed along the "Crossing" transect or and very occasional patches of prostrate epifauna was noted along the "HDD Exit" transect. Sand was the predominant substrate type in these transects. | Figure 6-24 |

*Source: Ramboll, 2020b*

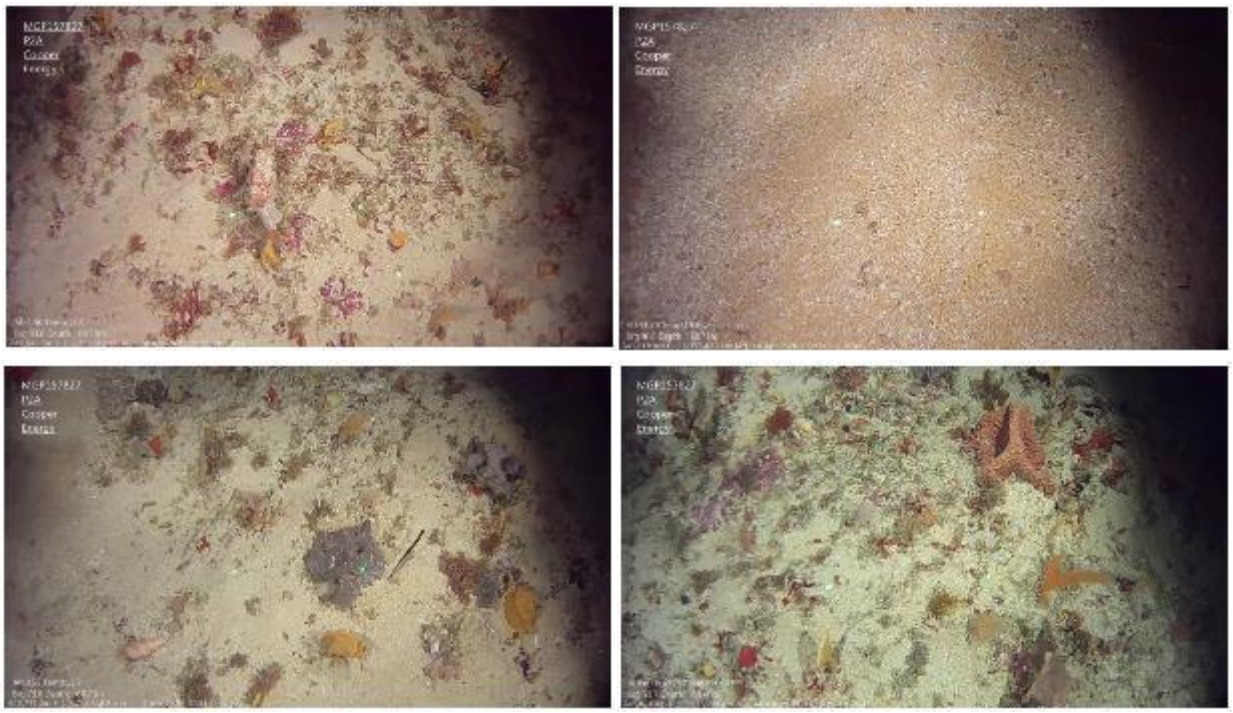


*Figure 6-18: Representative photographs from the video transect at the P2A location*



*Figure 6-19: Representative photographs from the video transect at the P2B location*

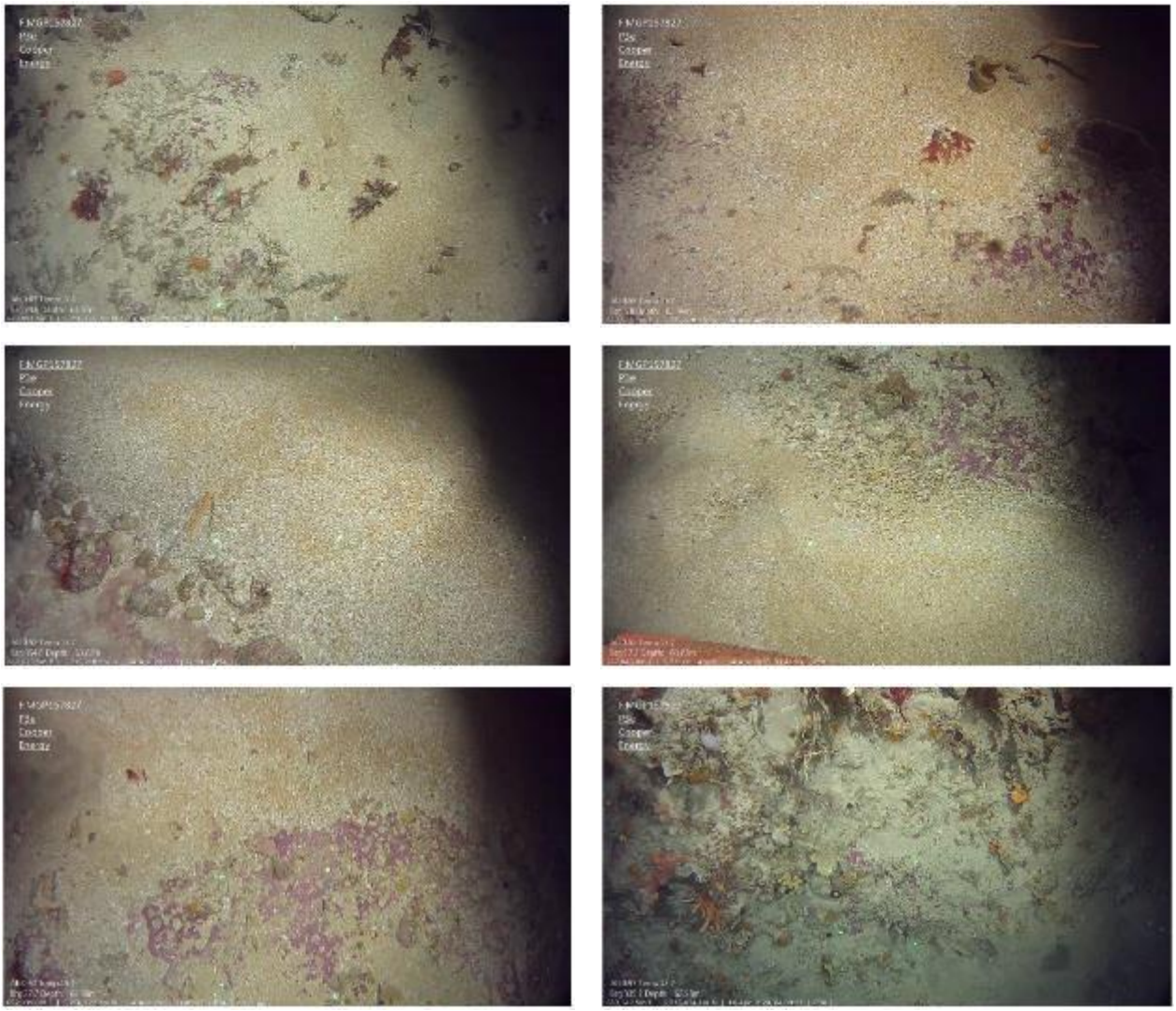


*Figure 6-20: Representative photographs from the video transect at the P3E location*




*Figure 6-21: Representative photographs from the video transcent at the P1A location*






*Figure 6-22: Representative photographs from the video transect at the P1B location*






*Figure 6-23: Representative photographs from the video transect at the P1C location*




*Figure 6-24: Representative photographs from the video transect at the Crossing and HDD Exit location*

### 6.5.2 Coastal Habitats

#### *6.5.2.1 Shorelines*

The coastal environment throughout south-eastern Australia is varied, and includes areas of rocky cliffs, sandy beaches, and tidal flats. Each of these shoreline types has the potential to support different flora and fauna assemblage due to the different physical factors (e.g. waves, tides, light etc.) influencing the habitat.

There is no potential for shoreline habitats to occur within the operational area as it is located offshore in commonwealth waters, however they will occur within the monitoring area (Figure 6-25).

**Rocky Shoreline**

Rocky shores, include bedrock outcrops, platforms, low cliffs (<5 m) 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. Australian fur-seals are also known to use rocky shores for haul-out and/breeding.

This is common shoreline along southern and eastern Australian coasts, including the limestone coast and features along the Great Ocean Road, Victoria.

**Sandy Beaches**

Beaches are dynamic environments, naturally fluctuating in profile and particle distribution in response to external forcing factors (e.g., waves, currents etc). Sandy beaches are characterised by sand-sized (0.063–2 mm) particles and can also include mixed sandy beaches (i.e. sediments may include muds or gravel, but sand is the dominant particle size). The variation of sand particles in size, structure and mineral content; this in turn affects the shape, colour and inhabitants, of the beach. Sandy beaches can support a variety of infauna and provide nesting and/or foraging habitat to shorebirds and seabirds and pinnipeds.

This shoreline type is very common along the Victorian coast, including Ninety Mile Beach (East Gippsland, Victoria), Apollo Bay (east of Cape Otway, Victoria), and the stretch of coast between Portland and Port Fairy. The Convincing Ground cultural heritage site is located along the stretch of sandy beaches between Portland and Port Fairy, which is described further in Section 6.8.3.7.2.

#### *6.5.2.2 Mangroves*

Mangroves have been recorded in all Australian coastal states except Tasmania. Mangroves grow in intertidal mud and sand, with specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie et al., 2006). Mangrove forests can help stabilise coastal sediments, provide a nursery ground for many species of fish and crustacean, and provide shelter or nesting areas for seabirds (McClatchie et al., 2006). The ‘Mangrove Dominated’ habitat class includes areas with greater than 10% coverage of mangroves (Mount and Bricher, 2008; OzCoasts, 2015b).

The mangroves in Victoria are found mostly along sheltered sections of the coast within inlets or bays, are the most southerly extent of mangroves found in the world (MESA, 2015). One species of mangrove, the white or grey mangrove (*Avicennia marina*) is the only species found in Victoria and is known to occur at Western Port and Corner Inlet, and also at larger estuaries like the Yarran and Barwon Rivers.

There is no potential for mangrove communities to occur within the operational area as it is located offshore in commonwealth waters, however they are known to occur within the monitoring area (Figure 6-25).

#### *6.5.2.3 Saltmarsh*

Saltmarshes are terrestrial halophytic (salt-adapted) ecosystems that mostly occur in the upper-intertidal zone and are widespread along the coast. The ‘Saltmarsh Dominated’ habitat class includes areas with greater than 10% coverage of saltmarshes (Mount and Bricher, 2008; OzCoasts 2015b).

Typically, these communities are dominated by dense stands of halophytic plants such as herbs, grasses and low shrubs. The vegetation in these environments is essential to the stability of the saltmarsh, as they trap and bind sediments. The sediments are generally sandy silts and clays and can often have high organic material content. Saltmarshes provide a habitat for a wide range of both marine and terrestrial fauna, including infauna and epifaunal invertebrates, fish and birds.

Saltmarsh is found along many parts of the Victorian coast, although is most extensive in western Port Phillip Bay, northern Western Port and within the Corner Inlet-Nooramunga complex. Saltmarsh environments are much more common in northern Australia (e.g. Queensland), compared to the temperate and southern coasts (i.e. New South Wales, Victoria, Tasmania) (Boon et al., 2011).

There is no potential for saltmarsh communities to occur within the operational area as it is located offshore in commonwealth waters, however they are known to occur within the monitoring area (Figure 6-25).

#### *6.5.2.4 Macroalgae*

Macroalgae communities are generally found on intertidal and shallow subtidal rocky substrates and can occur throughout the Australian coast. Macroalgal systems are an important source of food and shelter for many ocean species; including in their unattached drift or wrack forms (McClatchie et al., 2006). Macroalgae are divided into three groups: *Phaeophyceae* (brown algae), *Rhodophyta* (red algae), and *Chlorophyta* (green algae). Brown algae are typically the most visually dominant and form canopy layers (McClatchie et al., 2006). The principal physical factors affecting the presence and growth of macroalgae include temperature, nutrients, water motion, light, salinity, substratum, sedimentation and pollution (Sanderson, 1997). Macroalgae assemblages vary, but *Ecklonia radiata* and *Sargassum* sp. can be found in waters up to 45m depth (Pocklington, 2011). Known areas of macroalgae communities within Victoria include Port Philip Bay (Victoria) and various localities in the Otway region including Port Campbell, Warrnambool and Port Fairy (ALA, 2024).

There are no known macroalgae communities within the East Coast Project operational area and it is unlikely any occur given the reported depth range of macroalgae along the Victorian coastline of <45m (Pocklington, 2011). Macroalgae communities do occur within the monitoring area (Figure 6-25).

#### *6.5.2.5 Seagrass*

Seagrasses are marine flowering plants which generally grow in soft sediments within intertidal and shallow subtidal waters where there is sufficient light and are common in sheltered coastal areas such as bays, lees of islands and fringing coastal reefs (McClatchie et al., 2006; McLeay et al., 2003). Seagrass meadows are important in stabilising seabed sediments, and providing nursery grounds for fish and crustaceans, and a protective habitat for the juvenile fish and invertebrates species (Huisman, 2000; Kirkman, 1997). There is a distinction between tropical and temperate seagrasses with about 30 species total found in Australian waters (Huisman, 2000). While seagrass meadows are present throughout southern and eastern Australia particularly in Corner Inlet, Port Phillip Bay and Western Port Bay (Victoria), the proportion of seagrass habitat within the south-eastern sector is not high compared to the rest of Australia (Kirkham, 1997). The ‘Seagrass Dominated’ habitat class includes areas with greater than 5% coverage of seagrass (Mount and Bricher, 2008; OzCoasts 2015b).

There are no known seagrass communities within the East Coast Project operational area, and it is unlikely any occur given the reported depth range of seagrass along the Victorian coastline of <30m (Pocklington, 2011). Seagrasses do to occur within the monitoring area (Figure 6-25).

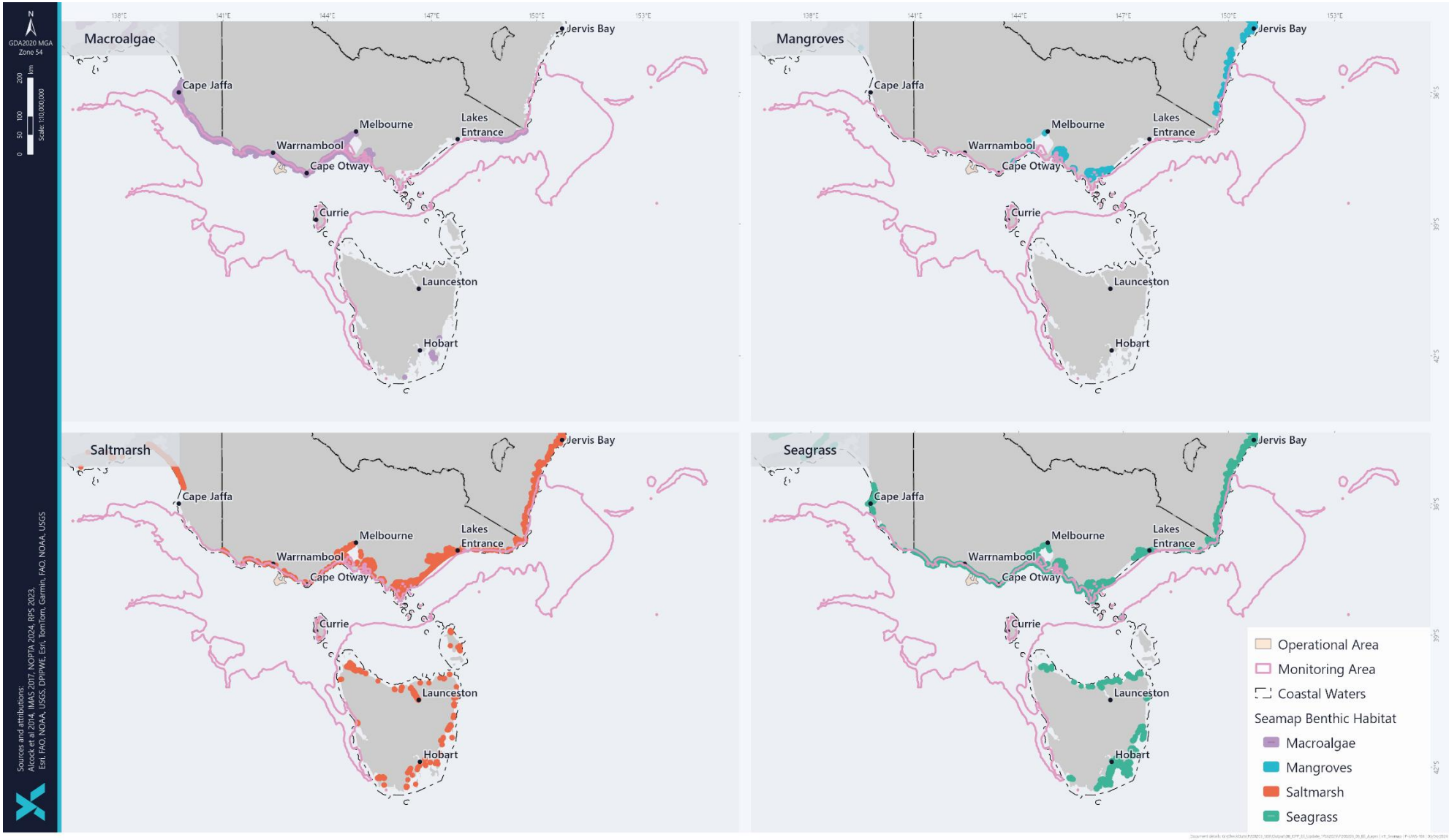



*Figure 6-25: Shoreline habitats within the monitoring area of the East Coast Project*

### 6.5.3 Plankton

Plankton species, phytoplankton and zooplankton, are a key components of oceanic food chains.

Phytoplankton are autotrophic planktonic organisms living within the photic zone; and are the start of the food chain in the ocean (McClatchie et al., 2006). Phytoplankton communities are largely comprised of protists, including green algae, diatoms, and dinoflagellates (McClatchie et al., 2006). Diatoms and dinoflagellates are the most abundant of the micro and nanoplankton size classes and are generally responsible for the majority of oceanic primary production (McClatchie et al., 2006). Phytoplankton are dependent on oceanographic processes (e.g. currents and vertical mixing), that supply nutrients needed for photosynthesis. Thus, phytoplankton biomass is typically variable (spatially and temporally), but greatest in areas of upwelling (e.g. Bonney Coast Upwelling), or in shallow waters where nutrient levels are high. Gill et al., (2011) describes the Bonney Coast Upwelling as generally starting in the eastern part of the Great Australian Bight and spreading eastwards to the Otway Basin. At the height of the upwelling during February and March, its area of influence often exceeds 12,000 km$^2$, while its sea surface temperature often exceeds 1°C, and the chlorophyll-a concentrations are often >1.5x adjacent areas (Huang and Wang, 2019).

Zooplankton are the faunal component of plankton, comprised of small protozoa, crustaceans (e.g. krill) and the eggs and larvae from larger animals. Zooplankton include species that drift with the currents and also those that are motile. More than 170 species of zooplankton have been recorded in eastern and central Bass Strait, but it has been found that seven dominant species make up 80% of individuals (Esso, 2009).

Data collected by the Integrated Marine Observing System (IMOS; Davies et al. 2022) includes biomass and diversity of phytoplankton in the different oceanic regions that surround Australia. This data indicates highest seasonal abundance of phytoplankton within the cooler waters of the Southern Ocean, followed by south-east and eastern zones whereas diversity of phytoplankton is greatest in the warmer Coral Sea. In addition, data indicated that the highest abundance of copepods is found in the Southern Ocean and south-east regions, with diversity highest in the Temperate east and Coral Sea, depending on time of year. The make-up of plankton, their distribution and abundance are also highly variable within the region. Figure 6-26 shows a snapshot of chlorophyll-a (indicator of phytoplankton abundance) off the southern coast of Australia on 15 January 2019. Increased productivity can be seen in the south-east in the major embayment's and also the Bonney coast upwelling KEF (a feature derived through review of enhanced chlorophyll occurrence in summer (DCCEEW, 2023l) to the west of the East Coast Project. By 31 January levels of chlorophyl A around the Bonney Coast upwelling KEF had returned to lower levels (Figure 6-27).

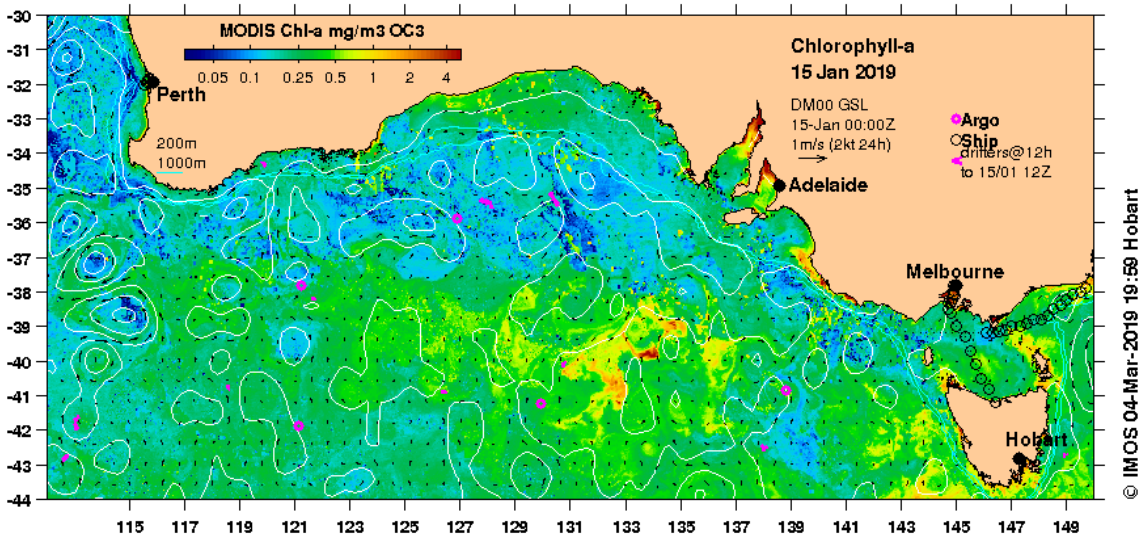



*Figure 6-26: Southern Australia chlorophyll-a snapshot 19 January 2024 (IMOS, 2024)*

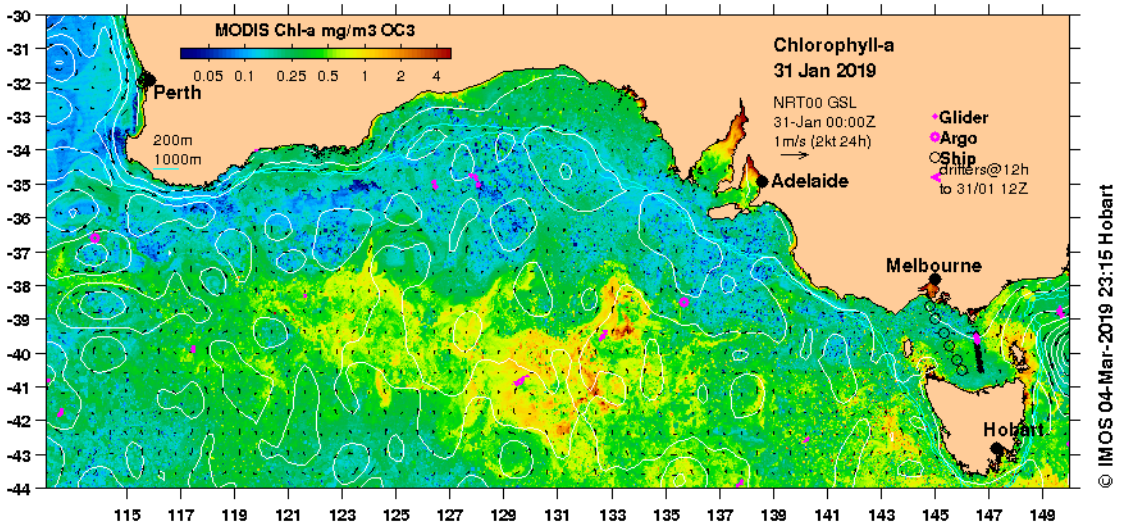



*Figure 6-27: Southern Australia chlorophyll-a snapshot 31 January 2024 (IMOS, 2024)*

Within the operational area and monitoring area plankton populations are expected to be highly variable both spatially and temporally and to comprise the plankton make-up characteristic of the south-east region described.

### 6.5.4 Invertebrates

Marine invertebrates are comprised of many groups of different organisms and occur from the sea surface to the seafloor and into the substrate. Their size ranges from tiny, microscopic organisms to several metres in length. Additionally, some marine invertebrates are commercially important, e.g., oysters, prawns, and scallops, whilst others, such as corals, can be a major attraction for tourists.

Within the south-east marine region, shelf rocky reef is identified as a key ecological feature (see Section 6.6.6 for further detail) which provides habitat and shelter for fish and are important for aggregations of biodiversity and enhanced productivity by increasing the structural diversity of shelf ecosystems (DCCEEW, 2023l; Young et al., 2022).

Marine invertebrates typical of the region include:

- Porifera (e.g., sponges)
- Cnidarians (e.g., jellyfish, corals, anemones, sea pens)
- Bryozoans (microscopic filter feeders)
- Arthropods (e.g., sea spiders)
- Crustaceans (e.g., rock lobster, krill)
- Molluscs (e.g., bivalves, sea slugs, gastropods, abalone)
- Echinoderms (e.g., urchins, sea cucumbers) and
- Annelids (e.g., polychaete worms).

Studies by the Museum of Victoria (Wilson and Poore, 1987; Poore et al., 1985) found that invertebrate diversity was high in southern Australian waters although the distribution of species was patchy, with little evidence of any distinct biogeographic regions. Shallower inshore sediment sampling by Parry et al. (1990) also showed high diversity and patchy distribution. However, in these areas, crustaceans, polychaetes and molluscs were dominant.

A past survey of the CHN development, parts of which are overlapped by the East Coast Project operational area, found seabed communities consistent with this description with observations at 60 to 70 m depths showing a patchy presence of epifauna such as bryozoans, gorgonian cnidarians and sponges with observed colonisation of existing infrastructure (Ramboll, 2020). See Section 6.5.1 for a further detail on the findings of this survey.

In 2022, Parks Victoria published results of predictive modelling of fish species richness offshore Victorian coastline; the modelling inputs included physical and biological attributes of the coastline, with reef and associated invertebrate communities strongly linked to high fish species richness (Young et al., 2022). Within the Otway region adjacent the operational area species richness was assessed and Low-moderate (Figure 6-28).

Marine invertebrates expected to be located within the vicinity of the East Coast Project are detailed below.

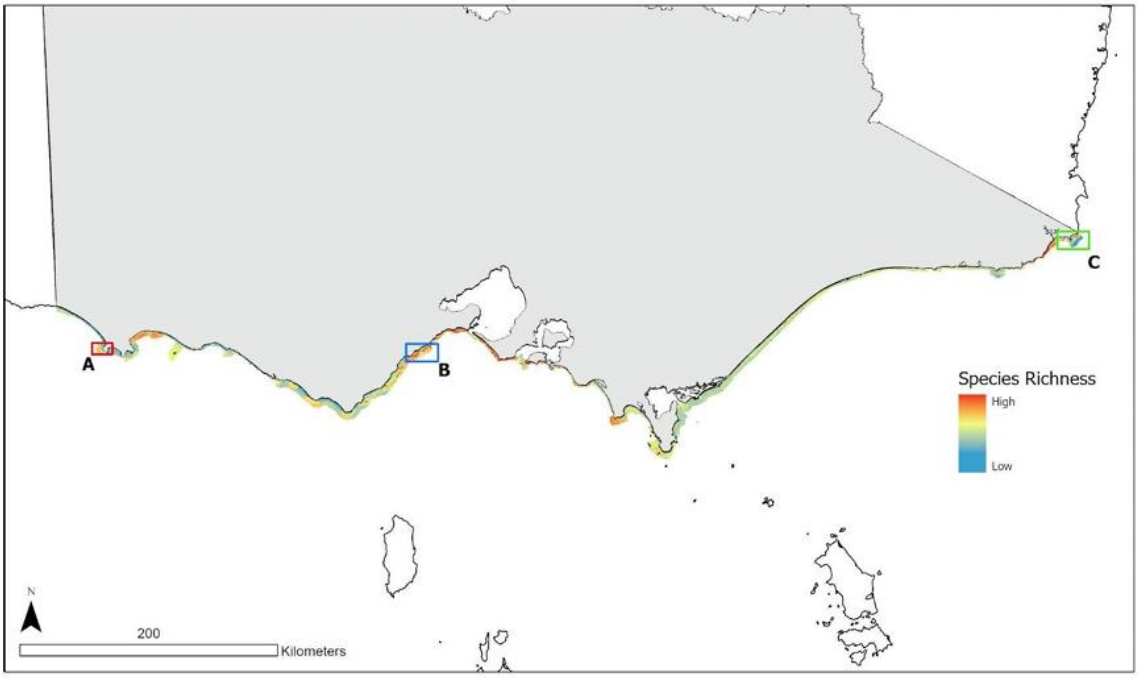



*Figure 6-28: Predicted statewide species (fish) richness in Victoria, Australia (Young et al., 2022).*

### *6.5.4.1 Porifera*

Porifera, or sponges, are sessile, multicellular organisms that have bodies full of pores and channels allowing water to circulate through the organism and provide food and oxygen and removes wastes. The flow is actively generated by the beating of flagella and filter bacteria and phytoplankton from the water which passes through them (Bond and Harris, 1988). Porifera flourish in waters where water movement is strong (Butler et al., 2002). Sponges do not have nervous, digestive or circulatory systems and reproduce by asexual and sexual means. Increasing temperature is generally accepted as a major environmental factor regulating the onset of reproduction activity particularly in regions of large seasonal change (spring / summer) (Fromont, 1993). Sponges are efficient colonisers of marine hard surfaces although they will not typically colonise a newly cleared surface as rapidly as some other groups (e.g. bryozoans). Once established sponges are effective competitors in retaining living space through asexual reproduction and by using chemicals to deter competitors and predators (Butler et al., 2002).

As discussed in Section 6.5.1.3 video transects and sediment samples within and adjacent to the operational area saw scattered areas of hard ground supporting patchy areas of abundant epibiota such as sponges (Ramboll, 2020b). While sponges were present, they were not highly abundant or morphological diverse as a taxonomic group to be considered as a sponge bed, rather sponges were interspersed throughout the patchy epifaunal covering which included other invertebrate species such as bryozoans and hydroids (Ramboll, 2020b). Therefore, it is known that porifera will be present within the operational area of the East Coast Project.

### *6.5.4.2 Hydrozoans*

Species are found in almost every marine habitat type except heavy surf zones. They are most abundant and diverse in warm shallow waters likely reflecting food abundance.

Most species have a planktonic larval stage which is pelagic before settling onto benthic substrates and developing a polyp, A founding polyp produced new polyps by budding. In many colonies, polyps are polymorphic with different structures reflecting different functions. Polyps produce “adult” sexually-reproducing medusae which are free-swimming and release sperm and eggs in the water (broadcast spawners) where fertilisation occurs. Colonies are usually sessile benthic, but some notably the siphonophores are pelagic floaters.

Most hydrozoans are predators or filter-feeders. Filter feeders trap small zooplankton; pelagic hydrozoans show selectivity in prey types taking mainly fish larvae, soft bodied invertebrates or micro-crustaceans. Predators can include snails, worms, fish and crustaceans (University of Michigan, 2017).

As discussed in Section 6.5.1.3 video transects and sediment samples within and adjacent to the operational area saw scattered areas of hard ground supporting patchy areas of abundant epibiota such as colonial hydroids (Ramboll, 2020b). Therefore, it is known that hydrozoans will be present within the operational area of the East Coast Project.

#### *6.5.4.3 Bryozoans*

Bryozoans are sessile, aquatic invertebrate filter feeding animals which attach to hard substrates and form lace-like colonies. They have no respiratory organs, heart, or blood vessels. Instead, they absorb oxygen and eliminate carbon dioxide through the body wall. Colonies of bryozoans are started by a single individual that, after its larval existence, settles onto a substrate and begins to reproduce asexually (by budding) after settlement. Bryozoans are hermaphrodites and fertilisation can be external in the water column or internal with embryos brooded in the body (as do ascidians) fertilised with sperm brought in on the feeding current. The larvae which are hatched are then released and swim but do not feed; they swim towards the light then after a few hours swim down to the sea floor to colonise. For species which do not brood but release eggs, fertilised eggs become part of the plankton stream for ~2 months until they are large enough to descend and start a new colony (Earthlife, 2014). Temperature controls all aspects of bryozoan life. In spring, rising water temperatures and increased intensity of light stimulate phytoplankton growth which initiates active budding in bryozoans and to some degree sexual reproduction (Smithsonian Institute, 2014). Most bryozoans use chemicals as well as spines as a predator deterrent and thus have only relatively few specialised predators (Butler et al., 2002).

As discussed in Section 6.5.1.3 video transects and sediment samples within and adjacent to the operational area saw scattered areas of hard ground supporting patchy areas of abundant epibiota such as bryozoans which were a common species observed (Ramboll, 2020b). Therefore, it is known that bryozoans will be present within the operational area of the East Coast Project.

#### *6.5.4.4 Molluscs*

**Gastropods (Abalone)**

Univalve gastropods can live up to 20 years growing to a shell length of over 200 mm. Abalone feed on algae and are prey for crabs, rock lobster, octopi, fish and rays. Blacklip abalone is the predominant species fished along the Victorian coastline area although greenlip abalone is also present. Blacklip abalone is found in shallow depths between 5-20 m and can be found in caves, on crevices and on sheltered reefs. Greenlip abalone is found in shallow reef habitats (5-40 m) and rough water at the base of steep granite cliffs. Abalone is a broadcast spawner; the species spawns from spring to autumn (Kailola et al., 1993).

Both blacklip and green abalone are target species of state fisheries including the Victorian Abalone Fishery. Habitat suitability for the blacklip abalone was mapped along the western Victorian coastline in an attempt to capture an effective footprint of the Victorian Abalone Fishery (Ierodiaconou et al., 2014). Results indicated that highly suitable regions were characterised by highly rugose seafloor structure (i.e. high-profile reefs), with the most suitable areas occurring at depths of around 10 m, and a gradual decline in suitability to depths of 20 m (Ierodiaconou et al., 2014). Colonisation success was identified to likely be driven by ecological factors such as resources and competition and physical factors such as exposure to wave energy and benthic currents (Ierodiaconou et al., 2014).

Considering the species preferred habitat occurs in water depths <20 m, it is unlikely that the species will be present in within the vicinity of the East Coast Project.

**Cephalopods**

Cephalopods (squid, octopus and cuttlefish) are active mobile predators. Generally, cuttlefish and octopus eat crustaceans (including lobsters) living on or near the seabed while squid eat crustaceans and fish. Cephalopods have a high growth rate, their lifespan is short and there is a single reproductive season (Boyle and Rodhurst, 2005).

The species actively swim by jet propulsion and propagate by sexual reproduction. The individual size and number of eggs (released in a jelly like egg mass) during a reproductive season is variable and ranges from a few large eggs (<30 mm long) attached to the seabed to numerous (>1 million) small eggs drifting in the plankton. The incubation period is highly temperature dependent and is completed with the hatching of the larval stage which resembles a miniature adult. After breeding the adults die within a short time and in species with a highly synchronised breeding population this can result in conspicuous mass mortality (Boyle and Rodhurst, 2005).

An important commercial cephalopod within the Otway region is the arrow squid which is endemic to southern Australia (Koopman et al., 2018) and inhabits waters from estuaries to ocean depths of about 500 m but are most abundant over the continental shelf from 50 m to 200 m (Kailola et al., 1993). Arrow squid are schooling and tend to aggregate near the seabed during daylight and disperse through the water column at night, migrating to the surface to feed. Arrow squid spawn throughout their distribution; spawning occurs in all months although there are 2 -3 peaks in spawning activity during the year. Peak catches and catch rates of squid have occurred during summer months, with peak catch timings moving earlier over time (February, March) particularly off Western Australia (Koopman et al., 2018). After eggs are released, they hatch within 1-2 months post fertilisation with the larvae most abundant in continental shelf waters of 50 – 200 m. Arrow squid are relatively short-lived reaching a maximum age of 12 months and are the prey of a number of fish species (Kailola et al., 1993).

Considering recent catch effort data (see section 6.7.2) and the species preferred habitat, there is potential that the species will be present in within the vicinity of the East Coast Project.

#### *6.5.4.5 Crustaceans*

**Rock Lobster**

Rock lobsters live in a variety of reef habitats on the continental shelf in water depths between 1 and 200 m. In Victoria, the abundance of rock lobsters reduces from west to east reflecting a decreasing area of suitable rocky reef habitat (VFA, 2024). The species is carnivorous and eats molluscs, small crustaceans, echinoderms and other benthic invertebrates. Major predators of the rock lobster are octopus, gummy shark, southern rock cod, flathead, wrasse, morwongs and rock ling (Kailola et al., 1993).

The lifecycle of the southern rock lobster is complex – after mating in autumn, fertilized eggs are carried under the tail of the female for approximately three months before hatching typically between September and November / December (DPI, 2009; Kailola et al., 1993). Egg hatching typically occurs earlier in the southern waters of the species distribution (Kailola et al., 1993). A female lobster with a carapace length of 124 mm can carry up to 400,000 eggs (Kailola et al., 1993).

The eggs hatch into larvae (or phyllosoma) which undergo eleven developmental stages over a period of 12-24 months in pelagic environments while being dispersed and distributed by oceanic currents to distances at least 1,100 km from land (Kailola et al., 1993). Given the long-lived nature of the SRL larval phase, there can be up to two cohorts of larvae present in shelf waters at any one time. Larval distribution is initially in shelf waters with currents quickly dispersing larvae along shore and into offshore waters. Mixing of larvae and loss of regional integrity of larvae is prevalent in southeast SA, Tasmania and eastern Victoria given the net drift east. Additionally, phyllosoma are found over a variety of water depths and are assumed to have no affective horizontal swimming capacity in the marine environment (Bruce et al., 2007). Phyllosoma are observed to rise to surface waters (~0-20 m) during night hours and sink during the daylight hours (~50-200 m) (Bruce et al., 2007).

During metamorphosis juvenile rock lobsters shift from a planktonic (phyllosoma) to a benthic existence (termed puerulus) (DPI, 2009) settling into coastal and shelf habitats. Historically the southern rock lobster was thought to be a highly resident species, remaining in one area for extensive periods of time. Movement patterns of the species in Victorian waters were analysed and found that the region and water depth were the greatest drives of southern rock lobster movement (Skeer et al., 2020). Results suggest that the movement of individuals off the Warrnambool and Apollo Bay regions (within close proximity to the East Coast Project operational area) was primarily in the offshore direction towards deeper water (Skeer et al., 2020). However, a maximum depth range of 50 – 60 m was observed with few recaptures observed beyond this (Skeer et al., 2020).

The southern rock lobster is the key target species of a number of state fisheries including the Victorian Rock Lobster Fishery. The most productive fishing grounds for the southern rick lobster occur in the waters adjacent to South Australia which support the largest fishery for the species, followed by Tasmania and then Victoria (VFA, 2024). Considering recent catch effort data (see section 6.7.2) and the species preferred habitat (<60 m), there is potential for individuals to be present within the vicinity of the East Coast Project.

**Giant Crab**

The giant crab occurs in oceanic waters of southern Australia along the continental shelf, typically found in water depths between 140 and 270 m (Levings et al., 2001). The giant crab movement is dependent on water temperature. This species lacks internal temperature control mechanisms and lives where the steep terrain of the continental margin offers easy access to a cooler or a warmer environment (Levings et al., 2001). Their growth and reproduction are linked with the food resources and physical character of where they live.

The giant crab reproduces annually. Females produce eggs in April/May and will carry eggs until October/November when they are released. Females carry approximately 1.5 million eggs on average (IMAS, 2023). Dispersal of larvae is considered to be localised due to the short planktonic phase of the species lifecycle. Survival of larvae may be dependent on factors such as prevailing currents, vertical migration (movement through the depths of the water column), temperature, light intensity, gravity, change in pressure, predator pressures, food availability, thermoclines and salinity (IMAS, 2023).

The giant crab is the key target species of a number of state fisheries including the Victorian Giant Crab Fishery. Considering the preferred habitat occurs along the edge of the continental shelf (<100 m), it is unlikely that the species will be present in high densities within the vicinity of the East Coast Project.

#### *6.5.4.6 Annelids*

Annelids are a large phylum of segmented worms, including polychaetes, clitellates, ragworms, earthworms and leeches.

Polychaetes are brightly coloured segmented worms. Most are less than 10 cm long, although they can range from 1 mm to 3 m and include forms such as sand worms, tube worms and clam worms. They are found in all habitats from the supra-littoral to the deepest parts of the ocean. Some such as the feather-duster worms are sedentary, living in tubes buried in sand/mud and feed by trapping food particles in mucus or by ciliary action. Others such as the clam worm are active mobile predators which capture prey in jaws (University of Michigan, 2017).

Most polychaetes have separate sexes - male and female and the sperm and eggs are released into the surrounding water through ducts or openings. The fertilised eggs hatch into larvae, which float among the plankton, and eventually metamorphose into the adult form by adding segments (MESA, 2015b).

As discussed in Section 6.5.1.3 video transects and sediment samples within and adjacent to the operational area saw scattered areas of hard ground supporting patchy areas of abundant epibiota (Ramboll, 2020b). Polychaete tubules were visible in one sediment sample (Table 6-4) suggesting that marine annelids have the potential to be present within the operational area of the East Coast Project.

#### *6.5.4.7 Ascidians*

All ascidians (commonly known as sea squirts) are sessile, sac-like marine invertebrate filter feeders and include both solitary and colonial species. Ascidians occur from intertidal to deep (>2,000 m) subtidal waters and can occur in high concentrations (Butler et al., 2017). A study conducted on the distribution of ascidians along Victoria's coast at identified rocky reef locations, which identified 37 different species found in the intertidal environment (Bathie and Pett, 2020). No rocky reef locations within the vicinity of the East Coast Project were surveyed. The closest was the Dutton Way biounit north of Portland. The species has a digestive, circulatory and nervous system however lacks any special sensory organs. Reproduction includes both asexual budding and sexual reproduction with a free-living larval stage. The species are hermaphrodites, and fertilisation can be external with development in the water column (solitary species) or internal with embryos brooded in the body (colonial species). Solitary larvae are free-swimming for periods of 1-24 hours and prior to hatching have been floating free in the water for up to 3 days. They are therefore subject to current dispersal which contributes to gene flow and removes risks of isolation. The colonial species are seldom free swimming for more than one hour and attach to substrates rapidly. In temperate and cold seas, breeding is usually seasonal and restricted to the warmer season but in tropical waters it may continue throughout the year (Shenkar, 2008). Only limited information on predators is available but they include some fish, molluscs and sea-stars. While some species are known to contain toxins which deter predators and settling larvae, most solitary species tough tests and colonial species a great ability to rapidly repair any damage through vegetative growth (Butler et al., 2002).

Considering the species prefers hard rocky reef habitat and may be found in water depths from the intertidal zone out to the deep ocean, there is potential that ascidians will be present within the vicinity of the East Coast Project.

### 6.5.5 Fish

PMST reports were generated for the operational area, EMBA and monitoring area to identify EPBC listed fish species (or species habitat) that may occur within the areas (Appendix 1). Table 6-7 identifies the presence and protection status of fish species for each area. There are 56 EPBC listed fish species (or species habitat) that may occur within the monitoring area, 36 of which belong to the Syngnathidae family. Of the species within the monitoring area, 32 occur within the operational area.

For the purpose of the OPP, only species listed as threatened or migratory under the EPBC Act which are known or likely to occur or have either a BIA or habitat critical to their survival, within the monitoring area are considered to have conservation significance warranting further discussion. Due to the number of Syngnathids which may occur within the operational area and EMBA a brief discussion has been included in section 6.5.5.2. Three fish species identified in the PMST Reports are freshwater species, eastern dwarf galaxias, Yarra pygmy perch and the variegated pygmy perch. As they will be outside of the spatial extent potentially affected by the activity they are not discussed further.

Commercially important fish species are known to occur within the operational area and EMBA. Although all commercially important species may not be EPBC listed they provide important economic services to ecological and social environment. Commercially important fish species which may occur within the operational area have been identified through Table 6-19 and Table 6-20 and are described in section 6.5.5.3.

BIAs were identified for 2 species of fish, white shark and grey nurse shark, within the monitoring area as displayed in Figure 6-29 and Figure 6-30.

There is no defined habitat critical to the survival of fish species within the operational area or EMBAs.

*Table 6-6: Fish species or habitat that may occur within the operational area and ecological and monitoring area*

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| **Sharks and rays** | | | | | | | | | |
| *Carcharodon carcharias* | White Shark | V | ✓ | | *Recovery Plan for the White Shark (Carcharodon carcharias) (DSEWPaC, 2013)* | * | KO*m | FKO*d, f | BKO*d, f, b |
| *Carcharhinus longimanus* | Oceanic Whitetip Shark | | ✓ | ✓ | | | - | MO | MO |
| *Carcharias taurus* | Grey Nurse Shark (east coast population) | CE | | | *Recovery Plan for the Grey Nurse Shark (Carcharias Taurus) (DoE, 2014a)* | * | - | - | AKO*m, f |
| *Centrophorus harrissoni* | Harrisson's Dogfish | CD | | | | | - | - | LO |
| *Centrophorus uyato* | Little Gulper Shark | CD | | | | | - | LO | LO |
| *Galeorhinus galeus* | School Shark | CD | | | | | MO | LO | LO |
| *Isurus oxyrinchus* | Shortfin Mako | | ✓ | | | | LO | LO | LO |
| *Lamna nasus* | Porbeagle, Mackerel Shark | | ✓ | | | | LO | LO | LO |
| *Manta birostris* | Giant Manta Ray | | ✓ | | | | - | - | KO |
| *Rhincodon typus* | Whale Shark | V | ✓ | | *Conservation Advice for Rhincodon typus (Whale Shark) (TSSC, 2015k)* | | - | MO | MO |
| **Fish and Syngnathids** | | | | | | | | | |
| *Epinephelus daemelii* | Black Rockcod | V | | | *Conservation Advice for Epinephelus daemelii (Black Rock-cod) (DSEWPaC, 2012e)* | | - | - | LO |
| *Galaxiella pusilla* | Eastern Dwarf Galaxias | E | | | *National recovery plan for the Dwarf Galaxias (Galaxiella pusilla) (Saddlier et al., 2010)*<br>*Conservation Advice for Galaxiella pusilla (dwarf galaxias) (DCCEEW, 2024j)* | | - | MO | KO |
| *Hoplostethus atlanticus* | Orange Roughy | CD | | | | | - | LO | LO |
| *Nannoperca obscura* | Yarra Pygmy Perch | E | | | *National recovery plan for the Yarra Pygmy Perch (Nannoperca obscura) (Saddlier and Hammer, 2010a)*<br>*Conservation Advice for Nannoperca obscura (Yarra pygmy perch) (DCCEEW, 2023b)* | | - | KO | KO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Nannoperca variegata* | Variegated Pygmy Perch | V | | | *National recovery plan for the Variegated Pygmy Perch (Nannoperca variegate) (Saddlier and Hammer, 2010b)* | | - | - | KO |
| *Prototroctes maraena* | Australian Grayling | V | | | *National Recovery Plan for Australian Grayling (Backhouse et al., 2008)*<br>*Conservation Advice Prototroctes maraena Australian Grayling (TSSC, 2021)* | | MO | KO | KO |
| *Rexea solandri* (eastern Australian population) | Eastern Gemfish | CD | | | | | - | - | LO |
| *Seriolella brama* | Blue Warehou | CD | | | | | KO | KO | KO |
| *Thymichthys politus* | Red Handfish | CE | | | *Conservation Advice for Thymichthys politus (Red Handfish) (DSEWPaC, 2012f)*<br>*Recovery Plan for the Three Handfish Species (CoA, 2015c)* | | - | - | MO |
| *Brachiopsilus ziebelli* | Ziebell's Handfish | V | | | *Recovery Plan for Three Handfish Species: Spotted Handfish (Brachionichthys hirsutus), Red Handfish (Thymichthys politus), and Ziebell's Handfish (Branchiopsilus ziebelli) (CoA, 2015c)* | | - | - | LO |
| *Acentronura australe* | Southern Pygmy Pipehorse | | | ✓ | | | - | - | MO |
| *Acentronura tentaculate* | Shortpouch Pygmy Pipehorse | | | ✓ | | | - | - | MO |
| *Campichthys tryoni* | Tryon's Pipefish | | | ✓ | | | - | - | MO |
| *Cosmocampus howensis* | Lord Howe Pipefish | | | ✓ | | | - | - | MO |
| *Heraldia nocturna* | Upside-down Pipefish | | | ✓ | | | MO | MO | MO |
| *Hippocampus abdominalis* | Big-belly Seahorse | | | ✓ | | | MO | MO | MO |
| *Hippocampus berviceps* | Short-head Seahorse | | | ✓ | | | MO | MO | MO |
| *Hippocampus minotaur* | Bullneck Seahorse | | | ✓ | | | - | MO | MO |
| *Histiogamphelus briggsii* | Crested Pipefish | | | ✓ | | | MO | MO | MO |
| *Histiogamphelus cristatus* | Rhino Pipefish | | | ✓ | | | MO | MO | MO |
| *Hypselognathus rostratus* | Knifesnout Pipefish | | | ✓ | | | MO | MO | MO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Kaupus costatus* | Deepbody Pipefish | | | ✓ | | | MO | MO | MO |
| *Kimblaeus bassensis* | Trawl Pipefish | | | ✓ | | | - | MO | MO |
| *Leptoichthys fistularius* | Brushtail Pipefish | | | ✓ | | | MO | MO | MO |
| *Lissocampus caudalis* | Australian Smooth Pipefish | | | ✓ | | | MO | MO | MO |
| *Lissocampus runa* | Javelin Pipefish | | | ✓ | | | MO | MO | MO |
| *Maroubra perserrata* | Sawtooth Pipefish | | | ✓ | | | MO | MO | MO |
| *Mitotichthys mollisoni* | Mollison's Pipefish | | | ✓ | | | - | MO | MO |
| *Mitotichthys semistriatus* | Halfbanded Pipefish | | | ✓ | | | MO | MO | MO |
| *Mitotichthys tuckeri* | Tucker's Pipefish | | | ✓ | | | MO | MO | MO |
| *Notiocampus ruber* | Red Pipefish | | | ✓ | | | MO | MO | MO |
| *Phycodurus eqques* | Leafy Seadragon | | | ✓ | | | MO | MO | MO |
| *Phyllopteryx taeniolatus* | Common Seadragon | | | ✓ | | | MO | MO | MO |
| *Pugnaso curtirostris* | Pugnose Pipefish | | | ✓ | | | MO | MO | MO |
| *Solegnathus robustus* | Robust Pipehorse | | | ✓ | | | MO | MO | MO |
| *Solegnathus spinosissimus* | Spiny Pipehorse | | | ✓ | | | MO | MO | MO |
| *Solenostomus cyanopterus* | Robust Ghostpipefish | | | ✓ | | | - | - | MO |
| *Stigmatopora argus* | Spotted Pipefish | | | ✓ | | | MO | MO | MO |
| *Stigmatopora nigra* | Widebody Pipefish | | | ✓ | | | MO | MO | MO |
| *Stipecampus cristatus* | Ringback Pipefish | | | ✓ | | | MO | MO | MO |
| *Syngnathoides biaculeatus* | Double-end Pipehorse | | | ✓ | | | - | MO | MO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Urocampus carinirostris* | Hairy Pipefish | | | ✓ | | | MO | MO | MO |
| *Vanacampus margaritifer* | Mother-of-pearl Pipefish | | | ✓ | | | MO | MO | MO |
| *Vanacampus phillipi* | Port Phillip Pipefish | | | ✓ | | | MO | MO | MO |
| *Vanacampus poecilolaemus* | Longsnout Pipefish | | | ✓ | | | MO | MO | MO |
| *Vanacampus vercoi* | Verco's Pipefish | | | ✓ | | | - | - | MO |

*Threatened Species:*

| | |
|---|---|
| *CD* | *Conservation Dependent* |
| *V* | *Vulnerable* |
| *E* | *Endangered* |
| *CE* | *Critically Endangered* |

Biologically Important Area (Designation shown where relevant in each spatial extent column)

| | |
|---|---|
| * | *BIA Present* |
| *d* | *Distribution* |
| *f* | *Foraging* |
| *b* | *Breeding (nursery area)* |
| *m* | *Migration* |

*Type of Presence:*

| | |
|---|---|
| *MO* | *Species or species habitat may occur within area* |
| *LO* | *Species or species habitat likely to occur within area* |
| *KO* | *Species or species habitat known to occur within area* |
| *FKO* | *Foraging, feeding or related behaviour known to occur within area* |
| *BKO* | *Breeding known to occur within area* |
| *AKO* | *Congregation or aggregation known to occur within area* |

#### *6.5.5.1 Cartilaginous Fish*

**White Shark**

The white sharks range extends from central Queensland, around the south coast, to northwest Western Australia (DSEWPaC, 2013). This species is primarily found on the continental shelf and in coastal waters, including inshore waters around oceanic islands. Although the white shark is not evenly distributed throughout its range, it is distributed throughout the South-east Marine Region with a foraging BIA located 30 km west of the operational area, with observations more frequent in some areas, including those around fur-seal or sea-lion colonies (Figure 6-29) (DSEWPaC, 2013). South-east Marine Region waters surrounding pinniped colonies are considered foraging BIAs for the species, none of which occur within the operational area but do overlap with the monitoring area (Figure 6-29). Juvenile sharks appear to aggregate seasonally in key areas, including Wilsons Promontory (Victoria), and along the coast between Newcastle and Forster, NSW (DSEWPaC, 2013). Recent studies have found that juvenile white sharks (<3 m) occupy estuaries at Port Stephens, NSWs and Corner Inlet, Victoria during October to January (Harasti et al., 2017). A BIA for breeding (nursery ground) has been established in the coastal region extending from Wilsons Promontory to Lakes Entrance (approximately 300 km east of the operational area and within the monitoring area). The white shark moves seasonally along the south and east Australian coasts, moving northerly along the coast during autumn and winter, and returning to southern Australian waters by early summer. The white shark is not known to form and defend territories; however, its seasonal return implies a degree of site fidelity (DSEWPaC, 2013).

The species is likely to occur in the vicinity of the East Coast Project and is known to forage and breed within the monitoring area.

**Grey Nurse Shark (east coast population)**

The grey nurse shark (east coast population) is broadly distributed around the world primarily in subtropical to cool temperate coastal waters. In Australia, the grey nurse shark is regularly reported in southern Queensland and along the NSW coastline (DoE, 2023). The east coast population covers a range extending from the Capricornia coast (central Queensland) to Narooma in southern New South Wales (DoE, 2014a). The grey nurse shark generally occurs as solitary individuals or in small schools; larger aggregations of individuals may occur for courtship and mating (DoE, 2014a). Key aggregation sites and habitat critical for the survival of the grey nurse shark have been identified within the monitoring area (Montague Island and Tollgate Island). The grey nurse shark migrates within its range, making seasonal north–south movements to form aggregations at critical habitat sites, thought to be related to breeding (DoE, 2023). Migration and foraging BIAs are overlapped by the monitoring area and displayed in Figure 6-30. The precise timing of mating and pupping in Australian waters is unknown; however, in South Africa mating occurs between late-October and late-November (DoE, 2023).

The species is not identified as occurring in the vicinity of the East Coast Project. The grey nurse shark (east coast population) may occur in the monitoring area where it extends off the coast of southern NSW.

**Shortfin Mako**

The shortfin mako has a circum-global distribution inhabiting tropical and temperate waters where it is rarely encountered in waters with temperatures below 16°C. The shortfin mako shark has been recorded in offshore waters all around the Australian coastline except for the Arafura Sea, Gulf of Carpentaria and Torres Strait in the north (DoE, 2014b). It is a pelagic species, primarily occurring in offshore, oceanic waters (Last and Stevens, 2009). The shortfin mako is highly migratory and can cover large distances, migrating from Australian waters to areas well beyond the Australian Exclusive Economic Zone (Rogers et al., 2009). The shortfin mako inhabits depths down to 600 m, with a slight trend indicating the species spend the majority of the night in shallow water, and the majority of daylight hours in deeper waters (Rogers et al., 2009). Satellite tracking data for shortfin makos showed a potential for year-round occupation of the Otway, Bass Strait and Gippsland Basins (Rogers and Bailleul, 2015).

The waters of Bass Strait are not known feeding, resting or reproductive grounds for the shortfin mako, although feeding may occur opportunistically where sufficient prey is present.

**Porbeagle**

The porbeagle is a wide-ranging species that inhabits oceanic waters around the edge of the continental shelf in temperate, subarctic and subantarctic waters of the North Atlantic and Southern Hemisphere (DoE, 2023). In Australia this species typically occurs in oceanic waters between southern Queensland south to south-west Australia. The porbeagle may temporarily move into coastal waters and are known to utilises a broad vertical range of the water column diving to depths exceeding 1,300 m (DoE, 2023). This species is known to undertake seasonal migrations; however, they are not well understood. Individuals in the Southern Hemisphere are thought to give birth off New Zealand and Australia in winter (DoE, 2023).

The waters of Bass Strait are not known feeding, resting or reproductive grounds for the porbeagle, although feeding may occur opportunistically where sufficient prey is present.

**Giant Manta Ray**

The giant manta ray is a migratory species that is found worldwide in tropical, subtropical, and temperate bodies of water. The species can inhabit a variety of marine environments such as, oceanic waters, coastal areas, estuarine waters, oceanic inlets, and within bays and intercoastal waterways (NOAA, 2023). The giant manta ray is a filter feeder and consumes a large quantity of zooplankton. They are seasonal visitors to productive coastlines which appear to correspond with the movement of zooplankton, current circulation and tidal patterns, seasonal upwelling, seawater temperature, and possibly mating behaviour (NOAA, 2023).

The waters of Bass Strait are not known feeding, resting or reproductive grounds for the giant manta ray, although feeding may occur opportunistically where sufficient prey is present.

**Harrissons Dogfish**

The Harrisson's dogfish is a species of gulper shark that are relatively small, deepwater sharks (DSEWPaC, 2013e). The species is mainly recorded in water depths between 200-650 m (Last and Stevens, 2009) but have been captured in depths down to 1,050 m (Daley et al., 2002). The distance that an individual can travel is not known but the species is identified to occur from the north of Evans Head in NSW, through waters off the coast of Victoria, to Cape Hauy in Tasmania (Williams et al., 2012). The Harrisson's dogfish diet consists mainly of fish and invertebrates including mesopelagic prey such as lanternfish and squid (Daley et al., 2002; Graham and Daley, 2011). The species also exhibits slow growth, late maturity age, and low fecundity, which makes them vulnerable to overfishing (Stobutzki et al., 2011).

The waters of the Bass Strait are not known feeding, resting or reproductive grounds for the Harrisson's dogfish, although feeding may occur opportunistically where sufficient prey is present. Considering the depth of the operational area (~85 m at its deepest) and the species preferred habitat (200 - 600 m), it is considered unlikely for the species to be present within the vicinity of the East Coast Project.

**Little Gulper Shark**

The little gulper shark, commonly known as the southern dogfish, are small, deepwater sharks (DSEWPaC, 2013f). The species is endemic to Australia in habitats on the upper-slope between 180 m to 900 m of the southern continental shelf (Williams et al., 2012). There are likely three distinct stocks of the little gulper shark: eastern stock (Australian east coast down to eastern Tasmania), central stock (west Tasmania to the Great Australian Bight), and a western stock (western Great Australian Bight to south Western Australia) (USDSWG, 2012; Williams et al., 2012). However, the species is absent in southern Tasmania through to the Bass Strait (DSEWPaC, 2013f). Similar to the Harrisson's dogfish, the little gulper shark is also vulnerable to overfishing due to its slow growth, late maturing age, and low fecundity (Stobutzki et al., 2011).

The little gulper shark is not recorded to be present within the Bass Strait and their reproductive migration is relatively unknown (Musick, 2011). Considering the depth of the operational area

(~85 m) and the species preferred habitat depth of 180 - 900 m, it is considered unlikely for the species to be present within the vicinity of the East Coast Project.

**School Shark**

The school shark is a globally widespread species that occurs in temperate waters offshore eastern United States, Hawaii, South America, South Africa, Europe, and New Zealand (Last and Stevens, 1994; McLoughlin, 2007). In Australian waters, the species is found in offshore waters from Moreton Bay, QLD to Perth, WA, including the offshore waters of Tasmania and Lord Howe Island (DEWHA, 2009b). However, the species moves more extensively in waters off southern Australia with individual migrations of up to 1,400 km recorded (DEWHA, 2009b). The school shark is primarily a demersal species and have been recorded at depths of 500 m during the day and then moving up during the night to about 100 m (McLoughlin, 2007). Female and juvenile sharks typically use inshore coastal areas around Victoria, Tasmania, and parts of South Australia for nursery areas (Pogonoski et al., 2002).

The school shark is a key commercial species that is primarily caught in the Gillnet, Hook, and Trap sector of the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) (DEWHA, 2009b). The species was historically the primary target within the fishery, but biomass was reduced below the limit reference point around 1990 (Davis et al., 2023). However, the school shark remains the second most economically important stock in the fishery despite being classified as overfished (Davis et al., 2023).

The waters of the Bass Strait are not known feeding, resting or reproductive grounds for the school shark, although pups and juveniles are known to aggregate in shallow, inshore waters during the spring and summer (AFMA, 2024a). Considering the depth of the operational area (55 - 85 m) and the species preferences, it is considered that the presence of school sharks within the operational area would only be of a transitory nature during movements between deep offshore waters and nursey grounds within the breeding season.

**Oceanic Whitetip Shark**

The oceanic whitetip shark is a pelagic species generally found offshore in the open ocean across the globe in tropical and subtropical waters. Although they have been recorded up to depths <1,000 m, they typically live in the upper part of the water column, from the surface to around 200 m (NOAA, 2024). The species are considered a surface-dwelling shark, showing a strong preference for the surface mixed layer in warm waters above 20°C (NOAA, 2024). Within Australian waters, the oceanic whitetip sharks range extends from Cape Leeuwin, WA north through parts of the Northern Territory, down the east coast of Queensland and NSW to Sydney (FRDC, 2019). The oceanic whitetip shark is considered an opportunistic forager, feeding primarily on bony fish and cephalopods, such as squid.

Considering the species known range which only extends as far south as Sydney on the east and Cape Lewin on the west it is considered unlikely for the species to be present within the vicinity of the East Coast Project.

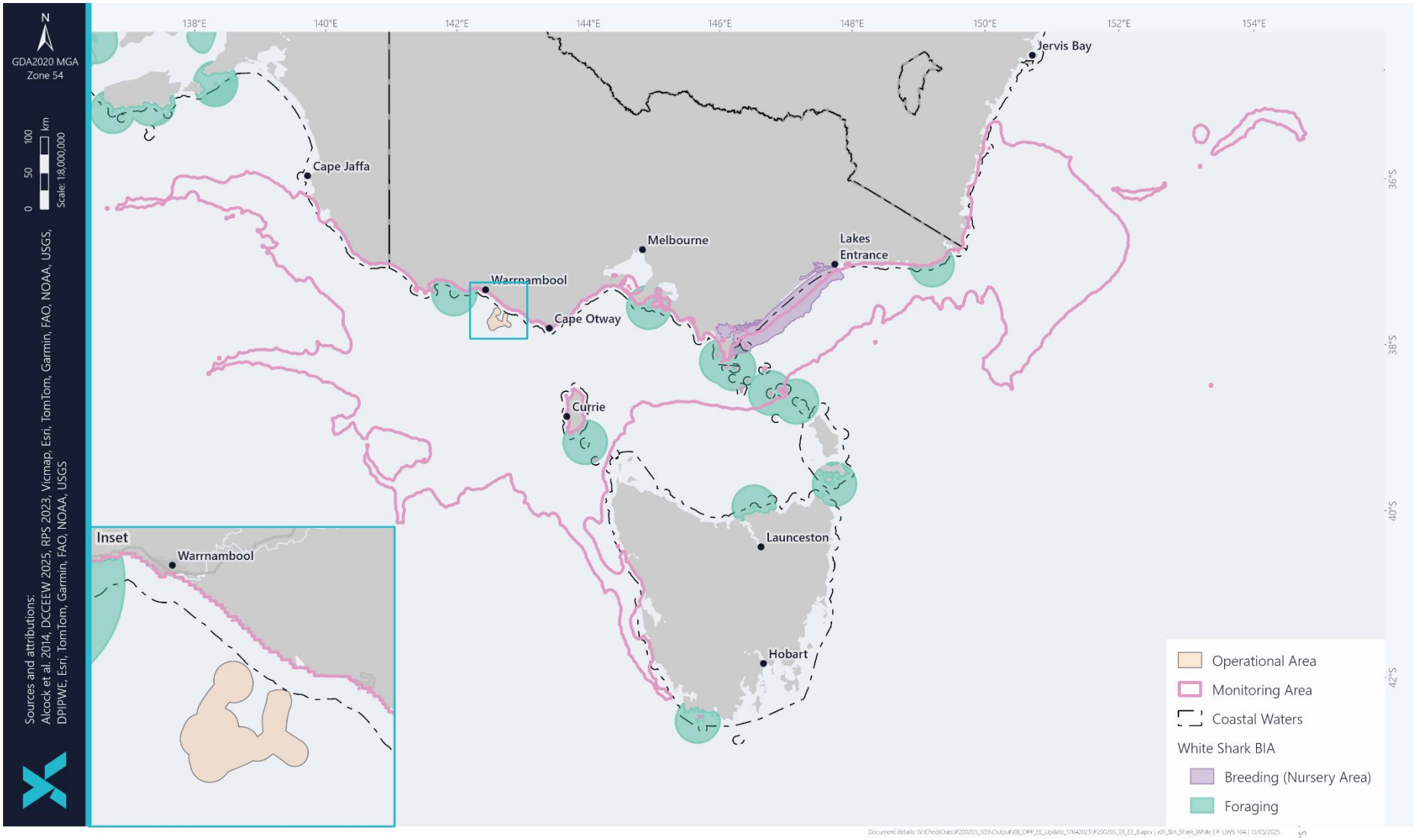



*Figure 6-29: White Shark BIAs overlapped by the monitoring area*

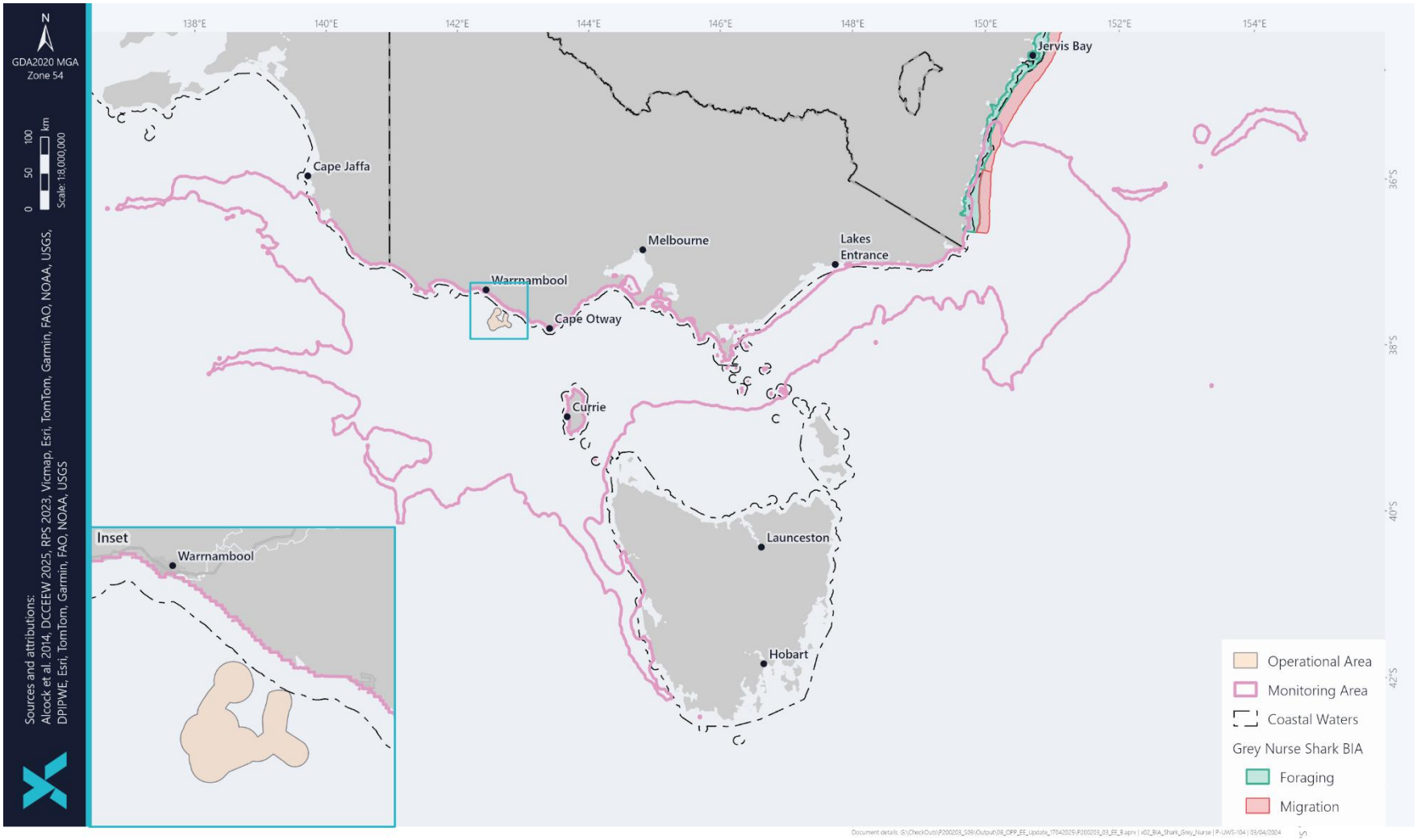



*Figure 6-30: Grey Nurse Shark BIAs overlapped by the monitoring area*

#### *6.5.5.2 Ray-finned Fish*

**Black Rock-cod**

The range of the black rock-cod includes warm temperate and subtropical waters of the southwestern Pacific, including south-eastern Australia and some Islands of New Zealand. However, the NSW coastline forms the species main range, both in Australia and internationally (DSEWPaC, 2012e). The species typically inhabits near shore rocky reefs and offshore coastal reefs up to 50 m deep (DSEWPaC, 2012e). Coastal habitats include rock caves, rock gutters and rock reefs. Young juveniles are often found in coastal rock pools while slightly older juvenile black cod are often found in estuary systems which is thought to potentially be an important part of the ecology of juvenile black cod, in NSW waters (DSEWPaC, 2012e).

The species is not expected to be found within the vicinity of the East Coast Project as its main range occurs in NSW state waters.

**Australian Grayling**

The Australian grayling is endemic to south-eastern Australia and occurs in coastal rivers and streams in NSW, Victoria and Tasmania. This is a dimorphous, migratory species that inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults (Backhouse et al., 2008). The Australian grayling will spend the majority of its life in freshwater and can penetrate far inland (has been recorded up to 100 km upstream from the sea) (Backhouse et al., 2008). Precise marine habitats are not well known. Spawning occurs in freshwater form late summer to winter and is thoughts to be initiated by an increase in river flow and a potential drop in water temperature (DoE, 2023). Once eggs hatch, they drift downstream and out to sea where they remain for ~6 months.

Juvenile Australian grayling may be found within the vicinity of the East Coast Project, with recent surveys of Victoria recording the species in almost all coastal rivers east of and including the Hopkins River catchment near Warrnambool (TSSC, 2021).

**Ziebell's Handfish**

Handfish are relatively small (60–151 mm) marine fishes with distributions restricted to the temperate waters of south-eastern Australia, predominantly concentrated in Tasmania (Last and Gledhill, 2009). They are demersal, generally cryptic in nature. Lacking a swim bladder, they prefer to use their 'hands' to 'walk' across the sea floor, rather than swim (although can do so over short distances when disturbed).

Ziebell's handfish is the largest known handfish species and is typically found on soft bottomed habitat with patches of rock that support sponge and algae communities (CoA, 2015c). The species is restricted to the coastal waters of southern and eastern Tasmania and is most often found at depths of 10-20 m. Habitat critical to the survival of the species is located in the Waterfall Bay area of the Tasman Peninsula, located outside of the monitoring area (CoA, 2015c).

The species is not expected to be found within the vicinity of the East Coast Project as it is restricted to eastern and southern Tasmanian state waters, in water depths of 3 to 20 m (Stuart-Smith et al., 2020).

**Short-finned Eels**

The short-finned eel in adult and glass eels forms have the potential to occur within the operational area and associated monitoring area during offshore spawning migration period. A study tracked downstream spawning migration of adult short-finned eels released from south-western Victoria (Hopkins and Fitzroy River estuaries) and observed the adult eels moved east or south along the Australian continental shelf exiting the Bass Strait to the east to migrate north to spawning grounds in tropical waters of the Coral Sea (Koster et al., 2021). From the spawning site in the Coral Sea, migration of short-finned eel larvae is influenced by ocean currents that carry the larvae from the Coral Sea south along the east Australian current and transport the developing larvae (glass eels) through the Bass Strait to the Victorian Coast (VFA,

2017). Based on the observed migratory route of short-finned eels, short-finned eels in adult and glass eel forms may pass the operational area.

Short-finned eels in the Otway Basin and Bass Strait have a seasonal presence. During late summer and autumn adult eels will enter the Otway Basin and Bass Strait to commence their migration to the Coral Sea. During mid-winter to late spring Short-finned eel in larvae and glass eel forms will enter Victorian estuaries to complete the upstream migration (VFA, 2017).

**Orange Roughy**

The orange roughy is a high-value commercial, deepwater species that is associated with pinnacles, seamounts, such as the Lord How Rise, and other features where its prey aggregates (CoA, 2012b). In Australia, the species is commonly found on the continental slope at depths of 700 - 1,400 m (AFMA, 2024b) between southern WA and central NSW, including Tasmania. (CoA, 2012b). The orange roughy forms dense spawning aggregations in winter, usually 5 - 10 m above the seabed (AFMA, 2024b).

The orange roughy is a commercially important species and a key target in the South East Trawl Sector of the SESSF (AFMA, 2024b).

The waters of the Bass Strait are not known feeding, resting or reproductive grounds for the orange roughy, although feeding may occur opportunistically where sufficient prey is present. Considering the depth of the operational area (~85 m at its deepest) and the species preferred habitat (700 - 1,400 m), it is unlikely for the species to be present within the vicinity of the East Coast Project.

**Eastern Gemfish**

Gemfish are found throughout temperate waters in southern Australian waters (Pogonoski et al., 2002). The eastern population of gemfish extends from offshore Cape Moreton in southern QLD to the western edge of the Bass Strait (DEWHA, 2009c). The species is a bottom-dwelling species and generally found in large schools at depths of 100 - 800 m on the continental shelf and upper slope (AFMA, 2024c). The eastern gemfish migrates up the southern east coast of Australia before spawning, commencing off the eastern Bass Strait in early June. The species travels north, parallel to the coast to then spawn off central and northern NSW in mid-August (Pogonoski et al., 2002; Morison et al., 2007).

The eastern gemfish is incidentally caught in the eastern zone of Commonwealth Trawl Sector and the Gillnet Hook and Trap Sector apart of the SESSF (AFMA, 2024c).

The waters of the Bass Strait are not known feeding, resting or reproductive grounds for the eastern gemfish, although feeding may occur opportunistically where sufficient prey is present. Considering the depth of the operational area (~85 m at its deepest) and the species preferred habitat (100 - 800 m), it is unlikely for the species to be present within the vicinity of the East Coast Project.

**Blue Warehou**

The blue warehou is a school fish that usually aggregate close to the seabed and is confined to Australian and New Zealand waters (Kaschner et al., 2010). In Australia, the species predominantly occurs in the coastal shelf, upper continental slope, and seamount waters offshore from NSW, Tasmania, Victoria and South Australia (Bruce et al., 1998; Gomon, 2008). The species is recorded at depths between 50 - 500 m (bray and Gomon, 2011; AFMA, 2024d), although it is more abundant in waters shallower than 200 m (TSSC, 2015a). Juvenile fish can sometimes be found schooling close to the surface in estuaries, often in association with jellyfish (AFMA, 2024d). The blue warehouse is a migratory species but shows preference for relatively warmer waters of between 10 and 15$^{o}$C (TSSC, 2015a).

Commercial fisheries are not permitted to target blue warehou, but the species is incidentally caught within the Gillnet, Hook and Trap Sector, Commonwealth Trawl Sector, and the Great Australian Bight Trawl Sector of the SESSF (AFMA, 2024d).

The waters of the Bass Strait are not known feeding, resting or reproductive grounds for the blue warehou, although feeding may occur opportunistically where sufficient prey is present.

The blue warehou can be found within the Bass Strait but has primarily been incidentally caught on the east and west coast of Tasmania (AFMA, 2024d).

**Syngnathids**

Syngnathidae is a group of bony fishes that includes seahorses, pipefishes, pipehorses and sea dragons; the closely related Solenostomidae family includes ghost pipefish. These species occupy a range of habitats, however, generally display a preference for seagrass and macroalgal beds, coral reefs, mangroves or sponge gardens (i.e. a habitat offering a protective environment) (DSEWPaC, 2012g). Syngnathids are typically carnivorous, feeding in the water column on or near the sea floor; their diet including small crustaceans, invertebrates, and zooplankton.

In Victoria, Tasmania, South Australian and NSW it is an offence to collect or harvest any species of seahorse, seadragon, pipefish, or pipehorse without a permit (Baker, 2006). Habitat that supports syngnathid populations is generally patchy, so populations of syngnathid species may be dispersed and fragmented (DSEWPaC, 2012g). There are 15 pipefish species, 2 seahorses, and 2 seadragon species which have known distribution or habitat within the Otway and Bass Strait, (Baker, 2006).

#### *6.5.5.3 Commercially Important Fish Species*

A number of commercial fisheries have previously operated within the operational area and monitoring area as described in section 6.7.2. Key target species (i.e., species with high monetary value) with reported fishing activity in the operational area that are not EPBC listed have been identified, a number of which are described below.

**Gummy shark**

The gummy shark is distributed throughout the temperate waters of Australia, from Port Stephens in NSW to Geraldton in WA, including Tasmania (Marton et al., 2014). The gummy shark is a demersal species that occurs on the continental shelf from the near shore region to depths of 80 - 350 m (AFMA, 2024e). The species remain either on or near the seabed with females traveling longer distances as their age increases (AFMA, 2024e).

The gummy shark is a commercially important species and a key target in the Gillnet, Hook and Trap Sector of the Commonwealth SESSF (AFMA, 2024e). The species became the main target of the fishery from 1986 due to the adoption of monofilament gillnets and the concern surrounding mercury poisoning from large school sharks and declining school shark catches (Davis et al., 2023).

The gummy shark has primarily been caught nearshore Tasmania, Victoria and South Australia (AFMA, 2024e). The waters of the Otway are not known feeding, resting, or reproductive grounds for the gummy shark, however, considering their preferred habitat (80-350 m), there is potential for the species to be present within the vicinity of the East Coast Project.

**Sawshark**

Sawsharks are a common demersal species that inhabit the continental shelf and upper slope (AFMA, 2024f). There are three species of sawsharks that are frequently caught in Australian waters: the common, southern, and the delicate sawshark (Raoult et al., 2020). The southern and common sawshark have overlapping distributions and occur down to 630 m (Last and Stevens, 2009). However, the depth where these two sawfish species are most common is not known (Raoult et al., 2020).

The sawshark is incidentally caught within the Gillnet Hook and Trap Sector and the Commonwealth Trawl Sector of the SESSF, and state managed fisheries (AFMA, 2024f). In Commonwealth waters, the highest total catches of sawshark were observed on the north-eastern side of Bass Strait (Raoult et al., 2020) approximately 90% of catch within the SESSF (Davis et al., 2023).

Considering the preferred habitat of sawshark (down to 650 m) and recent catch efforts, there is potential for sawsharks to be found within the vicinity of the East Coast Project.

**Wrasse**

Species of wrasse have different lifestyle characteristics such as diets (ranging from highly specialised diets to highly opportunistic carnivores), use different habitats, and occurrence across different depths (Berkstrom et al.,2012). Wrasses are key target species for the Victorian Wrasse (Ocean) Fishery. The bluethroat wrasse and purple wrasse are the most caught species within the fishery, comprising of approximately 90% of the commercial Victorian wrasse harvest (VFA, 2025). Small catches of rosy, senator, and southern Maori wrasse are also caught within the fishery (VFA, 2025).

The wrasse species targeted in Victoria can occur down to depths of 160 m. However, species are mostly caught in depth shallower than 30 m to reduce loss due to barotrauma (where the swim bladder expands and damages the fish brought to the surface) (VFA, 2025).

Considering the preferred habitat of the wrasse species targeted in Victoria (down to 160 m) and recent catch efforts, there is potential for wrasse species to be found within the vicinity of the East Coast Project.

**Flathead**

Flathead species are bottom-dwelling fish that are distributed in tropical and temperate waters around Australia (VFA, 2021). There are many species of flathead but the southern blue-spotted, sand, rock, tiger, and dusky flathead are the most commonly target species by recreational fisheries (VFA, 2021). The tiger flathead is also caught within the Commonwealth Trawl and Scalefish Hook Sector of the SESSF (Emery et al., 2023). The tiger flathead is endemic to Australia and found on sandy or muddy substrates in the continental shelf and upper-slope waters from Coffs Harbour in NSW through Bass Strait and around Tasmania to south-east South Australia (Emery et al., 2023). Majority of the commercial catch for the tiger flathead comes from depths between 50 m and 200 m (Emery et al., 2023).

Considering the catch effort for the tiger flathead occurring at depths between 50 - 200 m, there is potential for flathead species to be found within the vicinity of the East Coast Project.

**Pink ling**

The pink ling is a demersal species that can be found along the continental shelf and slope, occurring at depths between 20 – 1,000 m (AFMA, 2024g). However, juveniles are generally found in shallower locations than adults (Bessell-Browne et al., 2021). In Australia, the species is found from central NSW to the south-west coast of WA (Bessell-Browne et al., 2021).

The pink ling is a commercially important species and a key target in the Gillnet, Hook and Trap Sector and the South East Trawl Sector of the Commonwealth SESSF (AFMA, 2024g). The species has been commercially caught in southern Australia since the 1970s by both Commonwealth and state fisheries (Bessell-Browne et al., 2021).

Considering the preferred habitat of the pink ling at depths between 20 m to 1,000 m, and recent fishing effort, there is potential that the pink ling may be present within the vicinity of the East Coast Project.

**Blue grenadier**

The blue grenadier is a deepwater species and is found in the continental slope, occurring at depths between 200 - 700 m (AFMA, 2024h). The species is found from NSW around southern Australia, including Tasmania, to WA (Castillo-Jordan and Tuck, 2018).

The blue grenadier is a commercially important species and a key target in the South East Trawl Sector of the SESSF (AFMA, 2024h). The species is primarily caught off western and eastern Tasmania and mostly during winter (AFMA, 2024h), which coincides with peak spawning (Castillo-Jordan and Tuck, 2018).

Considering the species preferred habitat (200 - 700 m) and commercial catch history, it is unlikely for the species to be present within the vicinity of the East Coast Project.

### 6.5.6 Marine Reptiles

PMST reports were generated for the operational area, EMBA and monitoring area to identify EPBC listed marine reptile species (or species habitat) that may occur within the EMBA (Appendix 1). Table 6-7 identifies the presence and protection status of all marine reptile species for each EMBA. There are 5 EPBC listed marine reptile species (or species habitat) that may occur within the monitoring area. Of these, 3 occur within the operational area.

For the purpose of the OPP, only species listed as threatened or migratory under the EPBC Act which are known or likely to occur or have either a BIA or habitat critical to their survival within the monitoring area are considered to have conservation significance warranting further discussion.

There are no defined BIAs or habitat critical to the survival of marine turtle species within the operational area or EMBAs.

*Table 6-7: Marine reptile species or habitats which may occur within the operational area and ecological and monitoring area*

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Caretta caretta* | Loggerhead Turtle | E | ✓ | ✓ | *Recovery Plan for Marine Turtles in Australia, 2017-2027 (CoA, 2017)* | | LO | FKO | FKO |
| *Chelonia mydas* | Green Turtle | V | ✓ | ✓ | | | MO | KO | FKO |
| *Dermochelys coriacea* | Leatherback Turtle | E | ✓ | ✓ | *Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle) (DEWHA, 2008)*<br>*Recovery Plan for Marine Turtles in Australia, 2017-2027 (CoA, 2017)* | | LO | FKO | FKO |
| *Eretmochelys imbricata* | Hawksbill Turtle | V | ✓ | ✓ | *Recovery Plan for Marine Turtles in Australia, 2017-2027 (CoA, 2017)* | | - | BLO | FKO |
| *Natator depressus* | Flatback Turtle | V | ✓ | ✓ | | | - | - | KO |

*Threatened Species:*
*V* *Vulnerable*
*E* *Endangered*

*Type of Presence:*
*MO* *Species of species habitat may occur within area*
*LO* *Species or species habitat likely to occur within are*
*KO* *Species or species habitat known to occur within area*
*BLO* *Breeding likely to occur within area*
*FKO* *Foraging, feeding or related behaviour known to occur within area*

#### *6.5.6.1 Marine Turtles*

Adult marine turtles spend the majority of their lives in the ocean, typically only coming onshore to nest. Females can lay (on average) between two and six clutches per season (CoA, 2017); with the period between clutches known as the internesting period. Female turtles typically remain close to the same nesting site during an internesting period. Hatchlings disperse into oceanic currents, and the juveniles will stay in pelagic waters until large enough to settle into coastal feeding habitats. Leatherback turtles are an exception to these general patterns, often exhibiting larger internesting zones, and travelling vast distances to forage rather than settling in a coastal habitat (CoA, 2017). Flatback turtles also lack an oceanic phase and remain in the surface waters of the continental shelf.

There are no marine turtle BIAs or habitat critical to the survival of marine turtles located within the operational area or monitoring area including adjacent coastline.

**Loggerhead Turtle**

The loggerhead turtle has a global distribution throughout tropical, sub-tropical and temperate waters. In Australia the species is typically found in waters around coral and rocky reefs, seagrass beds, or muddy bays throughout eastern, northern and western Australia and is rarely seen off the Victorian, Tasmanian of South Australian coasts (CoA, 2017). While the species has a broad foraging range throughout Australian waters, nesting is only known to occur on sandy beaches on the central western and eastern coasts outside of the monitoring area (DoE, 2023).

The loggerhead is a carnivorous turtle, feeding primarily on benthic invertebrates in habitat ranging from nearshore to 55 m depth (DoE, 2023). Loggerhead turtles will migrate over distances in excess of 1,000 km between breeding and foraging grounds each season showing strong fidelity to these important areas (Limpus, 2008).

Although this species may occur within the monitoring area it is expected to only be of a transient nature due to the absence of suitable coastal habitat.

**Leatherback Turtle**

The leatherback turtle has the widest distribution of any marine turtle, occurring in tropical to sub-polar oceans (DEWHA, 2008). In Australia, the leatherback turtle has been recorded foraging in all Australian states, but no large nesting populations have been recorded (DEWHA, 2008).

Unlike other marine turtles, the leatherback turtle utilises cold water foraging areas, with the species most commonly reported foraging in coastal waters between southern Queensland and central NSW, southeast Australia (Tasmania, Victoria and eastern SA), and southern WA (DoE, 2023). This species is an occasional visitor to the Otway shelf and has been recorded only 9 times in Victoria, most recently in March 2024 where an individual was found deceased onshore in Port Phillip Bay (SWIFFT, 2024). It is mostly a pelagic species, and, away from its feeding grounds, is rarely found inshore (DoE, 2023).

Although this species may occur within the monitoring area it is expected to only be of a transient nature due to the absence of suitable coastal habitat.

**Green Turtle**

The green turtle is typically found in tropical and subtropical waters throughout the world, however, may stray into temperate waters (DoE, 2023). The species is predominantly found in Australian waters off the Northern Territory, Queensland, and WA coastlines with more limited numbers in NSW, Victoria and South Australia (CoA, 2017).

The first 5-10 years of the green turtles life is spent drifting on ocean currents, consuming plankton, crustaceans and algae (DoE, 2023; CoA, 2017). Once they reach an adequate size the species moves to shallow foraging grounds. The species is primarily herbivorous, foraging on algae, seagrass and mangroves (CoA, 2017). The green turtle migrates between foraging and nesting locations seasonally, which varies between states.

Although this species may occur within the monitoring area it is expected to only be of a transient nature due to the absence of suitable coastal habitat.

**Hawksbill Turtle**

The hawksbill turtle is found in tropical, subtropical and temperate waters across the world; however, nesting is typically confined to tropical beaches (DoE, 2023). Within Australia nesting for the hawksbill turtle is concentrated along the northern coastlines of Queensland, Northern Territory and WA. However, the species has been recorded as far south as northern NSW where foraging is believed to occur (CoA, 2017).

The first 5-10 years of the hawksbill turtles life is spent drifting on ocean currents, consuming plankton (DoE, 2023). Once they reach an adequate size the species moves to reef foraging grounds feeding on sponges, soft bodied invertebrates, seagrass and algae (DoE, 2023; CoA, 2017). The hawksbill turtle migrates between foraging and nesting locations seasonally, which varies between states.

Although this species may occur within the monitoring area it is expected to only be of a transient nature due to the absence of suitable coastal habitat. The extent of the hawksbill turtle distribution typically as far as southern NSW is supported by recorded sightings within the Atlas of Living things with infrequent sighting in waters offshore Victorian or South Australia.

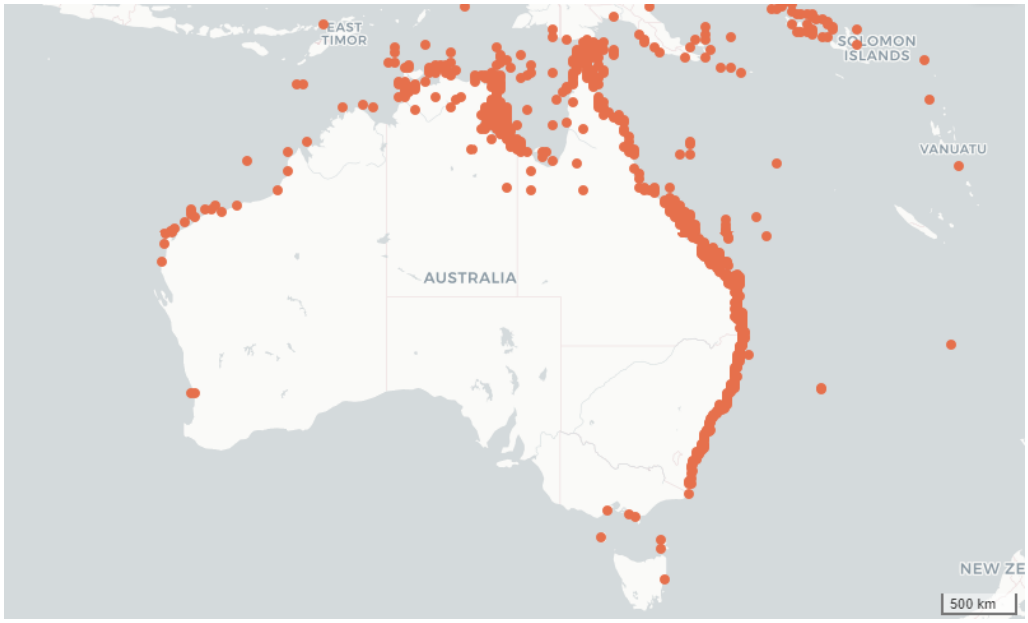



*Figure 6-31: Sightings of Hawksbill Turtles around Australia (Atlas of Living Australia, 2024)*

**Flatback Turtle**

The flatback turtle is only found in the tropical waters of northern Australia and is one of only two species of sea turtle without a global distribution (DoE, 2023). All known nesting locations for this species are located within Australia where the nesting occurs across northern Queensland, the Northern Territory and WA (CoA, 2017). The flatback turtle forages over the Australian continental shelf into continental waters off Papua New Guinea and Indonesia. This species is primarily carnivorous, feeding on soft-bodied invertebrates; juveniles eat gastropod molluscs, squid, siphonophores (CoA, 2017).

Although this species may occur within the monitoring area it is expected to only be of a transient nature due to the absence of suitable coastal habitat.

### 6.5.7 Seabirds and Shorebirds

PMST reports were generated for the operational area, EMBA and monitoring area to identify EPBC listed bird species (or species habitat) that may occur within the EMBA (Appendix 1).

Table 6-8 identifies the presence and protection status of all bird species for each EMBA. There are 133 EPBC listed seabird and shorebird species (or species habitat) that may occur within the monitoring area. Of these, 34 occur within the operational area.

For the purpose of the OPP, effort has been targeted towards species listed as threatened or migratory under the EPBC Act which are known or likely to occur or have either a BIA or habitat critical to their survival within the monitoring area.

Eighteen bird species identified in the PMST Reports are listed terrestrial (brown treecreeper (south-eastern), regent honeyeater, southern whiteface, King Island brown thornbill, King Island scrubtit, gang-gang cockatoo, south-eastern red-tailed black-cockatoo, south-eastern glossy black-cockatoo, diamond firetail, pilotbird, green rosella (King Island), plains-wanderer, south-eastern hooded robin, malleefowl, painted honeyeater, grey falcon, eastern bristlebird and the masked owl (Tasmanian). These species inhabit terrestrial environments, outside of the operational area and monitoring area, but were identified within the PMST search due to the application of a nominal buffer and are therefore not discussed further.

BIAs were identified for 24 species of seabirds: antipodean albatross, Australasian gannet, black petrel, black-browed albatross, black-faced cormorant, Buller's albatross, Campbell albatross, common diving-petrel, crested tern, flesh-footed shearwater, great-winged petrel, Indian yellow-nosed albatross, little penguin, northern giant petrel, short-tailed shearwater, shy albatross, soft-plumage petrel, sooty shearwater, southern giant petrel, wandering albatross, wedge-tailed shearwater, white-capped albatross, white-faced storm-petrel and the Wilson's storm petrel, within the monitoring area (Figure 6-33 to Figure 6-40).

There is no defined habitat critical to the survival of bird species within the operational area or EMBAs.

Many different species of seabirds and shorebirds utilise the Bass Strait and Otway regions and may potentially fly over the Operational Area or monitoring area using the East Asian-Australasian Flyway (EAAF). Globally, the EAAF is one of the most significant migratory bird routes, spanning over 13,000km from Arctic Russia and Alaska, through East and Southeast Asia, to Australia and New Zealand. The flyway spans 22 countries, including key nations such as China, Japan, South Korea, Indonesia, the Philippines, Papua New Guinea, and New Zealand, and supports the annual movements of over 50 million migratory waterbirds (DoEE, 2017a; Hansen et al., 2016). The Bass Strait represents a small segment of this expansive flyway, typically used by birds migrating between Tasmania and mainland Australia. Despite its minor geographic role in the broader flyway, the region is ecologically important, providing critical stopover and feeding habitats for several migratory species (DoEE, 2017a).

There are currently 900 sites recognised as internationally important to migratory waterbirds along the flyway. The operational area and monitoring area are in proximity to 7 of these sites including Discovery Bay Coastal Park, Port Phillip Bay (Western Shoreline) and Bellarine Peninsula, Western Port, Corner Inlet, Shallow Inlet Marine and Coastal Park, Logan Lagoon and Orielton Lagoon (Hansen et al., 2016). Several key species of the EAAF in Australia were also recognised in the PMST to be both migratory and in the vicinity of the project (Hansen et al., 2016). These species include curlew sandpiper, red knot, great knot, far eastern curlew and the black-tailed godwit (Hansen et al., 2016), which are listed in Table 6-8 and described in Section 6.5.7.2.

*Table 6-8: Seabird and shorebird species or habitats which may occur within the operational area and ecological and monitoring area*

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Diomedia antipodensis* | Antipodean Albatross | V | ✓(M) | ✓ | *National Recovery Plan for Albatross and Petrels (2022) (DCCEEW, 2022e)* | * | FLO*[f] | FLO*[f] | FLO*[f] |
| *Diomedea antipodensis gibsoni* | Gibson's Albatross | V | | ✓ | | | - | FLO | FLO |
| *Diomedia epomophora* | Southern Royal Albatross | V | ✓(M) | ✓ | | | FLO | FLO | FLO |
| *Diomedia exulans* | Wandering Albatross | V | ✓(M) | ✓ | | * | FLO*[f] | FLO*[f] | FLO*[f] |
| *Diomedia sanfordi* | Northern Royal Albatross | E | ✓(M) | ✓ | | | FLO | FLO | FLO |
| *Phoebetria fusca* | Sooty Albatross | V | ✓(M) | ✓ | | | LO | LO | LO |
| *Thalassarche bulleri* | Buller's Albatross | V | ✓(M) | ✓ | | * | FLO*[f] | FLO*[f] | FLO*[f] |
| *Thalassarche bulleri platei* | Northern Buller's Albatross | V | | ✓ | | | FLO | FLO | FLO |
| *Thalassarche carteri* | Indian Yellow-nosed Albatross | V | ✓ (M) | ✓ | | * | LO*[f] | LO*[f] | LO*[f] |
| *Thalassarche cauta* | Shy Albatross | E | ✓(M) | ✓ | *Conservation Advice Thalassarche cauta Shy Albatross (TSSC, 2020)*<br>*National Recovery Plan for Albatross and Petrels (2022) (DCCEEW, 2022e)* | * | FLO*[f] | FLO*[f] | FLO*[f] |
| *Thalassarche chrysostoma* | Grey-headed Albatross | E | ✓(M) | ✓ | *Conservation Advice for Thalassarche chrysostoma (grey-headed Albatross) (DEWHA, 2009)*<br>*National Recovery Plan for Albatross and Petrels (2022) (DCCEEW, 2022e)* | | MO | MO | MO |
| *Thalassarche eremita* | Chatham Albatross | E | ✓(M) | ✓ | *National Recovery Plan for Albatross and Petrels (2022) (DCCEEW, 2022e)* | | - | FMO | FMO |
| *Thalassarche impavida* | Campbell Albatross | V | ✓(M) | ✓ | | * | FLO*[f] | FLO*[f] | FLO*[f] |
| *Thalassarche melanophris* | Black-browed Albatross | V | ✓(M) | ✓ | | * | FLO*[f] | FLO*[f] | FLO*[f] |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Thalassarche salvini* | Salvin's Albatross | V | ✓(M) | ✓ | | | FLO | FLO | FLO |
| *Thalassarche steadi* | White-capped Albatross | V | ✓(M) | ✓ | | * | FKO | FKO | FKO*f |
| *Halobaena caerulea* | Blue Petrel | V | | ✓ | *Conservation Advice for Halobaena caerulea (Blue Petrel) (TSSC, 2015b)* | | MO | MO | MO |
| *Macronectes giganteus* | Southern Giant Petrel | E | ✓(M) | ✓ | *National Recovery Plan for Albatross and Petrels (2022) (DCCEEW, 2022e)* | * | MO | FLO | FLO*f |
| *Macronectes halli* | Northern Giant Petrel | V | ✓(M) | ✓ | | * | FLO | FLO | FLO*f |
| *Pterodroma cervicalis* | White-necked Petrel | | | ✓ | | | - | MO | BLO |
| *Pterodroma heraldica* | Herald Petrel | CE | | | *Conservation Advice Pterodroma heraldica (Herald petrel) (TSSC, 2015l)* | | - | - | MO |
| *Pterodroma leucoptera leucoptera* | Gould's Petrel | E | | | *Gould's Petrel (Pterodroma leucoptera leucoptera) Recovery Plan (DEC, 2006)* | | MO | MO | BKO |
| *Pterodroma mollis* | Soft-plumaged Petrel | V | | ✓ | *Conservation Advice for Pterodroma mollis (Soft-plumaged Petrel) (TSSC, 2015g)* | * | MO | MO | BKO*f |
| *Pelagodroma marina* | White-faced Storm-Petrel | | | ✓ | | * | - | *f | BKO*f, b |
| *Pelecanoides urinatrix* | Common Diving-Petrel | | | ✓ | | * | *f | BKO*f | BKO*f, b |
| *Pterodroma macroptera* | Great-winged Petrel | | | ✓ | | * | - | - | FKO*f |
| *Pterodroma neglecta neglecta* | Kermadec Petrel (western) | V | | | *Lord Howe Island Biodiversity Management Plan (DECC, 2008)*<br>*Norfolk Island Region Threatened Species Recovery Plan (DEWHA, 2010c)* | | - | - | FMO |
| *Procellaria parkinsoni* | Black Petrel | | ✓(M) | ✓ | | * | - | - | *f |
| *Fregetta grallaria grallaria* | White-bellied Storm-Petrel (Tasman Sea) | V | | | *Lord Howe Island Biodiversity Management Plan (DECC, 2008)* | | - | LO | LO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Oceanites oceanites* | Wilsons Storm Petrel | | ✓(M) | ✓ | | * | - | - | *m |
| *Actitis hypoleucos* | Common Sandpiper | | ✓(W) | ✓ | | | MO | KO | KO |
| *Calidris acuminata* | Sharp-tailed Sandpiper | V | ✓(W) | ✓ | *Approved Conservation Advice for Calidris acuminata (sharp-tailed sandpiper) (DCCEEW, 2024c)* | | MO | RKO | RKO |
| *Calidris ferruginea* | Curlew Sandpiper | CE | ✓(W) | ✓ | *Conservation Advice for Calidris ferruginea (Curlew Sandpiper) (DCCEEW, 2023q)* | | MO | KO | KO |
| *Calidris melanotos* | Pectoral Sandpiper | | ✓(W) | ✓ | | | MO | KO | KO |
| *Limicola falcinellus* | Broad-billed Sandpiper | | ✓ (W) | ✓ | | | - | - | RKO |
| *Tringa glareola* | Wood Sandpiper | | ✓ (W) | ✓ | | | - | RKO | RKO |
| *Xenus cinereus* | Terek Sandpiper | V | ✓ (W) | ✓ | *Approved Conservation Advice for Xenus cinereus (Terek sandpiper) (DCCEEW, 2024e)* | | - | - | RKO |
| *Puffinus carneipes* | Flesh-footed Shearwater | | ✓(M) | ✓ | | * | LO | KO | KO*f |
| *Puffinus griseus* | Sooty Shearwater | V | ✓(M) | ✓ | *Conservation Advice for Ardenna grisea (sooty shearwater) (DCCEEW, 2023c)* | * | MO | LO | BKO*f, b |
| *Puffinus pacificus* | Wedge-tailed Shearwater | | ✓(M) | ✓ | | * | *f | *f, b | BKO*f, b |
| *Ardenna tenuirostris* | Short-tailed Shearwater | | ✓(M) | ✓ | | * | - | BKO*f, b | BKO*f, b |
| *Hydroprogne caspia* | Caspian Tern | | ✓(M) | ✓ | | | - | - | BKO |
| *Onychoprion fuscatus* | Sooty Tern | | | ✓ | | | - | - | BKO |
| *Sterna striata* | White-fronted Tern | | | ✓ | | | FLO | FLO | FLO |
| *Sternula albifrons* | Little Tern | V | ✓ (M) | ✓ | | | - | BKO | BKO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Sternula nereis* | Fairy Tern | | | ✓ | | | - | - | BKO |
| *Sternula nereis nereis* | Australian Fairy Tern | V | | | *Conservation Advice for Sternula nereis nereis (Fairy Tern) (DSEWPaC, 2011)*<br>*National Recovery Plan for the Australian Fairy Tern (Sternula nereis nereis) (DAWE, 2020)* | | FLO | KO | KO |
| *Thalasseus bergii* | Greater Crested Tern | | ✓ (W) | ✓ | | * | - | BKO | BKO* [f, b] |
| *Charadrius bicinctus* | Double-banded Plover | | ✓ (W) | ✓ | | | - | RKO | RKO |
| *Charadrius leschenaultii* | Greater Sand Plover | V | ✓ (W) | ✓ | *Conservation Advice for Charadrius leschenaultia (Greater Sand Plover) (TSSC, 2016b)* | | - | LO | KO |
| *Charadrius mongolus* | Lesser Sand Plover | E | ✓ (W) | ✓ | *Conservation Advice for Charadrius mongolus (Lesser Sand Plover) (TSSC, 2016h)* | | - | RKO | RKO |
| *Charadrius ruficapillus* | Red-capped Plover | | | ✓ | | | - | RKO | RKO |
| *Pluvialis fulva* | Pacific Golden Plover | | ✓ (W) | ✓ | | | - | RKO | RKO |
| *Pluvialis squatarola* | Grey Plover | V | ✓ (W) | ✓ | *Approved Conservation Advice for Pluvialis squatarola (grey plover) (DCCEEW, 2024e)* | | - | - | RKO |
| *Thinornis cucullatus* | Hooded Plover | | | ✓ | | | - | KO | KO |
| *Thinornis cucullatus cucullatus* | Eastern Hooded Plover | V | | ✓ | *Conservation Advice for Thinornis rubricollis rubricollis (Hooded Plover, Eastern) (TSSC, 2014)* | | - | KO | KO |
| *Anous stolidus* | Common Noddy | | ✓ (M) | ✓ | | | - | LO | LO |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | | | ✓ | | | - | BKO | BKO |
| *Apus pacificus* | Fork-tailed Swift | | ✓ (M) | ✓ | | | LO | LO | LO |
| *Phaethon lepturus* | White-tailed Tropicbird | | ✓ (M) | ✓ | | | - | - | MO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Himantopus himantopus* | Pied Stilt | | | | | | - | RKO | RKO |
| *Calidris canutus* | Red Knot | V | ✓ (W) | ✓ | *Conservation Advice for Calidris canutus (Red Knot) (DCCEEW, 2024a)* | | MO | KO | KO |
| *Calidris tenuirostris* | Great Knot | V | ✓ (W) | ✓ | *Conservation Advice for Calidris tenuirostris (Great Knot) (DCCEEW, 2024b)* | | - | - | RKO |
| *Fregata ariel* | Lesser Frigatebird | | ✓ (M) | ✓ | | | - | - | MO |
| *Fregata minor* | Great Frigatebird | | ✓ (M) | ✓ | | | - | - | MO |
| *Numenius madagascariensis* | Eastern Curlew | CE | ✓ (W) | ✓ | *Conservation Advice for Numenius madagascariensis (far eastern curlew) (DCCEEW, 2023r)* | | MO | KO | KO |
| *Larus dominicanus* | Kelp Gull | | | ✓ | | | - | - | BKO |
| *Larus pacificus* | Pacific Gull | | | ✓ | | | - | BKO | BKO |
| *Chroicocephalus novaehollandiae* | Silver Gull | | | ✓ | | | - | BKO | BKO |
| *Morus capensis* | Cape Gannet | | | ✓ | | | - | BKO | BKO |
| *Morus serrator* | Australasian Gannet | | | ✓ | | * | - | BKO*[f, a] | BKO*[f, a] |
| *Stercorarius antarcticus* | Brown Skua | | | ✓ | | | MO | MO | MO |
| *Eudyptula minor* | Little Penguin | | | ✓ | | * | - | BKO | BKO*[f, b] |
| *Anseranas semipalmata* | Magpie Goose | | | ✓ | | | - | MO | MO |
| *Bubulcus ibis* | Cattle Egret | | | ✓ | | | - | MO | MO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Lathamus discolor* | Swift Parrot | CE | | ✓ | *Conservation Advice for Lathamus discolour (Swift Parrot) (TSSC, 2016d)*<br>*National Recovery Plan for the Swift Parrot (Lathamus discolor) (DCCEEW, 2024m)* | | - | KO | KO |
| *Merops ornatus* | Rainbow Bee-eater | | | ✓ | | | - | MO | MO |
| *Calidris subminuta* | Long-toed Stint | | ✓ (W) | ✓ | | | - | - | KO |
| *Numenius minutus* | Little Curlew | | ✓ (W) | ✓ | | | - | RLO | RLO |
| *Numenius phaeopus* | Whimbrel | | ✓ (W) | ✓ | | | - | RKO | RKO |
| *Tringa incana* | Wandering Tattler | | ✓ (W) | ✓ | | | - | - | RKO |
| *Tringa brevipes* | Grey-tailed Tattler | | ✓ (W) | ✓ | | | - | RKO | RKO |
| *Tringa nebularia* | Common Greenshank | E | ✓ (W) | ✓ | *Conservation Advice for Tringa nebularia (Common Greenshank) (DCCEEW, 2024f)* | | - | KO | KO |
| *Tringa stagnatilis* | Marsh Sandpiper | | ✓ (W) | ✓ | | | - | RKO | RKO |
| *Pandion haliaetus* | Osprey | | ✓ (W) | ✓ | | | - | KO | KO |
| *Limosa lapponica* | Bar-tailed Godwit | | ✓ (W) | ✓ | | | - | KO | KO |
| *Limosa lapponica baueri* | Nunivak Bar-tailed Godwit | E | | | *Conservation Advice for Limosa lapponica baueri (Alaskan bar-tailed godwit) (DCCEEW, 2024j)* | | - | KO | KO |
| *Limosa limosa* | Black-tailed Godwit | E | ✓ (W) | ✓ | *Conservation Advice for Limosa limosa (Black-tailed Godwit) (DCCEEW, 2024g)* | | - | - | RKO |
| *Gallinago hardwickii* | Latham's Snipe | V | ✓ (W) | ✓ | *Conservation Advice for Callinago hardwickii (Latham's Snipe) (DCCEEW, 2024h)* | | - | KO | KO |
| *Gallinago megala* | Swinhoe's Snipe | | ✓ (W) | ✓ | | | - | RLO | RLO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Gallinago stenura* | Pin-tailed Snipe | | ✓ (W) | ✓ | | | - | RLO | RKO |
| *Arenaria interpres* | Ruddy Turnstone | V | ✓ (W) | ✓ | *Conservation Advice for Arenaria interpres (Ruddy Turnstone) (DCCEEW, 2024i)* | | - | RKO | RKO |
| *Calidris alba* | Sanderling | | ✓ (W) | ✓ | | | - | RKO | RKO |
| *Calidris ruficollis* | Red-necked Stint | | ✓ (W) | ✓ | | | - | RKO | RKO |
| *Calidris subminuta* | Long-toed Stint | | ✓ (W) | ✓ | | | - | - | KO |
| *Phalaropus lobatus* | Red-necked Phalarope | | ✓ (W) | ✓ | | | - | - | RKO |
| *Philomachus pugnax* | Ruff (Reeve) | | ✓ (W) | ✓ | | | - | - | RKO |
| *Chalcites osculans* | Black-eared Cuckoo | | | ✓ | | | - | KO | KO |
| *Cuculus optatus* | Oriental Cuckoo, Horsfield's Cuckoo | | ✓ (T) | | | | - | - | KO |
| *Stiltia isabella* | Australian Pratincole | | | ✓ | | | - | - | KO |
| *Neophema chrysogaster* | Orange-bellied Parrot | CE | | ✓ | *National Recovery Plan for the Orange-bellied Parrot (Neophema chrysogaster) (DELWP, 2016)* | | MLO | KO | BKO |
| *Neophema chrysostoma* | Blue-winged Parrot | V | | ✓ | *Conservation Advice for Neophema chrysostoma (blue-winged parrot) (DCCEEW, 2023d)* | | - | KO | KO |
| *Phalacrocorax fuscescens* | Black-faced Cormorant | | | ✓ | | * | - | BKO | BKO*f, b |
| *Recurvirostra novaehollandiae* | Red-necked Avocet | | | ✓ | | | - | RKO | RKO |
| *Rostratula australis* | Australian Painted Snipe | E | | ✓ | *Conservation Advice for Rostratula australis (Australian painted snipe) (DSEWPaC, 2013b)*<br>*National Recovery Plan for the Australian Painted Snip (Rostratula australis) (DCCEEW, 2022g).* | | - | KO | KO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Pachyptila turtur* | Fairy Prion | | | ✓ | | | MO | KO | KO |
| *Pachyptila turtur subantartica* | Fairy Prion (southern) | V | | | *Conservation Advice for Pachyptila turtur subantartica (Fairy Prion Southern) (TSSC, 2015d)* | | MO | KO | KO |
| *Motacilla cinerea* | Grey Wagtail | | ✓ (T) | ✓ | | | - | - | KO |
| *Motacilla flava* | Yellow Wagtail | | ✓ (T) | ✓ | | | - | MO | KO |
| *Myiagra cyanoleuca* | Satin Flycatcher | | ✓ (T) | ✓ | | | - | - | BKO |
| *Monarcha melanopsis* | Black-faced Monarch | | ✓ (T) | ✓ | | | - | - | KO |
| *Rhipidura rufifrons* | Rufous Fantail | | ✓ (T) | ✓ | | | - | - | KO |
| *Symposiachrus trivirgatus* | Spectacled Monarch | | ✓ (T) | ✓ | | | - | - | KO |
| *Hirundapus caudacutus* | White-throated Needletail | V | ✓ (T) | ✓ | *Conservation Advice Hirundapus caudacutus White-throated Needletail (TSSC, 2019b)* | | - | KO | RKO |
| *Acanthiza pusilla magnirostris* | King Island Brown Thornbill, Brown Thornbill (King Island) | E | | | *Conservation Advice for Acanthiza pusilla magnirostris (King Island brown thornbill) (DCCEEW, 2023e)*<br>*King Island Biodiversity Management Plan (DPIPWE, 2012)* | | - | - | KO |
| *Acanthornis magna greeniana* | King Island Scrubtit, Scrubtit (King Island) | CE | | | *Conservation Advice for Acanthornis magna greeniana (King Island scrubtit) (DCCEEW, 2023f)*<br>*King Island Biodiversity Management Plan (DPIPWE, 2012)* | | - | - | KO |
| *Anthochaera phrygia* | Regent Honeyeater | CE | | | *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia) (DoE, 2016)*<br>*Conservation Advice Anthochaera phrygia regent honeyeater (TSSC, 2015h)* | | - | KO | KO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Aphelocephala leucopsis* | Southern Whiteface | V | | | *Conservation Advice for Aphelocephala leucopsis (southern whiteface) (DCCEEW, 2023g)* | | - | MO | KO |
| *Aquila audax fleayi* | Tasmanian Wedge-tailed Eagle | E | | | *Threatened Tasmanian Eagles Recovery Plan 2006-2010 (Threatened Species Section, 2006)* | | - | - | KO |
| *Botaurus poiciloptilus* | Australasian Bittern | E | | | *Conservation Advice Botaurus poiciloptilus Australasian Bittern (TSSC, 2019)*<br>National Recovery Plan for the Australasian Bittern (*Botaurus poiciloptilus*) (DCCEEW, 2022h). | | - | KO | KO |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | E | | | *Conservation Advice for Callocephalon fimbriatum (Gang-gang Cockatoo) (DAWE, 2022)* | | - | KO | KO |
| *Calyptorhynchus banksii graptogyne* | South-eastern Red-tailed Black-Cockatoo | E | | | *National Recovery Plan for the South-Eastern Red-tailed Black-Cockatoo Calyptorhynchus banksii graptogyne (CoA, 2007)* | | - | - | KO |
| *Calyptorhynchus lathami lathami* | South-eastern Glossy Black-Cockatoo | V | | | *Conservation Advice for Calyptorhynchus lathami lathami (South-eastern Glossy Black Cockatoo) (DCCEEW, 2022d)* | | - | MO | KO |
| *Ceyx azureus diemenensis* | Tasmanian Azure Kingfisher | E | | | *Conservation Advice for Ceyx azureus diemenensis (Tasmanian Azure Kingfisher) (DEWHA, 2010a)* | | - | - | KO |
| *Climacteris picumnus victoriae* | Brown Treecreeper (south-eastern) | V | ✓ | | *Conservation Advice for Climacteris picumnus victoriae (brown treecreeper (south-eastern)) (DCCEEW, 2023h)* | | - | MO | KO |
| *Dasyornis brachypterus* | Eastern Bristlebird | E | | | *National Recovery Plan for Eastern Bristlebird Dasyornis brachypterus (CoA, 2022c)* | | - | KO | KO |
| *Falco hypoleucos* | Grey Falcon | V | | | *Conservation Advice Falco hypoleucos Grey Falcon (TSSC, 2020b)* | | - | LO | LO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Grantiella picta* | Painted Honeyeater | V | | | *Conservation Advice Grantiella picta painted honeyeater (TSSC, 2015i)*<br>*National Recovery Plan for the Painted Honeyeater (Grantiella picta) (DAWE, 2021a)* | | - | KO | KO |
| *Leipoa ocellata* | Malleefowl | V | | | *National Recovery Plan for Malleefowl (Benshemesh, 2007)* | | - | - | LO |
| *Melanodryas cucullata cucullata* | South-eastern Hooded Robin | E | | | *National Recovery Plan for the South-Eastern Red-tailed Black-Cockatoo Calyptorhynchus banksii graptogyne (CoA, 2007)* | | - | MO | MO |
| *Pedionomus torquatus* | Plains-wanderer | CE | | | *Conservation Advice Pedionomus torquatus plains-wanderer (TSSC, 2015j)*<br>*National Recovery Plan for the Plains-wanderer (Pedionomus torquatus) (CoA, 2016)* | | - | MO | LO |
| *Pezoporus occidentalis* | Night Parrot | E | | | *Conservation Advice Pezoporus occidentalis night parrot (TSSC, 2016i)* | | - | - | MO |
| *Platycercus caledonicus brownii* | Green Rosella (King Island) | V | | | *Conservation Advice Platycercus caledonicus brownii green rosella (King Island) (TSSC, 2015m)* | | - | - | KO |
| *Pycnoptilus floccosus* | Pilotbird | V | | | *Conservation Advice for Pycnoptilus floccosus (Pilotbird) (DAWE, 2022a)* | | - | KO | KO |
| *Stagonopleura guttata* | Diamond Firetail | V | | | *Conservation Advice for Stagonopleura guttata (diamond firetail) (DCCEEW, 2023j)* | | - | KO | KO |
| *Strepera fuliginosa colei* | Black Currawong (King Island) | V | | | *Conservation Advice Strepera fuliginosa colei black currawong (King Island) (TSSC, 2015n)* | | - | - | BLO |
| *Tyto novaehollandiae castanops* (Tasmanian population) | Masked Owl (Tasmanian) | V | | | *Conservation Advice for Tyto novaehollandiae castanops (Tasmanian Masked Owl) (DEWHA, 2010b)* | | - | - | KO |
| *Threatened Species:* | *Type of Presence:* | | | | | | | | |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| *V* | *Vulnerable* | *MO* | *Species of species habitat may occur within area* |
| *E* | *Endangered* | *LO* | *Species or species habitat likely to occur within area* |
| *CE* | *Critically Endangered* | *KO* | *Species or species habitat known to occur within area* |
| *Migratory Species:* | | *MLO* | *Migration route known to occur within area* |
| *M* | *Marine* | *FMO* | *Foraging, feeding or related behaviour may occur within area* |
| *W* | *Wetland* | *FLO* | *Foraging, feeding or related behaviour likely to occur within area* |
| *T* | *Terrestrial* | *FKO* | *Foraging, feeding or related behaviour known to occur within area* |
| Biologically Important Area (Designation shown where relevant in each spatial extent column) | | *BLO* | *Breeding likely to occur within area* |
| | | *BKO* | *Breeding known to occur within area* |
| ✓ | *BIA Present* | *RLO* | *Roosting likely to occur within area* |
| *f* | *Foraging* | *RKO* | *Roosting known to occur within area* |
| *a* | *Aggregation* | | |
| *b* | *Breeding* | | |
| *m* | *Migration* | | |

#### *6.5.7.1 Seabirds*

**Albatross and Petrels**

There are 14 species of albatross that may occur within the operational area, with an additional 2 that may occur within the monitoring area. Of the 16 species with potential presence in the monitoring area, 15 are listed as threatened or migratory under the EPBC Act and are known or likely to occur or have a BIA or habitat critical to their survival and are listed below. The monitoring area overlaps 8 species have BIAs* that overlap the monitoring area. Of these species, 7 have BIAs that overlap the operational area. Those with BIAs are displayed in Figure 6-33 and Figure 6-40.

- Antipodean albatross – Foraging BIA*
- Black-browed albatross – Foraging BIA*
- Buller's albatross – Foraging BIA*
- Campbell albatross – Foraging BIA*
- Chatham albatross
- Gibson's albatross
- Indian yellow-nosed albatross – Foraging BIA*
- Northern Buller's albatross
- Northern royal albatross
- Salvin's albatross
- Shy albatross – Foraging Likely BIA*
- Sooty albatross
- Southern royal albatross
- Wandering albatross – Foraging BIA*
- White-capped albatross – Foraging BIA*.

Albatross species exhibit a broad range of diets and foraging behaviours; this combined with their ability to cover vast oceanic distances, means all waters within Australian jurisdiction can be considered foraging habitat for this species (DCCEEW, 2022e). However, the most critical foraging habitat is considered to be in waters south of 25°S where most species spend the majority of their foraging time (DCCEEW, 2022e). Therefore, albatross are likely to fly through and forage within the operational area and monitoring area.

Albatross species typically forage during the day and are less active at night as their ability to see and capture prey from the air is reduced, meaning they are less likely to be impacted by artificial light (Phalan et al., 2007). Albatrosses typically feed offshore, mainly along the edge of the continental shelf and over open waters, where they catch fish and cephalopods (e.g. squid, cuttlefish) by diving into the water (DSEWPaC, 2012a).

No habitats critical to the survival of threatened albatross species occur within the operational area or monitoring area, this includes known nesting sites or migrating sites.

The **Shy Albatross** is the only albatross endemic to Australia. The species breeds annually over an 8-month period between September and April on 3 islands located off the coast of Tasmania with Albatross Island located in the western Bass Strait, Mewstone and Pedra Branca located in the southern Bass Strait (ACAP, 2023). These islands are listed as Critical Habitat for the shy albatross, however, are all outside of the operational area and monitoring area. Individuals can be found at the colonies year-round exhibiting high site fidelity (TSSC, 2020). Adult individuals predominantly occur in waters adjacent to Tasmanian and southern Australia, while juveniles range extends across the Indian Ocean to southern Africa and potentially the south-western Atlantic Ocean (TSSC, 2020). This species feeds by surface seizing, however they have been observed to dive for prey and can swim down to 7 m (ACAP, 2023).



*Figure 6-32 Shy albatross with common dolphins observed from IMR vessel offshore Victoria in Gippsland region, 2023. Photo attributed to Claudia Hartmeier, Marine Fauna Observer.*

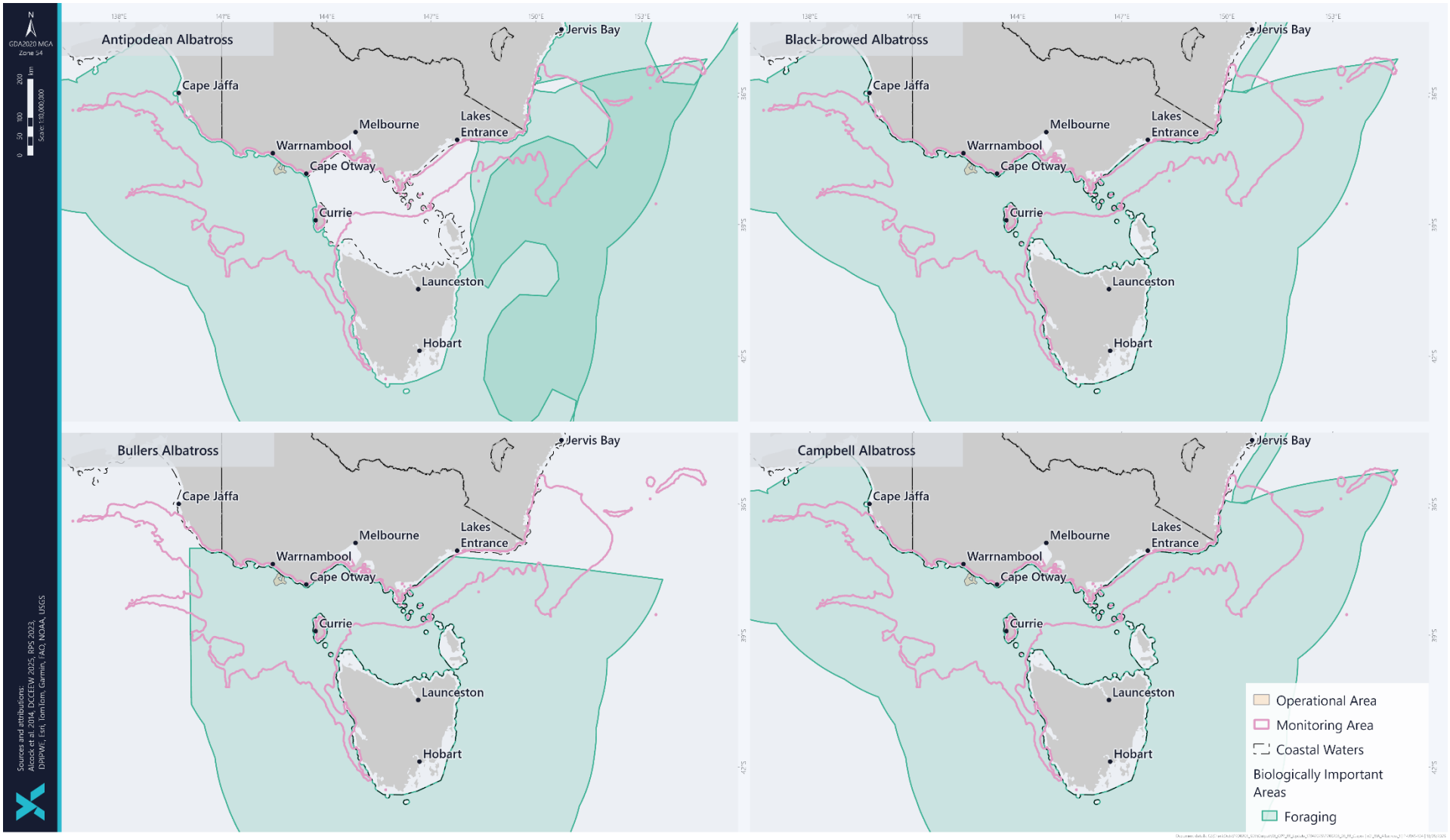



*Figure 6-33: Albatross species with BIAs within the monitoring area (1)*

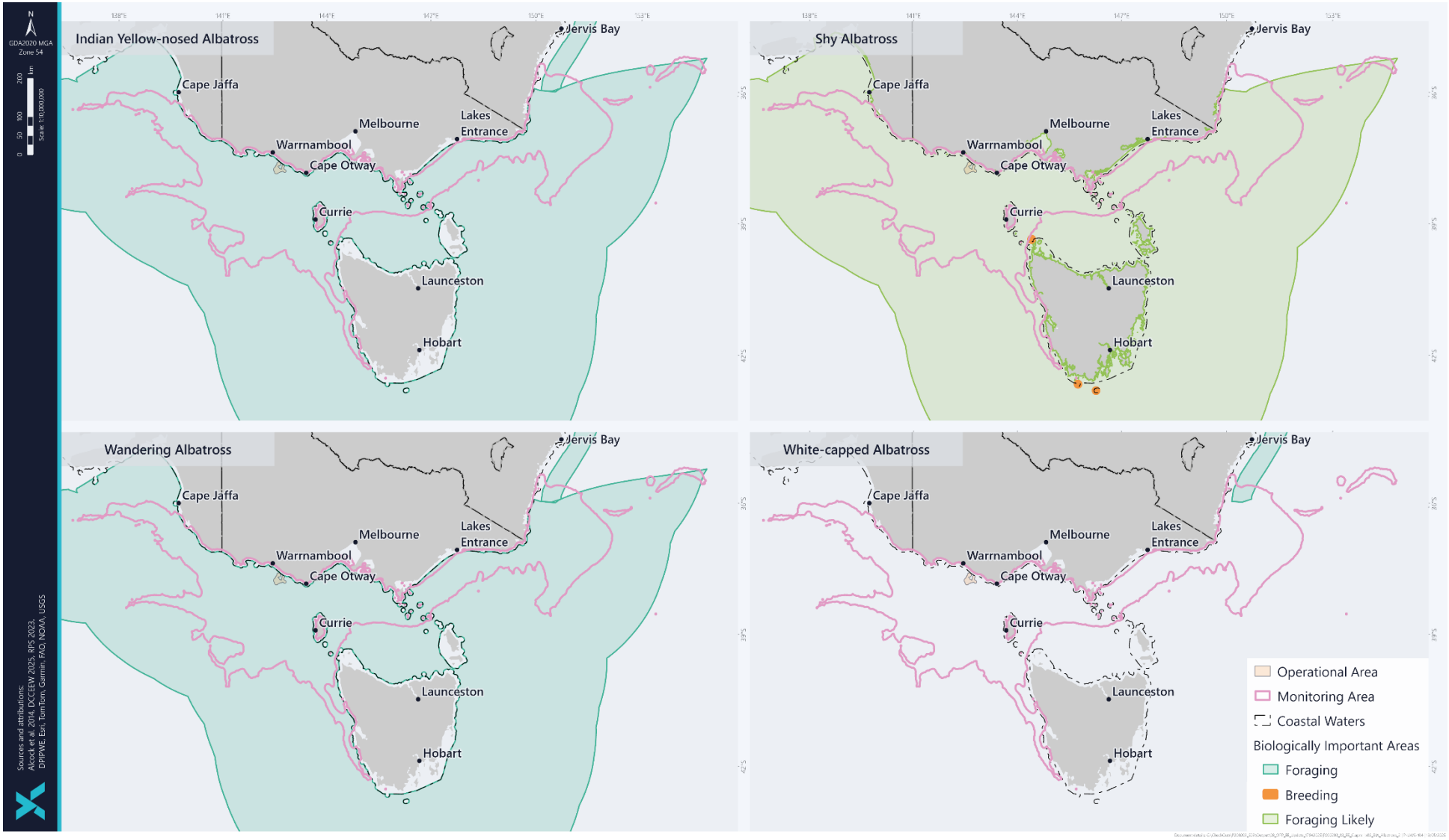



*Figure 6-34: Albatross species with BIAs within the monitoring area (2)*

There are 5 species of petrel that may occur within the operational area, with an additional 9 that may occur within the monitoring area. Of the 14 species with potential presence in the monitoring area, 12 are listed as threatened or migratory under the EPBC Act and are known or likely to occur or have a BIAs or habitat critical to their survival and are listed below. The monitoring area overlaps 8 species with BIAs*. Of these species only the common-diving petrel, has a foraging BIA which overlaps the operational area  Those with BIAs are displayed in Figure 6-35 and Figure 6-36.

- Black petrel – Foraging BIA*
- Blue petrel
- Common-diving petrel – Foraging and Breeding BIA*
- Gould's petrel
- Great-winged petrel – Foraging BIA*
- Kermadec petrel (western)
- Northern giant petrel – Foraging BIA*
- Soft-plumage petrel – Foraging*
- Southern giant petrel – Foraging BIA*
- White-bellied storm-petrel (Tasman Sea)
- White-faced storm petrel – Foraging and Breeding BIA*
- Wilsons storm petrel – Migration BIA*.

Similar to albatrosses, the petrels have a diverse foraging range, and all waters within Australian jurisdiction can be considered foraging habitat for this species (DCCEEW, 2022e). Typical diet for petrels includes cephalopods (e.g. squid) and fish, and prey is predominately caught by surface-seizing (DSEWPaC, 2011a). Therefore, petrels are likely to overfly and may forage within the operational area and monitoring area.

Petrels are considered to mainly be nocturnal at their breeding places making them susceptible to light emissions when they commute from their onshore colonies to the sea (Chevillion et al., 2022). One of the most critical phases in the life of petrels occurs during fledging (Rodríguez et al., 2017). Fledging is the juvenile's first flight from colony to sea which typically occurs within the first two hours after sunset during the fledging period (Gineste, 2016 cited in Chevillion et al., 2022). Survival rates during the first few weeks as a fledging are the lowest as there is no parental care and young petrels will need to learn how to fly, search and capture food, and maintain plumage alone (Menkhorst, 2010). This biologically sensitive period can be impacted by light and can cause fledgling grounding or fallout events, sometimes leading to mortality (Atchoi et al., 2024). Impacts to fledglings from light emissions are assessed in Section 8.3.4.5.

Neither the common-diving petrel or the white-faced storm petrel are listed as threatened species under the EPBC Act. These species have large populations within Australia, accounting for 5% and 25% respectively of the global population (CoA, 2015a). The common diving-petrel breeds on islands off south-east Australia and Tasmania; there are 30 sites with significant breeding colonies (defined as more than 1,000 breeding pairs) known in Tasmania, and 12 sites in Victoria (including Seal Island (~325 km east of operational area), Wilsons Promontory (~300 km east of operational area) and Deen Maar (~59 km west of operational area)) (CoA, 2015a). For the white-faced storm petrel, there are 15 sites with significant breeding colonies in Tasmania and 3 sites in Victoria including Tullaberga Island, Mud Island and South Channel Island (ranging from 170 to 630 km east of the operational area) (CoA, 2015a).

No habitats critical to the survival of EBPC listed threatened petrel species occur within the operational area or monitoring area; this includes known nesting sites or migrating sites.

The Wilson's storm petrel is one of the most abundant seabirds and has an extremely large range, however it is most often seen over the continental shelf (DoE, 2023). This species breeds in Antarctic waters and undergoes a trans-equatorial migration, where most individuals

spend the non-breeding season in the north Atlantic and north Indian Oceans (CoA, 2020). During migrations individuals will typically stay far out at sea.

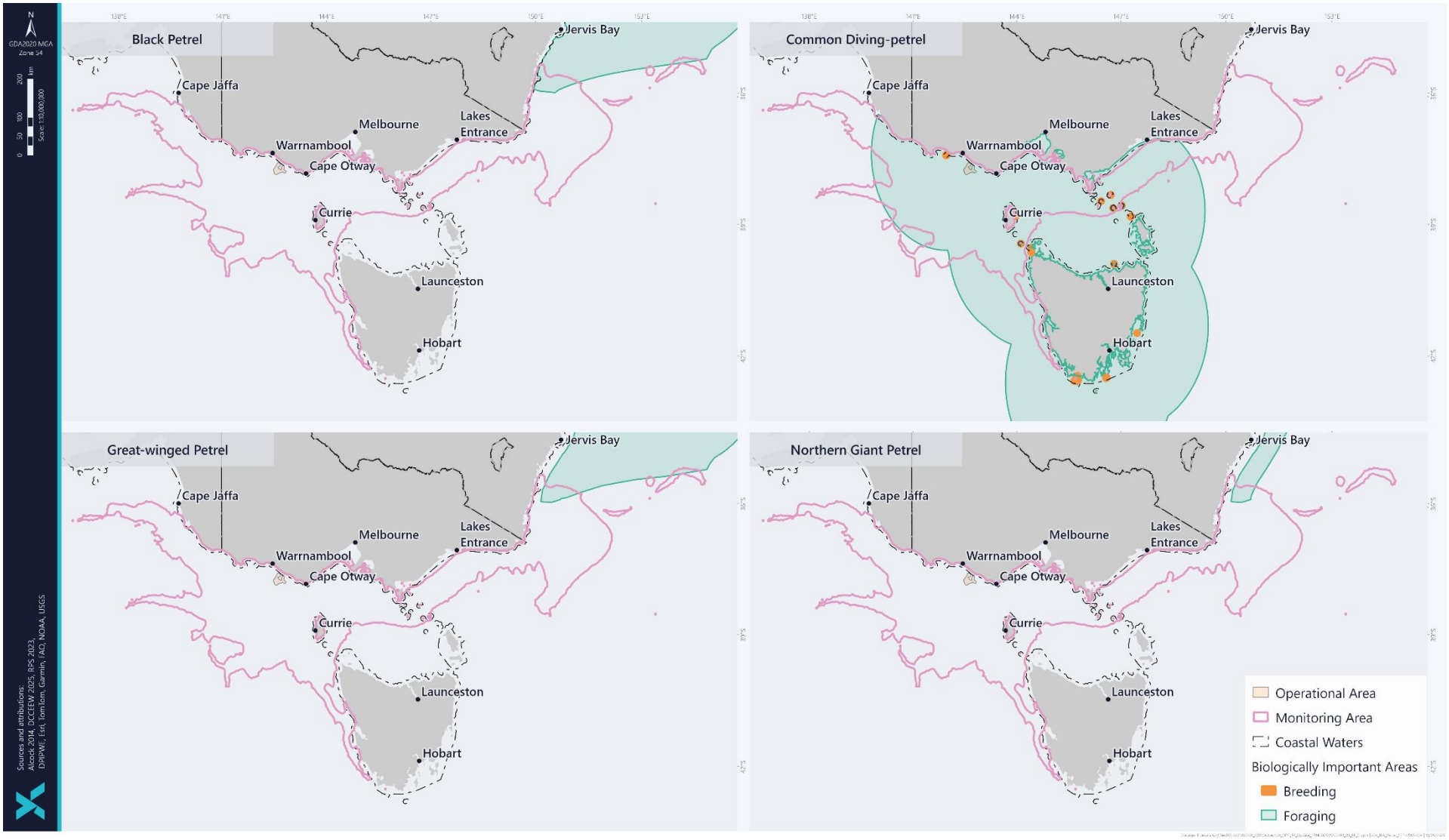



*Figure 6-35: Petrel species with BIAs within the monitoring area (1)*

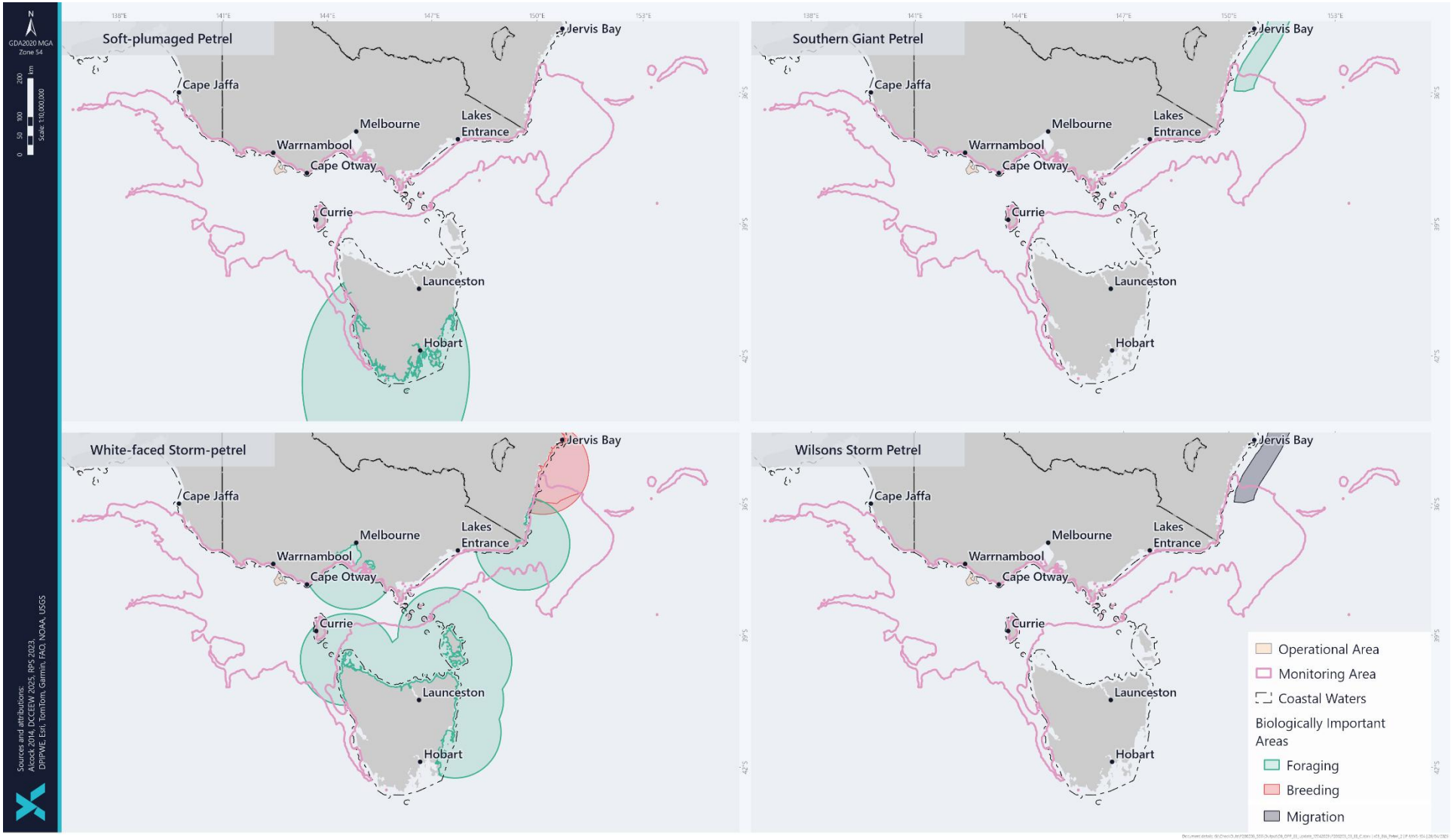



*Figure 6-36: Petrel species BIAs within the monitoring area (2)*

**Shearwaters**

The shearwaters represent the most abundant seabird in Australia. There are 2 species of shearwater that may occur within the operational area, with an additional 2 that may occur within the monitoring area. Of the 4 species with a potential presence in the monitoring area, all have BIAs which are listed below and displayed in Figure 6-38. Of these species, only the short-tailed shearwater has a BIA which overlaps the operational area.

- Flesh-footed shearwater – Foraging BIA
- Wedge-tailed shearwater – Foraging BIA
- Sooty shearwater – Foraging and Breeding BIA
- Short-tailed shearwater – Foraging and Breeding BIA.

Shearwaters are typically pelagic species, except during breeding seasons where they are found on remote islands or coastal headlands. The breeding season in eastern and south-eastern Australia for shearwaters is typically over summer; late-August/early-September to May (DoE, 2023). Shearwater nests are usually in burrows or rock crevices. Known breeding locations for Shearwater species within the monitoring area include:

- Northern-central Bass Strait (e.g. Phillip island)
- Western Victoria (e.g., Griffiths Island, Deen Maar)
- New South Wales oceanic islands (e.g., Montagu Island)
- Tasmanian oceanic islands (e.g., Kent Group Islands, Hogan Group Islands).

Similar to petrels, shearwaters are considered to mainly be nocturnal at their breeding places making them highly sensitive to light when they commute from their colonies to the sea (Chevillion et al., 2022). The fledgling phase for shearwaters is also considered a critical phase (Rodriquez et al., 2017). The fledging season may vary between species; however it is known to occur over a short period of time and the first flight typically occurs within the first two hours after sunset (Gineste, 2016 cited in Chevillion et al., 2022). For example, it is widely accepted that the fledging period of the short-tailed shearwater occurs between the third week of April and the first week of May each year (Skira, 1991; Rodríguez et al., 2014; Price, 2022). Known breeding locations located in the vicinity of the operational area include Griffiths Island, Muttonbird Island and Deen Maar which are 58.8 km, 18 km and 41.5 km from the operational area, respectively, from their closest points. This biologically sensitive period can be impacted by light which can cause fledgling grounding or fallout events, sometimes leading to mortality (Atchoi et al., 2024). This issue has been recorded within shearwater populations of Phillip Island, where lights from urbanised areas and traffic nearby breeding colonies (<10 km away) been associated with groundings and road mortality (birds being struck by cars) (Rodríguez et al., 2014). Victoria's Phillip Island, which is 195 km northeast of the operational area is home to the world's largest colonies of migratory short-tailed shearwaters, with more than 6% of the global population supported at this nesting site (DCCEEW, 2023k). Impacts to fledglings from light emissions are assessed in Section 8.3.4.5

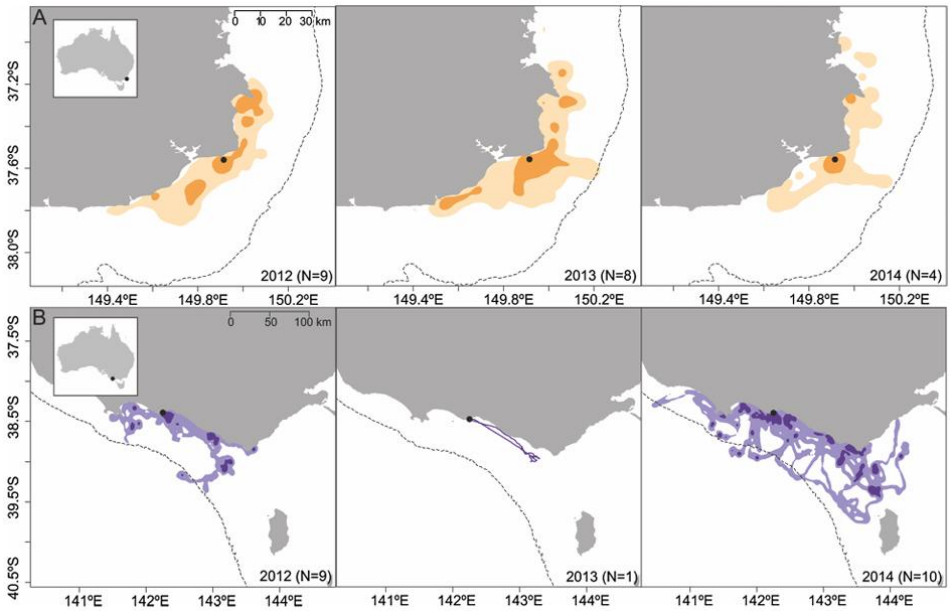
Shearwaters are known to forage for a variety of pelagic prey, including krill, cephalopods, fish and crustaceans. Food is usually taken by pursuit-plunging, surface plunging or surface-seizing; however other methods (e.g., hydroplaning, deep plunging) may be used. South-eastern Australia is characterised by contrasting oceanic conditions which can influence the foraging decisions of breeding short-tailed shearwaters. During the chick-rearing period, many shearwater species use a dual foraging strategy, generally involving short trips close to the breeding grounds and longer trips extending to highly productive areas, such as the Southern Ocean (Berlincourt and Arnould, 2015). The short-tailed shearwater has been observed foraging at Griffith Island in inshore habitat and over the continental shelf edge (20-240 km from the colony) (Figure 6-37) (Berlincourt and Arnould, 2015). A similar strategy was found by Raymond et al., 2010 who noted that breeding adult sooty and short-tailed shearwaters typically forage locally to the colony to provide for their chicks, but periodically undertake long foraging trips to Antarctic waters. This strategy is used to efficiently maintain parental body reserves while provisioning young, however, during years with lower food availability, it is likely

that short-tailed shearwaters will extend out their foraging ranges to find profitable prey (Berlincourt and Arnould., 2015). Therefore, considering the proximity of known shearwater breeding islands it is considered that they would be likely to overfly and forage within the operational area and monitoring area.

The timing of the incubation phase for shearwaters occurs between 21-24 November (±8 days) (Beaver, 2022). The arrival through to the incubation phase for wedge-tailed shearwaters use areas close to the colony using habitat south of Montague Island into the western edge of Bass Strait (Beaver, 2022). During the chick-rearing phase, occurring from 10-13 January (± 10 days), shearwaters are known to use areas further south past Bass Strait into south-east of Tasmania (Beaver, 2022).

The short-tailed shearwater is one of few native birds that is still commercially harvested to this day. Short-tailed shearwaters, or “muttonbirds” are harvested annually in Tasmania under the regulation of the Tasmanian government (CoA, 2020). Harvesting muttonbirds is a traditional activity that Tasmanian Aboriginal peoples have participated in for thousands of years. There are 3 separately managed harvests that occur in Tasmania:

- Indigenous commercial harvest - occurs on 3 islands in the Bass Strait (Trefoil Island, Great Dog (or Big Dog) Island and Babel Island). This harvest is licensed by the Tasmanian Government but entirely self-managed with no set quotas, just a restricted season duration.
- Indigenous cultural harvest – undertaken under permit on a couple of small sites including South Arm and Cape Queen Elizabeth on Bruny Island. The Tasmanian Government monitors the South Arm colony, the number of harvesters is restricted, and daily bag limits apply. There is also a small unreported cultural harvest on indigenous-owned islands.
- Recreational harvest – undertaken under licence between 38 and 44 of Tasmania’s known 209 colonies and is open to anyone eligible for purchasing a recreational licence. Harvest areas include the Bass Strait Island of King Island, Hunter Island Group and the Furneaux Island Group. The season generally runs for 16 days with a daily bag limit of 25 birds (15 on the west coast) (CoA, 2020).




*Source: (Berlincourt and Arnould., 2015)*

*Figure 6-37: Distribution of short-tailed shearwater foraging in the Bass Strait from (a) Gabo Island and (b) Griffith island breeding colonies. Darker shaded colours represent the core foraging area while light colours represent the home range.*

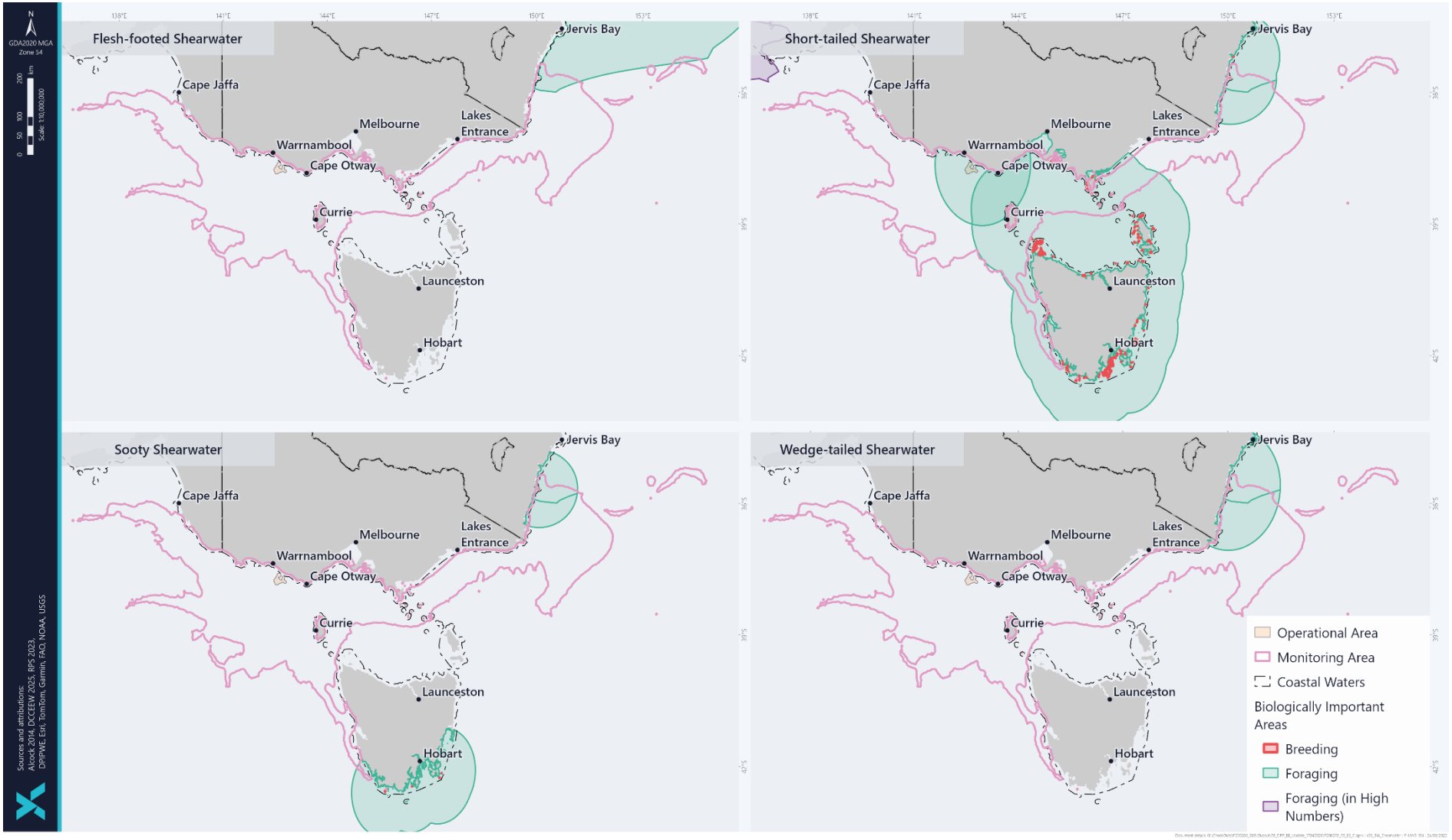



*Figure 6-38: Shearwater species with BIAs within the monitoring area*

**Terns**

There is one species of tern that may occur within the operational area, with an additional 7 that may occur within the monitoring area. None of these species have known BIAs that overlap with the operational area. Of the 7 species with potential presence in the monitoring area, 4 are listed as threatened or migratory under the EPBC Act and are known or likely to occur or have either a BIA or habitat critical to their survival and are listed below. Those with BIAs are displayed in Figure 6-40.

- Greater crested tern – Foraging and Breeding BIA
- Little tern
- Caspian tern
- Australian fairy tern.

Many tern species are widespread and occupy beach, wetland, grassland and beach habitats. Terns rarely swim; they hunt for prey in flight, dipping to the water surface or plunge-diving for prey (Flegg, 2002) usually within sight of land, for fish, squid, jellyfish and sometimes crustaceans (DEWHA, 2007).

Terns breed in colonies on small offshore islands, including those of the Furneaux Group in the eastern Bass Strait, and the Lord Howe Island group. Nests are in the open in sand or coral scrapes or among low vegetation (DoE, 2023). Tern species may be susceptible to impacts from artificial light pollution including foraging and nesting interference as well as disorientation during migration (CoA, 2020). Bright lights may disorient adult terns, during colony establishment or when returning to nests at night. This can lead to nest abandonment, exposing eggs and chicks to the elements or predators (CoA, 2023).

The greater crested tern is not listed as a threatened species under the EPBC Act; however, it is listed as migratory. During the breeding season this species can be found on islands and coastlines of tropical and subtropical areas, including Australia, where it breeds in dense colonies or in small groups. Outside of the breeding season it can be found at sea throughout this range (CoA, 2020). Therefore, species of tern are likely to overfly and may forage within the operational area and monitoring area.



*Figure 6-39 Crested tern observed on back deck of IMR vessel, offshore Victoria, Gippsland region in 2023. Photo attributed to Claudia Hartmeier, Marine Fauna Observer.*

**Australasian Gannet**

The Australasian gannet is confined to the temperate waters around Australia and New Zealand. Their diet is comprised mainly of pelagic fish, but also squid and garfish. Prey is caught mainly by plunge-diving, but it is also seen regularly attending trawlers (CoA, 2020). Foraging generally occurs during the day over the continental shelf or inshore waters. Australian gannets rely on their vision to locate prey and have been shown to visually accommodate when transitioning between underwater and aerial environments during foraging activities (Machovsky-Capuska et al., 2012). As a result, Australasian gannets are not anticipated to be impacted by artificial light. Australasian gannet breeding is highly seasonal (October–May) (CoA, 2020). Nesting occurs on the ground in small but dense colonies at breeding colonies off the coast of Victoria, Tasmania and New Zealand, including Black Pyramid Rock (Tasmania) and Lawrence Rocks (Victoria) (CoA, 2020). Foraging and aggregation BIAs for the Australasian gannet have been identified within the monitoring area (Figure 6-40). Therefore, considering the proximity of known breeding sites, Australasian gannets are likely to overfly and forage within the operational area and monitoring area.

**Little Penguin**

The little penguin is the smallest species of penguin in the world and are endemic, permanent residents on several inshore and offshore Australian and New Zealand islands (CoA, 2020). Bass Strait has the largest proportion (~60%) of the known breeding colonies in Australia; however, breeding populations are also found on the NSW coast. Individuals exhibit strong site fidelity, returning to the same breeding colony each year to breed in the winter and spring months (Gillanders et al., 2013). The little penguin is a generalist feeder, with large variability in diet amongst colonies (CoA, 2020). Prey may include small school fish, squid and krill. Prey is typically caught with rapid jabs of the beak and swallowed whole. Little penguins are primarily nocturnal which may make them susceptible to impacts from artificial light (CoA, 2020). Studies undertaken at Phillip Island (Victoria) suggest that little penguins have adapted to artificial light over time (Rodríguez et al., 2016). Foraging and breeding BIAs for the little penguin have been identified within the monitoring area (Figure 6-40). Therefore, considering the high occurrence of breeding sites within the region it is considered that the little penguin is likely to transit and forage within the operational area and monitoring area.

**Black-faced Cormorant**

The black-faced cormorant is endemic to southern Australia (CoA, 2020); and is primarily found along the rocky coasts of Tasmania and Victoria. The species feeds in coastal waters on a variety of fish, typically catching prey by pursuit-diving. Black-faced cormorants are mainly active during the day and therefore are not anticipated to be impacted by artificial light. Breeding usually occurs on rocky islands, but also on stacks, slopes and sea cliffs in colonies of up to 2,500 individuals (CoA, 2020). Foraging and breeding BIAs for the black-faced cormorant have been identified within the monitoring area (Figure 6-40). Therefore, considering the proximity of potential breeding grounds it is considered that the black-faced cormorant would be likely to overfly and forage within the operational area and monitoring area.

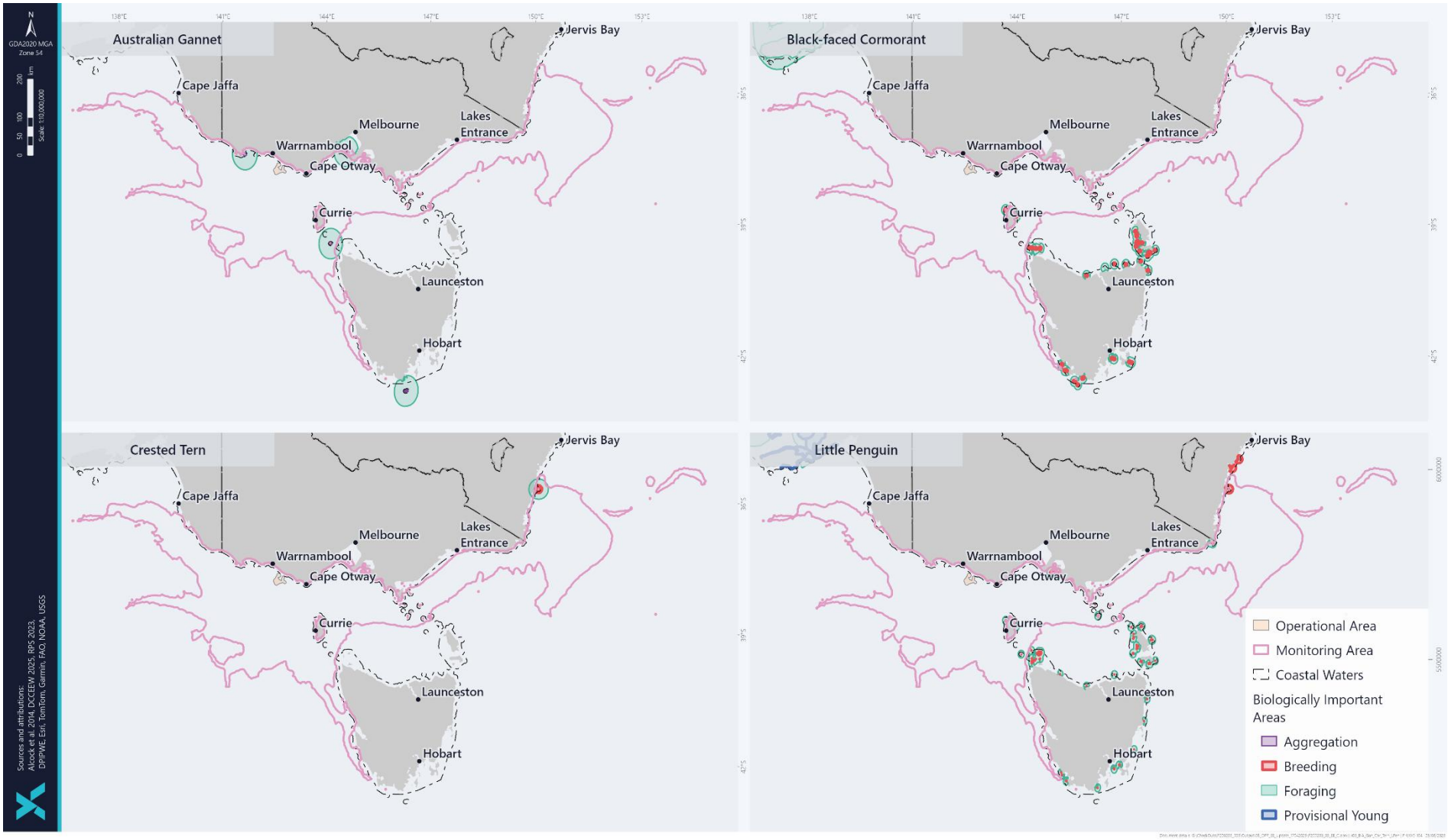



*Figure 6-40: Australian Gannet, Crested Tern, Black-faced Cormorant and Little Penguin BIAs within the monitoring area*

**Common Noddy**

The common noddy is found mainly off the coast of Queensland and occasionally off the north-west and central WA coast, they have also been recorded on Norfolk, Lord Howe, Christmas, and Cocos-Keeling Islands (DoE, 2024). During breeding season, this species nests on islands, rocky islets, coral or sand shoals, or cliffs and forages in the surrounding waters. Breeding colonies are recorded on around 50 Australian islands, ranging from a few pairs to over 100,000 pairs. This species feed during the day foraging mainly on fish, but may also consume squid, molluscs, aquatic insects, and fruit. The common noddy is considered to forage further from the shore than other similar species (DoE, 2024). As they are primarily active during the day (unless roosting or attending breeding colonies), common noddies are not anticipated to be impacted by artificial light. Migrating patterns of this species are unclear, but they are likely migratory, considering breeding islands are mostly or totally abandoned outside of breeding season (DoE, 2024). No biologically important behaviours or areas were identified to overlap the operational area or monitoring area, however, opportunistic foraging may occur.

**Fairy Prion (southern)**

The fairy prion (southern) breeds on Macquarie Island and other subantarctic islands outside of Australia (NRE Tas, 2024). The species has a breeding population of 50 to 250 breeding pairs in Australia and the subantarctic islands. This species will dig burrows among the rocks or low vegetation for nesting. Their foraging activities involve plucking food from the ocean surface, usually feeding off small fish or krill. Some individuals have been recorded to migrate towards New Zealand and Southern Australia (DoE, 2024). Fairy prions generally forage during the day and are only active at night around breeding colonies, thus are not expected to be susceptible to impacts from light emissions in the vicinity of the East Coast Project. No biologically important behaviours or areas were identified to overlap the operational area or monitoring area, however, opportunistic foraging may occur.

#### *6.5.7.2 Shorebirds*

The group of birds generally referred to as waders, or shorebirds, fall under the Charadriiforms order which contains 15 families and subfamilies including plovers (Charadriidae) and sandpipers (Scolopacidae).

These birds typically inhabit shorelines, estuarine mudflats or marshes and are characterized by long legs and bills suited to feeding on invertebrates in soft sediments or shallow water (Tully et al., 2009). Many taxa are considered ground nesters, and may nest on rocky shorelines, or in uplands or polar tundra. Further, many species within these families migrate long distances between summer nesting sites and winter-feeding grounds (Tully et al., 2009). Artificial light can potentially impact flying birds, often affecting their migration stopover selection, and cause their death or injury through collisions with infrastructure (CoA, 2023). The foraging behaviours of these species can also be impacted by light, hampering their ability to prepare for breeding or migration (DCCEEW, 2023k). However, some species have been shown to forage at night, particularly in coastal and wetland habitats, and may use moonlight or artificial light to aid their hunting strategies (McNeil et al., 1999).

Species that are listed as threatened or migratory under the EPBC Act and are known or likely to occur or have either a BIA, or habitat critical to their survival within the monitoring area and are listed under their respective families below.

**Charadriidae**

Six species within the Charadriidae family are listed as threatened or migratory under the EPBC Act and are known or likely to occur or have either a BIA, or habitat critical to their survival within the monitoring area. Species include the grey plover, greater sand plover, lesser sand plover, double-banded plover, Pacific golden plover and the eastern hooded plover. No known BIAs occur within the monitoring area.

**Scolopacidae**

Twenty-nine species within the Charadriidae family are listed as threatened or migratory under the EPBC Act and are known or likely to occur or have either a BIA or habitat critical to their

survival within the monitoring area. Species include the terek sandpiper, wood sandpiper, broad-billed sandpiper, pectoral sandpiper, curlew sandpiper, sharp-tailed sandpiper, common sandpiper, far eastern curlew, marsh sandpiper, long-toed stint, red-necked stint, long-toed stint, black-tailed godwit, bar-tailed godwit, Nunivak bar-tailed godwit, Australian painted snipe, Latham's snipe, Swinhoe's snipe, pin-tailed snipe, wandering tattler, grey-tailed tattler, red knot, great knot, ruff (reeve), red-necked phalarope, ruddy turnstone, sanderling, common greenshank, little curlew, whimbrel. No known BIAs occur within the monitoring area.

The curlew sandpiper is an EPBC listed critically endangered species that is a non-breeding visitor to Australia. The breeding range of this species is restricted to the Russian Arctic where it nests in June and July each year (TSSC, 2015a). Once the breeding season comes to an end, individuals will make the migration to the southern hemisphere, including Australia. Individuals begin to reach the northern shores of Australia in late August and early September where they are resident until mid-January when the earliest departures back to breeding grounds will take place (TSSC, 2015a). In Australia the curlew sandpiper will occupy intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast. Individuals will forage within these habitats where they prey on invertebrates, including worms, molluscs, crustaceans and insects (TSSC, 2015a).

#### *6.5.7.3 Parrots*

There are 4 species of parrots that may occur within the monitoring area. Of those, 3 species are listed as threatened or migratory under the EPBC Act and are known or likely to occur or have a BIA or habitat critical to their survival within the monitoring area and are listed below. No species of parrot have known BIAs within the monitoring area.

- Orange-bellied parrot
- Blue winged parrot
- Swift parrot.

Parrots are very social birds that are characterized by their strong, hooked bills, zygodactyl feet (two toes facing forward and two backward) and vibrant plumage. In, Australia parrots have adapted to diverse ecosystems, thriving in environments which range from arid landscapes to lush rainforests.

Although the orange-bellied parrot and swift parrot do not have defined BIAs within the monitoring area both species participate in yearly migrations over the Bass Strait to mainland Australia for winter. Both species are EPBC listed critically endangered species that strictly breed in Tasmania over summer. Further details on the lifecycle characteristic of each species are provided below.

- The breeding range of the swift parrot is largely restricted to the east and south-east coast of Tasmania and closely mirrors the distribution of blue gum tree (TSSC, 2016d). Individuals will begin to make the migration over to mainland Australia in autumn where they will spend in the non-breeding season. Swift parrots are primarily active during the day (unless roosting), and thus are not anticipated to be susceptible to impacts from artificial light in the vicinity of the East Coast Project. Primary habitat is dry forests and woodlands of the box-ironbark region on the inland slopes of the Great Dividing Range in Victoria. The species can also be found in NSW where they occupy forests and woodlands throughout the coastal and western slopes regions (TSSC, 2016d).
- The breeding range of the orange-bellied parrot is restricted to the south-west of Tasmania, within 10 km of the Melaleuca Lagoon. Breeding habitat is characterised by a mosaic of Eucalypt forest, rainforest and fire dependent moorland and sedgeland plains, in the Tasmanian Wilderness World Heritage Area (DEWLP, 2016). This species is endemic to south-eastern Australia and migrates from breeding grounds in Melaleuca to mainland Australia in April each year (DELWP, 2016). The migration route follows the west coast of Tasmania, with some individuals known to stop on King Island during the northward migration in autumn. Over winter individuals can be

found along the coast of South Australia and Victoria where they are found in locations associated with coastal saltmarshes and adjacent pastures, close to free-standing water bodies (DELWP, 2016). The migration back to breeding grounds begins in late September and appears to be more rapid with no stopovers on King Island (NRE Tas, 2023).

- The wild population of the orange-bellied parrot got as low as 35 individuals in 2010 (NRE Tas, 2023) and is one of the most threatened birds in Australia.
- Most recent census data has shown an increase in the wild population. 2023 census data resulted in a recorded number of individuals to return from the southern migration in 15 years. It is estimate that a total of 139 individuals would have migrated north from the breeding grounds at the end of the 2022/23 breeding season of which 81 returned for the 2023/24 breeding season resulting in a 58% return rate (DPC 2023).
- The National Recovery Plan for the Orange-Bellied Parrot states that highly mobile individuals will be impacted by barriers to movement (Navarrete, 2011). Resulting in death from flying into barriers, or behaviour may be modified by the presence of barriers, leading to avoidance of some habitat. Barriers may include wind energy turbines, powerlines and associated infrastructure, aircraft including small recreational aircraft, illuminated structures and illuminated boats. The impacts of these barriers may be greatest where they occur on migration routes, where a large portion of the population may be exposed to the barrier during a key life stage (DELWP, 2016).

Distribution and migration routes of the orange-bellied parrot overlapped by the monitoring area are displayed in Figure 6-41.

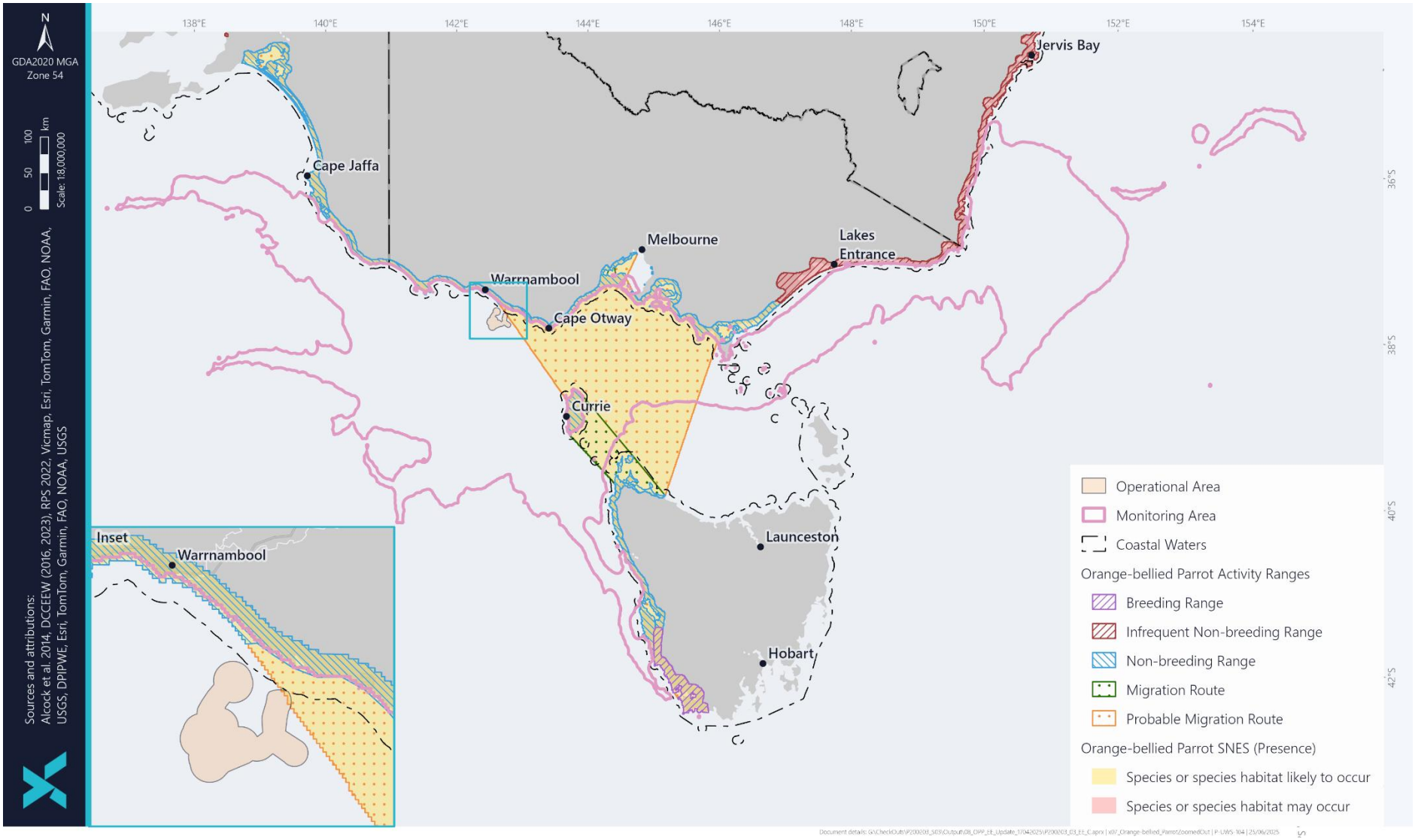



*Figure 6-41: Distribution and migration routes of the Orange-bellied Parrot and overlap with the monitoring area*

#### *6.5.7.4 Other Bird Species*

Other birds listed as threatened or migratory under the EPBC Act that are known or likely to occur or have habitat within the monitoring area are discussed below. These species are listed migratory (terrestrial) and predominately belong to the order Passeriformes, known as perching birds. None of these species have known BIAs within the monitoring area.

The spectacled and black-faced monarch, rufous fantail and the satin flycatcher are typically found in rainforests, eucalypt woodlands and coastal scrub (such as mangroves), along the coast of eastern Australia and south-east Asia. In Australia, these species migrate between resident grounds in northern Australian to summer breeding grounds along the south-eastern coast of Australia (Evans, 2022; Southey, 2013; Birdlife Australia, 2017). Diets of these species are typically composed of insects which they forage for in the air or among the foliage.

The fork-tailed swift, oriental cuckoo, white-throated needletail and the yellow and grey wagtails are non-breeding visitors to Australia. These species migrate between summer breeding grounds in the northern hemisphere and winter grounds in the southern hemisphere (DCCEEW, 2010). The fork-tailed swift has a large habitat range, occurring from inland plains, foothills, coastal areas, cliffs, beaches, islands, and sometimes well out into the ocean (DoE, 2024). The yellow and grey wagtails are more commonly found in northern Australia during the winter season and considered a vagrant to south-eastern Australia. While the white-throated needletail is most commonly spread across eastern and south-eastern Australia. Species are found among a range of habitats like wooded forested areas, wetlands and marshes. The yellow and grey wagtails in particular have a strong association with water and may occur on tidal mudflats or along the edges of mangroves (DCCEEW, 2010).

### 6.5.8 Marine Mammals

PMST reports were generated for the operational area, EMBA and monitoring area to identify EPBC listed marine mammal species (or species habitat) that may occur within the EMBA (Appendix 1). Table 6-9 identifies the presence and protection status of all marine mammal species for each EMBA. There are 37 EPBC listed marine mammal species (or species habitat) that may occur within the monitoring area. Of these, 17 occur within the operational area.

For the purpose of the OPP, species listed as threatened or migratory under the EPBC Act which are known or likely to occur or have either a BIA or habitat critical to the survival, within the monitoring area are discussed further below.

BIAs were identified for 4 species of marine mammals (Australian sea-lion, pygmy blue whale, southern right whale, humpback whale) within the monitoring area as displayed in Figure 6-44, Figure 6-47, Figure 6-51, Figure 6-52 and Figure 6-53. There is no habitat critical to the survival of marine mammal species defined within the East Coast Project operational area. One species, the southern right whale, has habitat critical to the survival of the species defined under the National Recovery Plan for the Southern Right Whale (DCCEEW, 2024l) adjacent to the operational area, and within the monitoring area. Within the Plan, all reproductive BIAs across the species range are proposed as habitat critical to the survival of the species. In 2024, DCCEEW updated the BIA boundaries to define a reproduction BIA across the entire coastline of Victoria including embayment's and major ports, as well as much of the coastline across the other south-eastern states (DCCEEW, 2024) (Figure 6-47).

*Table 6-9: Marine mammal species or habitats which may occur within the operational area and ecological and monitoring area*

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| **Pinnipeds** | | | | | | | | | |
| *Arctocephalus forsteri* | New Zealand Fur-seal | | | ✓ | | | MO | MO | BKO |
| *Arctocephalus pusillus* | Australian Fur-seal | | | ✓ | | | MO | BKO | BKO |
| *Mirounga leonina* | Southern Elephant Seal | V | | ✓ | *Conservation Advice Mirounga leonina southern elephant seal (TSSC, 2016f)*<br>*Sub-Antarctic Fur-seal and Southern Elephant Seal Recovery Plan (DEH, 2003)* | | - | - | BMO |
| *Neophoca cinerea* | Australian Sea-lion | E | | ✓ | *Recovery Plan for the Australian Sea Lion (Neophoca cinereal) (CoA, 2013a)*<br>*Conservation Advice for the Neophoca cinerea (Australian sea lion) (TSSC, 2020c)* | * | MO | MO | KO*[f] |
| **Whale and other cetaceans** | | | | | | | | | |
| *Balaenoptera acutorostrata* | Minke Whale | | | | | | MO | MO | MO |
| *Balaenoptera bonaerensis* | Antarctic Minke Whale | | ✓ | | | | - | LO | LO |
| *Balaenoptera borealis* | Sei Whale | V | ✓ | | *Conservation Advice for Balaenoptera borealis (Sei Whale) (TSSC, 2015e)* | | FLO | FKO | FKO |
| *Balaenoptera edeni* | Bryde's Whale | | ✓ | | | | - | MO | LO |
| *Balaenoptera musculus* | Blue Whale | E | ✓ | | *Conservation Management Plan for the Blue Whale, 2015-2025 (DoE, 2015a)* | * | FKO*[f, d] | FKO*[f, d] | FKO*[f, d] |
| *Balaenoptera physalus* | Fin Whale | V | ✓ | | *Conservation Advice for Balaenoptera physalus (Fin Whale) (TSSC, 2015f)* | | FLO | FKO | FKO |
| *Berardius arnuxii* | Arnoux's Beaked Whale | | | | | | - | MO | MO |
| *Caperea marginata* | Pygmy Right Whale | | ✓ | | | | FMO | FLO | FLO |
| *Eubalaena australis* | Southern Right Whale | E | ✓ | | *National Recovery Plan for the Southern Right Wale Eubalaena australis (DCCEEW, 2024l)* | * | BKO*[m] | BKO*[m, r] | BKO*[m, r] |
| *Globicephala macrorhynchus* | Short-finned Pilot Whale | | | | | | - | MO | MO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Globicephala melas* | Long-finned Pilot Whale | | | | | | - | MO | MO |
| *Grampus griseus* | Risso's Dolphin | | | | | | MO | MO | MO |
| *Hyperoodon planifrons* | Southern Bottlenose Whale | | | | | | - | - | MO |
| *Kogia breviceps* | Pygmy Sperm Whale | | | | | | - | MO | MO |
| *Kogia sima* | Dwarf Sperm Whale | | | | | | - | MO | MO |
| *Lagenorhynchus obscurus* | Dusky Dolphin | | ✓ | | | | MO | LO | LO |
| *Lissodelphis peronii* | Southern Right Whale Dolphin | | | | | | - | MO | MO |
| *Megaptera novaeangliae* | Humpback Whale | | ✓ | | *Listing Advice for Megaptera novaeangliae (Humpback Whale) (TSSC, 2022)* | * | LO | KO | FKO*[f] |
| *Mesoplodon bowdoini* | Andrew's Beaked Whale | | | | | | - | MO | MO |
| *Mesoplodon densirostris* | Blainville's Beaked Whale | | | | | | - | MO | MO |
| *Mesoplodon ginkgodens* | Gingko-toothed Beaked Whale | | | | | | - | - | MO |
| *Mesoplodon grayi* | Gray's Beaked Whale | | | | | | - | MO | MO |
| *Mesoplodon hectori* | Hector's Beaked Whale | | | | | | - | MO | MO |
| *Mesoplodon layardii* | Strap-toothed Beaked Whale | | | | | | - | MO | MO |
| *Mesoplodon mirus* | True's Beaked Whale | | | | | | - | MO | MO |
| *Delphinus delphis* | Common Dolphin | | | | | | MO | MO | MO |
| *Orcinus orca* | Killer Whale | | ✓ | | | | LO | LO | LO |
| *Physeter macrocephalus* | Sperm Whale | | ✓ | | | | - | MO | FKO |
| *Pseudorca crassidens* | False Killer Whale | | | | | | LO | LO | LO |
| *Tasmacetus shepherdi* | Shepherd's Beaked Whale | | | | | | - | - | MO |

| Scientific Name | Common Name | Threatened Species | Migratory Species | Listed Marine Species | Conservation/ Recovery Plan | BIA | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|---|---|---|---|
| *Tursiops aduncus* | Indian Ocean Bottlenose Dolphin | | | | | * | LO | LO | LO*[b] |
| *Tursiops truncatus* s. str. | Bottlenose Dolphin | | | | | | MO | MO | MO |
| *Ziphius cavirostris* | Cuvier's Beaked Whale | | | | | | - | MO | MO |

*Threatened Species:*

*V* *Vulnerable*

*E* *Endangered*

Biologically Important Area (Designation shown where relevant in each spatial extent column)

* *BIA Present*

*f* *Foraging*

*d* *Distribution*

*b* *Breeding*

*r* *Reproduction*

*m* *Migration*

*Type of Presence:*

*MO* *Species of species habitat may occur within area*

*LO* *Species or species habitat likely to occur within area*

*KO* *Species of species habitat known to occur within area*

*FLO* *Foraging, feeding or related behaviour likely to occur within area*

*FKO* *Foraging, feeding or related behaviour known to occur within area*

*BMO* *Breeding may occur within area*

*BKO* *Breeding known to occur within area*

#### *6.5.8.1 Cetaceans*

**Blue Whale**

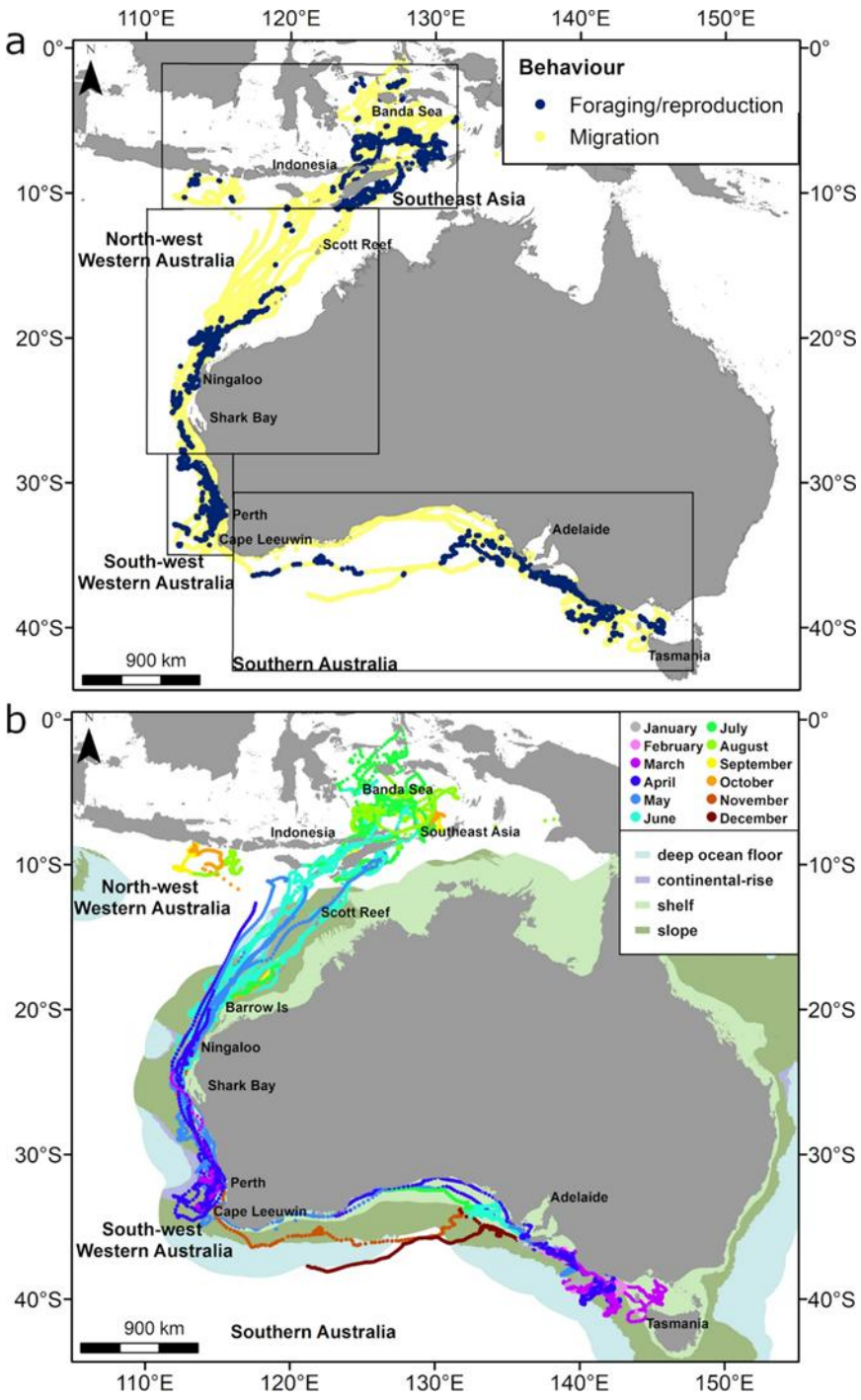
The blue whale is a large baleen whale with a broad spatial distribution. Within the Southern Hemisphere, including Australian waters, there are two subspecies that are known to occur: Antarctic blue whale and the pygmy blue whale (DoE, 2015a). The Antarctic blue whale appears to remain at higher latitudes and migrate, likely in oceanic waters east of Australia, to lower polar latitudes for feeding, breeding and calving during the Australian summer (Barlow et al., 2023). The pygmy blue whale has a more widespread distribution, found throughout the Indian Ocean usually at lower latitudes, with individuals migrating between Australian waters and Indonesia along the Western Australian coastline (DoE, 2023). The pygmy blue whale is mostly found north of 55°S, while Antarctic blue whales are mainly sighted south of 60°S. Blue whales sighted within the vicinity of the East Coast Project and associated monitoring area are likely to be the pygmy blue whale subspecies which will be the focus of this description. However, there is potential for occurrence of the Antarctic blue whale considering its migration path.

Blue whales have the highest known prey requirements of any predator, consuming up to two tonnes of krill per day (DoE, 2015a). Therefore, feeding grounds typically occur in areas of high primary productivity that can support sufficient densities of krill, such as oceanographic upwelling or frontal systems. Australia has 3 seasonal feeding aggregations known to be utilised by the pygmy blue whale:

- The Great Southern Australian Coastal Upwelling System (GSACUS) including the Bonney Upwelling and other small upwelling centres off South Australia, Victoria and Tasmania (within the monitoring area)
- The Perth Canyon and adjacent waters of the WA coastline (outside of the monitoring area)
- South along the sub-tropical convergence zone within the Bass Strait between Victoria and Tasmania (within the monitoring area) (Thums et al., 2022).

Möller et al., (2020) observations found that movements and behaviour corroborate previous suggestions that blue whales aggregate to feed in the wider GSACUS, between the Great Australian Bight to the Bass Strait from late spring to autumn each year. This timing coincides with the upwelling season which occurs yearly typically between November and March (Möller et al., 2020). Species concentration within the GSACUS occurred mostly over the continental shelf where krill are known to aggregate, with outlier observations occurring over the slope and deep sea (Möller et al., 2020).

A recently published study has supported these findings. Ferreira et al., (2024) analysed satellite tracking data for 38 Eastern Indian Ocean pygmy blue whales where movement models were applied to identify relationships between whale occurrence and the environment. This was used to predict foraging and migration habitat suitability in Australia and Southeast Asia. Where there was low move persistence behaviours such as foraging, or reproduction were assumed, where there was high move persistence migration was assumed. Results indicated that the depth of the water column was a top predictor of suitable habitat for most regions, however dynamic localised oceanic processes also influenced the probability of occurrence (Ferreira et al., 2024). In southern Australia suitable habitat was represented as a semi-continuous area encompassing both shelf and slope habitats (43% of suitable habitat on the shelf and 48% on the slope) (Ferreira et al., 2024). Suitable foraging habitat occurred on the slope and shelf break throughout Australia with activity occurring along the continental shelf between South West and Southern Australia (Figure 6-42) (Ferreira et al., 2024). While the shelf off the Bonney Upwelling, Great Australian Bight and southern Western Australia and the slope off WA coast was identified as suitable migration habitat (Figure 6-42).




*Source: Ferreira et al., 2024*

*Figure 6-42: Predicted suitable habitat for foraging and migration in Eastern Indian Ocean pygmy blue whales from satellite tracking*

Defined foraging BIAs overlapped by the operational area and associated monitoring area are described below and displayed in Figure 6-44 and Figure 6-45.

- Foraging – Occurs throughout the majority of the Bass Strait and coastal waters of Tasmania
- Known foraging – Occurs within the Bonney Upwelling from Robe to the eastern edge of the Great Australian Bight and the north-west of Bass Strait, from Cape Otway to Port Phillip Heads and to the south of King Island

- Foraging (annual high use area) – Occurs between Cape Otway and Robe (include the Bonney Upwelling)
- Foraging (abundant food source) – Occurs in the eastern Great Australian Bight upwelling (Kangaroo Island Canyons)

Typically, blue whales migrate between breeding grounds (low latitudes) where mating and calving take place in the winter, to feeding grounds (high latitudes) where foraging occurs in the summer. The pygmy blue whale population shows three migratory stages around Australia, a "southbound migratory stage" where whales travel southwards from Indonesian waters down the WA coast, mostly over October to December but possibly into January of the following year, a protracted "southern Australian stage" (January to June) where animals spread across southern waters of the Indian Ocean and south of Australia, then a northbound migratory stage (April to August) where whales move north back to Indonesia again (Figure 6-43) (McCauley et al., 2018). These findings are supported by Möller et al., (2020) and Thums et al., (2022) who observed a high probability of transiting behaviour (i.e., migration periods) between April and June and November and December. Movements from the GSACUS occur initially in a westward direction before turning northwards along the WA coastline to breeding grounds outside of Australian waters (Möller et al., 2020).

The pygmy blue whale has a known distribution range which is broadly consistent with foraging areas and migratory paths of the species which extend through the South-east Marine Region, overlapping the operational area and monitoring area (Figure 6-44).

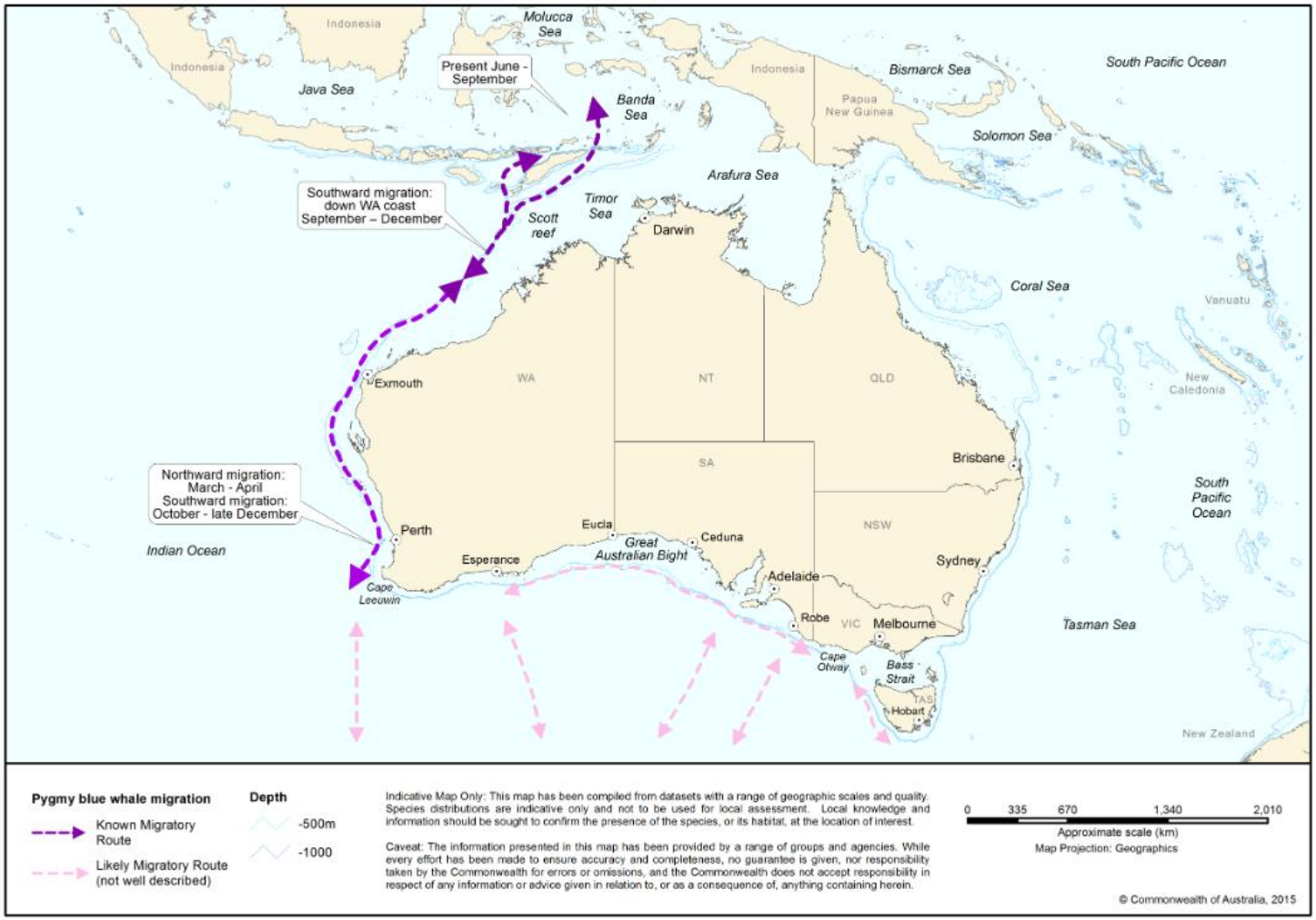



*Figure 6-43: Pygmy Blue Whale migration routes around Australia*

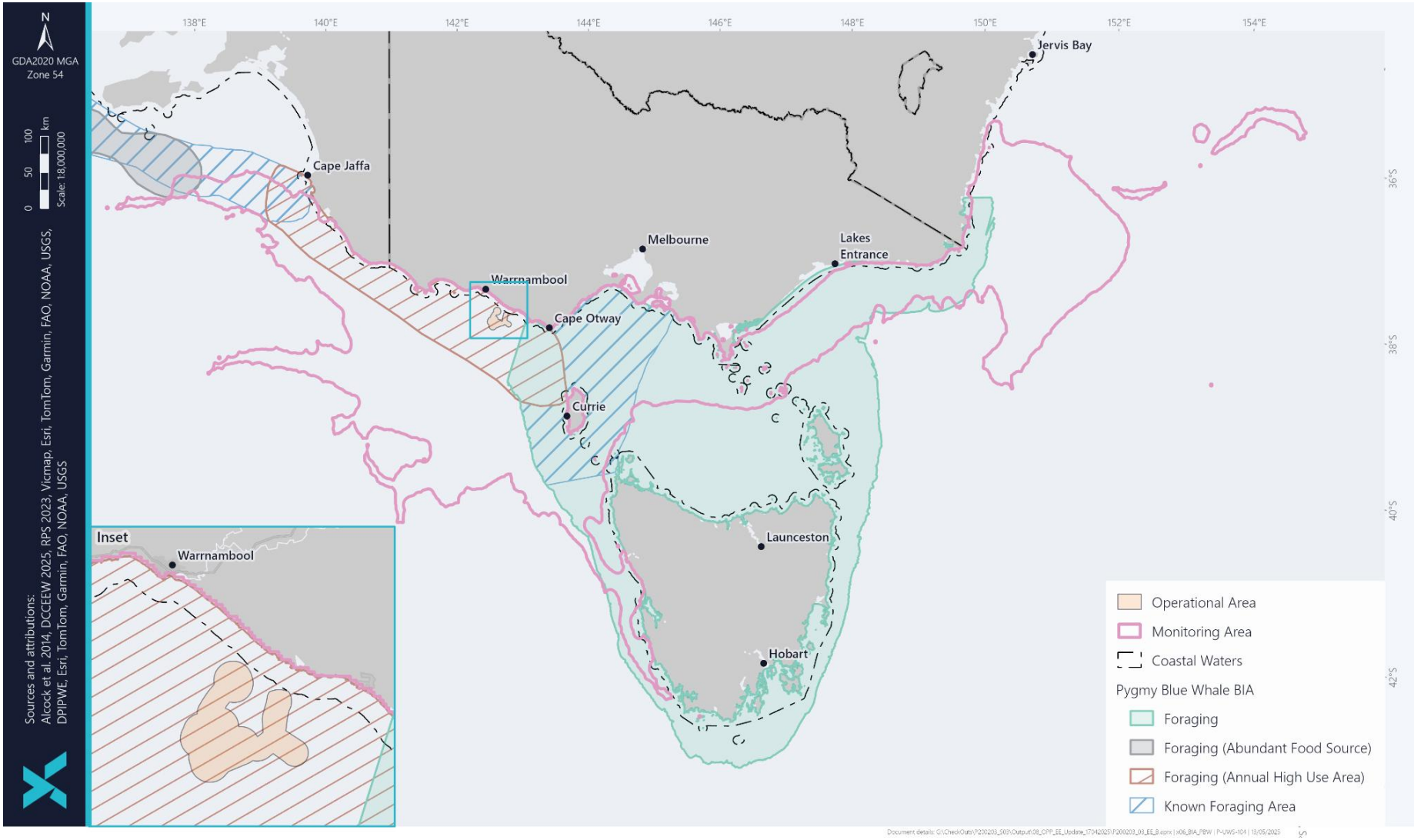



*Figure 6-44: Pygmy Blue Whale BIAs within the monitoring area*

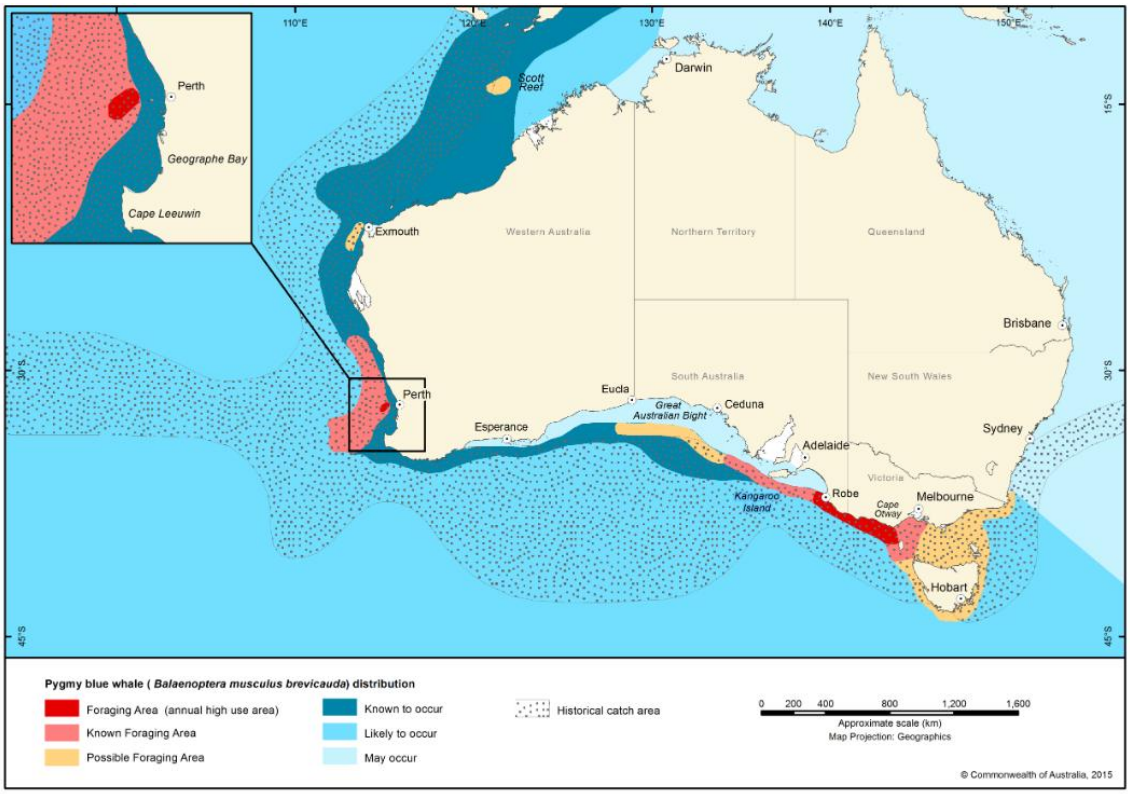



*Figure 6-45: Pygmy Blue Whale distribution around Australia*

**Southern Right Whale**

Southern right whales have a circumpolar distribution in the Southern Hemisphere occurring seasonally in all state coastal waters of Australia between April and November each year. There are two populations of the southern right whale within Australian waters (eastern and western). The western population is present west of Ceduna in South Australian (outside EMBA), and the eastern population is present from east of Ceduna to Queensland and Tasmania (DCCEEW, 2024l).

The seasonal presence of the southern right whale in Australia correlates with breeding behaviours. The peak abundance period occurs between May and October each year when the southern right whale will predominately occur in shallow (< 10 m) coastal waters within 1 km of the coast (Charlton et al., 2019, Smith et al., 2019 cited in DCCEEW, 2024l). Breeding behaviours (i.e., mating, calving and nursing) typically occur within reproductive areas which have been defined by the National Recovery Plan for the Southern Right Whale (DCCEEW, 2024l) as habitat critical to the survival of the species (Figure 6-47). The importance of the reproduction BIA to the species is twofold.

Female southern right whales are known to show strong site fidelity to breeding locations, often returning to the same location to breed each cycle (peaking every 3 and 5 years) (Stamation et al., 2020) and it is believed that females transmit this preference to offspring within the first year of their life (Valenzuela et al., 2009, Carroll et al., 2015, Carroll et al., 2016 cited in DCCEEW, 2024l). For example, one female whale was sighted to had calved at Logans Beach at least 7 times over a 17-year period, before shifting to calve at Head of Bight in South Australia for four consecutive calving events over 10 years (Stamation et al., 2020). Additionally, while partaking in breeding behaviours within Australian waters female southern right whales do not feed, resulting in a decline in energy stores. Considering their finite energy stores and the energetic costs of reproduction, environmental influences and/or disturbance have the potential to impose further demands on the whale's limited energy stores and affect the body condition of lactating females and the reproductive viability of offspring (DCCEEW, 2024l).Therefore, habitat critical

to survival for the southern right whale has been identified as all reproductive BIAs across the species range (Figure 6-46).

As highly mobile migratory species, the southern right whale travels thousands of kilometres between habitats used for essential life functions. Similar to breeding areas, the southern right whale is known to show strong site fidelity to foraging locations. The foraging ecology of the southern right whale is poorly understood, and observations of feeding whales are rare. Foraging and feeding is thought to occur in a latitudinal range between at least 30°S and 65°S, particularly in offshore areas associated with large-scale features such as the Sub-Tropical and Polar Fronts (Torres et al., 2013, Carman et al., 2019 cited in DCCEEW, 2024l). Feeding has not been observed in coastal Australian waters, although other parts of the Australian EEZ may be utilised for feeding (Torres et al., 2013 cited in DCCEEW, 2024l). A counter-clockwise migration between foraging and breeding areas has been suggested whereby movements from Australian coastal waters include directly southern and western migration pathways (DCCEEW, 2024l). Migration areas include the movement of whales along the coast (highlighting the importance of coastal habitat connectivity) and the movement from offshore areas, including foraging areas, to nearshore and coastal areas (DCCEEW, 2024l). A migration BIA has been identified within the monitoring area (Figure 6-47).

The south-eastern population of southern right whales currently have one established calving ground located at Logans Beach, Warrnambool in south-west Victoria, located ~24 km north-west of the operational area (Watson et al., 2021). At least 93 calves were born at Logans Beach between 1980 and 2018 (Watson et al., 2021), however, there has been no increase in the average number of calves born annually at Logans Beach over the last three decades (Stamation et al., 2020). Southern right whales live long with late maturing and long calving intervals (Charlton, 2017), therefore a significant increase in the number of calves born at Logans Beach is not expected until 2028 (Stamation et al., 2020). The total number of southern right whale individuals identified in south-eastern Australia in a single whale-watching season increased from 3 in 1993 to 368 individuals in 2017 (Stamation et al., 2020). Between 1993 and 2017, a total of 37 individual female southern right whales with calves were identified. Of these, 20 were identified west of Warrnambool, with 14 individual breeding females sighted at Logans Beach (Stamation et al., 2020). A further 21 individual females were sighted east of Warrnambool: 5 in the Great Ocean Road area, 3 near Wilson's Promontory, 10 off Flinders Island and the east coast of Tasmania, and 3 in New South Wales (Stamation et al., 2020).

Southern right whales have been observed during Cooper Energy offshore activities. Two individuals were observed from a moored semi-submersible MODU at the Casino-5 well location in the Otway in 2018. Sighting cues were body and blow. The sighting occurred in April, which may seem unusually early for southern right whale occurrence in the region, though is not unprecedented; the ALA reports 8 southern right whale sightings in the Otway in April between 1984 and 2019 (ALA, 2024). Whales observed during Cooper Energy activities are reported to the Australian Marine Mammal Centre.

First Nations people around Australia have long had a strong connection to whales, which has significance as totemic ancestors to some groups. Whales that travel through Sea Country are recognised by Gunditjmara First Nations people within the Gunditjmara Nyamat Mirring Plan 2023-2033 (GMTOAC, 2023). The southern right whale (Koontapool) migration which occurs along the Victorian coast provides known resting and feeding sites for the species, and safe havens for mothers with calves (DCCEEW, 2024l). First Nations people's cultural heritage, including identified values and sensitivities are further described in Section 6.8.3.7.

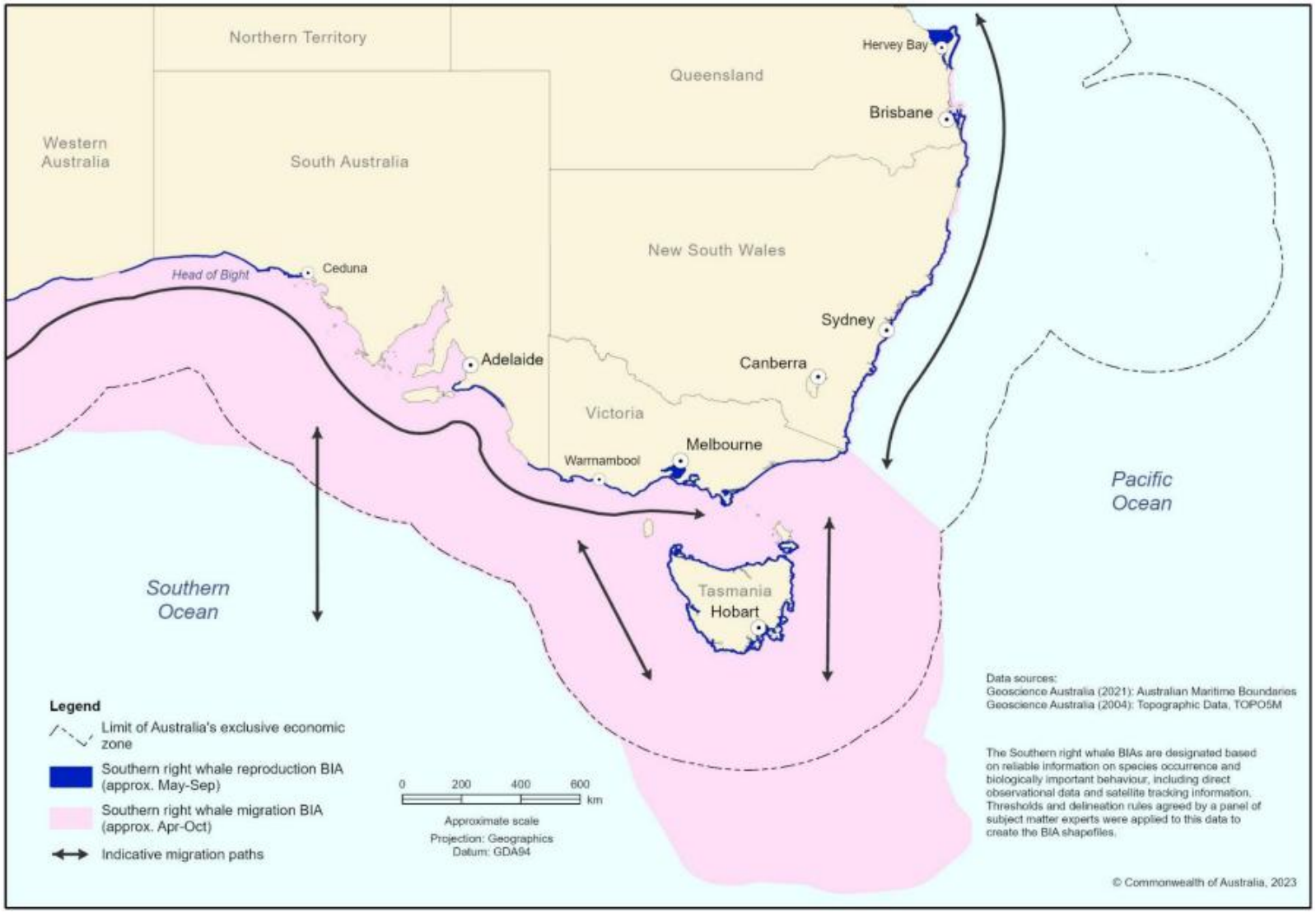



*Figure 6-46: Southern right whale Biologically Important Areas and Habitat Critical to the Survival (reproduction BIA) in eastern Australia (DCCEEW, 2024l)*

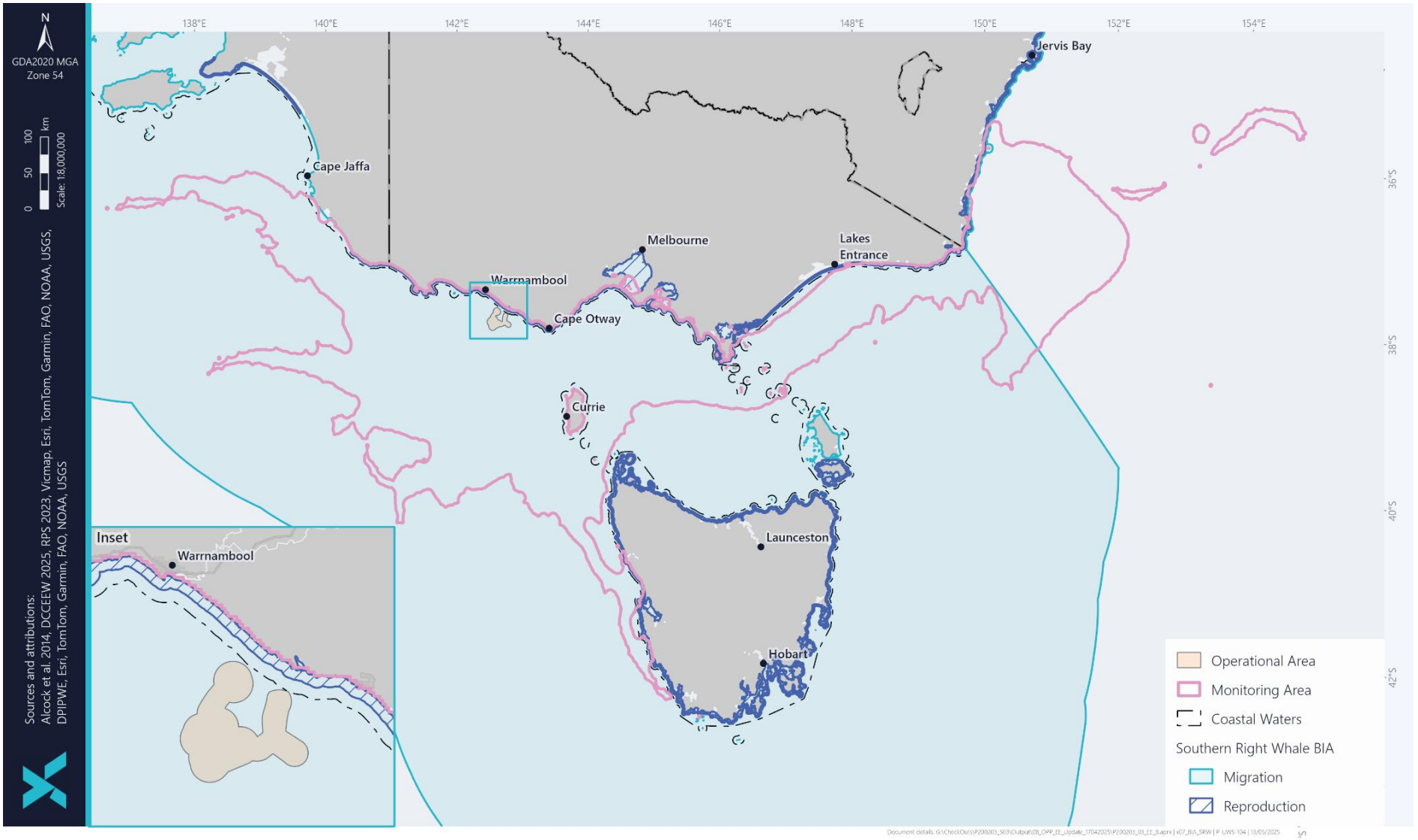



*Figure 6-47: Southern Right Whale BIAs within the monitoring area*

**Humpback Whale**

Humpback whales have a near global distribution, migrating annually between high latitude feeding areas and low latitude breeding and calving grounds. Within Australian waters Humpback whales can be found migrating between May and November each year from breeding areas along the east and west coast of Australia and feeding areas in the Antarctic (DoE, 2023) (Figure 6-50).

There are two distinct populations of humpback whale in Australian waters. The east coast population, with the potential to occur within the monitoring area, migrate along the continental shelf, within 50 km of the coast, to the east of the Bass Strait. The exact timing of the migration period varies between years in accordance with variations in water temperature, extent of sea ice, abundance of prey, and location of feeding grounds (DoE, 2023).

During 2023 Cooper Energy undertook vessel-based IMR activities in the Gippsland region. Over the course of this 33-day campaign there were approximately 435 whales sighted by marine mammal observers on board the vessel, with visual range being up to ~6.2km depending on weather conditions. Sightings were primarily of humpback whales undertaking their southerly migration, including mothers and calves. Behaviours observed include fast and slow travel, milling and surface active (e.g. fin slapping and breaching) (Figure 6-48). Figure 6-49 shows sightings distribution relative to the vessel.

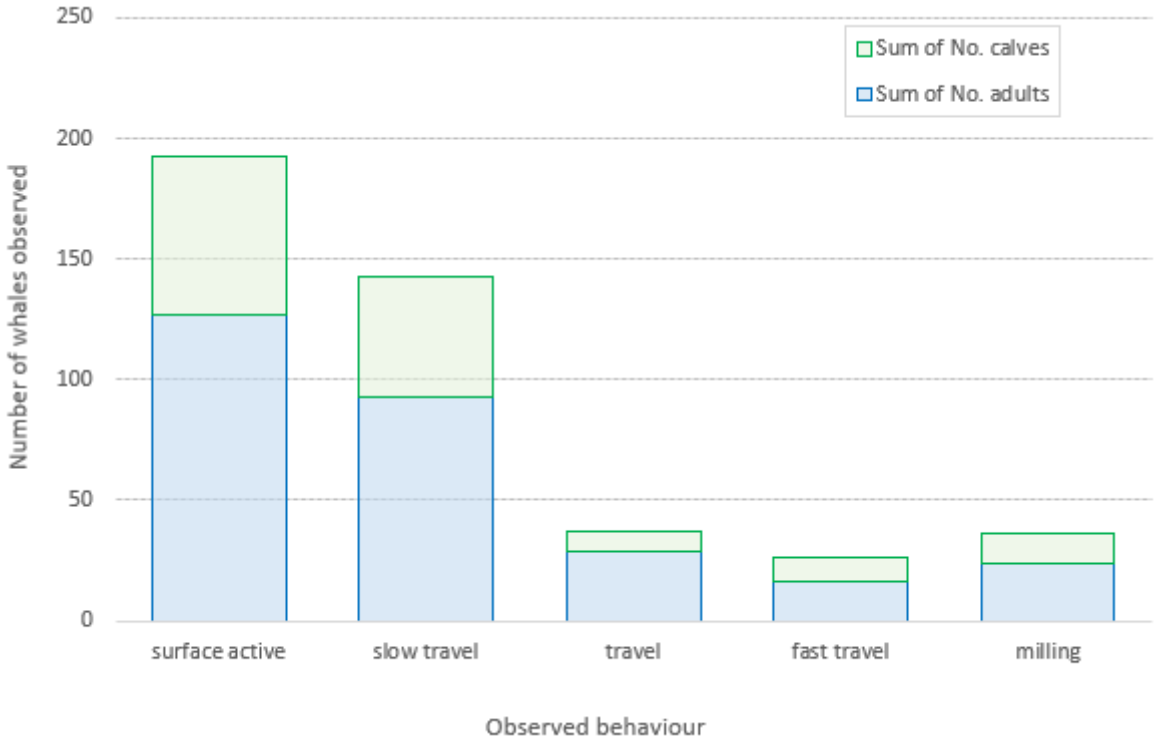



*Figure 6-48: Whale observations (behaviours) within the Gippsland Region during Cooper Energy activities (Basker Manta Gummy (BMG) / Gippsland MMO Sightings Sheet, 2023)*

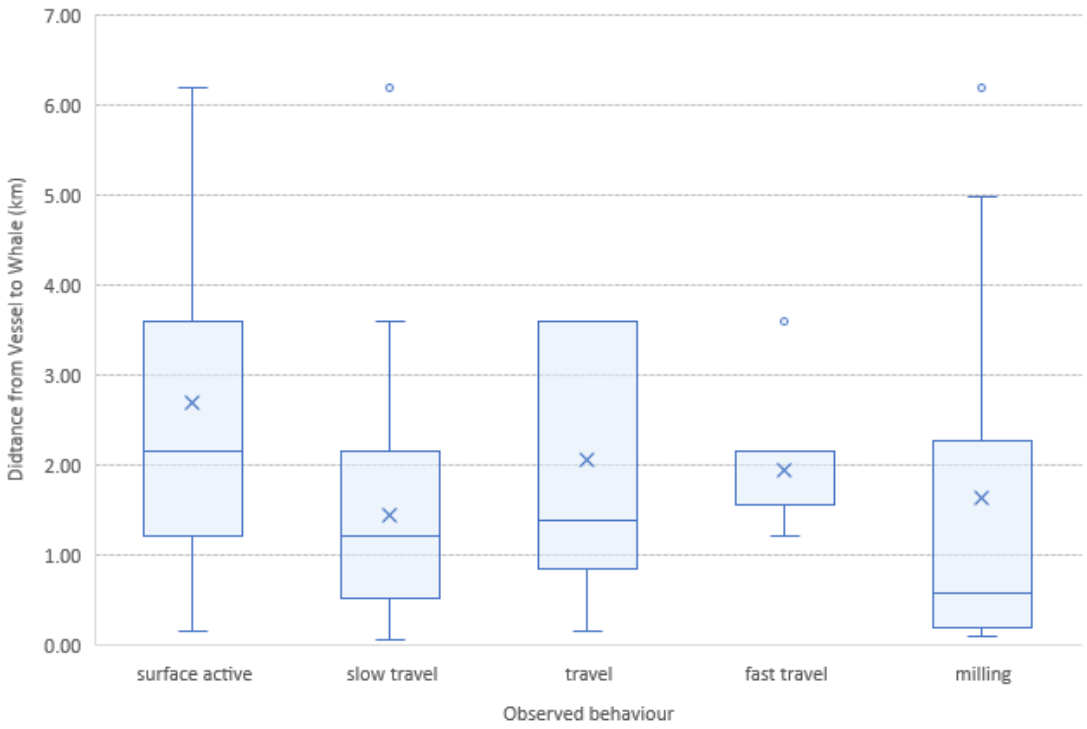



*Figure 6-49: Whale observations during Cooper Energy activities – sightings distribution relative to observer vessel (BMG / Gippsland MMO Sightings Sheet, 2023)*

Humpback whales feed primarily on krill in Antarctic waters south of 55°S, though opportunistic feeding during migration has been observed in Eden, NSW (DoE, 2023). A foraging area (Figure 6-50) for the Humpback Whale occurs along the NSW-QLD border to Eden, which corresponds with the migration (North and South) BIA which is overlapped by the monitoring area (Figure 6-51).

In 2022, the humpback whales EPBC threatened species status was removed due to significant population recovery (TSSC, 2022). The Humpback Whale remains a MNES under the EPBC Act as a listed Migratory Species, and as a Cetacean.

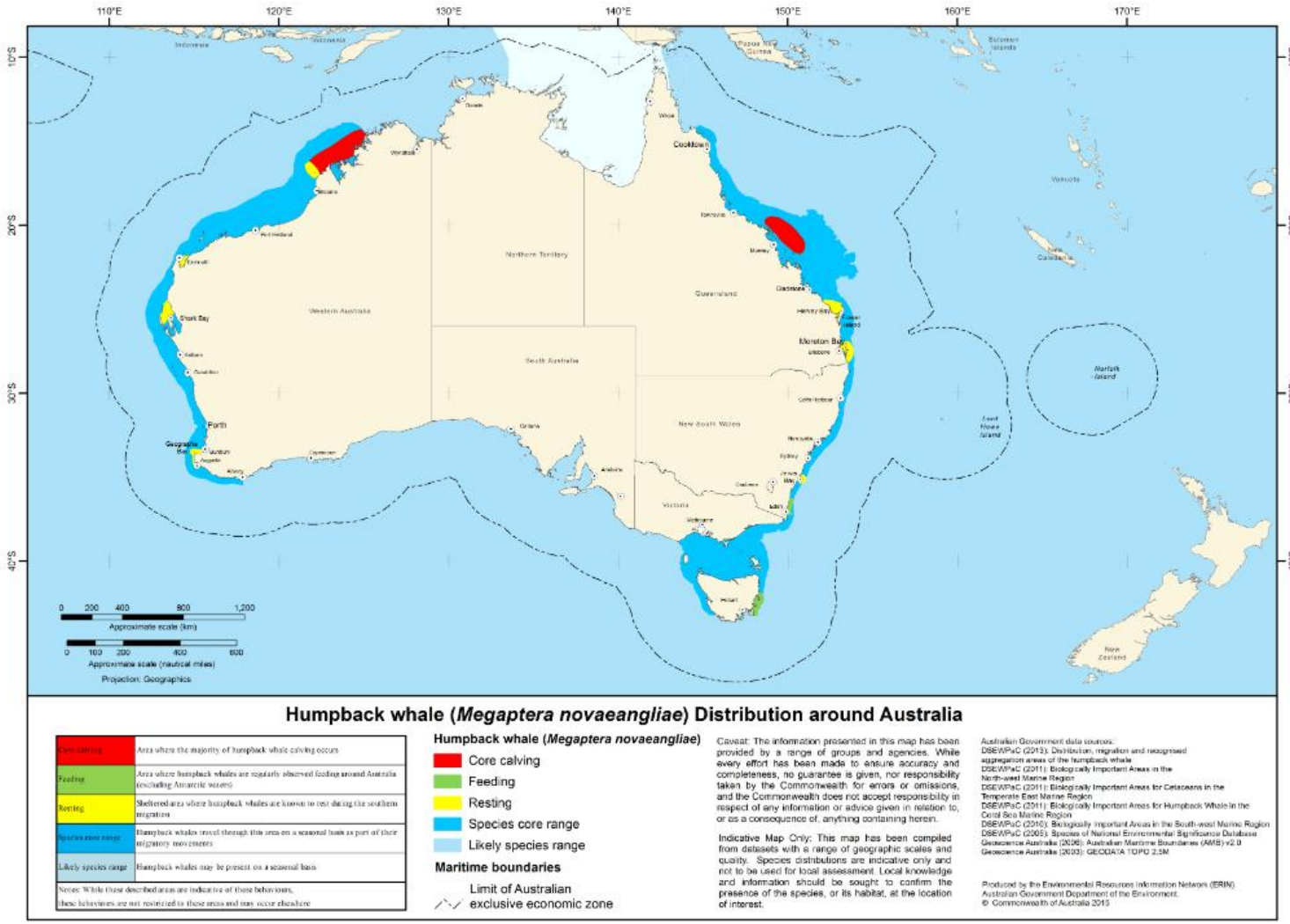



*Figure 6-50: Humpback Whale distribution around Australia*

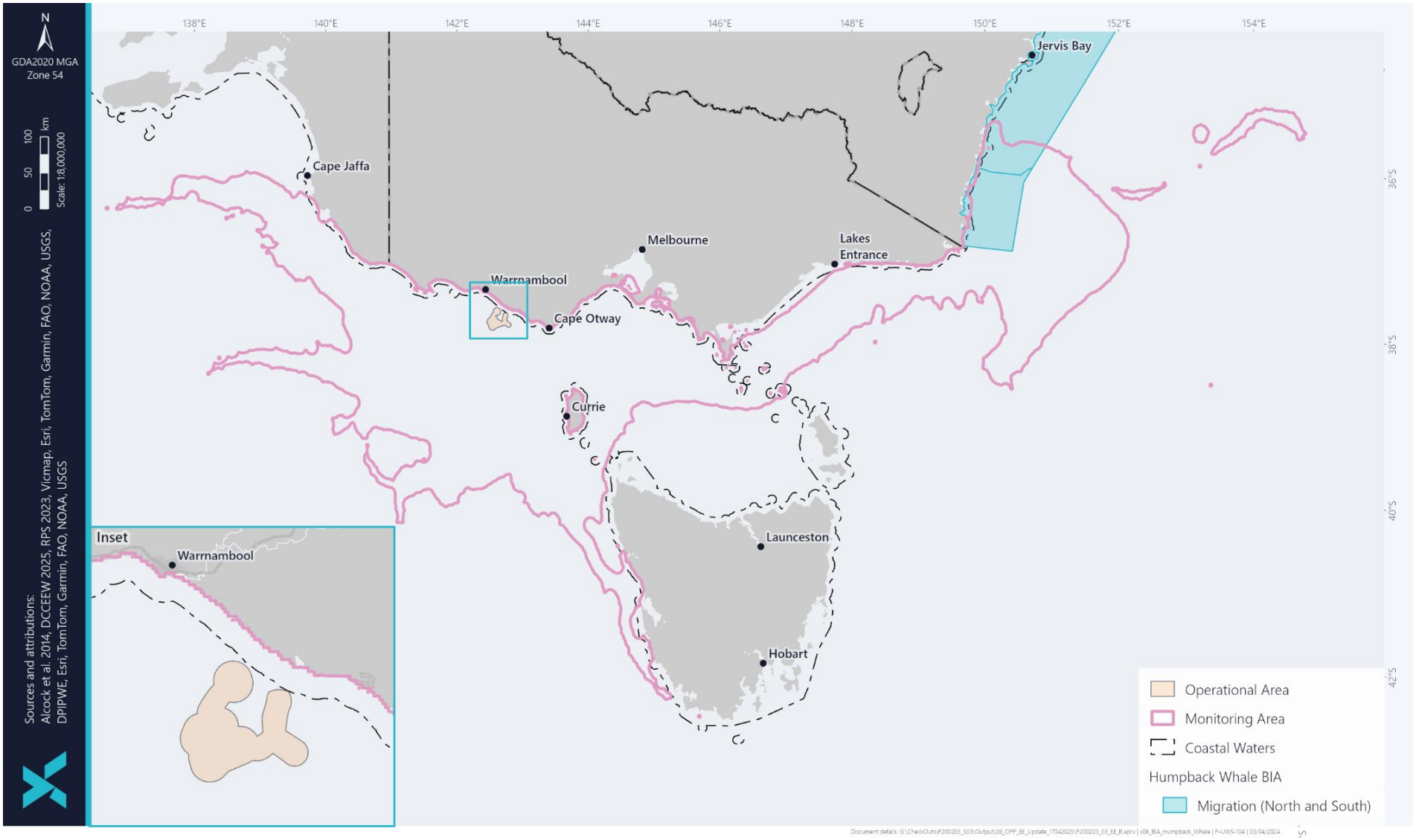



*Figure 6-51: Humpback Whale BIAs within the monitoring area*

**Sei Whale**

Sei whales are considered a cosmopolitan species, ranging from polar to tropical waters, but tend to be found more offshore than other species of large whales. They show well-defined migratory movements between polar, temperate and tropical waters. Migratory movements are strictly north-south with little longitudinal dispersion.

The sei whale has been infrequently recorded in Australian waters; however occasional sightings have been recorded off most states (DoE, 2023). Sei whales move between Australian waters and Antarctic feeding areas, sub-Antarctic feeding areas (e.g., Subtropical Front), and tropical and subtropical breeding areas. The species feeds intensively between the Antarctic and subtropical convergences on planktonic crustacea, in particular copepods and amphipods (DoE, 2023). However, sei whales have also been observed feeding on the continental shelf in the Bonney Upwelling region during November and May, suggesting the area may be used for opportunistic feeding (DoE, 2023).

The species is likely to forage in the vicinity of the East Coast Project and have a known foraging presence in the monitoring area.

**Fin Whale**

Fin whales are considered a cosmopolitan species and occur from polar to tropical waters and are rarely in inshore waters. They show well-defined migratory movements between polar, temperate and tropical waters. Migratory movements are strictly north–south with little longitudinal dispersion.

The fin whale has been infrequently recorded in Australian waters; however occasional sightings have been recorded off most states (DoE, 2023). Fin whales migrate between Australian waters and Antarctic feeding areas, sub-Antarctic feeding areas and tropical and subtropical breeding areas. The species frequency feed on the surface of the water through lunge of skim methods, however they may also dive up to 230 m to feed depending on prey availability (DoE, 2023). Fin whales have been observed within proximity of the Bonney Upwelling along the continental shelf between November and May, suggesting the area may be used for opportunistic feeding (DoE, 2023).

The species is likely to forage in the vicinity of the East Coast Project and have a known foraging presence in the monitoring area.

**Bryde's Whale**

The Bryde's whale can be found in tropical and warm temperate waters exceeding 16.3°C, but generally in the 20°C isotherm where they stay year-round (DoE, 2023). The species appears to have coastal and offshore forms which display different life cycle characteristics such as migration patterns and feeding preferences.

In Australia, the Bryde's Whale has been recorded in all states except the Northern Territory. Typically, the coastal form is restricted to within 32 km from the coast, while the offshore form occupies waters over 80 km from the coast (DoE, 2023). The Bryde's whale is considered an opportunistic feeder, consuming any shoaling prey that is available and frequently exploit the activities of other predators. There is no evidence of large-scale movements of the inshore form of the species, however it appears that the offshore form may migrate seasonally, heading towards warmer tropical waters during the winter (DoE, 2023).

The waters of Bass Strait are not known feeding, resting or calving grounds for Bryde's whales, although feeding may occur opportunistically where sufficient krill density is present.

**Antarctic Minke Whale**

Antarctic minke whales appear to primarily occupy offshore and pelagic habitats and can be found throughout the southern hemisphere within cold temperate to Antarctic waters (DoE, 2023). In Australia, the Antarctic minke whale has been recorded in all states except the Northern Territory. Little is known about their foraging or breeding locations in Australian waters. The species undergo extensive migration between the summer Antarctic feeding grounds and winter sub-tropical to tropical breeding grounds (DoE, 2023). The Antarctic minke

whale feeds primarily on Antarctic krill and do not appear to feed much whilst in the breeding grounds of lower latitudes (DoE, 2023).

The species is unlikely to forage in the vicinity of the East Coast Project and do not have a known foraging presence in the monitoring area.

**Sperm Whale**

The sperm whale inhabits a large geographical range from the polar regions to the equator, typically occurring offshore in deep waters (>600 m). In Australia, the sperm whale has been recorded in all states, with concentrations of individuals known to occur at the shelf edge off Albany WA and south-west of Kangaroo Island (DoE, 2023).

In the open ocean, there is a generalised movement of sperm whales southwards in summer, and corresponding movement northwards in winter, particularly for males (DoE, 2023). Male and female sperm whales exhibit different distributions. Females mostly inhabit tropical and subtropical waters while adult males are found at higher latitudes (apart from the breeding season) in ice-free deep waters or along the edges of continental shelves (Chambault et al., 2021). After accompanying the females from 4 to 21 years, young males may leave their female relatives to migrate towards higher latitudes. The diet of the sperm whale is primarily composed of oceanic cephalopods, however, may include demersal fishes, rays and sharks. Sperm whales are deep and prolonged divers and are able to forage throughout the entire water column, however, they seem to forage mainly on or near the bottom (DoE, 2023).

The species is considered to likely forage in the vicinity of the East Coast Project and have a known foraging presence in the monitoring area. However, considering the deep offshore preference of the species (>600 m) (DoE, 2023) individuals are unlikely to occur in the operational area where water depths range from 50–90 m.

**Killer Whale**

The killer whale can be found throughout all oceans; however, they are found in highest concentrations in coastal waters and in cooler regions where productivity is high (DoE, 2023). In Australia, they are recorded in all states, with concentrations reported around Tasmania and frequent sightings in South Australia and Victoria. Individuals are most often seen in along the continental slope and on the shelf, particularly near seal colonies. Due to their cosmopolitan nature and ability to inhabit most marine environments the killer whale is difficult to characterise (DoE, 2023).

Killer whales make seasonal migrations; however, little is known about specific seasonal movement patterns as it is likely that movements are related to the movement of their prey. It is thought that some individuals migrate to Antarctica during the southern summer to prey on Antarctic minke whales and then migrate back to lower altitudes during the southern winter (DoE, 2023). The killer whale is an apex predator whose diet fluctuates seasonally and regionally. A 'resident' whale will eat mostly fish, while a 'transient' whale will feed on birds and marine mammals (DoE, 2023). Pack-hunting strategies have been reported in Australian waters for individuals preying on pods of whales or dolphins.

The species is unlikely to forage in the vicinity of the East Coast Project, although feeding may occur opportunistically in the monitoring area.

**Dusky Dolphin**

The dusky dolphin can be throughout the southern hemisphere in temperate and sub-Antarctic regions, typically in association with cold currents. This species primarily occupies inshore habitats but may also be pelagic at times (DoE, 2023). In Australia, the dusky dolphin occurs along the southern coastline from WA to Tasmania. The seasonal reports of dusky dolphin sightings suggest a link with changes in oceanographic features in this region (DoE, 2023). For example, movement patterns may be linked to the position of the Subtropical Convergence and/or El Nino Southern Oscillation events (DoE, 2023). This species is generally considered a surface feeder that preys on schooling fish, cephalopods or other benthic prey.

The waters of Bass Strait are not known feeding, resting or calving grounds for the dusky dolphin, although feeding may occur opportunistically where sufficient prey is present.

**Indian Ocean Bottlenose Dolphin**

The Indian Ocean bottlenose dolphin is found in tropical and sub-tropical coastal and shallow offshore waters. In Australia, the species is distributed continuously and occurs mainly in riverine and shallow coastal waters (on the shelf or around oceanic islands) (DoE, 2023). They inhabit a variety of inshore (<20 m water depth) habitats including, inshore reefs, tidal and dredged channels, mangroves and river mouths. Movement patterns of the Indian Ocean bottlenose dolphin in Australia are variable, and include year-round residency in small areas, long-range movements and migration (DoE, 2023). This species is a generalist feeder, preying on bottom-dwelling and pelagic fish and cephalopods. Gestation lasts approximately 12 months, and calving peaks occur in spring and summer or spring and autumn which coincide with the peak mating period in each location (DoE, 2023).

Breeding BIAs for the Indian Ocean bottlenose dolphin occurs throughout state waters of the East Marine Region, within the 20 m contour. Breeding BIAs are overlapped by the monitoring area and displayed in Figure 6-52.

#### *6.5.8.2 Pinnipeds*

**Australian Sea-lion**

The Australian sea-lion is the only endemic, and least abundant, pinniped that breeds in Australia (DoE, 2023). They use a variety of shoreline types but prefer the more sheltered side of islands typically avoiding exposed rocky coasts. The breeding range of the Australian sea-lion extends from Houtman Abrolhos, WA to The Pages Island, SA where breeding colonies occur on islands or remote sections of coastline (DoE, 2023). However, the species is known to forage in Commonwealth waters adjacent to these states.

Australian sea-lion is considered to be a specialised benthic forager, i.e., feeding primarily on the sea floor (CoA, 2013a). The Australian sea-lion feeds on the continental shelf, most commonly in depths of 20–100 m, with adult males foraging further and into deeper waters (CoA, 2013a). Foraging trips are relatively short compared to other sea lions, with maximum durations of 5.1, 6.2 and 6.7 days in juveniles, adult females and adult males, respectively with individual dives rarely exceed 8 minutes in duration (CoA, 2013a).

A foraging BIA for males occurs within the Great Australian Bight, Eyre Peninsula, Spencer Gulf, Investigator Passage, Gulf of St Vincent and Kangaroo Island. An additional foraging BIA for both males and females occurs at Kangaroo Island, Investigator Passage and the Gulf of St Vincent. Both foraging BIAs are overlapped by the monitoring area and displayed in Figure 6-53.

**Australian Fur-seal**

Australian fur-seal populations are in a phase of slow recovery following near-extinction after commercial sealing during 18th and 19th centuries (Shaughnessy, 1999). Breeding colonies are occupied year-round. Peak numbers occur during the breeding season which occurs in summer months with pups born between October and December each year (DoE, 2024). All but one of the known 20 breeding colonies (total number quoted in McIntosh, 2018) occur on islands within Bass Strait, characterised by a shallow continental shelf region with a relatively uniform bathymetry (average depth 60 m). The largest breeding colonies are at Deen Maar and Seal Rocks in Victoria (McIntosh, 2018).

In practice, seals are frequently observed offshore and around vessels; hundreds of sightings of seals were recorded near vessels over the course of the BMG Closure Project – Phase 1 offshore Gippsland in 2024, Marine mammal observers for the project reported behaviours including foraging, milling and swimming.

Reports by Arnould and Kirkwood (2008 and 2011) tracked the foraging habits of female Australian fur-seals from four breeding sites in northern Bass Strait during the winters of 2001-2003. The studies found that all individuals foraged over the shallow continental shelf of Bass Strait and none of the foraging trips recorded any individuals venturing beyond the continental shelf-edge of Bass Strait. This data supports earlier studies that suggested the species is an exclusively benthic forager, although will opportunistically hunt throughout their transit to

feeding grounds. Analysis of habitat use indicated that individuals selected areas with depths of 60–80 m with several areas regularly frequented and considered ‘hot spots’, while others with similar bathymetries were never entered by the individuals in this study. Furthermore, while there was substantial inter-individual variation, most seals displayed some degree of foraging site fidelity (Arnould and Kirkwood, 2008 and 2011). Hoskins et al., (2015) considered the role of intensive foraging zones for Australian fur-seal, finding that foraging intensity ‘hot spots’ occur in a mosaic throughout the Bass Basin (within the Bass strait), primarily to the south-west of the known colonies. Diving data also suggested that individuals were maximising their time within the benthic foraging zone.

The species is known to breed within the vicinity of the East Coast Project and likely to have a foraging presence in the monitoring area. Australian fur-seal colonies and breeding habitat within the monitoring area are displayed in Figure 6-54.

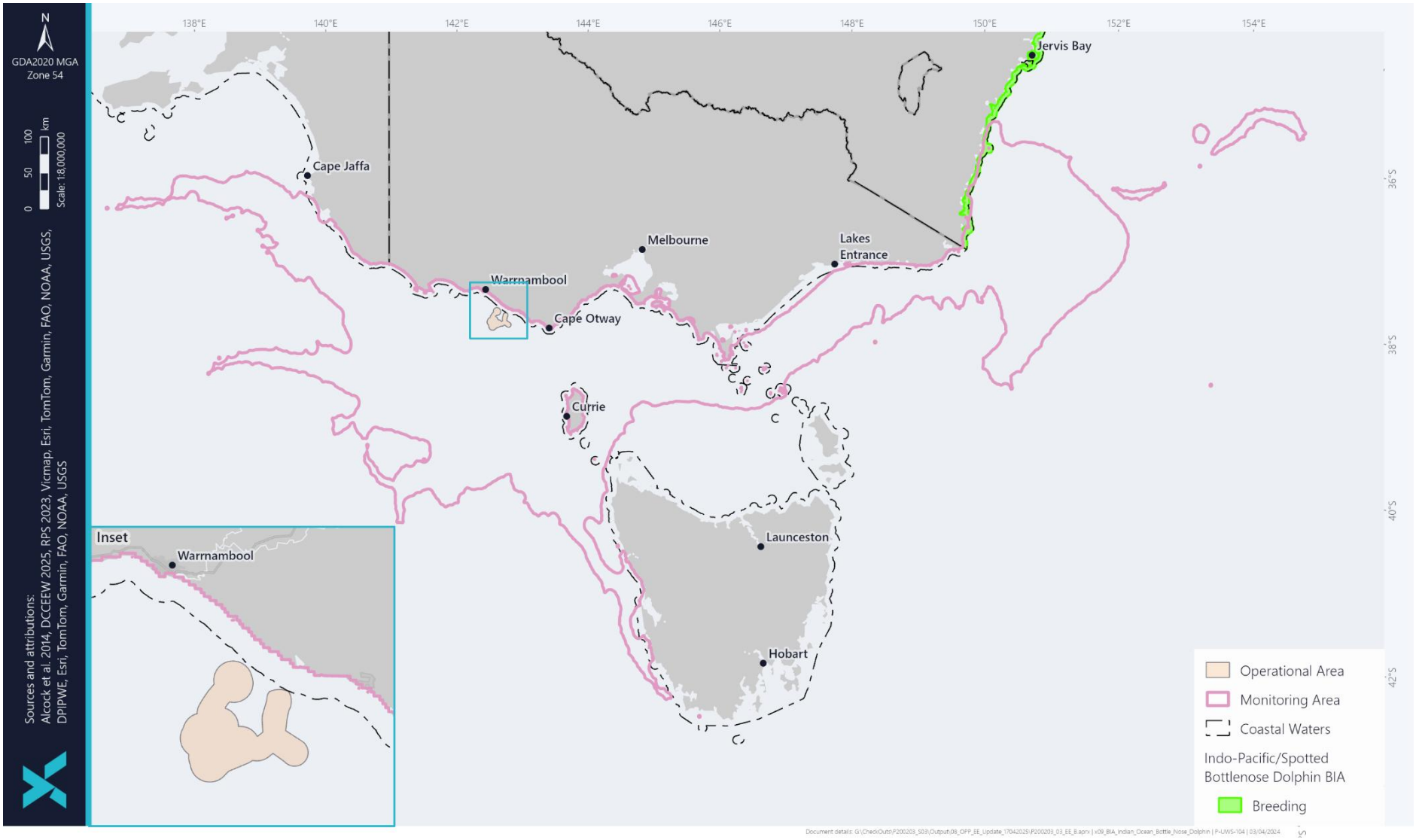



*Figure 6-52: Indian Ocean Bottlenose Dolphin BIAs within the monitoring area*

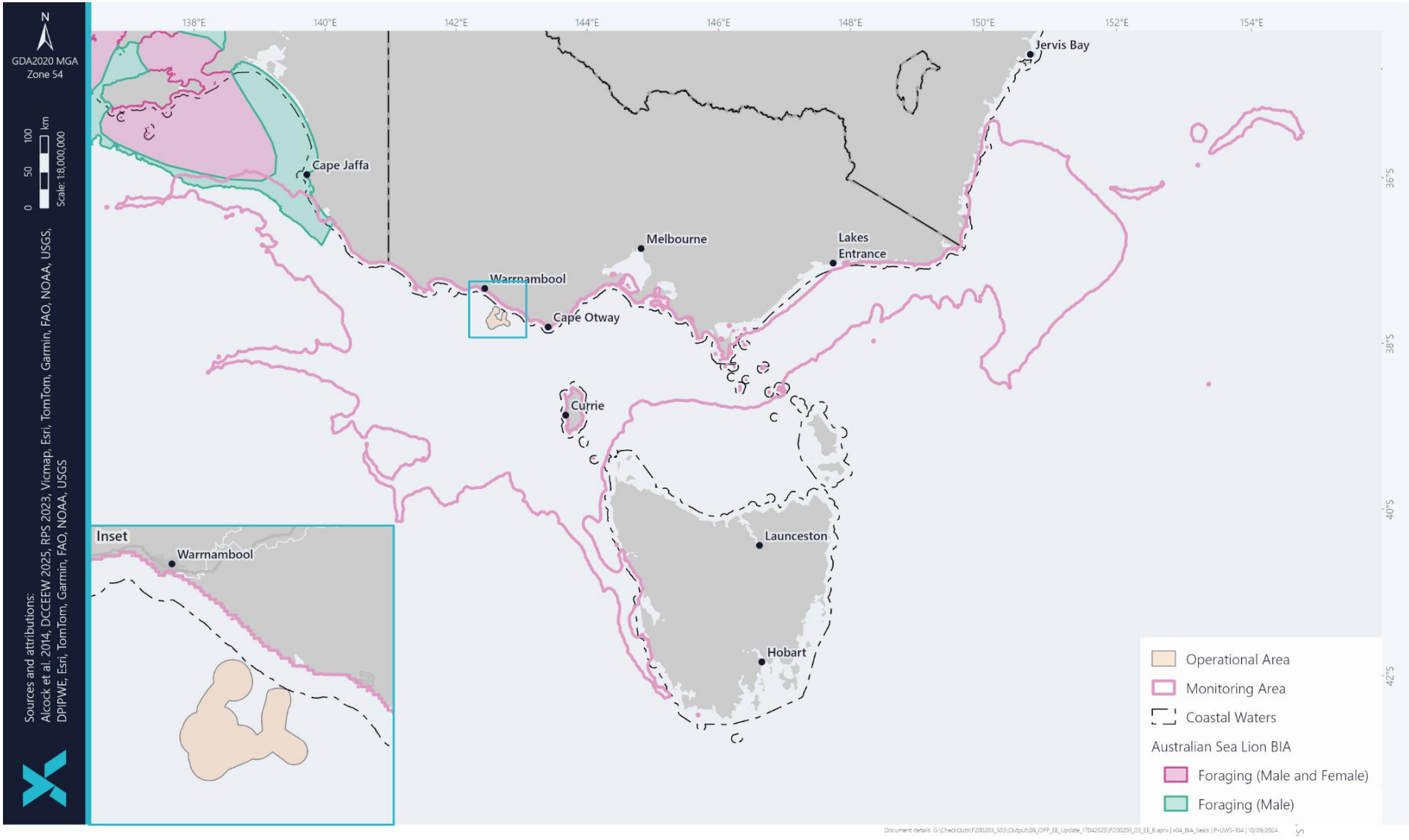



*Figure 6-53: Australian Sea-Lion BIAs within the monitoring area*

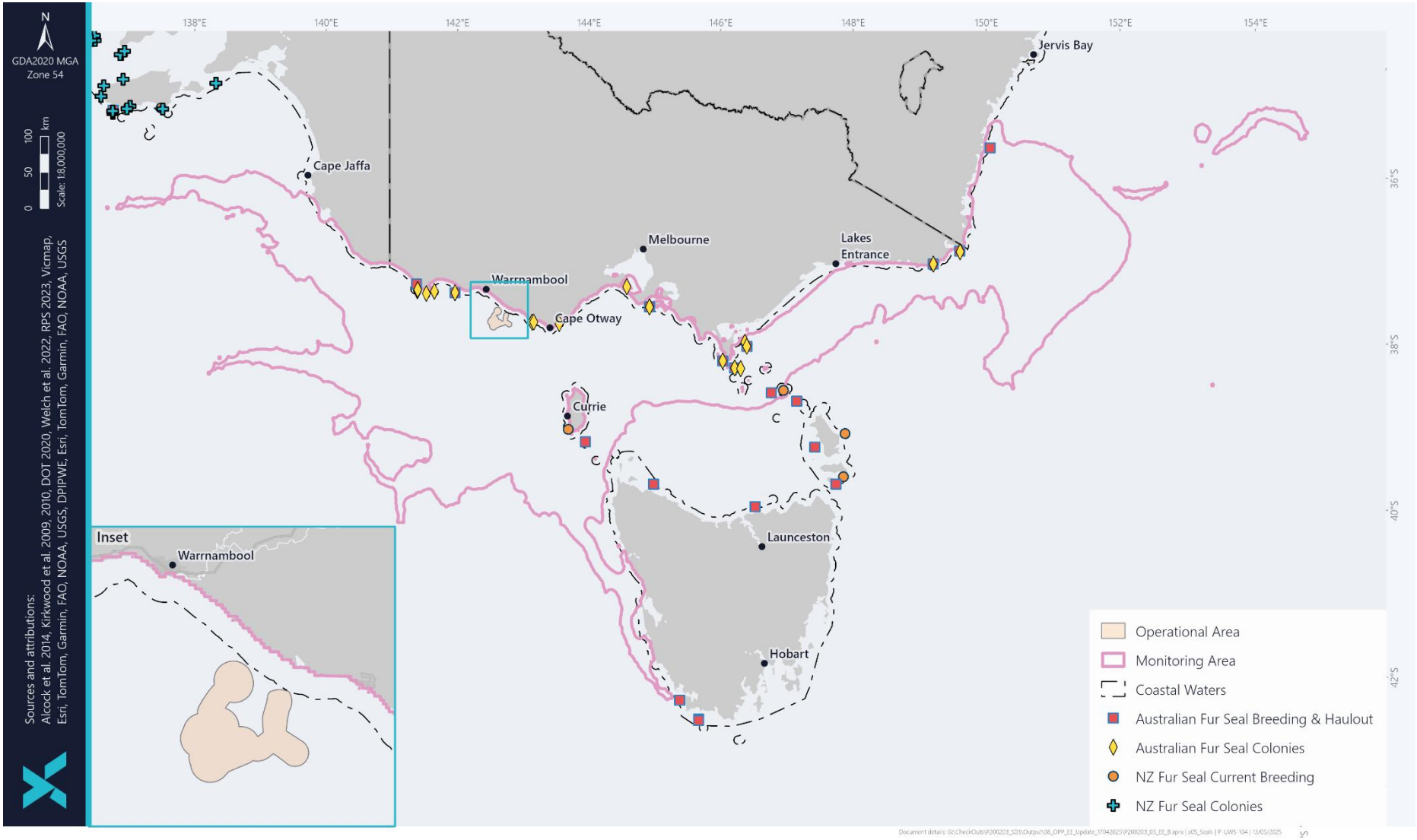



*Figure 6-54: Australian fur-seal colonies and breeding sites within the monitoring area*

### 6.5.9 Seasonality of Key Sensitivities

Table 6-10 identifies when species described within this section of the OPP typically occur within the region. Some species may occur year, round which some may be transient, or have a seasonal occurrence. The arrival of some species to the region is linked to physical processes such as seasonal upwellings in the region and may vary from year to year. This information is used to inform the impact and risk assessment, including the likelihood of a particular consequence eventuating.

*Table 6-10: 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 – South-east marine region (SEMR) is a known range | | | | | | | | | | | |
| Australian fur seal (Koorn Moorn) | Present year-round – Islands of the Bass Strait are known colonies<br>Breeding occurs during summer months (October-December) | | | | | | | | | | | |
| Pygmy blue whale | | Foraging occurs linked to 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 events | | | | | | | | | | | |
| 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 | | | | | | | | | | | |

| Environmental Sensitivity | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Southern right whale – migration | | | | Species is regularly present on the Australian coast between early-April to early November | | | | | | | | |
| Southern right whale – reproduction | | | | | | | Peak reproductive behaviours mid-July through to August | | | | | |
| Sperm whale | Prefer deep offshore environments >600 m | | | | | | | | | | | |
| **Marine Reptiles** | | | | | | | | | | | | |
| Green turtle | Occurs in limited numbers in Vic and SA | | | | | | | | | | | |
| Leatherback turtle | Foraging in the SEMR is known to occur | | | | | | | | | | | |
| Loggerhead turtle | Uncommon in southern Australia | | | | | | | | | | | |
| **Fish, Sharks and Rays** | | | | | | | | | | | | |
| Kooyang (Short finned eel) | | Adult eels begin seasonal migration to the Coral Sea. | | | | | Larvae and glass eel forms enter Victorian estuaries to complete upstream migration. | | | | | |
| 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 | | | | | | | | | | | |
| White shark | Assumed present year-round with foraging BIAs identified within the monitoring area | | | | | | | | | | | |
| 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 | | | | | | | | | | | |

| Environmental Sensitivity | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Southern dogfish | Assumed present year-round | | | | | | | | | | | |
| **Seabirds and Shorebirds** | | | | | | | | | | | | |
| Antipodean albatross | Foraging known to occur all year | | | | | | | | | | | |
| Australasian gannet | | | | | | Present year-round – foraging and aggregation BIAs | | | | Breeding occurs Oct – May | | |
| Black-browed albatross | | | | Fledglings (Apr – May) | | Present – foraging BIA | | | Breeding within SEMR on Macquarie Is. | | | |
| Black-faced cormorant | Assumed present year-round (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 | | | |
| Short-tailed shearwater (mutton bird) | Present Sep-May – foraging BIA | | | | | 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 BIA | | | | | | | | | | | |
| White-faced storm petrel | Fledglings mid-Feb – mid-Mar<br>Foraging BIA during breeding season | | | 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.<br>Foraging BIA during breeding season | | | |

| Environmental Sensitivity | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Other seabirds<br>(With no BIAs identified) | Various species – assumed present | | | | | | | | | | | |
| 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 | | | | | | | | | | | |

### 6.5.10 Marine Pests

Estuarine and marine non-native species are typically introduced and spread through coastal waters by vessel movements and, to a lesser extent, the aquarium trade and aquaculture (Clark and Johnston, 2017). Over 250 introduced marine plants and animals have been recorded in Australian waters (DAFF, 2017). Marine pests are non-native plants or animals which can have a detrimental impact on native marine ecosystems. Not all non-native species become pests, but, when they do, they are classified as invasive. Invasive species often occur in high proportions on artificial substrates (Clark and Johnston, 2017).

The Australian Government National Introduced Marine Pest Information System (NIMPIS) provides information on marine pests in Australian Waters. No IMS have been identified to occur within the operational area of the East Coast Project. One location identified on NIMPIS is in the same region as the East Coast Project: Portland (Otway Region) and has a number of detected IMS which are listed below (DAWE, 2023):

- Asian Bag Mussel (*Arcuatula senhousia)* – likely to inhabit shores and shallow waters up to 20 m deep.
- European Fan Worm (*Sabella spallanzanii)* – likely to inhabit hard and soft surfaces in shallow water up to 30 m deep.
- Japanese Kelp (*Undaria pinnatifida)* – likely to inhabit shores and shallow waters up to 20 m deep.
- Fanworm (*Euchone limnicola)* – likely to inhabit the soft sediments of sub-tidal waters up to 24 m deep.
- White Bushy Bryozoan (*Amathia distans)* – likely to inhabit the hard substrates, including on other organisms, in sheltered subtidal waters.
- Bryozoan spp. (*Cryptosula pallasiana* and *Bugula neritina)* – likely to inhabit hard substrates and is characteristically shallow water species, have been found up to 77 m deep.
- Dead Man's Finger (*Codium fragile ssp fragile)* – likely to inhabit hard substrates but has the ability to tolerate various marine environments. The species appears to occur most frequently in the low subtidal zone up to 15 m deep.
- Solitary Ascidian (*Ascidiella aspersa)* – likely to inhabit hard sediments from intertidal to shallow subtidal water 50 m deep.
- East Asian Bivalve (*Theora lubrica)* – likely to inhabit muddy sediments from the low tide mark to 50 m deep.
- European Clam (*Varicorbula gibba)* – likely to inhabit the soft sediments of subtidal waters up to 146 m deep.
- Toxic Dinoflagellate spp. (*Alexandrium tamarense* and *Alexandrium minutum)* – likely to inhabit temperate to warm temperate coastal and estuarine waters between shore and 20 m depths.

## 6.6 Conservation Values and Sensitivities

### 6.6.1 World Heritage Areas

World Heritage Places are sites of outstanding universal value, defined by cultural and/or natural criteria. Australia is home to more listed natural World Heritage Sites than any other country and contains a total of 20 World Heritage Places altogether (DCCEEW, 2022c).

There are no known World Heritage Places located within the operational area or the monitoring area. One site, the Tasmanian Wilderness, is described briefly below and displayed in Figure 6-55 due to its close proximity to the monitoring area.

#### 6.6.1.1 *Tasmanian Wilderness*

The Tasmanian Wilderness is one of the largest temperate wilderness areas in the world encompassing more than 1,580,000 hectares and covering almost a quarter of the island state of Tasmania (DCCEEW, 2023m). The place is a stronghold for several animals that are either extinct or threatened on mainland Australia and is recognised as an International Centre for Plant Diversity by the IUCN. Additionally, it is an important cultural landscape for Tasmanian Aboriginal people, who have lived there for at least 35,000 years (DCCEEW, 2023m). At its closest point the World Heritage Place is ~270 m from the monitoring area.

### 6.6.2 National Heritage Areas

The National Heritage List has been established to list places of outstanding heritage significance to Australia. In Australia, National Heritage Places are categorised as natural, historic or Indigenous sites of significance.

There are no known National Heritage Places located within the operational area, however a total of 4 were identified within the monitoring area:

- Great Ocean Road and Scenic Environs
- Point Nepean Defence Sites and Quarantine Station Area
- Western Tasmania Aboriginal Cultural Landscape
- Tasmanian Wilderness (as detailed in section 6.6.1.1).

Further, there is an additional National Heritage Place nomination which is currently under assessment, Summerland Peninsula.

Of those listed above, listed places with marine or shoreline features are described below and displayed in Figure 6-55.

#### 6.6.2.1 *Western Tasmania Aboriginal Cultural Landscape*

The Western Tasmania Aboriginal Cultural Landscape holds evidence of people moving seasonally up and down the north-west coast of Tasmania. This way of life began approximately 1,900 years ago and lasted until colonisation in the 1830s. Dotted along the wind-swept coastline of the Western Tasmania Cultural Landscape are the remains of numerous hut depressions found in Aboriginal shell middens. These huts and middens are the remnants of specialised way of life based on the hunting of seals and land mammals, and the gathering of shellfish. The Western Tasmania Aboriginal Cultural Landscape was listed as a National Heritage Place in 2013 and is categorised as an Indigenous site of significance (DCCEEW, 2021a).

#### 6.6.2.2 *Great Ocean Road and Scenic Environments*

The geomorphological features of the Port Campbell Limestone Coast are rare in their diversity, and it is the definitive place in Australia to observe limestone geomorphology and coastal erosion processes on rocky coasts. The Cretaceous coast of the Otway's displays geomorphological processes that are contributing to research into the origins of significant shore platforms that illustrate the environment prior to the breakup of Gondwana. Recreational tourism was among the purposes for the road's construction, and the cultural and natural tourism experiences it offers, including the iconic Twelve Apostles and the treacherous Shipwreck Coast, are greatly valued by the Australian community. The iconic Bells Beach is valued by Australia's surfing community for its place in Australian surfing. It was the world's first Surfing Recreation Reserve and remains the location of the world's longest running international surfing carnival and home to one the most prestigious trophies in surfing. The Great Ocean Road and Scenic Environments was listed as a National Heritage Place in 2011 and is categorised as a historic site of significance (DCCEEW, 2021b).

#### *6.6.2.3 Point Nepean Defence Sites and Quarantine Station Area*

Point Nepean is the site of the oldest, surviving, purpose-built, barracks-style, quarantine accommodation buildings in Australia, as well as fortifications demonstrating the primary importance of coastal defence to the Australian colonies. Point Nepean, and its surroundings, are a historic landscape, which features a range of values relating to both Victorian and national quarantine processes from the 1850s and to the history of coastal defence from the 1870s. The Point Nepean Defence Sites and Quarantine Station Area was listed as a National Heritage Place in 2006 and is categorised as a historic site of significance (DCCEEW, 2021c).

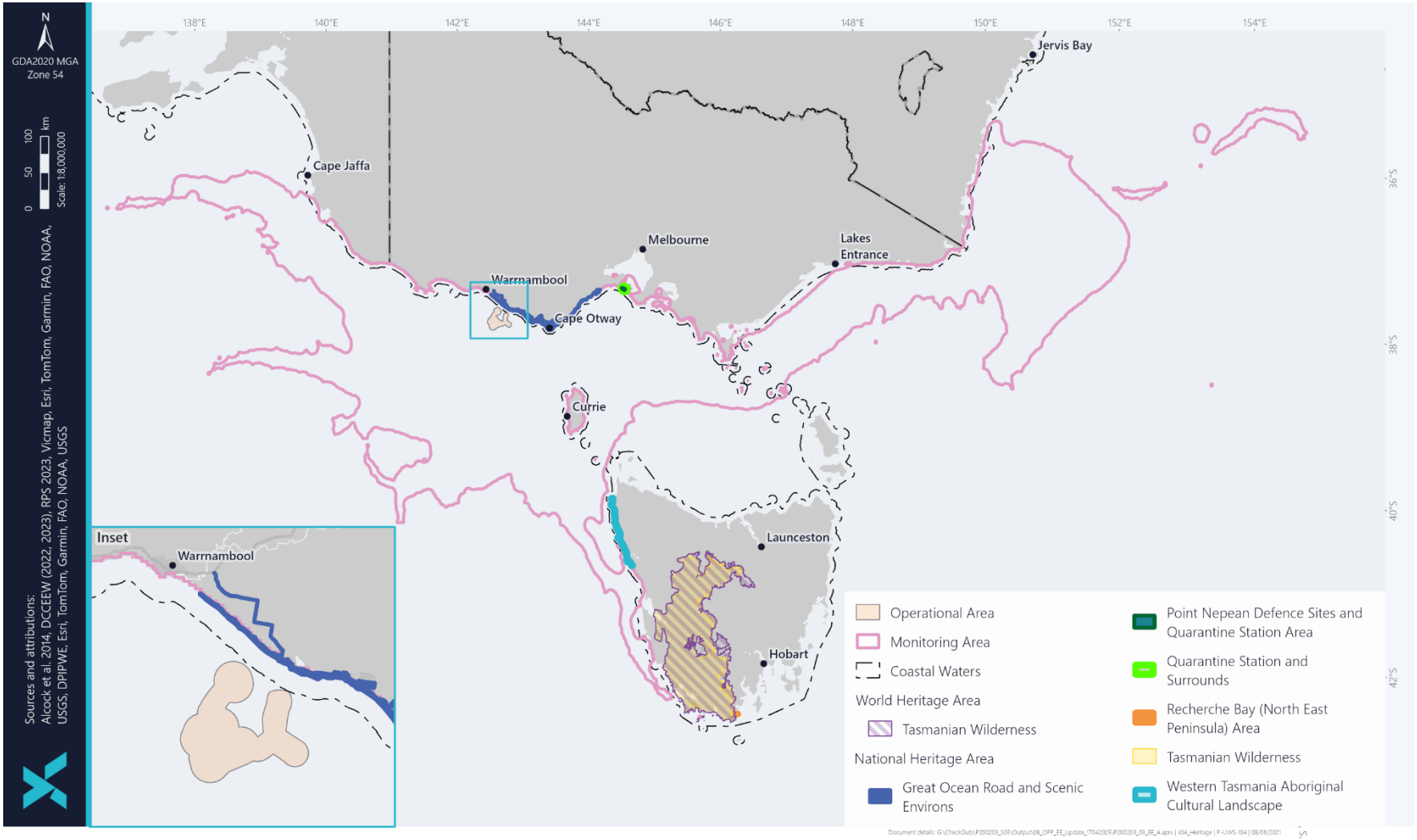



*Figure 6-55: Listed World and National Heritage Places located within the monitoring area*

### 6.6.3 Australian Marine Parks

The East Coast Project is located within the South-east marine region while the associated monitoring area overlaps both the South-east marine region and the Temperate-east marine region. Each marine region around Australia has a series of Australian Marine Parks (AMP) which are managed for the primary purpose of conserving the biodiversity found within them, while also allowing for sustainable use of natural resources. No AMPs are intersected by the operational area, however 7 are overlapped by the monitoring area (Figure 6-56) all of which are managed under the South-east marine region and described in Table 6-11.

As identified by the Director of National Parks (2025) in the South-east Marine Parks Network Management Plan key pressures to each of the 7 parks listed below include:

- Resource extraction
- Climate change
- Physical disturbance
- Invasive species
- Marine pollution (including noise, light, marine debris, sewage, and discharge of oil, chemical and heavy metals).

*Table 6-11: Australian Marine Parks located within the monitoring area*

| AMP | Zoning[8] | Major Conservation Values |
|---|---|---|
| **Apollo**<br>**Depth: 47 – 101 m** | Multiple use (VI) | Apollo AMP covers representative areas of five bioregions and contains a variety of ecosystems such as sediment-based communities, deep (mesophotic) reefs, a 5 m high raised ridge feature. There is suspected to be deeper (rariphotic) reef habitat extending from the western park boundary to the northern park boundary. The AMP is an important foraging area for a variety of seabird species such as the shy albatross and short-tailed shearwater. Further, the commercially important southern rock lobster (*Jasus edwardsii*) is thought to migrate throughout the year between state waters and the parks reef systems.<br>There is one known site of cultural heritage significance located in the AMP<br>• MV City of Rayville shipwreck |
| **Zeehan** | Multiple use (VI)<br>Special purpose (VI)<br>National Park Zone (II) | Zeehan AMP covers representative areas of four bioregions and displays low-profile platform reef across much of the shelf area. The eastern edge of the park is smooth and undulating before changing in the mid shelf to a more corrugated pavement characterised by 3-5 m high ledges with flat faces. The variety of seafloor features including the rocky limestone reefs, small canyons and coarse seafloor sediments support a diverse community of associated fauna (i.e. crustaceans, sponges, bryozoans). |
| **Nelson**<br>**Depth: 2,557 – 5,612 m** | National Park Zone (II) | Nelson AMP covers representative areas of the West Tasmania Transition bioregion and contains complex undersea topography, including lower-slope and abyssal ecosystems. The AMP is likely located in a migration pathway for a variety of whale species such as the humpback, blue, fin and sei whales. |
| **Franklin**<br>**Depth: 49 – 116 m** | Multiple use (VI)<br>National Park Zone (II) | Franklin AMP covers representative areas of four bioregions and is dominated by shelf unvegetated sediment habitat. The northern section of the AMP contains complex reef, likely formed by |

[8] *IUCN zoning categories as defined in Table 2-2*

| AMP | Zoning[8] | Major Conservation Values |
|---|---|---|
| | | volcanic lava flows, which at its shallowest depths of 35 m support kelp forests (*Ecklonia radiata*). The southern end of the AMP contains limestone pavement outcrops, and is sponge dominated in areas of higher relief. Further, the AMP is an important foraging area for a variety of seabird species. Of particular interest is the northern half of the park which is a core foraging area for the endangered shy albatross. |
| **Beagle**<br>**Depth: 46 – 77 m** | Multiple use (VI)<br>National Park Zone (II) | Beagle AMP covers representative areas of three bioregions and contains an extensive area of soft sediment with some areas of rocky reef which are likely to be a relict sand dune field prior to sea level rise. Deep (mesophotic) reefs are exposed to large currents leading to high biological productivity providing habitat for a diverse range of species from the little penguin to the white shark. Further, a high density and diversity of sponges provide food for other species by concentrating the nutrients swept past in the currents.<br>The marine park was once dry land which made up part of a land bridge to Tasmania and continues to be culturally significant for First Nations communities. There are two known sites of cultural heritage significance located in the AMP:<br>• SS Cambridge shipwreck<br>• SS Queensland shipwreck |
| **Murray**<br>**Depth: 24 – 5,729 m** | Multiple use (VI),<br>National Park Zone (II)<br>Habitat Protection Zone (IV) | Murray AMP covers representative areas of four bioregions and contains highly varied geomorphology throughout the park, potentially encompassing many shelf reef habitats. The northern edge consists predominately of Lacepede shelf, a large shelf area intersected by ancient channels of the Murray River that runs from NSW through Victoria and South Australia to the deep ocean. Further, the AMP is an important foraging area for a variety of seabirds and whales including EPBC listed species like they shy albatross and the pygmy blue whale<br>The marine park has one of the first produced management plans for Sea Country which was developed by the Ngarrindjeri Nation in associated with the Australian Government marine team. |
| **East Gippsland**<br>**Depth: 604 – 5,276 m** | Multiple use (VI) | East Gippsland AMP covers representative areas of the south-east transition bioregion and contains deep water habitats featuring large box canyons, ridges, margin slumps, and plateaus bordered by steep escarpments. There is a sufficient level of knowledge regarding the features of the park as 100% of the seafloor has been mapped. Rocky escarpments provide valuable habitat for benthic communities and mid bathyal seafloor habitats support a diverse array of mobile and sessile fauna which contribute valuable biomass to the seafloor. Further, the east Australian current interacts with the complex seafloor and results in the formation of large eddies mixing warm waters with cool nutrient-rich waters increasing marine biodiversity. |
| **Boags***<br>**Depth: 40 – 80 m** | Multiple use (VI) | Boags AMP covers ecosystems, habitats and communities associated with the Bass Strait Shelf Province and associated with the sea-floor features: plateau and mobile dune fields. Diverse soft sediment communities are dominated by crustaceans, polychaete worms and molluscs. Boags Marine Park also provides important foraging grounds for nearby breeding colonies of seabirds such as the short-tailed shearwater and shy albatross, and habitat for southern right and pygmy blue whales. |
| *Although the Boags AMP is identified by the PMST report to occur within the EMBA it is located ~3.85 km outside of the EMBA at its closest point. | | |

*Source: Director of National Parks, 2025*

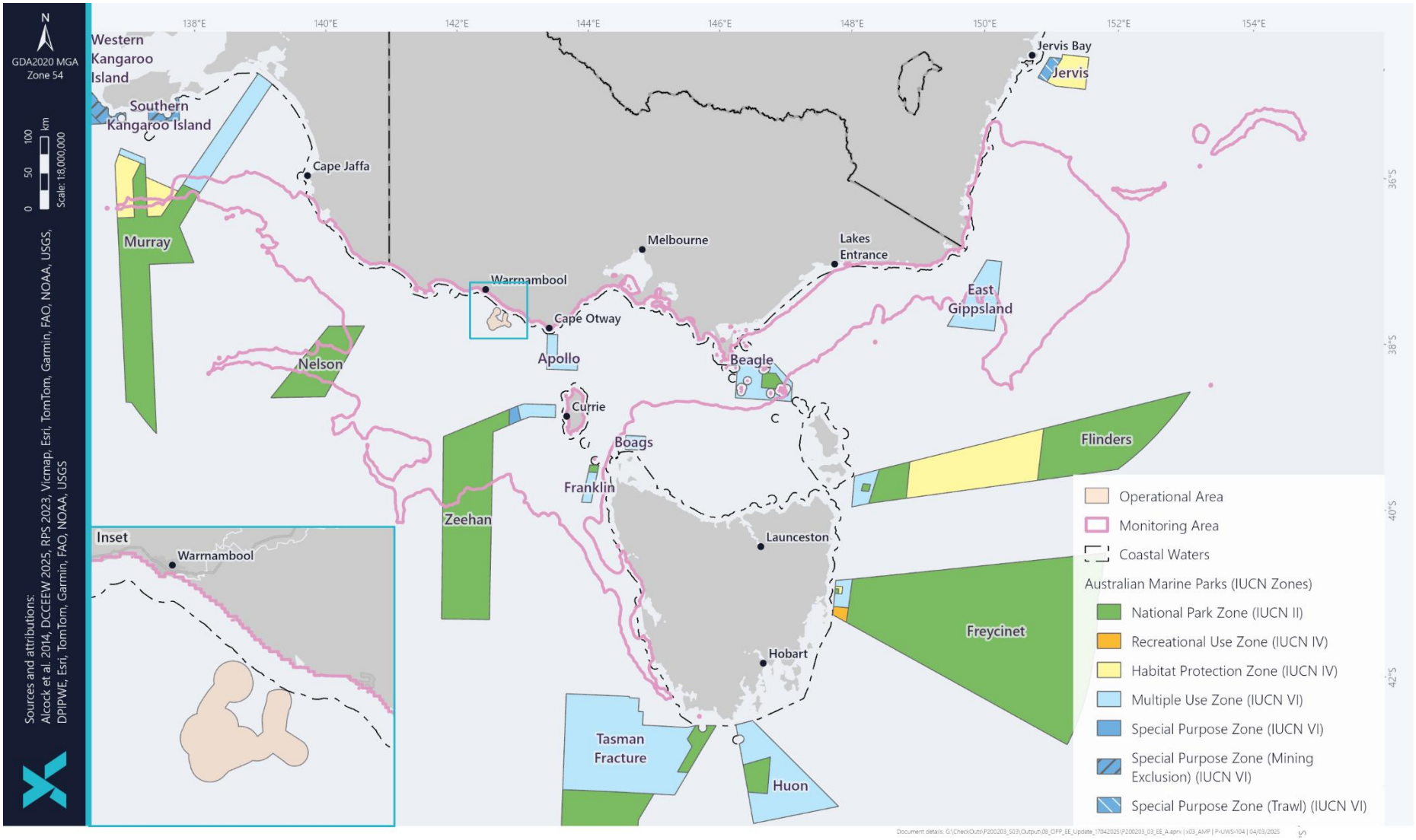



*Figure 6-56: Australian Marine Parks located within the monitoring area*

### 6.6.4 Wetlands

#### *6.6.4.1 Wetlands of International Importance*

Internationally important wetlands are termed 'Ramsar wetlands' and are representative, rare of unique, or are important for conserving biological diversity. Australia currently has 67 listed Ramsar wetlands that cover more than 8.3 million hectares (DCCEEW, 2022b).

Several Ramsar wetlands occur along the coasts of Tasmania, Victoria, NSW and South Australia. Due to their coastal presence, no Ramsar wetlands will be intersected by the operational area. Those located within the monitoring area are described below in Table 6-12 and displayed in Figure 6-57.

*Table 6-12: Ramsar wetlands located within the monitoring area*

| Ramsar Wetland | State | Major Conservation Values |
|---|---|---|
| **Corner Inlet** | Victoria | Corner Inlet protects 67,186 ha on the south-east coast of Victoria including a barrier islands, multiple beach ridges, lagoons and swamps, tidal creeks, tidal deltas, and tidal washovers.<br>Coastal habitats protected by this site include mangroves, saltmarshes, sandy beaches and extensive intertidal mudflats. Additionally, the area contains the only extensive bed of the Broad-leafed Seagrass in Victoria. A high diversity of fauna species utilise the variety of floral communities associated with the site including EPBC listed species such as the orange-bellied parrot, the growling grass frog and a variety of migratory wader species.<br>First Nations people traditionally used the site and many archaeological sites including scarred trees, burial sites, artefact scatters, shell middens and camps have been found. Additionally, the site has recreational and industrial uses.<br>Source: DCCEEW, 2019a |
| **Western Port** | Victoria | Western Port protects a large bay of ~260 km of coastline and 59,950 ha in southern Victoria. Six major rivers flow into the northern and eastern shores of Western Port and several minor rivers and creeks drain into the western shores.<br>A wide variety of habitats, from deep channels, seagrass flats, intertidal mudflats, extensive mangrove thickets and saltmarsh vegetation occur within the site. White mangrove communities within Western Port are the most well-developed and extensive in Victoria and are the largest communities situated this far south from the Equator. A high diversity of fauna species utilise the variety of floral communities associated with the site including EPBC listed species such as the orange-bellied parrot, swift parrot, fairy tern and the southern right whale.<br>First Nations people traditionally used the site and a number of cultural heritage sites on the shores of Western Port have been identified. Additionally, the site has recreational and industrial uses.<br>Source: DCCEEW, 2019b |
| **Port Phillip Bay (Western Shoreline) and Bellarine Peninsula** | Victoria | Port Phillip Bay (Western Shoreline) and Bellarine Peninsula protects 6 distinct district areas in the western portion of Port Phillip Bay, Victoria totalling 22,897 ha. The site is low-lying and a natural discharge point for the rivers draining southern central Victoria.<br>A wide variety of habitats, from shallow marine waters, seasonal freshwater swamps, estuaries, saltmarshes, intertidal mudflats and seagrass beds. This site is the most important area in Victoria for migratory waders such as the fairy tern and the sharp-tailed sandpiper. Additionally, a high diversity of other fauna species utilise the variety of floral communities associated with the site including EPBC listed species such as the orange-bellied parrot and the little tern.<br>First Nations people traditionally used the site and many sites including burial sites, artefact scatters and shell middens have been found. Additionally, the site has recreational and industrial uses. |

| Ramsar Wetland | State | Major Conservation Values |
|---|---|---|
| | | Source: DCCEEW, 2019c |
| **Lavinia** | Tasmania | Lavinia protects 7,034 ha on the north-east coast of King Island, Tasmania. The boundary of the site forms the Lavinia State Reserve, with major wetlands in the reserve including the Sea Elephant River estuary area, Lake Martha Lavinia, Penny's Lagoon, and the Nook Swamps.<br>The Lavinia State Reserve is one of the few largely unaltered areas of King Island, containing remaining native vegetation, such as Succulent Saline Herbland, Coastal Grass and Herbfield, Coastal Scrub and King Island *Eucalyptus globulus* Woodland. A high diversity of fauna species utilise the variety of floral communities associated with the site including EPBC listed species such as the orange-bellied parrot who is heavily dependent on the samphire plant for food during migration, which occurs in the saltmarsh.<br>Prior to the last ice age King Island was connected to mainland Tasmania via the Bassian Plain which allowed for passage. There are artefacts of First Nations Australian occupation on King Island that date back to this time period. Additionally, the site has recreational, and conservation uses.<br>Source: DCCEEW, 2019d |
| **Glenelg Estuary and Discovery Bay Wetlands** | Victoria | Glenelg Estuary and Discovery Bay Wetlands protects 22,289 ha on the western coast of Victoria. The site comprises three broad systems that support different wetland types: freshwater wetlands, the Glenelg Estuary and the beach and dune system. Further, the site contains several regional, and international, rare wetland types such as a humid dune slack system.<br>The wide variety of habitats supported by this wetland system in turn support a variety of fauna species. A total of 14 native, diadromous, fish species utilise these systems and migrate through them throughout their lifecycle. The site also provides habitat for 95 species of waterbirds, some of which nest on the dunes.<br>First Nations people traditionally used the site which has cultural value as it is part of their Koonang (sea) and Bocara Woorrowarook (river forest) Country. Specifically, the Gunditjmara have a living association with the site. Additionally, the site has recreational and industrial uses.<br>Source: DCCEEW, 2019e |
| **Piccaninnie Ponds Karst Wetland** | South Australia | Piccaninnie Ponds Karst Wetlands protects 862 ha on the south-east coast of South Australia. The site is an exceptional example of karst spring wetlands with the deepest spring reaching more than 110 m. There are 4 distinct area of the wetlands; Piccaninnie Ponds, Western Wetland, Eastern Wetland and Pick Swamp.<br>The karst springs support unique macrophyte and algal associations, with macrophyte growth extending to 15 m below the surface. The geomorphic and hydrological features of the site produce a complex and biologically diverse ecosystem which supports considerable biodiversity, including EPBC listed species such as the orange-bellied parrot, Australian bittern and Yarra pygmy perch.<br>First Nations people traditionally used the site which has spiritual and cultural value. The Bunganditj peoples are the Traditional Owners of the land. Additionally, the site is a popular cave diving and snorkelling attraction for the public.<br>Source: DCCEEW, 2019f |
| **Gippsland Lakes*** | Victoria | The Gippsland Lakes Wetlands protects 60,015 ha on the south-east coast of Victoria, ~300 km from Melbourne. The site contains an extensive system of estuarine, fresh and brackish coastal wetlands present including lagoons, marshes and tree-swamps.<br>The site supports a broad range of ecosystem services and benefits including nationally and internationally threatened wetland species, waterbird breeding and fish spawning sites. Cultural and socio-economic values are equally diverse, noting the particular importance of the site in |

| Ramsar Wetland | State | Major Conservation Values |
|---|---|---|
| | | a regional context in terms of recreational activities such as boating, recreational fishing and holiday tourism.<br>Source: BMT, 2011 |
| *Although the Gippsland Lakes Ramsar site is identified by the PMST report to occur within the EMBA it is located ~3 km outside of the EMBA at its closest point. | | |

#### *6.6.4.2 Wetlands of National Importance*

Nationally important wetlands are considered important for their role in maintaining ecological and hydrological conditions in wetland systems, providing important habitat for animals at a vulnerable stage in their life cycle, supporting 1% or more of the national population of any native plant or animal taxa and/or for their outstanding historical or cultural significance.

Many nationally important wetlands occur along the coasts of Tasmania, Victoria, NSW and South Australia. Due to their coastal presence, no nationally important wetlands will be intersected by the operational area. Those located within the monitoring area can be found in Appendix 1 and are displayed in Figure 6-57.

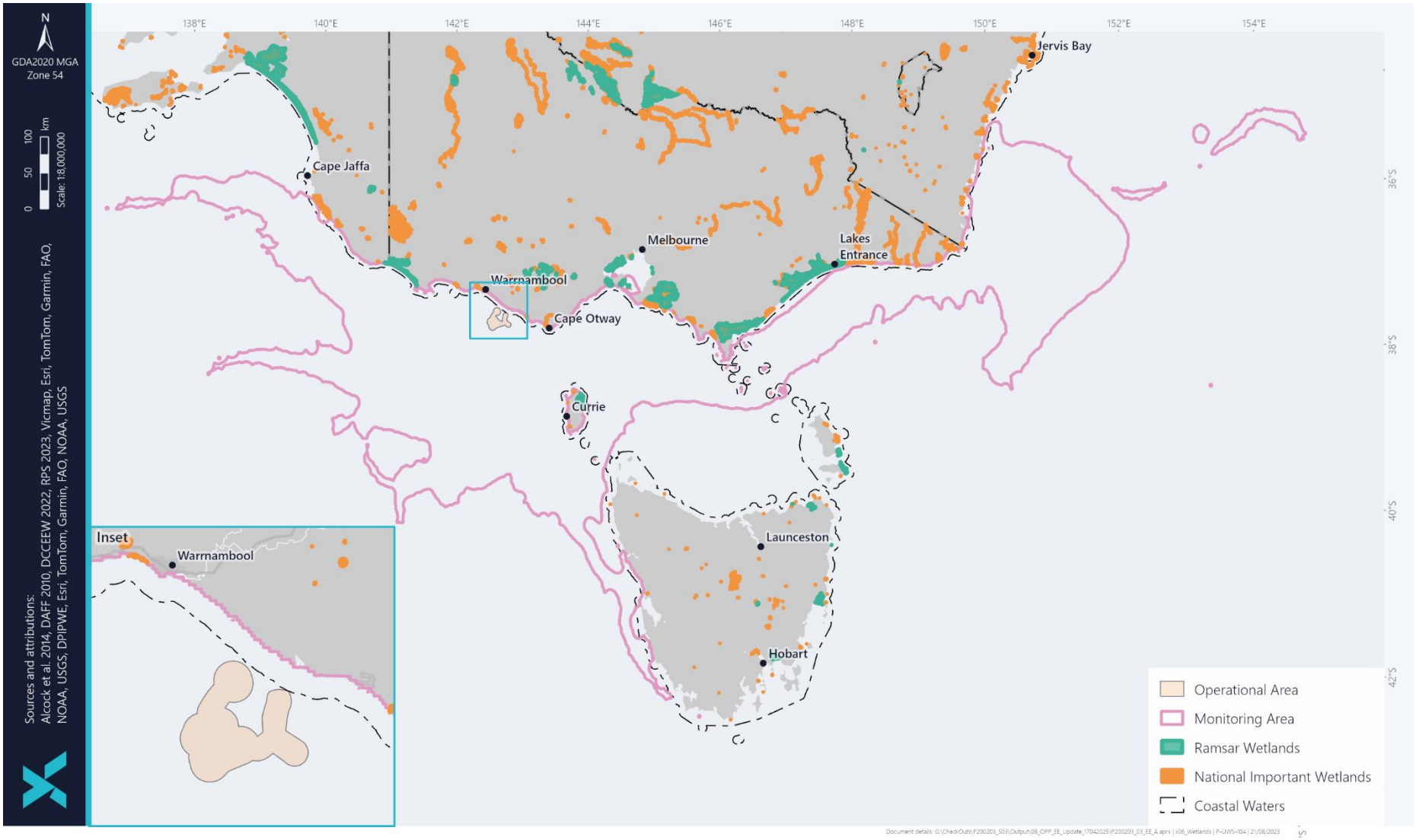



*Figure 6-57: Wetlands of Importance located within the monitoring area*

### 6.6.5 State Parks and Reserves

#### *6.6.5.1 Victoria*

In Victoria, Parks Victoria, is the statutory authority that acts in accordance with the Parks Victoria Act 2018. The group is responsible for the management of over 4 million hectares of terrestrial, coastal and marine protected areas making up 18% of Victoria's landmass and 70% of Victoria's coastline (PV, 2023). Those of relevance to the activities described in this OPP include coastal and marine protected areas (Figure 6-58) which protect coastal, intertidal or subtidal land which are of conservation or scientific significance.

There are no state protected marine or coastal protected areas located within the operational area. Those located within the monitoring area are described in Table 6-13.

*Table 6-13: Victorian Marine and Coastal Protected Areas located within the monitoring area*

| Map reference | Title | Classification | Values |
|---|---|---|---|
| **1** | Barwon Bluff | Marine Sanctuary | The Barwon Bluff Marine Sanctuary is located east of Torquay and protects 17 ha of diverse habitats including kelp forests, subtidal reef and rockpools.<br>Important Aboriginal cultural landscape is associated with the Sea Country of the protected area in association with the Wadawurrung People.<br>Surfing, diving and snorkelling are popular activities that occur within the protected area. |
| **2** | Bay of Islands Coastal Park | Conservation Park | The Bay of Islands Coastal Park is located along the Great Ocean Road west of Peterborough to Warrnambool. Main habitats within the park include beaches and dunes which are home to the threatened hooded plover. Further, in the months between May and October the southern right whale can be observed offshore.<br>The Bay of Islands Coastal Park is recognised as part of an Aboriginal cultural landscape with evidence of activities in the form of shell middens, stone artefacts, and staircases cut into the coastal cliffs found in the park.<br>Fishing, bush walking and wildlife viewing are popular activities that occur within the protected area. |
| **3** | Beware Reef | Marine Sanctuary | The Beware Marine Sanctuary is located east of Cape Conran and 3 km offshore. The sanctuary covers 1.5 km of partially exposed offshore reef making it a preferable resting place for the Australian fur-seal. The isolated reef showcases a unique mix of both warmer and cooler temperate species. Between June and August migrating whales can be seen utilized the protected area. Species may include the humpback whale or the southern right whale.<br>The protected area contains the remains of numerous shipwrecks and is a popular diving location. |
| **4** | Bunurong | Marine National Park | Bunurong Marine National Park is located on the Bass Strait coastline between Inverloch and Wonthaggi and extends out several kilometres from shore.<br>The park has intertidal sandstone rock platforms with pink coralline algae, barnacles, many molluscs and beaded algae (Neptune's Necklace). There are groups of Port Jackson sharks and southern rock lobsters in areas with kelp. The park is also home to 31 |

| Map reference | Title | Classification | Values |
|---|---|---|---|
| | | | conservation listed sea birds and shorebirds, including the hooded plover.<br>Snorkelling, surfing, and rock pooling activities are popular activities for visitors. |
| **5** | Yallock-Bulluk Marine and Coastal Park | Conservation Park | The park is located along the Bass Coast from San Remo to Inverloch.<br>This area is the traditional land and hunting grounds of the Bunurong people. It is home to the Hooded Plover.<br>There are walking and cycling trails within the park and camping areas nearby. |
| **6** | Cape Conran Coastal Park | Conservation Park | Cape Coran Park is located along Victoria's far-east Wilderness Coast.<br>The park is home to the Lace Monitor, wombats, southern brown bandicoots, long-nosed potoroos, and birds such as the New Holland honeyeater and white-bellied sea eagle. Humpback whales and southern right whales migrate through the park during the winter months. The park is part of an Aboriginal cultural landscape.<br>There are camping areas within the park as well as snorkelling, surfing, fishing, and walking activities. |
| **7** | Cape Howe | Marine National Park | Cape Howe Marine National Park is located on the eastern border of New South Wales near Gabo Island. The park is part of an Aboriginal cultural landscape.<br>The park contains shallow and deep subtidal reefs with warm and cool water species like eastern blue groper, purple wrasse, blue-throated wrasse, and herring cale. southern right whales and humpback whales regularly occur in the park, as well as humpback whales which migrate through the park and occasionally killer whales. A grey nurse shark was observed in the park in 2021.<br>SCUBA diving and coastal walking activities are popular in the park. |
| **8** | Cape Liptrap Coastal Park | Conservation Park | Cape Liptrap Coastal Park is located between Point Smythe and Waratah Bay.<br>Several rare fauna species occur in the park, including the hooded plover, swamp antechinus and powerful owl. The area also provides a vegetated coastal corridor for migratory birds.<br>The park has a camping area and is popular for fishing, swimming, rock pooling, and coastal walks. |
| **9** | Churchill Island | Marine National Park | Churchill Island Marine National Park is located south of Rhyll on the eastern shore of Phillip Island.<br>The park is influenced by tidal activities that expose mudflats and seagrass beds that provide a foraging habitat for migratory waders with the park forming part of the Western Port Ramsar Site and the East Asian-Australasian Flyway. There are migratory birds in winter months and roosting areas in the saltmarsh and mangroves for seabirds and shorebirds in the park.<br>The park is popular for bird watching, tidal watching, and coastal walks. |
| **11** | Corner Inlet Marine and Coastal Park | National Parks Act Schedule 4 park or reserve | Corner Inlet Marine and Coastal Park is located near Toora Beach.<br>The park includes a wetland area listed under the Ramsar Convention. The wetland inhabits coastal |

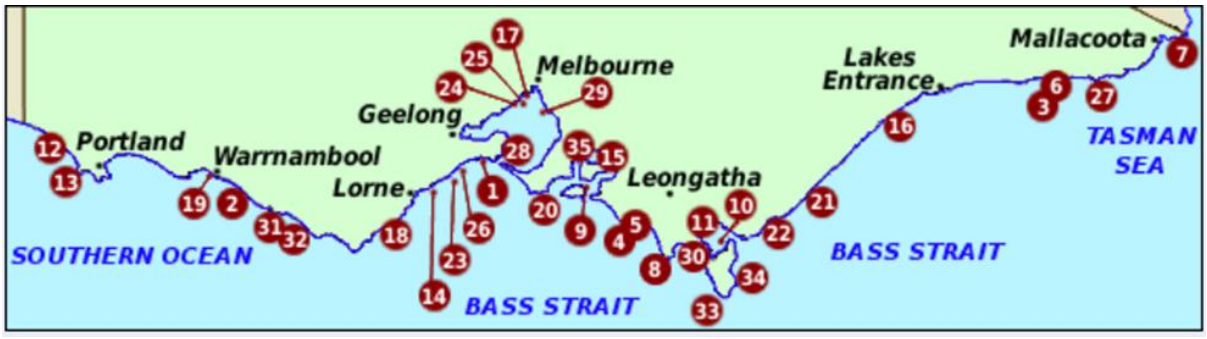
| Map reference | Title | Classification | Values |
|---|---|---|---|
| | | | woodland, vast mangrove communities, saltmarsh areas, intertidal zones and broadleaf seagrass forests.<br>The park is popular for walking, fishing, boating, picnics, and camping. |
| **12** | Discovery Bay Coastal Park | Conservation Park | Discovery Bay Coastal Park is in south-west Victoria between Portland and Nelson.<br>The beaches of the park are home to the Hooded Plover.<br>There are campgrounds located within the park, and it is popular for swimming, snorkelling, bird watching, walking, horse riding, and picnics.<br>Cultural heritage significance of Discovery Bay is discussed in Section 6.8.3.7.2. |
| **13** | Discovery Bay | Marine National Park | Discovery Bay Marine National Park is in south-west Victoria between Portland and Nelson.<br>Southern right whales and humpback whales are regularly seen within the park during their migration in winter. Blue whales are also seen in the summer months. Australian fur-seals forage nearby. The hooded plover breeds on the beaches in the Autumn months.<br>The park is popular for surfing, snorkelling, swimming, rock pooling, and coastal walks.<br>Cultural heritage significance of Discovery Bay is discussed in Section 6.8.3.7.2. |
| **14** | Eagle Rock | Marine Sanctuary | Eagle Rock Marine Sanctuary is located in Aireys Inlet and extends offshore for 300 m.<br>The shore rocks are home to octopuses, decorator crabs, chiton, and schools of tiny silver fish. Other species found in the park include Port Jackson sharks, sparsely spotted stingarees, and rusty catsharks.<br>The park is popular for rock pooling, snorkelling, diving, surfing, and coastal walks. |
| **15** | French Island | Marine National Park | The French Island Marine National Park is located in the Western Port Ramsar listed wetland. The park contains significant habitats including seagrass beds, deep channels, mangroves, and intertidal mudflats. Seagrass beds are nursery habitats for fish species including king George whiting, bream and mullet. Australian fur seals and nudibranchs are also found to use the seagrass habitats The mudflats support a variety of animals including migratory wading birds, fish, and benthic fauna including bivalves, and worms. A total of 295 migratory shorebird species have been recorded in Western Port including black swans, pied oystercatchers and royal spoonbills. |
| **18** | Marengo Reefs | Marine Sanctuary | Marengo Reefs Marine Sanctuary near the township of Marengo which is just 3 km from Apollo Bay.<br>The island is a known haul out area for Australian Fur-seals and is a Special Protection Area. southern right whales pass through this section of the coast during their migration.<br>Popular activities include snorkelling, swimming, boating, and coastal walks. |
| **19** | Merri | Marine Sanctuary | Merri Marine Sanctuary is located near the Breakwater within the City of Warrnambool. There are two islands, Merri and Middle, that sit just offshore. |

| Map reference | Title | Classification | Values |
|---|---|---|---|
| | | | A colony of little penguins live on Middle Island which is accessible during low tide. The pot-bellied seahorse is found on subtidal reefs in the sanctuary.<br>The sanctuary is popular for snorkelling, diving, rock pooling, and coastal walks. |
| **20** | Mushroom Reef | Marine Sanctuary | Mushroom Reef Marine Sanctuary is located in Flinders, on the Mornington Peninsula. The sanctuary sits within an Aboriginal cultural landscape in the traditional Sea Country of the Bunurong People.<br>Anemones, black and white sea star, saddled wrasse, magpie morwong, cowfish, weedy seadragons, crabs, elephant snail, chiton, sea hare, intertidal slug, dog winkle, blue-ringed octopus, shore crab, bryozoan, and biscuit star are all found within the sanctuary.<br>The sanctuary is popular for snorkelling, diving, coastal walks, rock pooling. |
| **22** | Nooramunga Marine and Coastal Park | National Parks Act Schedule 4 park or reserve | Nooramunga Marine and Coastal Park is located near McLoughlins Beach and is protected from the harsh surf of the Bass Strait by barrier islands resulting in quiet waters.<br>The park is composed of a network of shallow marine waters, extensive tidal inlets, intertidal mudflats and a the only extensive broad-leaf seagrass meadows in Victoria.<br>Common recreational activities include fishing, bird watching, swimming, and bush camping. |
| **23** | Point Addis | Marine National Park | Point Addis is located between Torquay and Anglesea.<br>Many sea birds and mammals of conservation significance, including blue whales, southern right whales, filler whales, and Australian fur-seals, have been recorded in this park. Twenty-six conservation listed shore and sea birds have been sighted in the park.<br>There are two historic shipwrecks within the park.<br>The park is popular for rock pooling, snorkelling, diving, surfing, and coastal walks. |
| **26** | Point Danger | Marine Sanctuary | Point Danger Marine Sanctuary is located in Torquay.<br>The sanctuary is recognised for its diverse sea slug fauna found on both intertidal and subtidal reefs with 96 species recorded, many of which are endemic. There are three species of albatross located in the sanctuary.<br>The sanctuary is popular for snorkelling, SCUBA diving, rock pooling, scenic walks. |
| **27** | Point Hicks | Marine National Park | Point Hicks Marine National Park is ~450 km east of Melbourne and 25 km south of Cann River.<br>The park contains a variety of marine ecological communities, including sandy beaches, intertidal and subtidal rocky reefs, subtidal soft sediments and pelagic communities. The park has high landscape and seascape values. The granite headland of Point Hicks contrasts strongly with the adjacent sandy shorelines.<br>The most popular activity in the park is sightseeing and appreciating the seascape values. |
| **28** | Port Phillip Heads | Marine National Park | Port Phillip Heads Marine National Park is located in Queenscliff, east of Melbourne. |

| Map reference | Title | Classification | Values |
|---|---|---|---|
| | | | The park is part of an Aboriginal cultural landscape in the traditional Sea Country of the Wadawurrung Peoples.<br>Australasian gannets, blue devilfish, octopus, feather stars, cuttlefish, Australian fur-seals, whales, dolphins, little penguins and weedy sea dragons are all found within the sanctuary.<br>The park is popular for diving, snorkelling, surfing, water sports, and bird watching. |
| **30** | Shallow Inlet Marine and Coastal Park | National Parks Act Schedule 4 park or reserve | Shallow Inlet Marine and Coastal Park is located between Waratah Bay and the majestic peaks of Wilsons Promontory.<br>It is characterised by sheltered waters with extensive areas of subtidal and intertidal sediments.<br>The sheltered waters of Shallow Inlet provide a secluded and peaceful setting for a range of water-based activities such as fishing, boating and sailboarding. |
| **31** | The Arches | Marine Sanctuary | The Arches Marine Sanctuary is only accessible by boat and is located offshore from Port Campbell.<br>The sanctuary is an important site for Port Jackson sharks. Birds such as the shy albatross, the short-tailed shearwater, and the black-faced cormorant use the sanctuary as a feeding ground.<br>The sanctuary is popular for diving, beach walks, and trail walks. |
| **32** | Twelve Apostles | Marine National Park | The Twelve Apostles Marine National Park is located near Princetown.<br>Port Jackson sharks and southern rock lobsters are found in the park, as well as birds such as magpie perch and blue throated wrasse. A large breeding colony of little penguins in found within the park, as well as the hooded plover.<br>There is a shipwreck within the sanctuary but is known for rough waters.<br>Popular activities in the park are trail walks, diving, beach walks, surfing, and fishing. |
| **33** | Wilsons Promontory | Marine National Park | Wilsons Promontory National Park is approximately three hours' drive from Melbourne.<br>Southern right whales and humpback whales can be seen during their migration. The hooded plover can also be found within the park.<br>Popular activities include trail walks, swimming, snorkelling, and camping.<br>Cultural heritage significance of Wilsons Promontory is discussed in Section 6.8.3.7.2. |
| **34** | Wilsons Promontory Marine Park and Reserve | National Parks Act Schedule 4 park or reserve | Wilsons Promontory National Park is approximately three hours' drive from Melbourne.<br>Southern right whales and humpback whales can be seen during their migration. The offshore islands are home to Australian fur-seals which breed on Kanowna Island. The park is vital for the recovery of white shark populations.<br>The park is popular for SCUBA diving, kayaking, canoeing, and snorkelling.<br>Cultural heritage significance of Wilsons Promontory is discussed in Section 6.8.3.7.2. |

| Map reference | Title | Classification | Values |
|---|---|---|---|
| **35** | Yaringa | Marine National Park | Yaringa Marine National Park is Victoria's smallest Marine National Park and located in the sheltered northwest corner of Western Port in Watsons Inlet between Watsons Creek and Quail Island. The Park includes large areas of mangroves and saltmarshes which are of high value roosting and feeding habitat for seabirds and shorebirds. Around 30% of the park is covered by saltmarsh, and another 30% covered by mangroves including the some of the largest White Mangroves (*Avicennia marina*) remaining in Victoria. More than 82% of the Park is intertidal. Extensive intertidal and subtidal seagrass meadows provide important habitat for grazing invertebrates and also provides a nursery for many fish, including a number of recreationally and commercially targeted species such as King George whiting. |

*Source: Parks Victoria, 2023*




*Source: Travel Victoria, 2023*

*Figure 6-58: Victorian Coastal and Marine Protected Areas*

### *6.6.5.2 Tasmania*

In Tasmania, Tasmanian Parks and Wildlife Service (PWS) and Forestry Tasmania, manage 3,621,000 ha of reserved area across the terrestrial, coastal and marine environments (PWS Tas, 2022a). Those of relevance to the activities described in this OPP include coastal and marine protected areas (Figure 6-59 and Figure 6-60). These areas conserve the state's nature and cultural heritage while still allowing for sustainable use and economic opportunity for the Tasmanian community.

There are no state protected coastal or marine protected areas located within the operational area. Those located within the monitoring area are described in Table 6-14.

*Table 6-14: Tasmanian Marine and Coastal Protected Areas located within the monitoring area*

| Council | Title | Classification | Values |
|---|---|---|---|
| **Marine** | | | |
| **Flinders** | Kent Group | National Park<br>Marine Reserve | The Kent Group is located in the north-eastern Bass Strait and consists of a group of 5 isolated granitic islands and several islets. The islands themselves are protected as a National Park while the waters around the islands are protected by the Beagle AMP and Kent Group Marine Reserve. Values and sensitivities associated with the island include:<br>• Rocky shorelines, with steep cliffs on the southern and western shorelines. |

| Council | Title | Classification | Values |
|---|---|---|---|
| | | | • The convergence of 3 major ocean currents occurs at the Kent Group resulting in a unique diversity of marine life<br>• Breeding habitat for the resident white-bellied sea eagle from June to January<br>• Breeding habitat for short-tailed shearwater and the Pacific Gull who are present from September to May<br>• Breeding habitat for the little penguin. Species is present year-round, breeds June to February and moults February to March<br>• Over 20 recorded shipwrecks lay in the shallow waters surrounding the islands.<br>*Source: EPA Tas, 2023* |
| **Terrestrial** | | | |
| **Circular Head** | Arthur-Pieman | Conservation Area | The Arthur Pieman Conservation Area is located along the coastline of north-west Tasmania from the Arthur River in the north to the Pieman River in the south. The Conservation Area protects a range of ecosystems including some of the largest dune fields and the most extensive peatlands in the state. Species of significance found within the Conservation Area include the orange-bellied parrot whose migration pathway crosses over the reserve while the beaches are known habitat for the hooded plover.<br>The region forms part of the homelands of four clans from the North West nation, peerapper, manegin, tarkinener and peternidic. Stories of these clans are embedded in the landscape and to this day provide a spiritual connection for Tasmanian Aboriginal people. The Conservation Area is rich in Aboriginal shell middens, hut depression sites, artefacts and rock engravings.<br>Other popular activities conducted within the Conservation Area include fishing, camping and surfing.<br>*Source: PWS Tas, 2022a* |
| **King Island** | Lavinia | State Reserve | The Lavinia State Reserve is located on the eastern coast of King Island, Tasmania and is largely unaltered. The State Reserve include the internationally protected Lavinia Ramsar wetland and protects multiple types of wetlands (swamp, freshwater and sedge/rush), swamp forest, lagoons and herbfields.<br>Ecological communities on the site are considered traditional as they represent a transition between vegetation on mainland Tasmania and mainland Australia making it a regional biodiversity hotspot. Species of significance found within the State Reserve include the orange-bellied parrot which often stop in King Island on their migration across the Bass Strait.<br>*Source: Ramsar, 2014* |
| **Circular Head** | Black Pyramid Rock | Nature Reserve | Black Pyramid Rock Nature Reserve is located south of King Island and west of Hunter Island within the Bass Strait. Values and sensitivities associated with the island include:<br>• Geological features include tertiary basaltic volcanics including both lava and pyroclastic deposits and small areas of limestone.<br>• Largest breeding ground for Australasian gannets in the Bass Strait and one of 8 sites nationally (breeding occurs between September and April).<br>*Source: DPIWE, 2000* |
| **King Island** | Christmas island | Nature Reserve<br>Game Reserve | Christmas Island Nature Reserve and New Year Island Game Reserve which are located off the north-west coast of King Island. Councillor Island Nature Reserve is located off the east coast of King Island. |

| Council | Title | Classification | Values |
|---|---|---|---|
| | New Year Island<br>Councillor Island<br>Reid Rocks | Nature Reserve<br>Nature Reserve | Values and sensitivities associated with the islands include:<br>• Seabird rookery complex, small terns<br>  ○ Nesting colonies for the fairy tern and the little tern (Christmas Island)<br>Reid Rocks Nature Reserve is located in western Bass Strait between King Island and the north-western coastline of Tasmania. Values and sensitivities associated with Reid Rocks Nature Reserve include:<br>• Home to one of Tasmania's only Australian fur-seal breeding colonies<br>• The vegetation of the reserves is dominated by succulent herbfield communities.<br>*Source: DPIWE, 2000; Threatened Species Section, 2012* |
| **Flinders** | Curtis Island<br>Cone Islet | Nature Reserve<br>Conservation Area | Curtis Island is a granite island located in the northern Bass Strait. Curtis Island is one of 3 islands in the Curtis Group and is a protected Nature Reserve. Values and sensitivities associated with the Curtis Island include:<br>• Rocky shorelines, with steep cliffs on the southern shorelines<br>• Little penguins are found in high numbers. Species is present year-round, breeds June to February and moults February to March<br>• Haul out site for the Australian fur-seal which are present year-round<br>• Breeding habitat for threatened seabird species:<br>  ○ Short-tailed shearwater (present September to May)<br>  ○ Pacific gull (present all year, breed September to January).<br>Cone Islet is a small granite island part of the Curtis Group and is a protected Conservation Area. It is located to the south-east of Curtis Island.<br>*Source: EPA Tas, 2023* |
| | Devils Tower | Nature Reserve | Devils Tower is a Nature Reserve located in the northern Bass Strait north of the Curtis Group. Values and sensitivities associated with the Devils Tower include:<br>• Rocky shorelines, with steep cliffs on the southern and western shorelines<br>• Haul out site for the Australian fur-seal which are present year-round<br>• Breeding habitat for threatened seabird species:<br>  ○ Short-tailed shearwater (present September to May)<br>  ○ Smaller petrel species.<br>*Source: EPA Tas, 2023* |
| | Rodondo Island<br>East Moncoeur Island<br>West Moncoeur Island | Nature Reserve<br>Conservation Area<br>Nature Reserve | The Rodondo Group is comprised of 3 islands; Rodondo Island and East and West Moncoeur Island. The islands are comprised entirely of rocky shorelines, with steep cliffs on most shorelines. Values and sensitivities associated with the islands of the Rodondo Group include:<br>• Rocky shorelines, with steep cliffs on the western shorelines<br>• Haul out site for the Australian fur-seal which are present year-round (Rodondo Island)<br>• Breeding colony for the Australia fur-seal which are present year-round, pups are born November to December and moult January to March (West Moncoeur Island)<br>• Little penguins are found in high numbers. Species is present year-round, breeds June to February and moults February to March |

| Council | Title | Classification | Values |
|---|---|---|---|
| | | | • Breeding habitat for threatened seabird species:<br>  ○ Short-tailed shearwater (present September to May)<br>  ○ Pacific gull (present all year, breed September to January)<br>  ○ Fairy prion.<br>*Source: EPA Tas, 2023* |
| | Hogan Group | Conservation Area | The Hogan Group is located in the north-eastern Bass strait at the northern limit of Tasmanian territorial waters. Hogan Island is the largest of 7 islands that make up the group and is a protected Conservation Area. Values and sensitivities associated with the Hogan Group include:<br>• Rocky shorelines, with steep cliffs on the western shorelines<br>• Little penguins are found in high numbers. Species is present year-round, breeds June to February and moults February to March<br>• Breeding habitat for threatened seabird species:<br>  ○ Short-tailed shearwater (present September to May)<br>  ○ Pacific gull (present all year, breed September to January).<br>Further, Boundary Islet (previously North East Islet) is grouped within the Hogan Group and is a protected Nature Reserve. It is located to the north-east of Hogan Island. Sensitivities associated with Boundary Islet include:<br>• A haul-out site for the Australian fur-seal which are present year-round.<br>*Source: DPIPWE, 2011; EPA Tas, 2023* |
| **West Coast** | Ocean Beach | Conservation Area | Ocean Beach Conservation Area is located on mainland Tasmania ~6 km west of Strahan on the western coast. The Conservation Area protects over 40 km of coastline and is considered Tasmania's longest beach.<br>The area provides habitat for threatened beach-nesting birds, shearwaters, and the critically endangered orange-bellied parrot.<br>*Source: Wildcare Tasmania, 2023* |
| **Huon Valley** | Southwest | National Park<br>Conservation Area | The Southwest National Park is part of the Tasmanian Wilderness World Heritage Area and is Tasmania's largest National Park covering almost 10% of the state. The National Park is located along the south-western coast of mainland Tasmania. The park protects a wide range of habitats from rocky coastlines and beaches to mountain ranges and buttongrass plains. The extensive variety of habitat leads to a high species diversity. Species of significance supported by the park include the critically endangered orange-bellied parrot who breeds exclusively within the park each year, the short-tailed shearwater and the hooded plover.<br>The south-west of Tasmania is rich in resources and considered an Aboriginal cultural landscape where midden sites, artefact scatters, hut depressions and rock shelters provide links to the people that have lived, hunted, gathered and walked this land.<br>The South Coast Track is a difficult 86 km multi-day hike located within the park that is popular among experienced hikers. Other popular activities conducted within the National Park include fishing, kayaking and bush walking.<br>*Source: PWS Tas, 2022a* |

*Source: PWS Tas, 2022b*

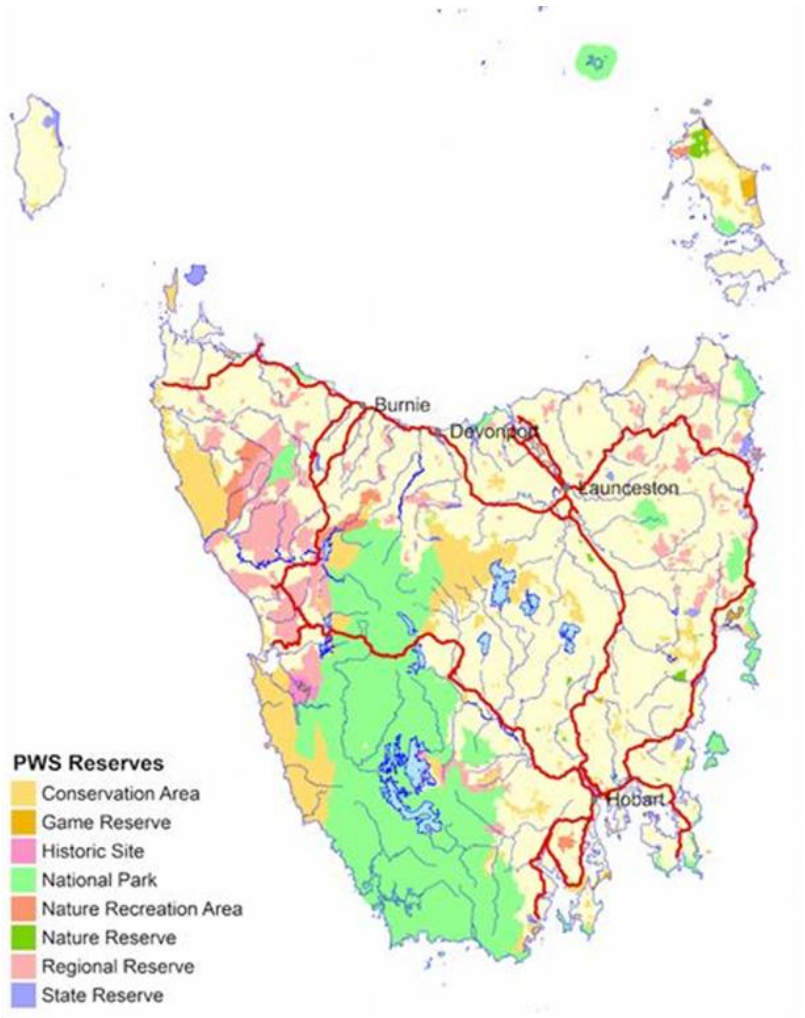
Additional protected areas were identified within the monitoring area, however limited data is available, therefore they are listed below.

**Mainland Tasmania** (Figure 6-59)

- Four Mile Beach – Regional Reserve
- Sugarloaf Rock – Conservation Area
- Mount Heemskirk – Regional Reserve
- Trial Harbour – State Reserve.

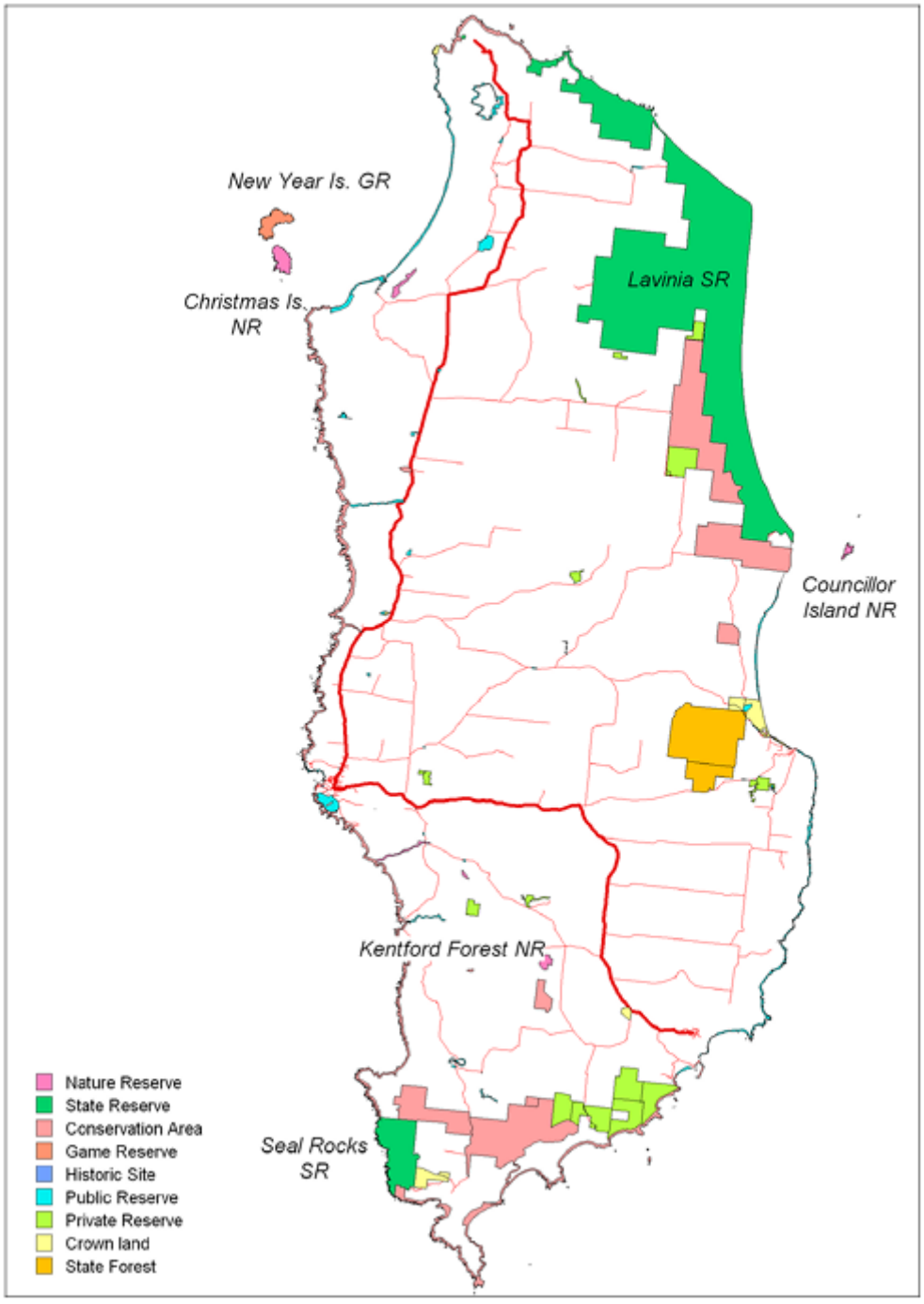
**King Island** (Figure 6-60)

- Seal Rocks – Conservation Area and State Reserve
- Porky Beach – Conservation Area
- Cataraqui Point – Conservation Area
- Stokes Point – Conservation Area
- Badger Box Creek – Nature Reserve
- Cape Wickham – Conservation Area and State Reserve
- City of Melbourne Bay – Conservation Area
- Red Hut Point – Conservation Area
- Sea Elephant – Conservation Area
- Disappointment Bay – State Reserve.




*Source: PWS Tas, 2022*

*Figure 6-59: Tasmanian Reserved Areas*




*Source: Threatened Species Section, 2012*

*Figure 6-60: Reserves on King Island*

### *6.6.5.3 New South Wales*

Protected areas in NSW are set aside for conservation and include a range of habitats and ecosystems, a diversity of flora and fauna species, significant geological features and landforms, as well as Aboriginal cultural heritage sites, heritage buildings and historic sites (NSW DPE, 2023). In NSW protected areas are managed by the NSW Nationals Parks and Wildlife Service (NPWS). Additionally, 30 protected areas are jointly managed between NPWS and Aboriginal peoples. Figure 6-61 displays protected reserves within the state of NSW.

There are no state protected coastal or marine protected areas located within the operational area. Those with marine or shoreline features located within the monitoring area are described in Table 6-15.

*Table 6-15: NSW Marine and Coastal Protected Areas located within the monitoring area*

| Title | Classification | Values |
|---|---|---|
| **Marine** | | |
| **Batemans Bay** | Marine Park | Batemans Bay Marine Park is one of 6 Marine Parks within NSW state waters. The boundary of the Marine Park extends from the mean high water mark seaward 3 nm from Murramarang Beach near Bawley Point to the southern side of Wallaga Lake entrance at Murunna Point and includes the Tollgate Islands and Montague Island. It is a multiple use protected area that is sectioned into zones:<br>• General Use Zone<br>• Habitat Protection Zone<br>• Sanctuary Zone.<br>Each zone has specific strict management rules for activities such as recreational fishing and spearfishing permissions.<br>Batemans Bay Marine Park is unique for its large expanses of rocky reef which support a diverse array of species. A large variety of habitats occur within the Marine Park such as rocky shores, offshore rocky reefs, kelp beds, seagrasses, mangroves, sponge gardens, sandy beaches, estuaries and open waters. The Marine Park contains important habitat for the critically endangered grey nurse shark and is a common location to see the humpback whale and southern right whale.<br>One of the most culturally and spiritually significant Aboriginal sites within Batemans Marine Park is Barunguba, or Montague Island which features artefact scatters and mideens. Further, dreaming stories and song lines link the island to the mainland's Gulaga (Mount Dromedary) and Najanuga (Little Dromedary).<br>Popular activities conducted in the Marine Park include swimming, boating, fishing and wildlife viewing. |
| **Terrestrial** | | |
| **Beowa** | National Park | Beowa National Park, formally known as Ben Boyd National Park is located on the southern NSW coastline near Eden. The National Park is split by Twofold Bay into 2 sections and has a variety of landscape features such as rocky cliffs, red-rock platforms, lakes and beaches. The National Park is along the humpback whales migration path and is a popular whale watching spot in winter and spring. Further, the 32 km Light to Light walk traces the National parks coastline and has been deemed one of the best coastal walks in NSW.<br>More than 50 Aboriginal sites have been recorded in Beowa National Park including middens, rock shelters, campsites and long-distance travel routes.<br>Popular activities conducted in the National Park include swimming, surfing, fishing and camping. |
| **Bournda** | National Park | Bournda National Park is located on the NSW coastline, near Tathra and contains a mix of lagoons, lakes, creeks, beaches and coastal forests. The estuarine wetlands provide roosting and feeding areas for a large variety of bird species like the little tern and the hooded plover.<br>Bournda has been a special place for the Dhurga and Yuin people for thousands of years. The terrain provided plentiful food supply and quarry for making tools. Further, there is evidence of European heritage dating back to the 1830s within the National Park. Anchor bolts can be seen at Kangarutha Point, which was established as a port with Kianinny Bay in 1859.<br>Popular activities conducted in the National Park include swimming, surfing, fishing and camping. |

| Title | Classification | Values |
|---|---|---|
| **Eurobodalla** | National Park | The Eurobodalla National Park is located on the NSW coastline, stretching between Moruya Head to Mystery Bay and contains a range of aquatic environments. The National Park provides habitat for a variety of birds like the hooded plover and little tern and is an over-wintering area for migratory species.<br>Eurobodalla National Park is the traditional Country of the Yuin People. The terrain provided a rich source of food, shelter, medicines and weapons and continues to be an important place for Aboriginal people today. The reserve contains the Bingi Dreaming track, a 14 km walk along the coast from Congo to Tuross Head.<br>Other popular activities include camping, surfing and fishing. |
| **Nadgee Nature Reserve** | Nature Reserve | The Nadgee Nature Reserve is located on the NSW coastline, south of Eden. The reserve sits within Australia's Coastal Wilderness, which runs from the south coast of NSW to East Gippsland in Victoria. The reserve is largely undisturbed providing a combination of coastal health, forest and shoreline where flora and fauna flourish.<br>A section of the reserve is associated with the Bidawal people and the Dtharwa and Monaroo people. Aboriginal people have a long spiritual and cultural association with the area around Nadgee and middens can be seen and along the shore of the park.<br>The reserve contains a large section of the Nadgee wilderness walk which is a 55 km coastal walk from Merrica River, VIC to Mallacoota, NSW. Other popular activities include camping, wildlife viewing and swimming. |
| **Barunguba Montague Island** | Nature Reserve | The Barunguba Montague Island Nature Reserve is located 9 km off the south coast of NSW, near Narooma. The National Park is home year-round to a large colony of seals (both New Zealand and Australian fur-seals) who are a major tourism attraction for the island. The island is in the migration pathway of the humpback whale which can often be seen making its migration in spring and winter.<br>The Yuin people have a long connection with the Island, travelling to the island for traditional ceremonies and food, and using it as a men's teaching place. There are many Aboriginal artefacts and middens on the island. In June 2018 Barunguba was declared an Aboriginal Place under the *National Parks and Wildlife Act 1974*.<br>Access to the island is only available by NPWS-contracted commercial vessel tour operators for guided tour visitors or visitors with an overnight accommodation. Wildlife viewing is the most popular activity on the island. |

*Source: DPI,2023; NSW NPWS, 2023*

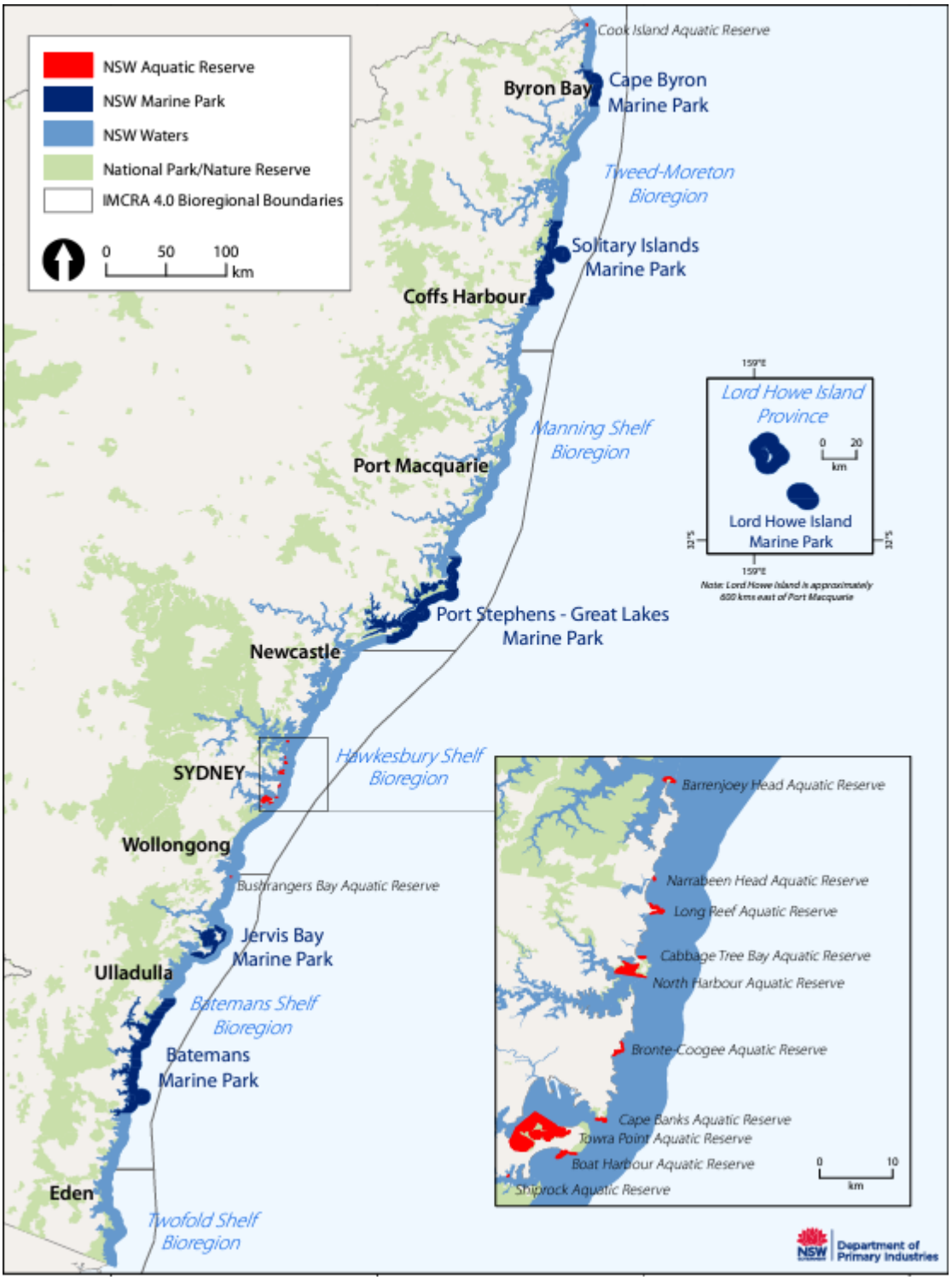



*Figure 6-61: NSW Protected Areas (DPI, 2023)*

### *6.6.5.4 South Australia*

In South Australia protected areas are managed National Parks and Wildlife Services South Australia. In South Australia protected areas:

- Conserve important ecosystems, habitats, flora and fauna, unique land formations, and culturally significant places
- Ensure clean air, soil and water

- Contribute to global efforts to conserve biodiversity against the impacts of climate change.
- Maintain connection to Country for Aboriginal people (DEW, 2023a).

Figure 6-62 displays protected reserves within the state of South Australia. There are no state protected coastal or marine protected areas located within the operational area. Those with marine or shoreline features located within the monitoring area are described in Table 6-16

*Table 6-16: South Australian Marine and Coastal Protected Areas located within the monitoring area*

| Title | Classification | Values |
|---|---|---|
| **Marine** | | |
| **Lower South East** | Marine Park | The Lower South East Marine Park is divided into 2 sections: the first adjacent to Canunda National Park and the second from MacDonnell Bay just west of French Point to the Victorian border. The Marine Park lies within the Limestone Coast and is considered a major tourism destination. The Marine Park features various habitats such as:<br>• High energy sandy beaches and freshwater springs associated with the Piccaninnie Ponds Ramsar site<br>• Various reef types (shore platforms, fringing and limestone)<br>• South Australia's only giant kelp forest<br>• Natural process such as the Bonney Upwelling that supplies nutrient-rich water to the area and is an important feeding ground for the endangered pygmy blue whale<br>• Two sanctuary zones establish to help foster the population of the southern rock lobster, a species of commercial importance.<br>The Buandig Aboriginal people have traditional associations with this region, including with the marine environment and associated marine life.<br>Popular activities conducted in the Marine Park include boating, fishing diving and snorkelling. |
| **Upper South East** | Marine Park | The Upper South East Marine Park overlaps the Coorong and Otway Bioregions and is divided into 2 sections. The northern section runs from 11 km north of Tea Tree Crossing on the Coorong Ocean Beach to the Maria Creek outlet at Kingston SE. The second from Wright Bay to the northern most point of Stinky Bay.<br>The Marine Park lies within the Limestone Coast and is considered a major tourism destination. The Marine Park features various habitats such as<br>• High energy sandy beaches back by vast sand dunes<br>• Fringing limestone and platform reefs<br>• Dense seagrass beds and kelp forests which provide important nursey habitat for juvenile fish and invertebrate species<br>• Natural process such as the Bonney Upwelling that helps drive the region's high biological productivity and is an important feeding ground for the endangered pygmy blue whale<br>• Baudin Rocks is an important breeding and haul-out site for seal species including the vulnerable Australian sea lion.<br>Two Aboriginal groups, the Ngarrindjeri and Buandig people, have traditional associations with areas of the marine park.<br>Popular activities conducted in the Marine Park include boating, fishing diving and snorkelling. Annual fishing competitions occur at Robe and Kingston SE. |
| **Terrestrial** | | |
| **Piccaninnie Ponds** | Conservation Park | Piccaninnie Ponds Conservation Park is located on the lower south-east coast of South Australia next to the Victorian border. The park features a Ramsar listed wetland (see section 6.6.4.2) and is valued for its underwater limestone chasms making it a renowned diving site.<br>Popular activities conducted in the park include diving, snorkelling and bush walking. |

| Title | Classification | Values |
|---|---|---|
| **Douglas Point** | Conservation Park | Douglas Point Conservation Park is located on the lower south-east coast of South Australia just west of Port Macdonnell. The coastal park features areas of exposed limestone, sea cliffs, small sandy beaches and dense coastal vegetation.<br>The Bunganditj Aboriginal people are the traditional owners of this area.<br>Popular activities conducted in the park include bush walking, diving and fishing. |
| **Canunda** | National Park | Canunda National Park is located on the lower south-east coast of South Australia north-west of Millicent. The park features 40 km of coastline, limestone cliffs, sea stacks, offshore reefs, mobile sand dunes and stretches of beach.<br>There is evidence throughout the park of the Boandik Peoples, who once regularly camped along the coast.<br>Popular activities conducted in the park include four-wheel driving, snorkelling and fishing. |
| **Little Dip** | Conservation Park | Little Dip Conservation Park is located on the lower south-east coast of South Australia just south of Robe. The park features a rugged coastline, dunes and a number of small lakes and is key habitat for threatened species such as the hooded plover.<br>The park was traditionally home to the Bunganditj and Meintangk indigenous groups. Shell middens can still be seen in the park today.<br>Popular activities conducted in the park include bush walking, surfing and fishing. |

*Source: DEW, 2023b; DEW, 2023c*

Additional protected areas were identified within the monitoring area, however limited data is available, therefore they are listed below.

- Nene Valley – Conservation Park
- Unnamed (No.HA1404) – Heritage Agreement
- Unnamed (No.HA26) – Heritage Agreement
- Unnamed (No.HA1457) – Heritage Agreement.

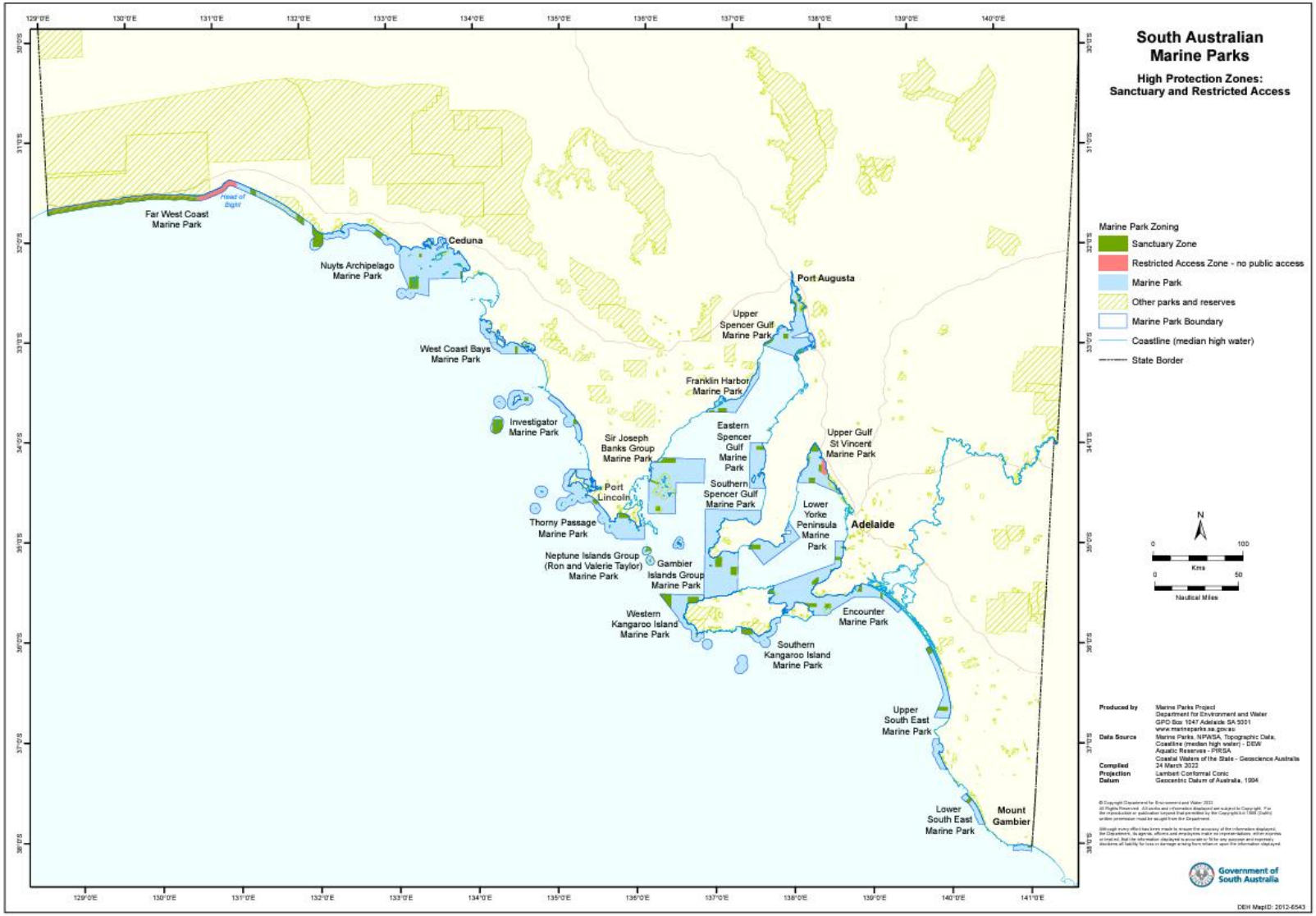



*Figure 6-62: South Australia Protected Areas*

### 6.6.6 Key Ecological Features

Key Ecological Features (KEFs) are not matters of national environmental significance and have no legal status in their own right. However, they may be considered as components of the Commonwealth marine environment and may have some values that are of importance for the region's biodiversity, productivity. KEFs with mapped spatial boundaries are presented in the Australian Marine Spatial Information System (AMSIS) (AMSIS, 2025).

PMST reports were generated for the operational area, EMBA and monitoring area to identify spatially delineated KEFs within these areas (Appendix 1). Several spatially delineated KEFs are located within the South-east marine region and the Temperate east marine region, however none are intersected by the operational area (Appendix 1). Those within the monitoring area are described in Table 6-17 and spatially delineated KEFs are displayed in Figure 6-64.

Within the Otway Bioregion the Shelf Rocky Reef and hard substrate KEF is not reported in the PMST search, but is described in the Species Profile and Threat (SPRAT) database. There are no shape files available for this KEF but its presence is described as occurring '*in all areas of the South-east Marine Region continental shelf including Bass Strait'* (CoA, 2015a). CoA (2015) describes Shelf Rocky Reef and Hard Substrate as occurring in water depths ~50m to 220m. It provides attachment sites for macroalgae and sessile invertebrates, increasing the structural diversity of shelf ecosystems.

Seabed surveys and facility inspections proximal to the East Coast Project, including over the existing network of wells and pipelines (Figure 6-16) show that there are areas of hard substrate, often exposed and sometimes covered with a thin layer of sand (Santos, 2004; Ramboll, 2020b). No macroalgae beds are present within any of the survey reports for the operational area, and they are not expected given the water depths of the operational area, and known locations which are closer to shore (Section 6.5.1). Sessile invertebrates are frequently observed on the seabed inside the Operational Area on areas of hard seabed, as well as overgrowing previously installed equipment, which also adds to the structural diversity of the shelf ecosystem (Fugro, 2020b, Ramboll 2020). Figure 6-63 shows examples of the common hard seabed interspersed with thin layers of sand, and existing subsea equipment offshore Otway, with the hard surfaces of the rocky seabed and pipeline both providing attachment sites for sessile invertebrates.

The presence of hard substrate with sessile invertebrates is considered consistent with the value of this described value of the Shelf rocky reefs and hard substrates KEF. These benthic communities, when in depths >30m may be referred to as mesophotic reef because they are reef-associated communities within the mesophotic zone. The term 'mesophotic' refers to water depths where sunlight reaches the seabed at lower levels compared to shallower coastal waters; benthic communities in these water depths are adapted to low levels of light and derive much of their energy heterotrophically; filter feeding sessile invertebrates such as sponges and bryozoans are often observed, represented in

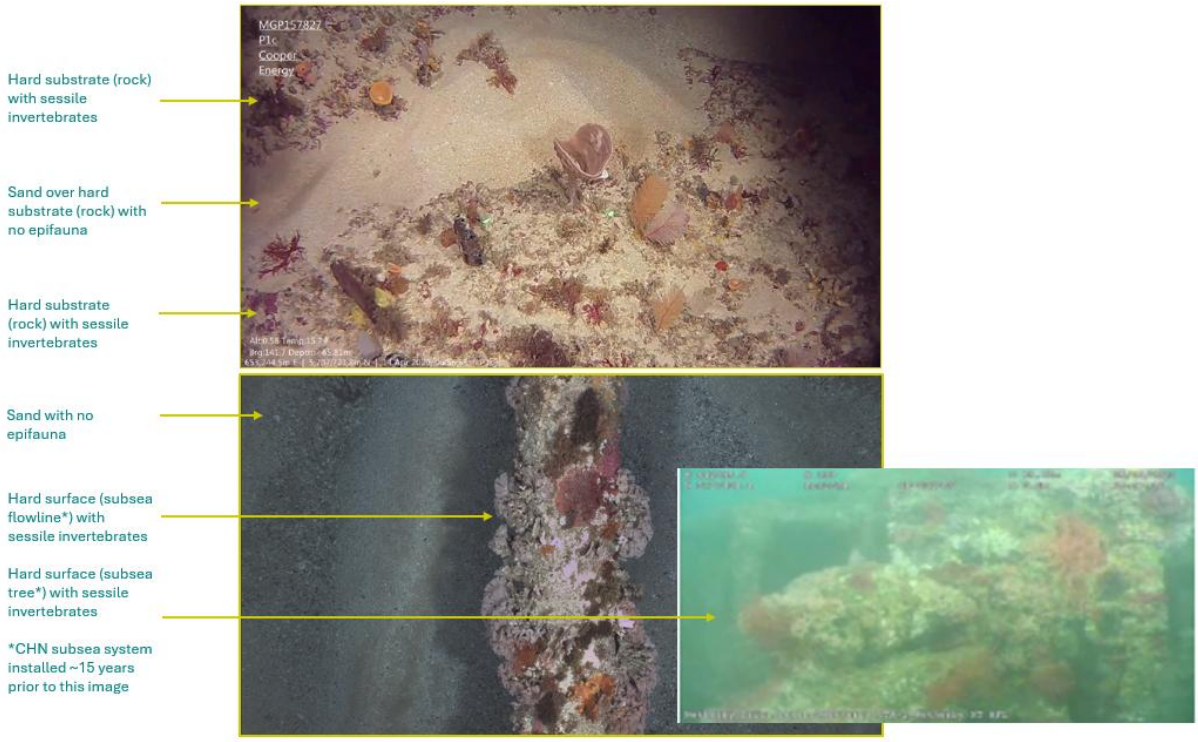



*Figure 6-63: Common shelf substrates (top picture) with existing subsea equipment (bottom picture), providing attachment sites for sessile invertebrates.*

Figure 6-65 shows the National Values Ecosystems dataset (IMAS, 2022). This data set includes the modelled presence of mesophotic rocky reef. The dataset uses Geoscience Australia's 250 m resolution Australian Bathymetry and Topography Grid (Geoscience Australia, 2009) in addition to previous analysis of multibeam sonar data, previous shelf reef data and collation of Baited Remote Underwater Video (BRUV) data sets. Cross-validation of modelling using the BRUV habitat data indicates a limited ability to discriminate reef from non-reef sites in a hold-out data set (IMAS, 2022). However, comparison with local Seamap data (Lucieer et al., 2017) shows alignment with mixed hard and soft which is consistent with observations of hard ground and patchy epifauna in the area (Ramboll 2022a, 2020b). Figure 6-65 shows the overlap of modelled mesophotic rocky reef with the East Coast Project operational area. At a macro-level, the modelled mesophotic reef appears to be predominantly inshore of the operational area, becoming patchy with distance from shore.

Table 6-17 includes consideration of the shelf rocky reefs and hard substrate KEF that occurs within the operational area, EMBA and monitoring area. Though the operational area has not been completely surveyed there is high confidence from the existing data sets, bathymetry and regional descriptions of the KEF coverage, that the seabed will be a mix of hard substrate interspersed with sand, as is common throughout the shelf environment of the south-east marine region.

*Table 6-17: Key Ecological Features identified within the operational area, EMBA and monitoring area*

| Key Ecological Feature | Marine Region | National / regional importance | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|
| **Bonney Coast Upwelling** | South-east | **An area of high productivity and aggregations of marine life**<br>The Bonney Coast Upwelling is a predictable, seasonal upwelling bringing cold nutrient rich water to the sea surface and supporting | - | - | ✓ |

| Key Ecological Feature | Marine Region | National / regional importance | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|
| | | regionally high productivity and high species diversity in an area where such sites are relatively rare and mostly of smaller scale.<br>It is one of 12 widely recognised and well-known areas worldwide where blue whales are known to feed in relatively high numbers.<br>The area is significant as one of the largest and most predictable upwellings in south-eastern Australia. This is not the only upwelling in southeast Australia driven by the prevailing south-easterly winds, but it is the most prominent. In addition to whales, many endangered and listed species frequent the area, possibly also relying on the abundance of krill that provide a food source to many seabirds and fish. The high productivity of the Bonney Upwelling is also capitalised on by other higher predator species such as little penguins and Australian fur-seals feeding on baitfish. | | | |
| **West Tasmania Canyons** | South-east | **An area of high productivity and aggregations of marine life**<br>The West Tasmania Canyons are located on the edge of the continental shelf offshore of the north-west corner of Tasmania and as far south as Macquarie Harbour. These canyons can influence currents, act as sinks for rich organic sediments and debris, and can trap waters or create upwellings that result in productivity and biodiversity hotspots. For example, plumes of sediment and nutrient-rich water can be seen at or near the heads of canyons.<br>Sponges are concentrated near the canyon heads, with the greatest diversity between 200 m and 350 m depth. Sponges are associated with abundance of fishes and the canyons support a diversity of sponges comparable to that of seamounts. | - | - | ✓ |
| **Upwelling East of Eden** | South-east | **An area of high productivity and aggregations of marine life**<br>Dynamic eddies of the East Australian Current cause episodic productivity events when they interact with the continental shelf and headlands. The episodic mixing and nutrient enrichment events drive phytoplankton blooms which are the basis of productive food chains including zooplankton, copepods, krill and small pelagic fish. It is important to note that the upwelling east of Eden displays seasonal and annual variation.<br>The upwelling supports regionally high primary productivity that in turn supports increased biodiversity, including top order predators, marine mammals, sharks and seabirds. For example, this area is one of two feeding areas for blue whales and humpback whales, known to arrive when significant krill aggregations form. | - | - | ✓ |
| **Big Horseshoe Canyon** | South-east | **An area of high productivity and aggregations of marine life**<br>The Big Horseshoe Canyon is located south of the coast of eastern Victoria and is the easternmost arm of the Bass Canyon systems. Steep, rocky slopes provide hard substrate habitat for attached large megafauna. Sponges and other habitat forming species provide structural refuges for benthic fishes, including the commercially important species like the pink ling. Further, it is the only known temperate location of the stalked crinoid *Metacrinus cyaneu*. | - | - | ✓ |
| **Shelf rocky reefs** | Temperate-east | **Unique sea-floor feature with ecological properties of regional significance**<br>The shelf rocky reefs of the temperate east marine region occur along the continental shelf south of the Great Barrier Reef. The KEF supports a variety of benthic communities from algae-dominated sea-floor communities to those dominated by attached invertebrates (including large sponges, moss animals and soft corals). These invertebrates create complex habitats that support a multitude of animals including crabs, snails, worms and starfish. The habitats also contain a diverse assemblage of temperate and tropical species, whose distributions are strongly regulated by the East Australian Current. | - | - | ✓ |

| Key Ecological Feature | Marine Region | National / regional importance | Operational area | EMBA | Monitoring Area |
|---|---|---|---|---|---|
| | | Note: The temperate-east shelf rocky reef KEF is not spatially delineated within the AMSIS. | | | |
| **Canyons on the eastern continental slope** | Temperate-east | **Unique seafloor feature with enhanced ecological functioning and integrity and biodiversity, which apply to both its benthic and pelagic habitats**<br>The Canyons on the eastern continental slope have a powerful influence on the diversity and abundance of species, driven by the combined effects of steep and rugged topography, ocean currents, sea-floor types and nutrient availability. They significantly contribute to the overall habitat diversity of the sea floor, by providing hard surfaces in depth zones where soft sediment habitats are dominant. Large benthic animals such as sponges and feather stars are abundant, with particularly high diversity found in the upper slope regions (150–700 m). Canyons also create localised changes in productivity in the water column above them, providing feeding opportunities for a range of species, many of which are commercially important or threatened. | - | - | ✓ |
| **Shelf rocky reefs and hard substrates** | South-east | **An area of high productivity and aggregations of marine life**<br>Rocky reefs and hard substrates occur in all areas of the South-east Marine Region continental shelf, including Bass Strait and the sub-tidal zone to the continental shelf break. The continental shelf break generally occurs in 50 m to 150–220 m water depth. The shallowest depth at which the rocky reefs occur in Commonwealth waters is approximately 50 m.<br>On the continental shelf, rocky reefs and hard substrates provide attachment sites for macroalgae and sessile invertebrates, increasing the structural diversity of shelf ecosystems. The reefs provide habitat and shelter for fish and they are important for aggregations of biodiversity and enhanced productivity.<br>Note: The Shelf rocky reefs and hard substrates KEF are not spatially defined other than being described as located in all areas of the south-east marine region. | ✓ | ✓ | ✓ |
| ***Type of Presence:***<br>***MO*** ***KEF may occur within area*** | | | | | |

*Source: DCCEEW, 2023s*

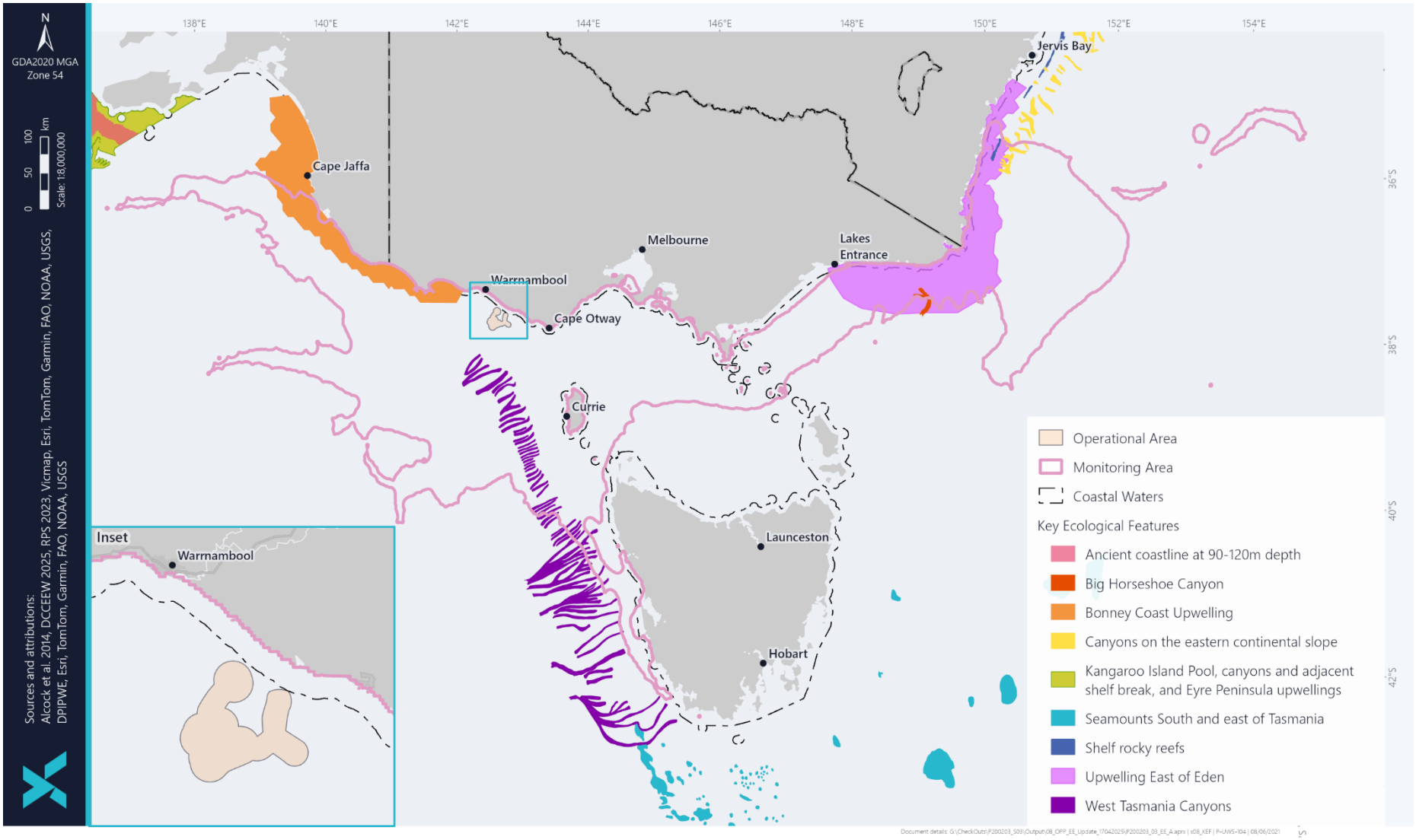



*Figure 6-64: Key Ecological Features located within the monitoring area*

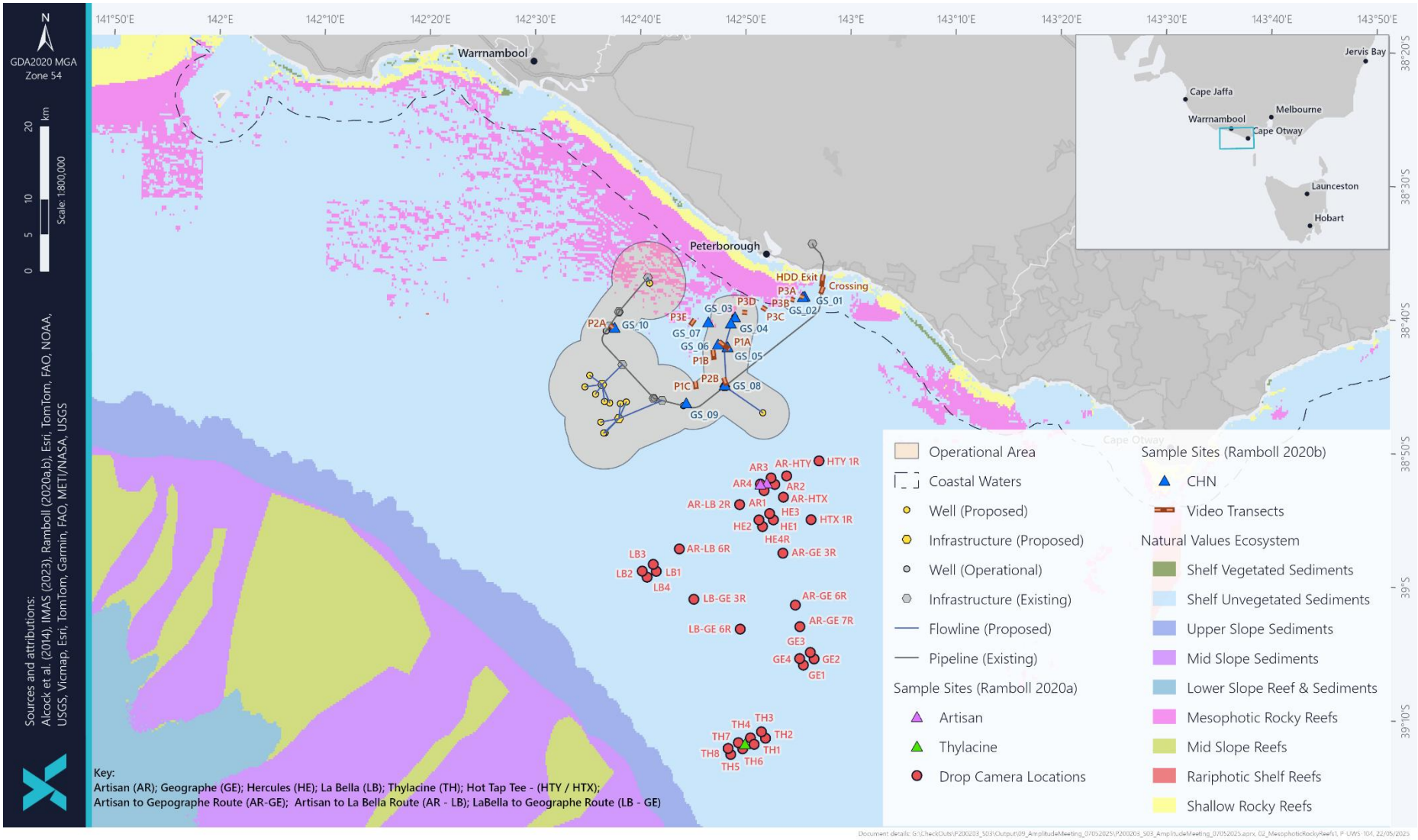



*Figure 6-65: Distribution of Mesophotic Rocky Reef and observation sites within the region of the operational area*

### 6.6.7 Threatened Ecological Communities

Ecological communities are groups of native plants, animals and other organisms that naturally occur and interact in a unique habitat. These communities often provide wildlife corridors and / or habitat refuges for many plant and animal species, including threatened species and other Australian plants and animals that are in decline. An ecological community become threatened when it is at risk of extinction. In Australia Threatened Ecological Communities (TECs) can be listed as critically endangered, endangered or vulnerable.

Several TECs are located along the coastline and within the nearshore waters of Victoria, Tasmania, NSW and South Australia. No TECs are intersected by the operational area, however the PMST identified a total of 23 TECs within the monitoring area:

- Alpine Sphagnum Bogs and Associated Fens
- Araluen Scarp Grassy Forest
- Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community
- Brogo Vine Forest of the South East Corner Bioregion
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland
- Giant Kelp Marine Forests of South East Australia
- Gippsland Red Gum (*Eucalyptus tereticornis* subsp. *mediana*) Grassy Woodland and Associated Native Grassland
- Grassy Eucalypt Woodland of the Victorian Volcanic Plain
- Illawarra and south coast lowland forest and woodland ecological community
- Karst springs and associated alkaline fens of the Naracoorte Coastal Plain Bioregion
- King Island scrub complex
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia
- Lowland Grassy Woodland in the South East Corner Bioregion
- Lowland Native Grasslands of Tasmania
- Natural Damp Grassland of the Victorian Coastal Plains
- Natural Temperate Grassland of the Victorian Volcanic Plain
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
- Subtropical and Temperate Coastal Saltmarsh
- Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (*Eucalyptus ovata / E. brookeriana*)
- Tasmanian white gum (*Eucalyptus viminalis*) wet forest
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Of the TECs listed above, those with marine or shoreline features are described in Table 6-18 and displayed in Figure 6-66.

*Table 6-18: Threatened Ecological Communities located within the monitoring area*

| Threatened Ecological Community | State | EPBC Listing Status | Major Conservation Values |
|---|---|---|---|
| **Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community** | Victoria | Endangered | The TEC is a collection of native plants, animals and micro-organisms associated with the dynamic salt-wedge estuary systems that occur within the temperate climate, microtidal regime (<2 m), high wave energy coastline of western and central Victoria (DoEE, 2018a). There are currently 25 estuaries with this listing which are defined by the border between South Australia and Victoria and the most southerly point of Wilsons Promontory (DoEE, 2018a).<br>A sufficient hydrological regime is essential to the survival of the TEC to ensure salinity stratification; salt-wedge dynamics; connectivity; and ecological function between the estuary, river and ocean (and floodplain wetland components where applicable). These estuaries are influenced by seasonal longshore sand drift and characterised by intermittent mouths (sometimes open and sometimes closed) (DoEE, 2018a).<br>The ecological community associated with this TEC is characterised by estuarine taxa, with associated components of coastal, estuarine, brackish and freshwater taxa that may reside in the estuary for periods of time and/or utilise the estuary for specific purposes (e.g., reproduction, feeding, refuge, migration) (DoEE, 2018a). |
| **Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland** | NSW | Endangered | The TEC occurs in coastal catchments of sub-tropical, sub-humid and temperate climatic zones from Curtis Island, north of Gladstone, in QLD to Bermagui in southern NSW. Typically, the TEC is found within 30 km of the coast at elevations of <20 m above sea-level where groundwater is saline or brackish (DoEE, 2018b). Associated habitats include coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated (DoEE, 2018b).<br>The TEC is often found in association with other vegetation types such as coastal saltmarsh, mangroves, freshwater wetlands, littoral rainforests or swamp sclerophyll forests in a 'mosaic' of coastal floodplain communities (DoEE, 2018b). |
| **Giant Kelp Marine Forests of South East Australia** | Victoria, South Australia, Tasmania | Endangered | Kelp forests are shallow coastal ecological communities of cold-water regions that extends between the ocean floor and ocean surface exhibiting a 'forest-like' structure (DSEWPaC, 2012b). The TEC occurs on rocky substrate along the east and south coastlines of Tasmania; some patches may also occur in the coastal waters of western and northern Tasmania, south-eastern South Australia, and Victoria (TSSC, 2012a).<br>The TEC is characterised by a closed to semi-closed surface or subsurface canopy of *Macrocystis pyrifera* that hosts a diverse range of organisms occupying its benthic, pelagic and upper-canopy layers (TSSC, 2012a). *M. pyrifera* is the only species of kelp to provide this three-dimensional structure from the sea floor to the sea surface (TSSC, 2012a).<br>The high primary and secondary productivity of the giant kelp forests create and provide a number of ecosystem services to the local environment including settlement habitat for juvenile life stages of commercially important fisheries, improvements in local water quality conditions and coastal protection via buffering strong wave conditions from reaching the shore (TSSC, 2012a). |
| **Littoral Rainforest and Coastal Vine Thickets of Eastern Australia** | Victoria, NSW | Critically Endangered | The TEC is a complex of rainforest and coastal vine thickets on the east coast of Australia influenced by its proximity to the sea (typically occurring with 2 km) (DoE, 2015b; TSSC, 2008). The littoral rainforests and coastal vine thickets of Eastern Australia occur from Princess Charlotte Bay, Cape York Peninsula to the Gippsland Lakes in Victoria as well as on offshore islands on the east coast.<br>The TEC occurs as a series of naturally disjunct and localised stands, on a range of landforms which have been influenced by coastal processes including dunes and flats, headlands and sea-cliffs (TSSC, 2008). The unique habitat and provides |

| Threatened Ecological Community | State | EPBC Listing Status | Major Conservation Values |
|---|---|---|---|
| | | | important stepping stones along the eastern Australian coast for various migratory and marine birds like the Gould's petrel (TSSC, 2008). |
| **River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria** | NSW, Victoria | Critically endangered | The TEC spans across coastal floodplains of the eastern and southern watershed of the Great Dividing Range from central and southern New South Wales to eastern Victoria. This TEC includes plants, animals and other organisms associated with the tall woodland forest structure with a canopy dominated by eucalypts and an understory of small trees, shrubs, grasses, and other herbs and climbers.<br>The ecological community occurs on alluvial landforms related to coastal river floodplains and associated sites where transient water accumulates and is associated with alluvial soils of various textures including silts, clay loams, and sandy loams, gravel and cobbles.<br>The canopy is dominated by eucalyptus species and may extend 40 m in height. Abundant groundcover typically includes grasses, forbs, ferns, sedges and scramblers. The TEC supports a diversity of fauna including ground dwelling, soil fauna, and water dependant fauna.<br>The TEC corresponds to country (the traditional lands) of several Indigenous groups, including the Worimi, Wonnarua, Awabakal, Darkinung, Kurin-gai, Eora, Dharug, Tharawal/D'harawal, Yuin, Bidwell and the Kurnai (DAWE, 2020a) |
| **Subtropical and Temperate Coastal Saltmarsh** | Victoria, Tasmania, NSW, SA | Vulnerable | The TEC spans 6 states and occurs on islands within its geographic range. It occurs within a relatively narrow margin along the southern and eastern Australian coast, within the subtropical and temperate climatic zones (DSEWPaC, 2013c). The physical environment for the ecological community is coastal areas under regular or intermittent tidal influence where it is typically restricted to the upper intertidal environment.<br>The TEC consists mainly of salt-tolerant vegetation (halophytes) including grasses, herbs, sedges, rushes and shrubs (DSEWPaC, 2013c). A wide range of infaunal and epifaunal invertebrates and temporary inhabitants such as prawns, fish and birds (and can often constitute important nursery habitat for fish and prawn species) (DSEWPaC, 2013c). Many species of non-vascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats (DSEWPaC, 2013c). The dominant marine residents are benthic invertebrates, including molluscs and crabs that rely on the sediments, vascular plants, and algae. |

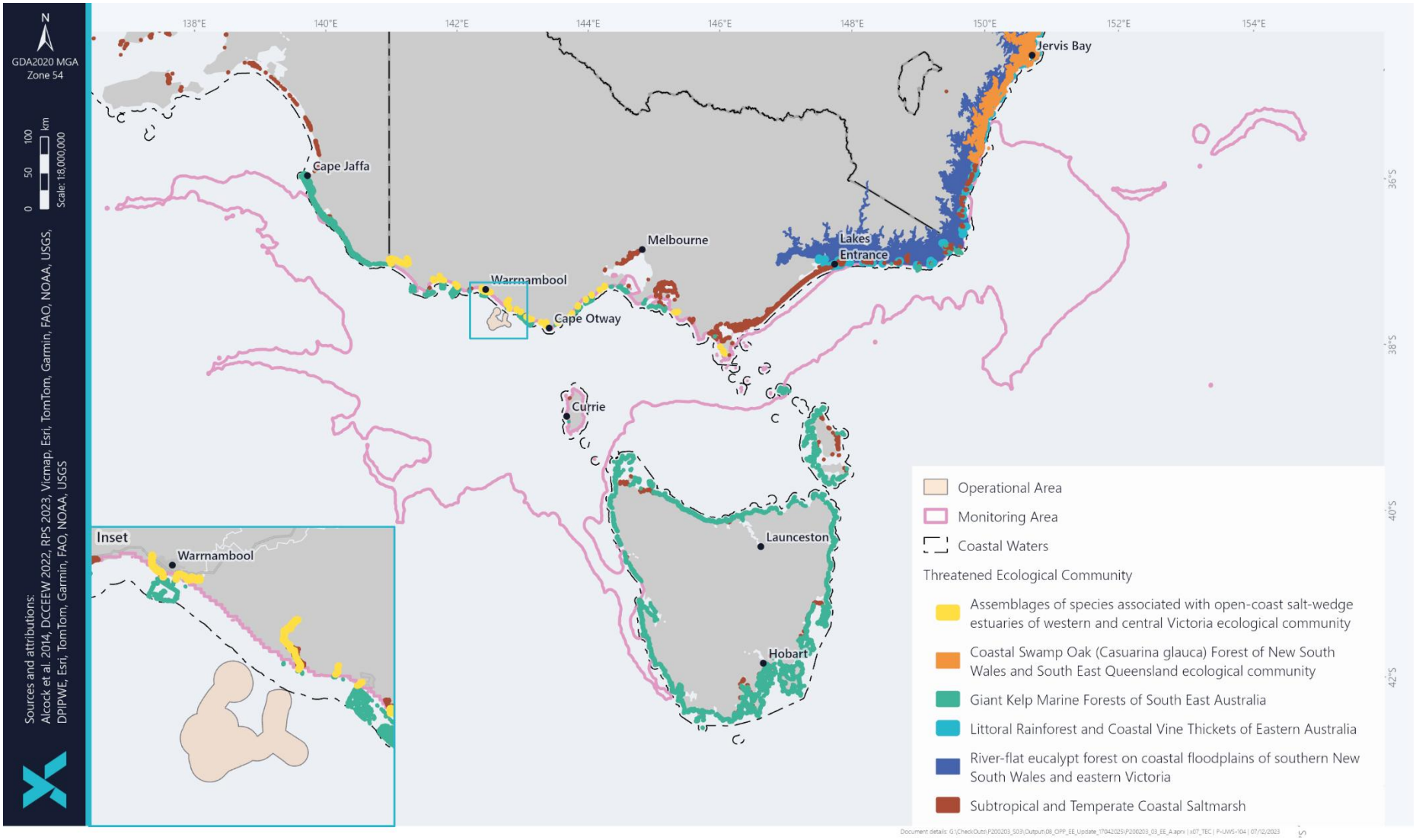



*Figure 6-66: Threatened Ecological Communities located within the monitoring area*

## 6.7 Socio-Economic Environment

### 6.7.1 Coastal Settlements

Over 80% of the population in Australia live within 50 km of the coast (Hugo et al., 2013). Coastal hubs of Western Victoria are connected via the great Ocean Road with is a historical and popular tourist route. Key coastal hubs within and adjacent to the Otway Region are described below and displayed in Figure 6-67.

#### *6.7.1.1 Portland*

Portland is located within the Glenelg Shire on the southwest coast of Victoria. The 2021 Australian census estimated a total population of 10,450 with a median age of 47 (ABS, 2021). Of the total population 52.3% are in the workforce with 199 people employed by the Agriculture, Forestry and Fishing industry (ABS, 2021).

Portland is Victoria's western-most commercial port and is a deep-water port with breakwaters sheltering a marina and boat ramp. Commercial fishing in Portland includes a number of local and visiting boats, including trawling, targeting abalone, sharks, lobsters and giant crab. Two shops in Portland sell trawl fish and lobster fresh off the boats while squid and abalone are processed locally at a factory (Portland Tourist Association, 2022).

The southern right whales and blue whales can often be seen off the coast of Portland, typically over the winter months. The seasonal Bonney coast upwelling which occurs just off the coast of Portland is a known foraging location for the blue whale. Further, between September and March, Portland is home to the Australian gannet and cape gannet.

#### *6.7.1.2 Warrnambool*

Warrnambool is located within the Warrnambool Shire on the southwest coast of Victoria. The 2021 Australian census estimated a total population of 35,406 with a median age of 40 (ABS, 2021). Of the total population 69.8% are in the workforce with 237 people employed by the Agriculture, Forestry and Fishing industry (ABS, 2021).

Historically the Port of Warrnambool was an important port for cargo shipments and whaling. A breakwater was constructed in 1890 in an attempt to provide shelter from the waves and currents of the Bass Strait (Warrnambool City Council, 2023). Today the major function of the port is to provide safe haven and service to the commercial fishing industry, and recreational fishing and boating interests. Warrnambool also hosts an established tourism industry with holiday parks and attractions, as well as a competitive, community-focussed surf-life-saving club. The most sheltered section of the port waters inside the breakwater are used for exercising horses, while the Warrnambool racecourse hosts large meets through the year.

Offshore Warrnambool is within the designated biologically important area for the southern right whale and has long been associated with the species. Specifically, Logans Beach which is a known calving ground for the species and has an exclusion zone between 1 June and 31 October each year prohibiting vessels in the area. There is substantial local interest and tourism based on the seasonal occurrence and sightings of southern right whales in the winter months; there is an established 'winter whale trail' which identifies where whales can be observed and other notable location, spanning from Portland to Warrnambool (Glenelg Shire Council, 2024)

#### *6.7.1.3 Port Campbell*

Port Campbell is located with the Corangamite Shire and is the nearest town to East Coast Project. The 2021 Australian census estimated a total population of 440 with a median age of 42 (ABS, 2021). Of the total population 61.6% are in the workforce with 45 people employed by the Agriculture, Forestry and Fishing industry (ABS, 2021).

Port Campbell has both harbour and fish processing facilities but is not suitable for use by large vessels. The Port Campbell Jetty is a popular location for recreational fishing. The town is a

popular tourist destination with an associated National Park (Port Campbell National Park) and proximity to the Great Ocean Roads most popular stops (i.e., Twelve Apostles, London Bridge).

The AMSIS identifies offshore Port Campbell within the reproduction BIA for the southern right whale (AMSIS, 2025). The whales aggregate along the coastline between Port Campbell and Portland and perform behaviours such as mating, calving and nursing (DCCEEW, 2022a).

#### *6.7.1.4 King Island*

King Island is located in the Bass Strait between Victoria and Tasmania. The 2021 Australian census estimated a total population of 1,617 with a median age of 45 (ABS, 2021). Of the total population 63.8% are in the workforce with 189 people employed by the Agriculture, Forestry and Fishing industry (ABS, 2021).

King Island is a major trading centre for some of Australia's highest value wild-catch fisheries primarily targeting southern rock lobsters (*Jasus edwardsii*), greenlip abalone (*Haliotis laevigata*), blacklip abalone (*Haliotis rubra*) and giant crabs (*Pseudocarcinus gigas*) (Norwood, 2014). Large quantities of bull kelp (*Durvillaea potatorum*) washed up on the coasts of King Island is also commercially harvested for sale domestically and for export (Norwood, 2014). King Island's fishing industry employs 2.5% of the workforce (ABS, 2021).

Offshore waters surround King Island are known foraging areas for pygmy blue whales based on the overlap with known foraging area BIA and a migratory BIA for the southern right whale (DCCEEW, 2022).

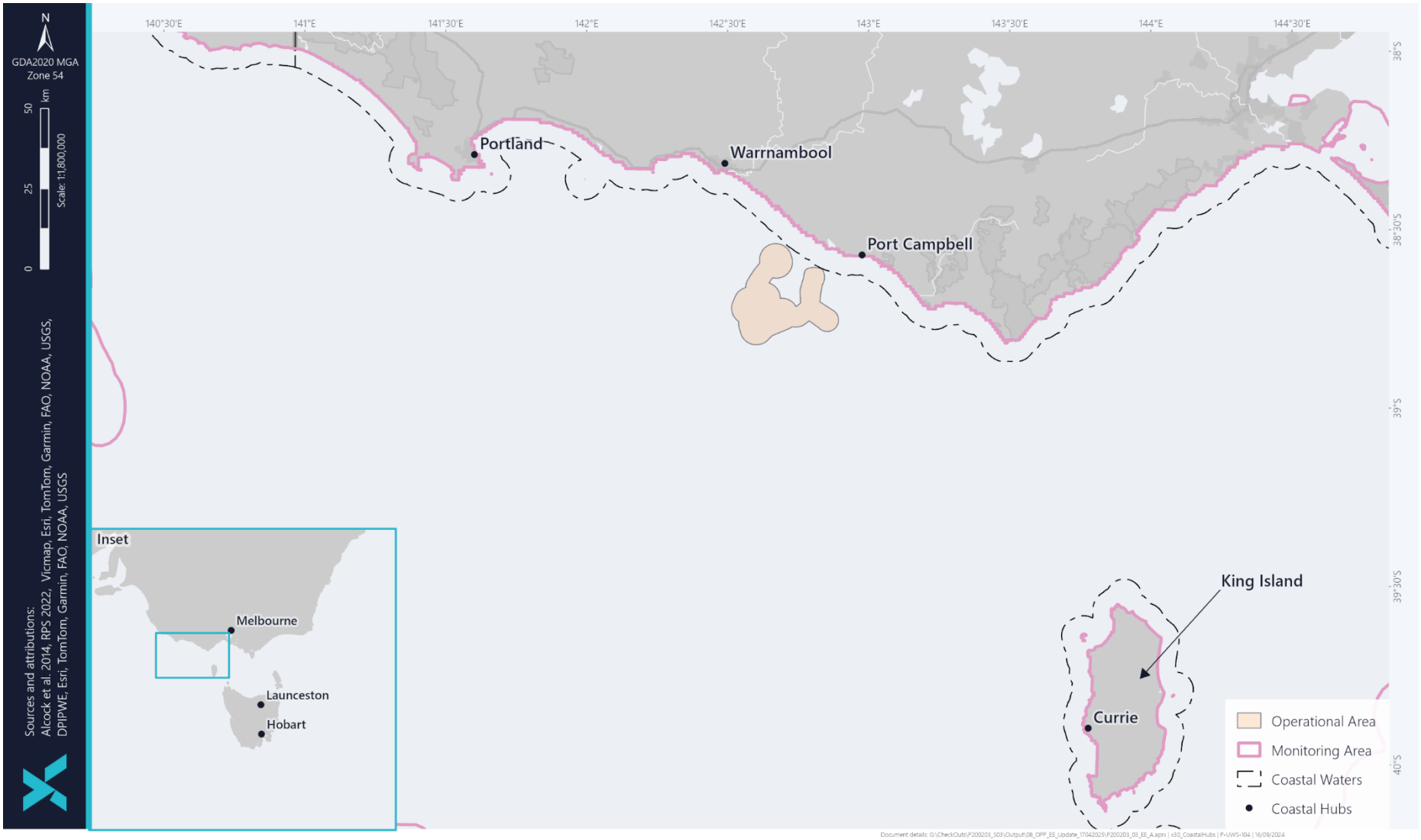



*Figure 6-67: Coastal hubs within and adjacent to the Otway Region*

### 6.7.2 Commercial Fisheries

#### *6.7.2.1 Commercial Fisheries*

Commonwealth fisheries are managed by the Australian Fisheries Management Authority (AFMA), with the fisheries typically operating within 3 nm to 200 nm offshore (i.e., to the extent of the Australian Fishing Zone).

Commonwealth-managed commercial fisheries with potential to occur within the operational area and/or associated monitoring area are detailed in Table 6-19. Information relating to the target species, fishing locations, landed catch, value and other relevant aspects of each fishery are taken from current and previous Commonwealth Fishery Status Reports (Butler et al. 2024; Butler et al. 2023; Patterson et al. 2022), unless otherwise indicated. Overlap with reported fishing activity for each relevant Commonwealth fishery is displayed in Figure 6-68 to Figure 6-78.

#### *6.7.2.2 State Fisheries -Victoria*

Victorian fisheries are managed by an independent statutory authority, Victorian Fisheries Authority (VFA). The VFA work closely with stakeholder to ensure sustainable fishing, clear resource access and increased economic, social and cultural value.

Victorian state-managed commercial fisheries with potential to occur within the operational area and/or associated monitoring area are detailed in Table 6-20. Information is from the Victorian Fisheries Authority Commercial Fisheries (VFA, 2025) unless otherwise indicated. Where data is available overlap with reported fishing activity for each relevant Victorian fishery is displayed in Figure 6-79 to Figure 6-85. Note that where data is confidential, fishing activity figures have not been provided.

#### *6.7.2.3 State Fisheries – Tasmania*

Tasmanian fisheries are managed by the state government under the jurisdiction of the Department of Natural Resources and Environment in accordance with the *Living Marine Resources Management Act 1995*.

Tasmanian state-managed commercial fisheries with potential to occur within the operational area and/or associated monitoring area are detailed in Table 6-21. Information is from the Department of Natural Resources and Environment Tasmania (DNRET, 2024) unless otherwise indicated. Where data is available overlap with reported fishing activity for each relevant Tasmanian fishery is displayed in Figure 6-87 and Figure 6-88. Note that where data is confidential fishing activity figures have not been provided.

#### *6.7.2.4 State Fisheries – New South Wales*

NSW fisheries are managed by the state government under the jurisdiction of the Department of Primary Industries in accordance with the *Fisheries Management Act 1994*.

NSW state-managed commercial fisheries with potential to occur within the operational area and/or associated monitoring area are detailed in Table 6-22. Information is from the Department of Primary Industries NSW (DPI, 2025) unless otherwise indicated. Where data is available overlap with reported fishing activity for each relevant NSW fishery is displayed in Figure 6-90 to Figure 6-97. Note that where data is confidential fishing activity figures have not been provided.

#### *6.7.2.5 State Fisheries – South Australia*

South Australian fisheries are managed by the state government under the jurisdiction of the Department of Primary Industries and Regions (PIRSA) in accordance with the *Fisheries Management Act 2007*.

South Australian state-managed commercial fisheries with potential to occur within the operational area and/or associated monitoring area are detailed in Table 6-23. Information is

from the Department of Primary Industries and Regions SA (PIRSA, 2023a) or BDO Australia (BDO Australia, 2024) unless otherwise indicated. Where data is available overlap with reported fishing activity for each relevant South Australian fishery is displayed in Figure 6-98 to Figure 6-101. Note that where data is confidential fishing activity figures have not been provided.

*Table 6-19: Commercial Fisheries with Management Areas overlapped by the monitoring area – Commonwealth*

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and Vessels | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| **Bass Strait Central Zone Scallop Fishery** | Scallops (*Pecten fumatus*) | Typically:<br>July to 31 December each year | Commonwealth waters between Victoria and Tasmania<br>In 2023, fishing was permitted throughout the management area, except in 4 scallop beds that were closed to fishing under the harvest strategy. | Towed dredge fishing method.<br>Fishery managed via seasonal/area closures and total allowable catch (TAC) controls together with quota statutory fishing rights (35 permits for the 2021 and 2022 season) and individual transferrable quotas.<br>9 vessels were active in the 2023 season | Scallop spawning occurs from winter to spring (June to November). The timing is dependent on environmental conditions such as wind and water temperature (Sause et al., 1987).<br>Fishery can operate down to 120 m water depth but prefers water depth of 70-80 m.<br>Value of fishery: $1.4 million for 2023 season. | Unlikely<br>Between the 2016-2023 seasons all recorded fishing intensity was concentrated to the east of Flinders Island and King Island, outside of the operational area.<br>(Figure 6-68) | Likely |
| **Eastern Tuna and Billfish Fishery** | Albacore tuna (*Thunnus alulunga*), bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*), broadbill swordfish (*Xiphias gladius*), striped marlin (*Kaijikia audux*) | 12-month fishing season:<br>Commences 1 January each year | Commonwealth waters from Cape York (Queensland) to the Victoria – South Australia border | Pelagic longline, minor line (such as handline, troll, rod and reel).<br>Vessels active in 2023 and 2022 season – 34 and 36 longline; 12 and 6 minor-line. | Spawning occurs through most of the year in water temperatures greater than 26°C (Wild Fisheries Research Program, 2012).<br>Value of fishery: $40.1 million for 2023 season. | Unlikely<br>Between the 2016-2023 seasons the majority of recorded fishing intensity was concentrated off the coast of NSW and QLD and the southern coast of Tasmania. There was no recorded activity off the western coast of Victoria.<br>(Figure 6-69) | Likely |
| **Western Tuna and Billfish Fishery** | Bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*), broadbill swordfish (*Xiphias gladius*) and striped marlin (*Tetrapturus audux*) | 12-month fishing season:<br>Commences 1 February each year | Commonwealth waters west from the tip of Cape York in Queensland, around Western Australia, to the border between Victoria and South Australia.<br>Fishing occurs in both the Australian Fishing Zone and adjacent high seas. | Longline and minor line (including handline, troll, rod and reel)<br>As of 2023 season there were 93 boat statutory fishing rights.<br>Two longline vessels and 3 minor line vessels were active during the 2023 season. | The species caught in the fishery are also caught by many other countries. Australia's catch of tuna and billfish is a very small part of the total catch internationally<br>Value of fishery: Confidential<br>Annual catch: 208 tonnes in 2023 season | None<br>The management area of the fishery does not overlap with the operational area.<br>(Figure 6-70) | Likely |
| **Skipjack (eastern) Fishery**<br>NOT ACTIVE | Skipjack tuna (*Katsuwonus pelamis*) | 12-month fishing season:<br>previously would commence 1 February each year | Extends from the border of Victoria and South Australia to Cape York, Queensland. | N/A | There has been no fishing effort within the Skipjack fishery since the 2008-09 season, due to availability of target species and prices received for the product | None | None |
| **Small Pelagic Fishery** | Jack mackerel (*Trachurus declivis, T. symmetricus, T. murphyi),* blue mackerel (*Scomber australasicus*), redbait (*Emmelichthys nitidus*) and Australian sardine (*Sardinops sagax*) | 12-month fishing season:<br>Commences 1 May each year | Commonwealth waters from southern Queensland to southern Western Australia | Midwater trawl and purse seine methods are permitted.<br>There were 5 purse seine and 3 midwater trawl vessels active in the 2023 season. | The fishery is divided into two sub areas, east and west of latitude 146°30' due to evidence of separate stocks both east and west of Tasmania for jack mackerel, blue mackerel and redbait<br>Value of Fishery: Confidential due to small number of fishers<br>Annual catch: 23,230 tonnes in 2023 season | Unlikely<br>Between the 2016-2023 seasons the majority of recorded fishing intensity was concentrated along the southern NSW coastline into Gippsland and the eastern coast of South Australia.<br>(Figure 6-71) | Likely |
| **Southern and Eastern Scalefish and Shark Fishery –**<br>Commonwealth Gillnet and Shark Hook Sector | Elephantfish (*Callorhinchus milii*), gummy shark (*Mustelus antarcticus*), sawsharks (*Pristiophorus cirratus, P.nudipinnis*) and school shark (*Galeorhinus galeus*) | 12-month fishing season:<br>Commences 1 May each year | Extends from the NSW and Victorian border west to the South Australian and Western Australian border | Demersal gillnet, demersal longline, auto-longline<br>Vessels operating in the 2023 season – 31 gillnet and 68 shark hook. | Since 2007 – after the closure to trawling of most SESSF waters deeper than 700 m – effort has become increasingly concentrated on the shelf (to 200 m) rather than on the slope<br>Most fishing using nets occurs in Bass Strait, while most fishing using hooks occurs off South Australia<br>Value of Fishery: $21.6 million for 2022 season. No value is provided for 2023 season. | Likely<br>In the 2022 season the shark Gillnet sub-sector the majority of recorded fishing intensity for the gillnet sector occurred around the Furneaux Islands and along the eastern Victorian coastline. However, there was recorded activity along the entire Victorian coastline. Between the 2016-2023 seasons high fishing intensity occurred along the eastern coast of Victoria and around the Furneaux Islands, however low to moderate activity was recorded | Likely |

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and Vessels | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| | | | | | | along the western Victorian coastline within the operational area.<br>(Figure 6-72)<br>Between the 2016-2023 seasons the Shark Hook sub-sector recorded fishing intensity was concentrated along the south coast of SA and south of the Furneaux Islands.<br>(Figure 6-73) | |
| **Southern and Eastern Scalefish and Shark Fishery –**<br>Commonwealth Scalefish Hook Sector | Blue grenadier (*Macruronus novaezelandiae*), tiger flathead (*Neoplatycephalus richardsoni*), orange roughy (*Hoplostethus atlanticus*), pink ling (*Genypterus blacodes*), blue-eye trevalla (*Hyperoglyphe antarctica)* and eastern school whiting (*Sillago flindersi*) | 12-month fishing season:<br>Commences 1 May each year | Extends from the south-eastern Australia to the border between South Australia and Western Australia | Multi-gear fishery<br>Vessels operating in the 2023 season – 13 | Since 2007 – after the closure to trawling of most SESSF waters deeper than 700 m – effort has become increasingly concentrated on the shelf (to 200 m) rather than on the slope<br>Sector is reported with the Commonwealth Trawl Sector as it shares many target species<br>Value of fishery: $65.9 million for 2022 season (combined with Commonwealth Trawl Sector). No value is provided for 2023 season. | Potential<br>Between the 2016-2023 seasons recorded fishing intensity was concentrated along the continental shelf, particularly where the shelf wraps around Tasmania.<br>(Figure 6-74) | Likely |
| **Southern and Eastern Scalefish and Shark Fishery –**<br>Commonwealth Trawl Sector | Blue grenadier (*Macruronus novaezelandiae*), tiger flathead (*Neoplatycephalus richardsoni*), orange roughy (*Hoplostethus atlanticus*), pink ling (*Genypterus blacodes*), blue-eye trevalla (*Hyperoglyphe antarctica)* and eastern school whiting (*Sillago flindersi*) | 12-month fishing season:<br>Commences 1 May each year | Extends south from Barrenjoey Point in northern NSW to east of Kangaroo Island off South Australia | Multi-gear fishery: Otter-board trawl, Danish-seine<br>Vessels operating in the 2023 season – 24 trawl, 18 danish-seine | Since 2007 – after the closure to trawling of most SESSF waters deeper than 700 m – effort has become increasingly concentrated on the shelf (to 200 m) rather than on the slope<br>Sector is reported with the Scalefish Hook Sector as it shares many target species<br>Value of fishery: $65.9 million for 2022 season (combined with Scalefish Hook Sector). No value is provided for 2023 season. | Potential<br>Between the 2016-2023 seasons recorded fishing intensity was concentrated along the continental shelf. With high intensity occurring along the shelf offshore southern NSW, wrapping around Tasmania and along the eastern and western Victorian shelf.<br>(Figure 6-75 and Figure 6-76) | Likely |
| **Southern Bluefin Tuna Fishery** | Southern bluefin tuna (*Thunnus maccoyii*) | 12-month fishing season:<br>Commences 1 December each year | Spans the Australian Fishing Zone | Pelagic longline, purse seine, and minor line (such as troll and poling) fishing gear is used in this fishery<br>Vessels operating in 2023season – 24 longline and 6 purse seine. | Majority of catch occurs by purse seine in the Great Australian Bight<br>Value of fishery: $32.6 million for 2023 season. | Potential<br>Between the 2016-2023 seasons, fishing intensity was largely concentrated in two locations off the coast of South Australia and off the southern coast of NSW. Low levels of fishing were reported along the Victorian coast in 2023.<br>(Figure 6-77) | Likely |
| **Southern Squid Jig Fishery** | Gould's squid (*Nototodarus gouldi*) | 12-month fishing season:<br>Commences 1 January each year | Commonwealth waters of NSW, Victoria, Tasmania and South Australia, and in a small area of oceanic waters off southern Queensland | Single method: jigging<br>Vessels operating in the 2023 season – 6<br>Squid are also caught in the Commonwealth Trawl Sector and GAB Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery. | Vessels typically operate at night in continental shelf waters between 60–120 m water depth.<br>Value of fishery: $4.00 million for 2022 season. No value is provided for 2023 season. | Potential<br>In the 2023 season recorded fishing intensity was concentrated within the Bass Strait. Between 2016-2023 seasons high fishing intensity occurred off the western Victoria coastline (outside of the operational area), north of King Island and on the east coast of Tasmania. However low activity was recorded within the operational area.<br>(Figure 6-78) | Likely |

*Sources: AFMA, 2025; Butler et al., 2024; Butler et al., 2023; Patterson et al., 2022*

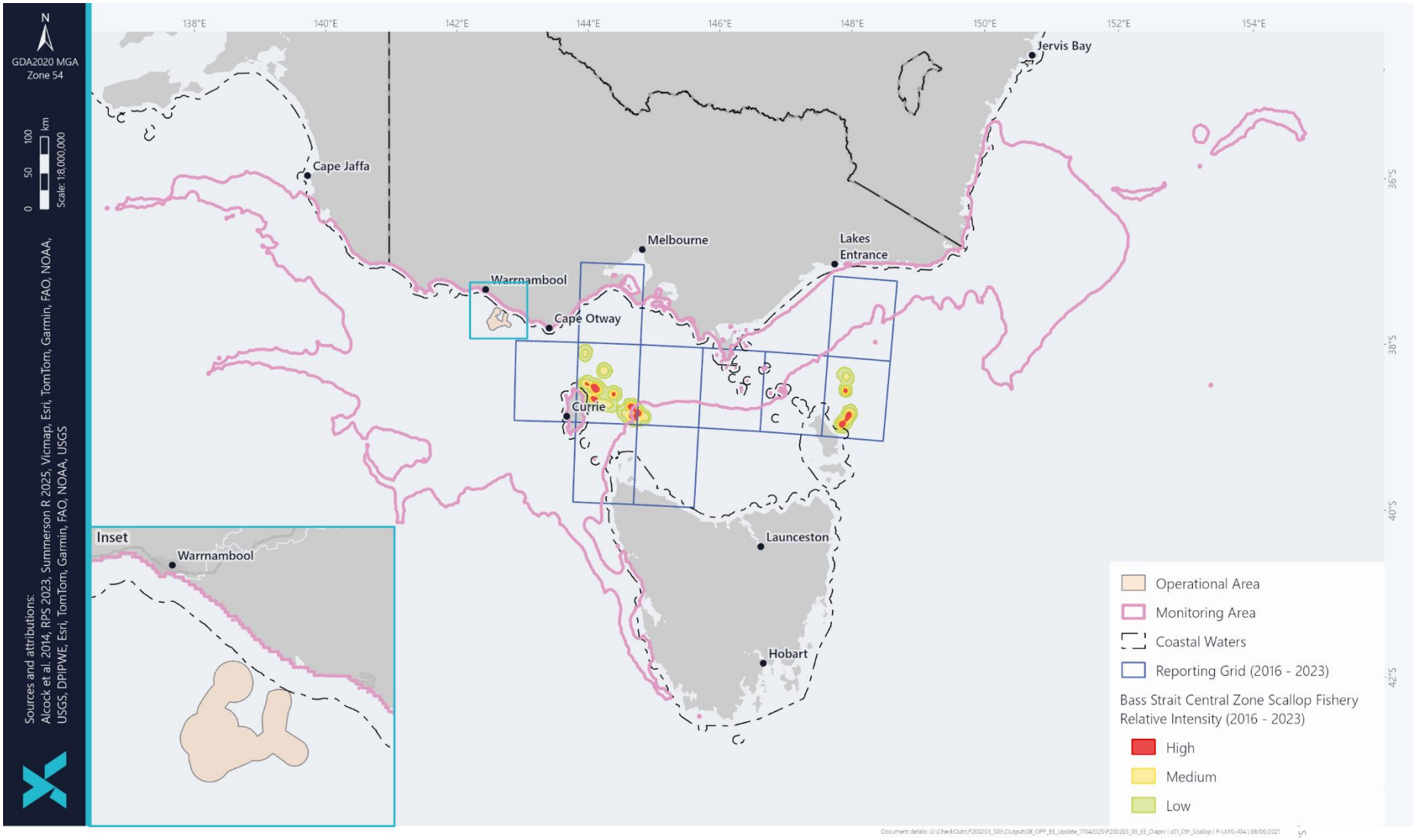



*Figure 6-68: Bass Strait Central Zone Scallop Fishery and overlap with monitoring area*

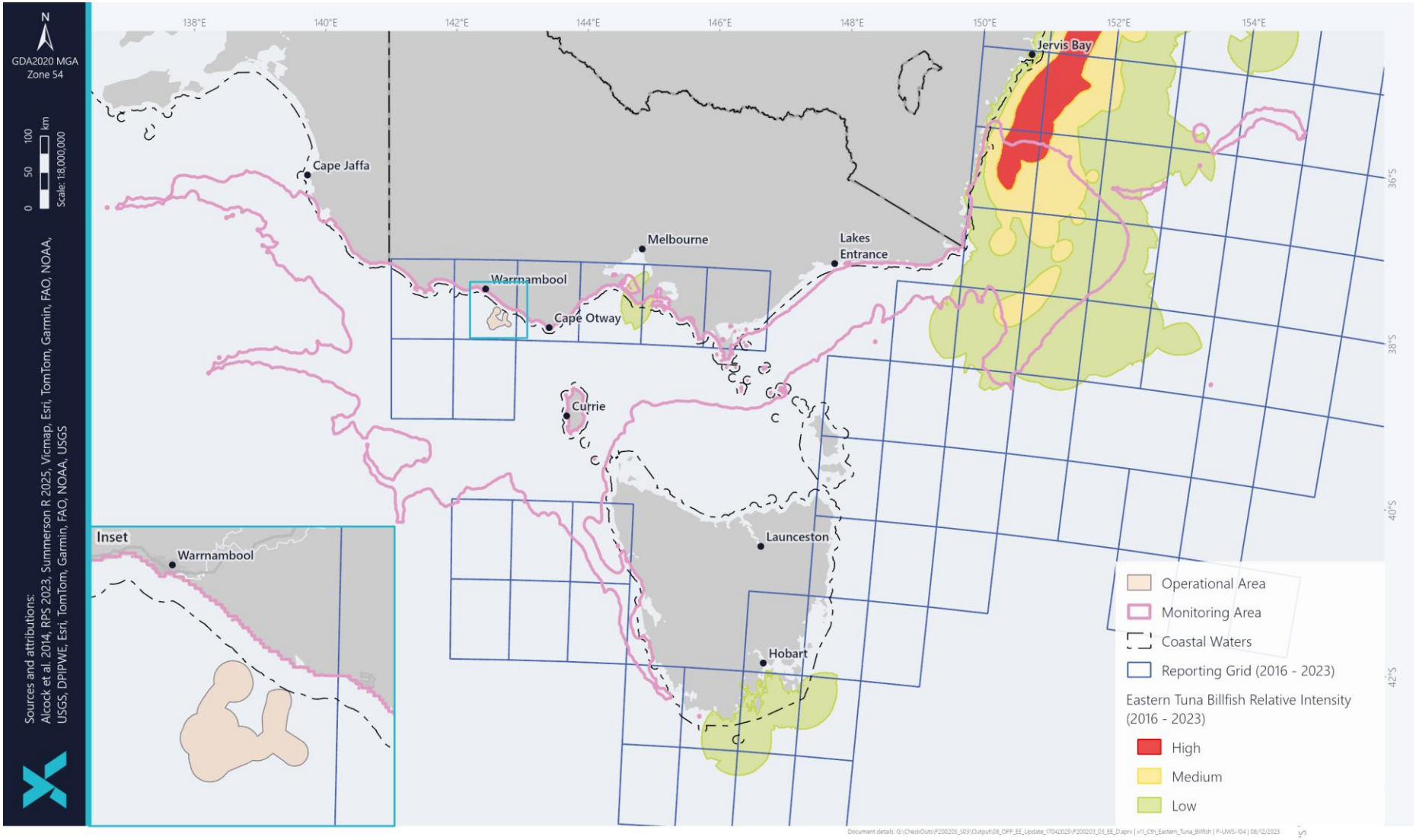



*Figure 6-69: Eastern Tuna and Billfish fishery and overlap with monitoring area*

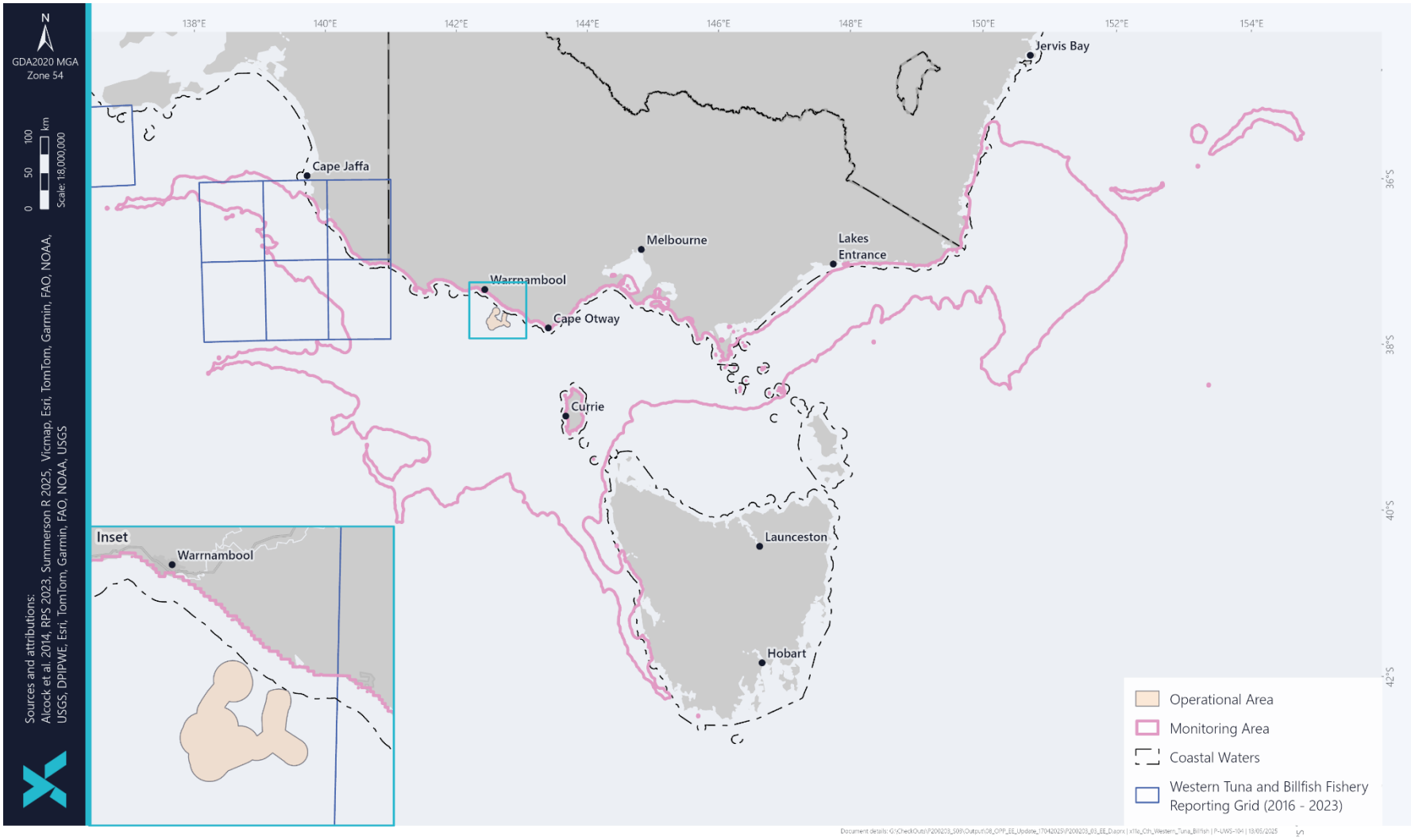



*Figure 6-70: Western Tuna and Billfish Fishery and overlap with the monitoring area*

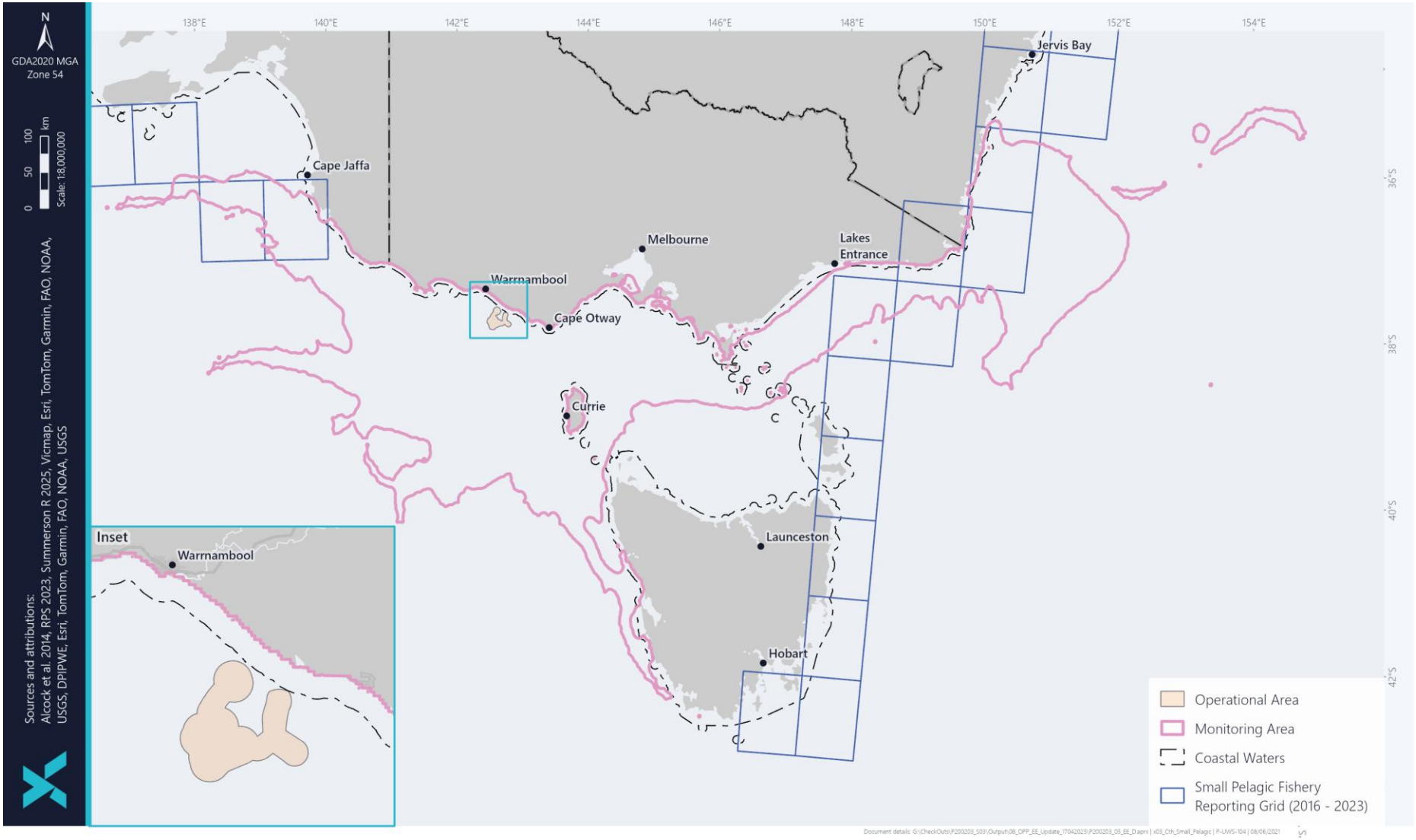



*Figure 6-71: Small Pelagic Fishery and overlap with monitoring area*

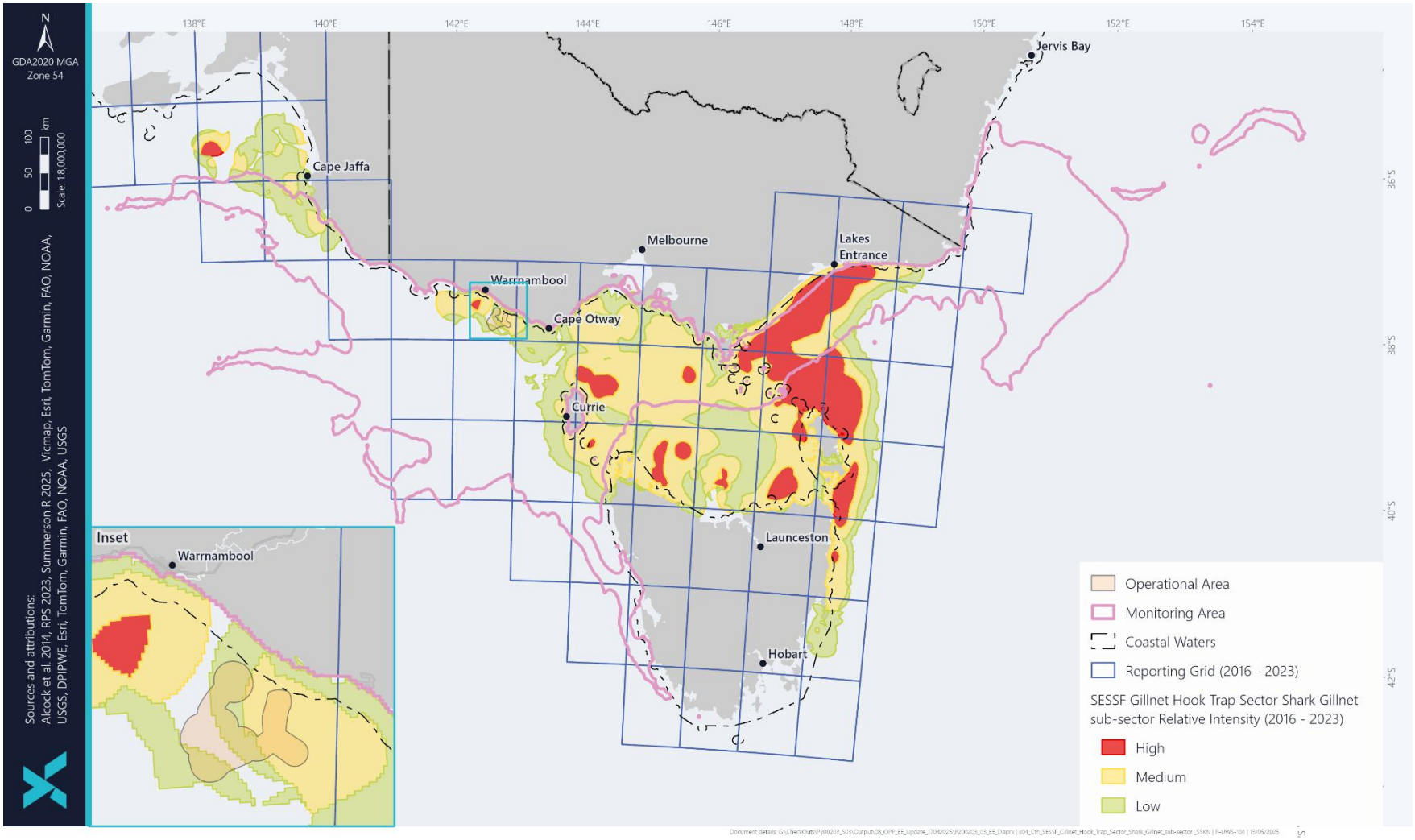



*Figure 6-72: SESSF – Shark Gillnet sub-sector and overlap with the monitoring area*

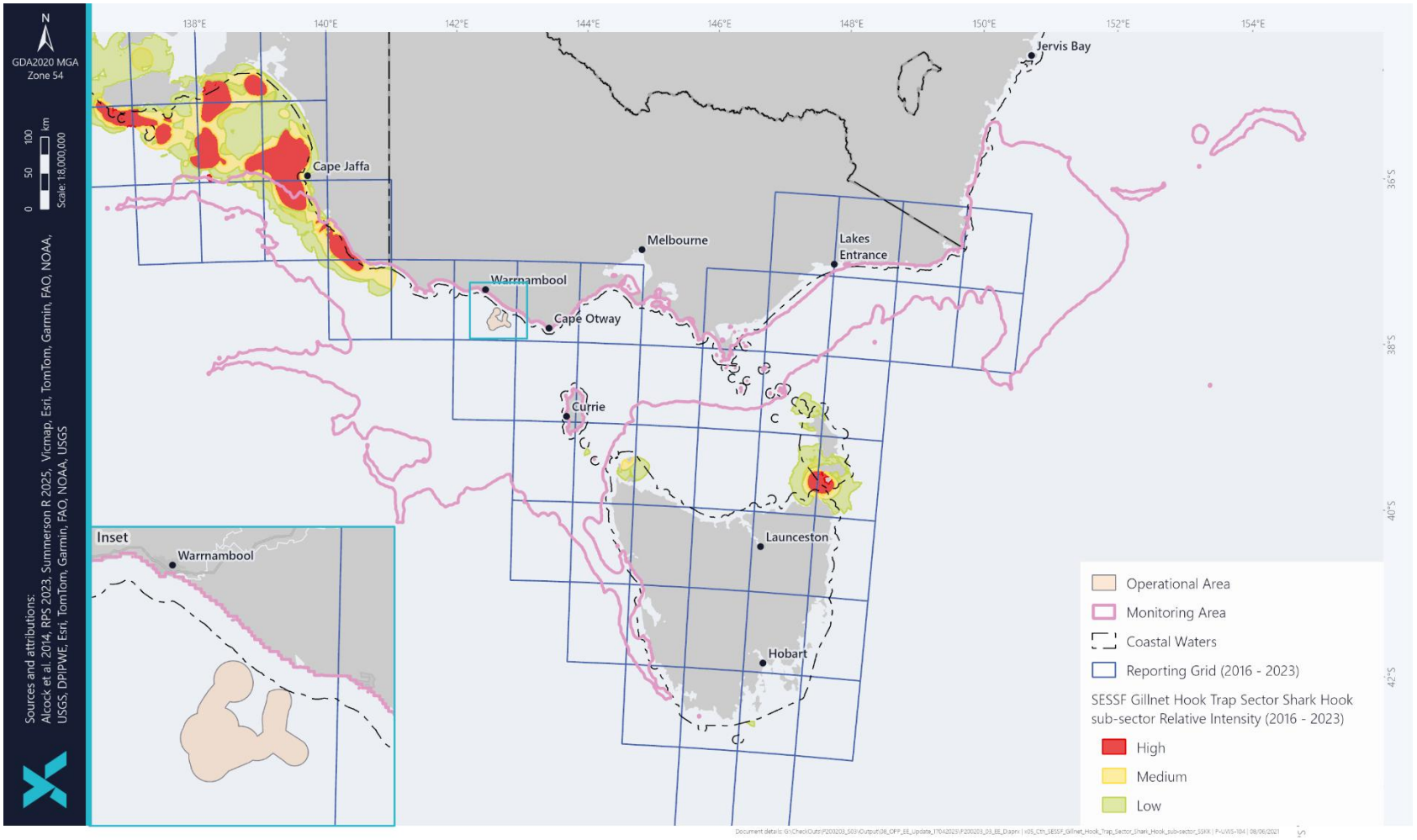



*Figure 6-73: SESSF – Shark Hook sub-sector and overlap with the monitoring area*

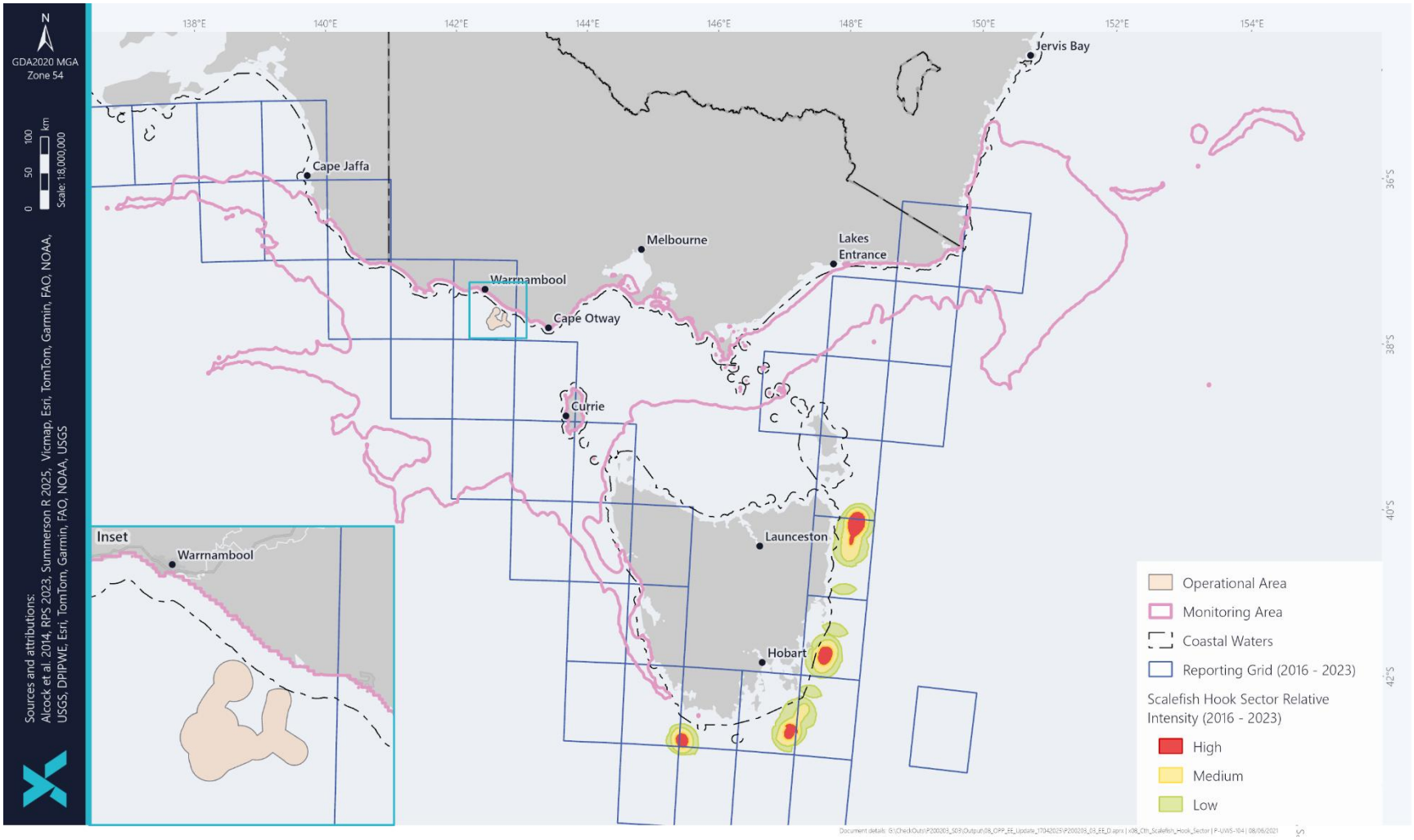



*Figure 6-74: SESSF – Scalefish Hook Sector and overlap with the monitoring area*

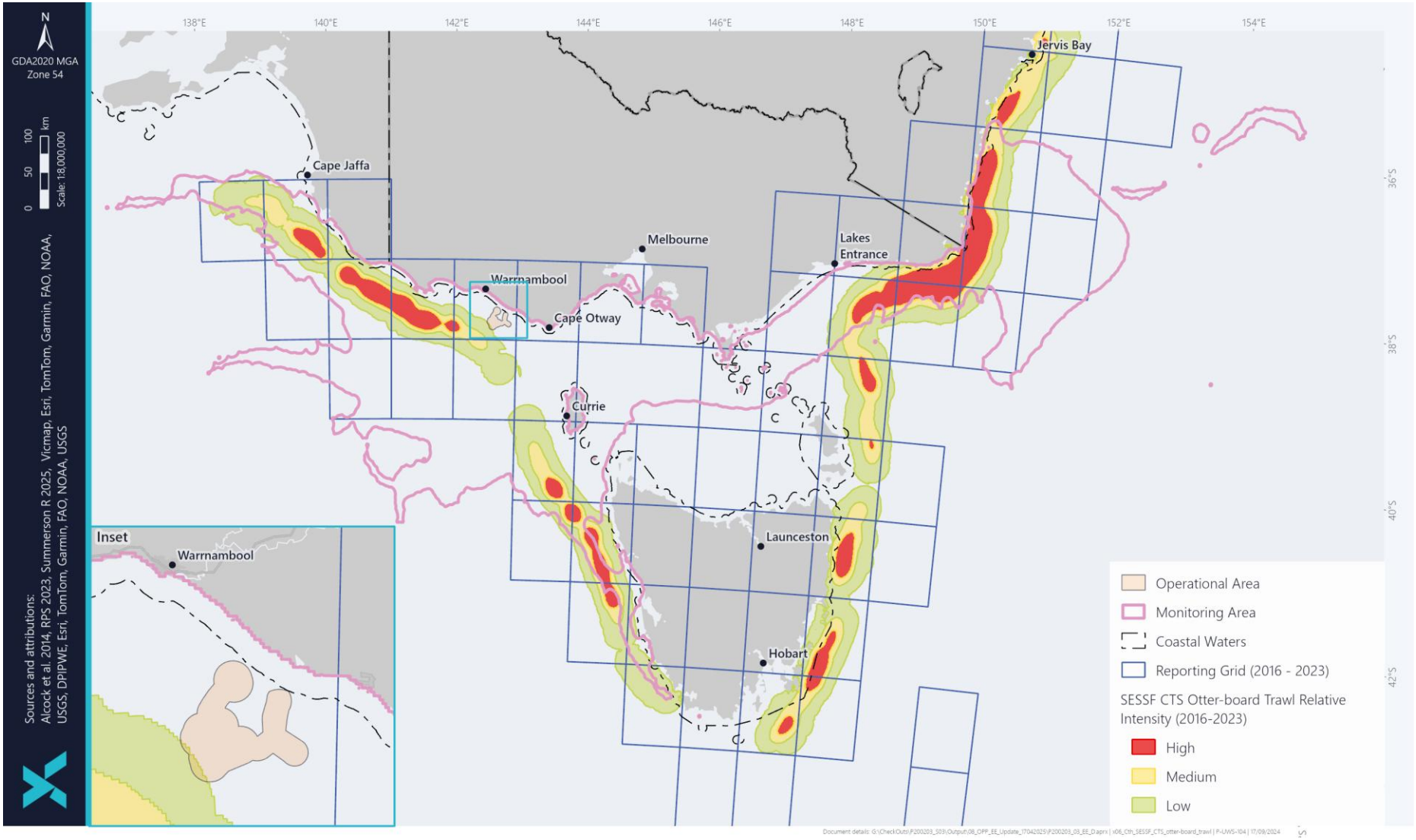



*Figure 6-75: SESSF – CTS – Otter-board Trawl and overlap with the monitoring area*

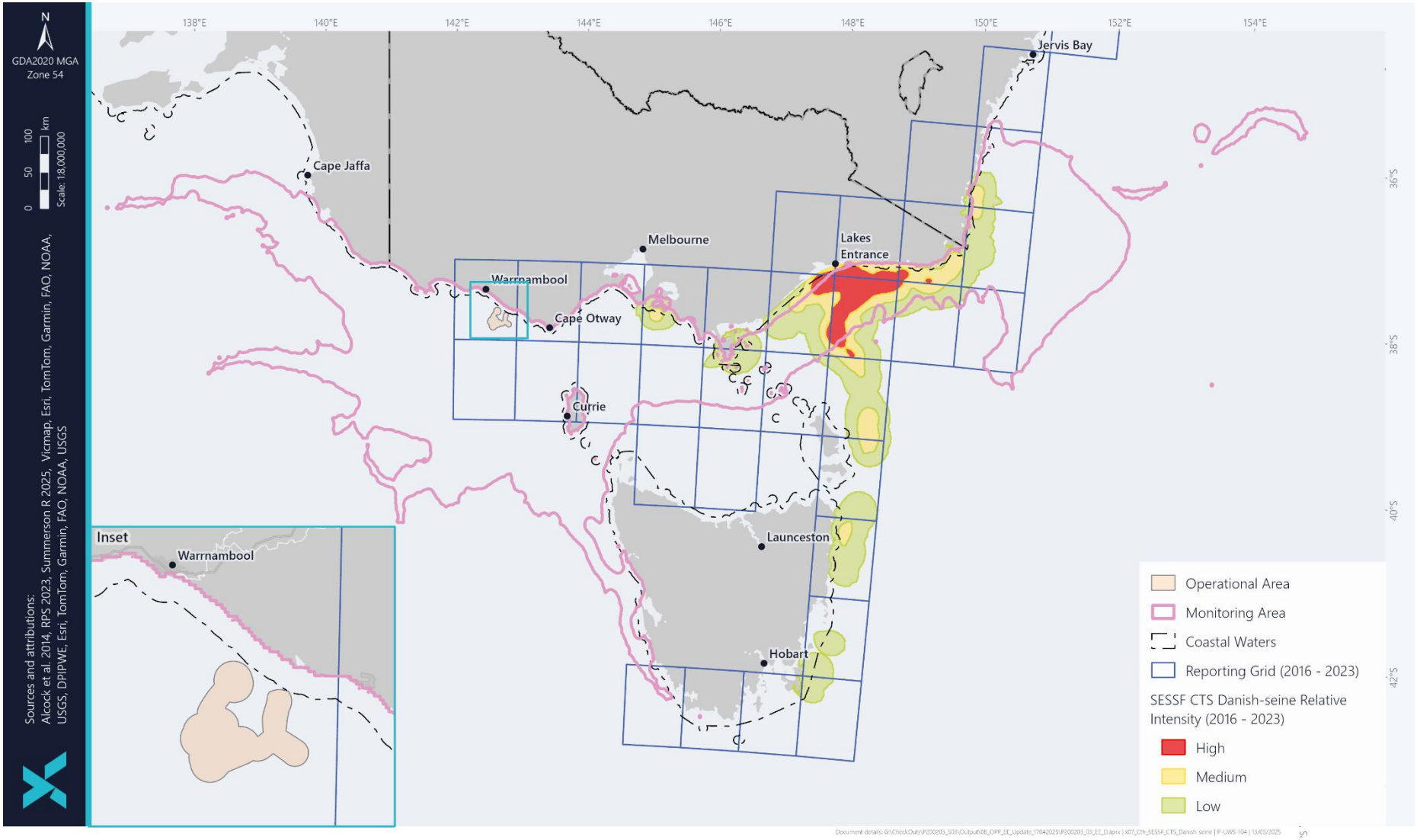



*Figure 6-76: SESSF – CTS – Danish-seine and overlap with the monitoring area*

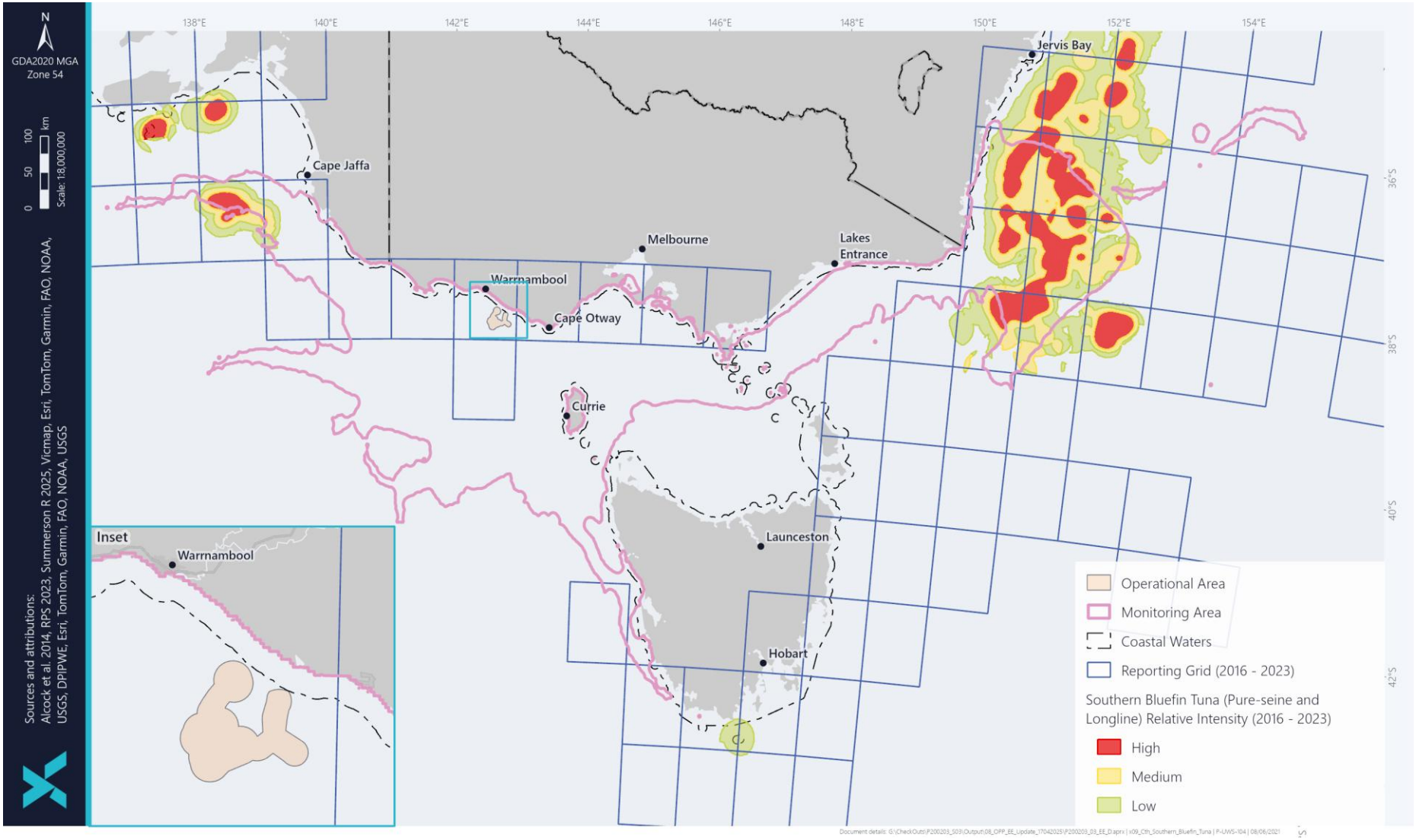



*Figure 6-77: Southern Bluefin Tuna Fishery and overlap with the monitoring area*

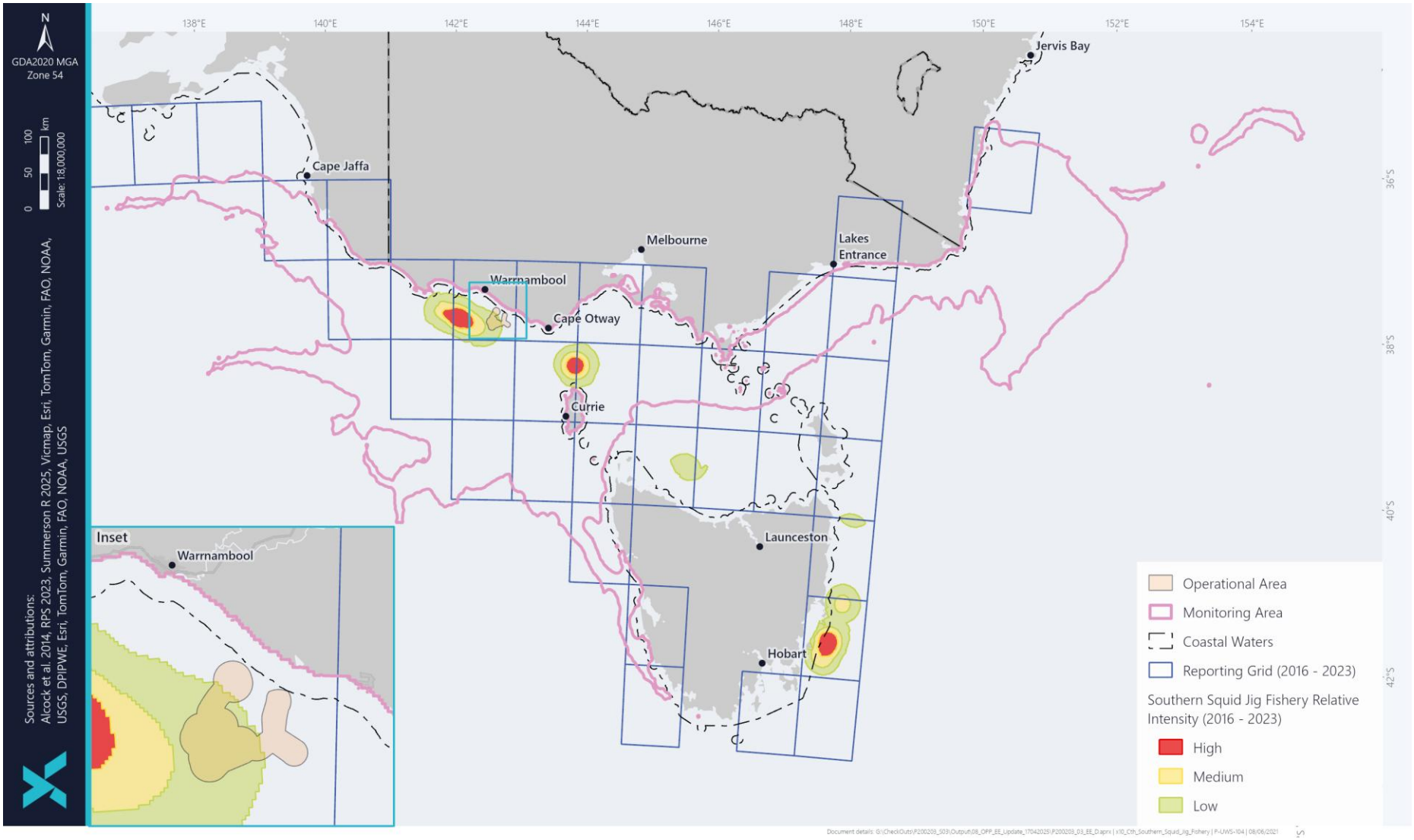



*Figure 6-78: Southern Squid Jig Fishery and overlap with the monitoring area*

*Table 6-20: Commercial Fisheries with Management Areas overlapped by the monitoring area – Victoria*

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and licenses | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| **Victorian Abalone Fishery** | Blacklip abalone (*Haliotis rubra*) and greenlip abalone (*Haliotis laevigata*) | 12-month fishing season:<br>Commences 1 April each year | The Victorian Abalone Fishery is divided into 3 management zones: western, central and eastern | Hand collected by divers<br><br>10 vessels were active in the 2021 season | Abalone is a mollusc (shellfish) that lives on rocky reefs from the shore out into the sea to depths of 30 m.<br><br>71 fishery access licences in the Victorian Abalone Fishery, which is subdivided into three management zones (14 in the Western Zone, 34 in the central zone and 23 in the Eastern Zone). | Unlikely<br>Water depths of the East Coast Project operational area range from approximately 55 to 85 m, outside of the species depth range.<br>No figure provided due to data confidentiality. | Likely |
| **Victorian Rock Lobster Fishery** | Southern rock lobster (*Jasus edwardsii*) | Female open season:<br>Nov 16 – May 31<br>Male open season:<br>Nov 16 – 16 Sept | The Victorian Rock Lobster Fishery is divided into management zones: western (Portland, Warrnambool and Apollo Bay) and eastern (Queenscliff, San Remo and Lakes Entrance) | Baited pots<br><br>Western zone: 35 active vessels in the 2022 season<br><br>Eastern zone: 12 active vessels in the 2022 season | In the 2022-23 season the Western Zone produced an average annual catch of 7.1t per vessel over 63 days fished.<br><br>TACC for the western zone 2023/24 season has been set at 242 t.<br><br>In the 2022-23 season the Eastern Zone produced an average annual catch of 1.3t per vessel over 76 days fished.<br><br>TACC for the eastern zone 2023/24 season has been set at 21 t. | Potential<br>Water depths of the East Coast Project operational area range from approximately 55 to 85 m. The median pot depth for the 2022-23 season was <30 m.<br>Between 2013-2023 a moderate number of days fished have occurred across the entire operational area.<br>(Figure 6-79) | Likely |
| **Victorian Giant Crab Fishery** | Giant crab (*Pseudocarcinus gigas*) | Female open season:<br>Nov 16 -May 29<br>Male open season:<br>Nov 16 – 16 Sept | The Victorian Giant Crab Fishery is divided into management zones: western (Portland, Warrnambool and Apollo Bay) and eastern (Queenscliff, San Remo and Lakes Entrance) | Baited pots; can only have one entrance and one chamber<br><br>Maximum number of licenses: 30 | In the Western zone, giant crabs can only be taken using commercial rock lobster pots by Western Zone rock lobster fishers.<br>The total landed catch during 2022-23 season was 6.7 t (1 July to 30 June).<br>TACC for the 2023/24 season has been set at 7.5 t. | Potential<br>Same likelihood as the Victorian Rock Lobster Fishery as they are the only ones allowed to target Giant Crabs in the Western Zone.<br>Between 2013-2023 a low number of days fished have occurred across the eastern extent of the operational area.<br>(Figure 6-80) | Likely |
| **Victorian Scallop Fishery** | Scallop (*Pecten fumatus*) | 12-month fishing season:<br>Commences 1 April | The Victorian Scallop Fishery extends 20 nm south of the Victorian coastline. Excluding bays and inlets along the coast where commercial fishing for scallops is prohibited | Scallop dredge<br><br>Maximum number of licenses: 91 and approximately 10-15 vessels | Scallops mature after one year but do not spawn until the second year. Adult scallops normally spawn between late winter and early spring<br><br>TACC for the 2023/24 season has been set at 135 t | Unlikely<br>Between 2013 – 2023 reported days fished has been concentrated along the eastern Victorian coastline.<br>(Figure 6-81) | Likely |
| **Victorian Octopus Fishery** | Pale octopus (*Octopus pallidus*), Maori octopus (*Macroctopus maorum*) and gloomy octopus (*Octopus tetricus*) | Year-round | The Victorian Octopus Fishery is divided into 3 management zones: western, central and eastern<br>*Central and western zones are managed through exploratory and temporary permits | Baited pots<br><br>Eastern zone: 11 licenses<br>Western and central zones: permit only, number unknown | Fishery commenced on 1 August 2020. Octopus Fishery Access Licenses authorise commercial take of octopus from the eastern octopus zone. This is where the majority of commercial octopus fishing in Victoria has occurred to date | Potential<br>Highest catch and effort expected in the central and eastern zones, however potential for interaction with exploratory and temporary permit holders in the western zone.<br>(Figure 6-82) | Likely |
| **Victorian Multi-species Fishery** | Pale octopus (*Octopus pallidus*) | Year-round | The fishery operates in Victorian state waters. | Multi-gear | This fishery is comprised of 3 sub-sectors: Ocean fishery, Commercial Permit fishery and Octopus fishery (central and western). | Potential<br>Between 2013 – 2023a low number (between 5-300) of days fished have occurred within the north eastern extent of the operational area.<br>(Figure 6-83) | Likely |
| **Victorian Pipi Fishery** | Pipi (*Donax deltoides*) | Year-round | The fishery covers the entire Victorian coastline, with the exception of Port | Hand collection | The species is found in the surf zone of high-energy sandy beaches. | Unlikely | Likely |

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and licenses | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| | | | Phillip Bay and Marine National Parks where shellfish cannot be harvested in the intertidal region | There are 11 classes of Fishery Access Licenses that authorize Pipi harvest | Victorian Pipi Fishery commenced on 1 April 2020. | Pipi are harvested on the beach and the East Coast Project is located in offshore commonwealth waters.<br>(Figure 6-84) | |
| **Victorian Sea Urchin Fishery** | White sea urchin (*Heliocidaris erythrogramma*), black, long-spined sea urchin (*Centrostephanus rodgersii*) | 12-month fishing season:<br>Commences 1 July each year | The Victorian Sea Urchin Fishery is managed spatially on the basis of four separate management zones: The Eastern Zone (EZ), Port Phillip Bay Zone (PPBZ), Central Zone (CZ) and Western Zone (WZ) | Hand collection | Allocated quota has only been established for the EZ and PPBZ | Unlikely<br>Water depths of the East Coast Project operational area range from approximately 55 to 85 m, outside of recreational diving limits.<br>No figure provided due to data confidentiality. | Likely |
| **Victorian Wrasse Fishery** | Blue-throat wrasse (*Notolabrus tetricus*), saddled (or purple) wrasse (*Notolabrus fucicola*), rosy wrasse (*Pseudolabrus psittaculus*), senator wrasse (*Pictilabrus laticlavius*) and southern Maori wrasse (*Ophthalmolepis lineolatus*) | Year-round | The fishery extends along the entire length of the Victorian coastline and out to 20 nm, excluding marine reserves<br><br>Fishery is split into 3 management zones; western, central and eastern | Hook and line<br><br>22 Wrasse Fishery access license are currently issued | All species of wrasse are near-shore and are highly territorial with limited home ranges. | Potential<br>Between 2013 – 2023 reported days fished has been concentrated along the western and central Victorian coastline with a low number (between 5-50) of days fished occurring within the north eastern extent of the operational area.<br>(Figure 6-85) | Likely |

*Source: VFA, 2025*

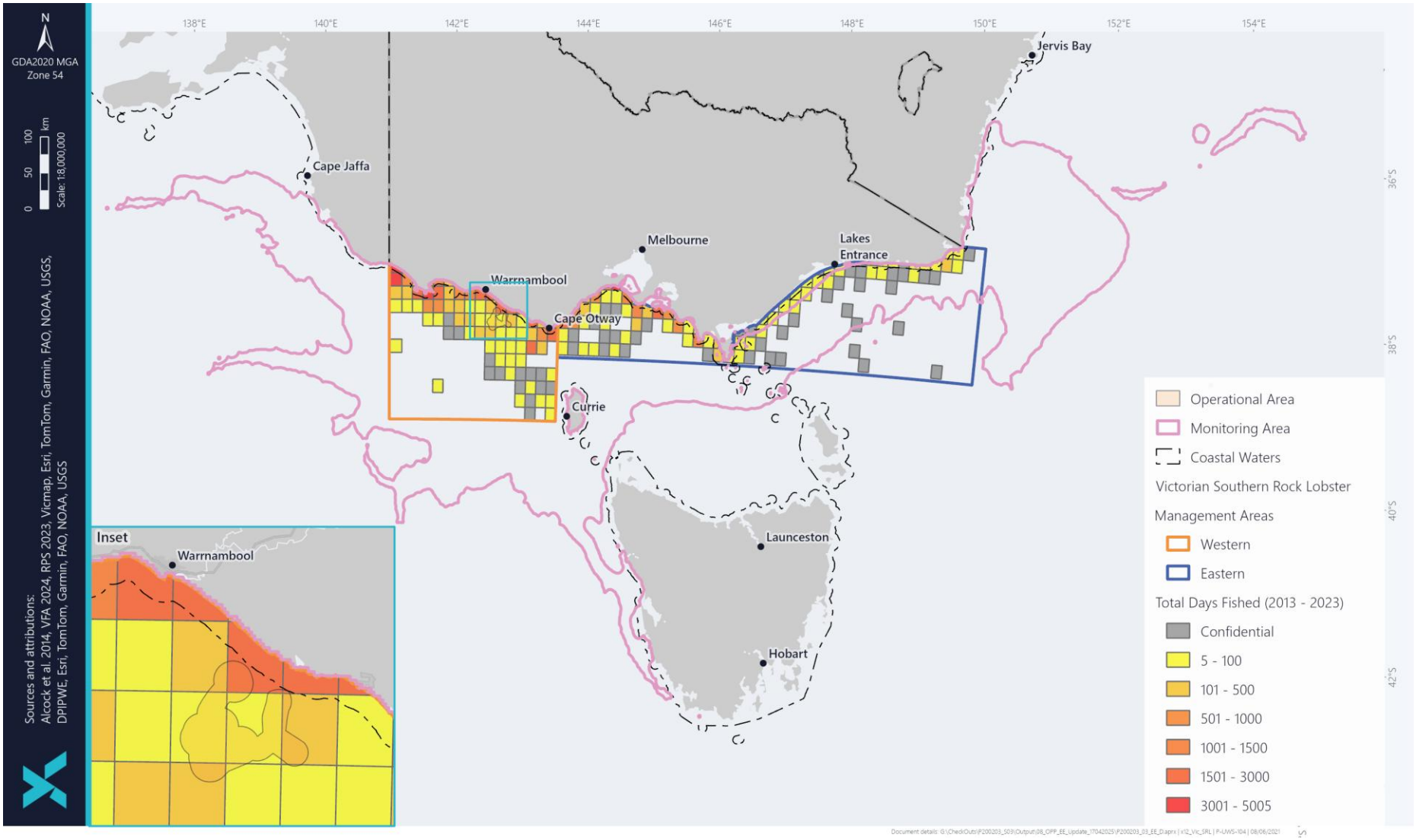



*Figure 6-79: Victorian Southern Rock Lobster Fishery and overlap with the monitoring area*

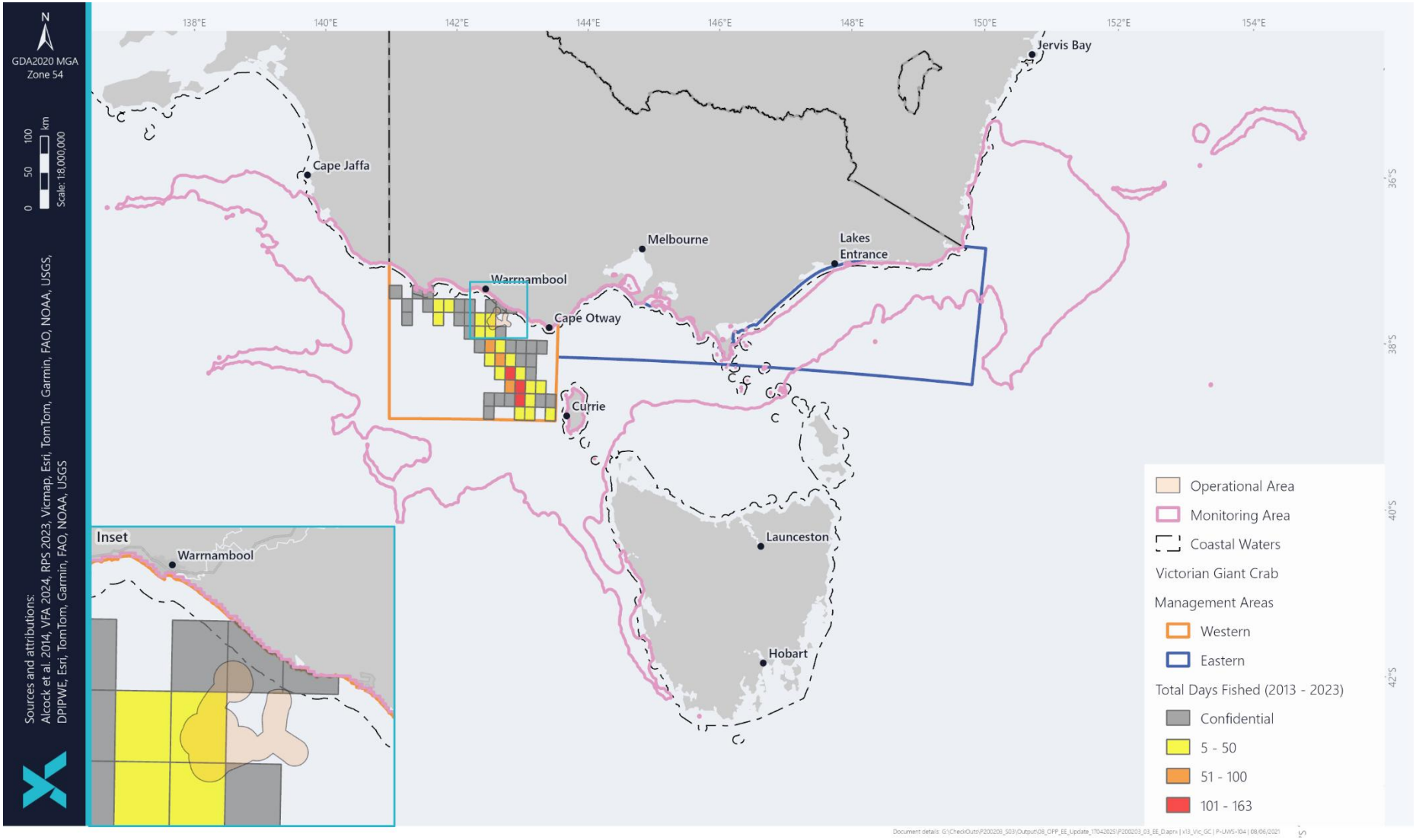



*Figure 6-80: Victorian Giant Crab Fishery and overlap with the monitoring area*

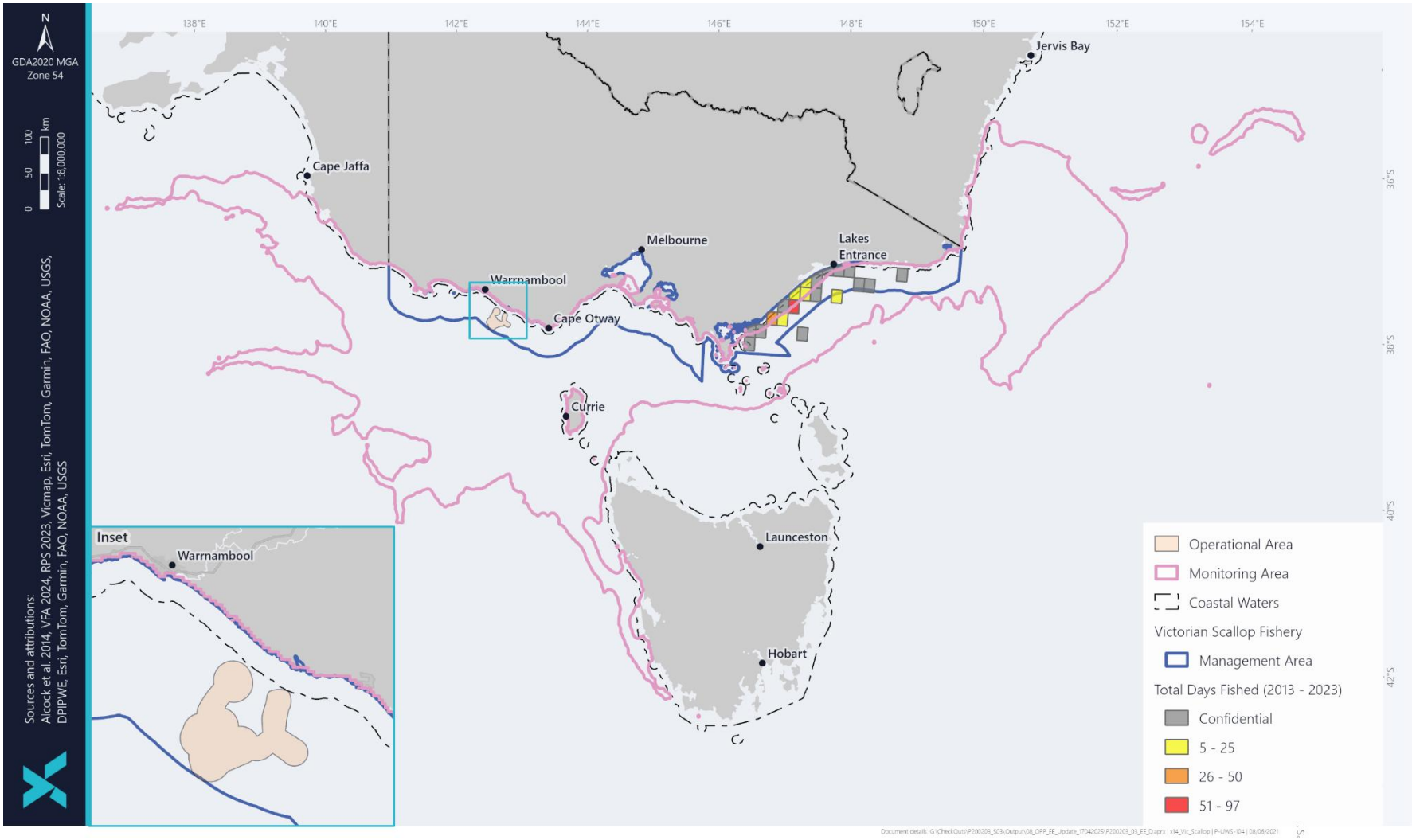



*Figure 6-81: Victorian Scallop Fishery and overlap with the monitoring area*

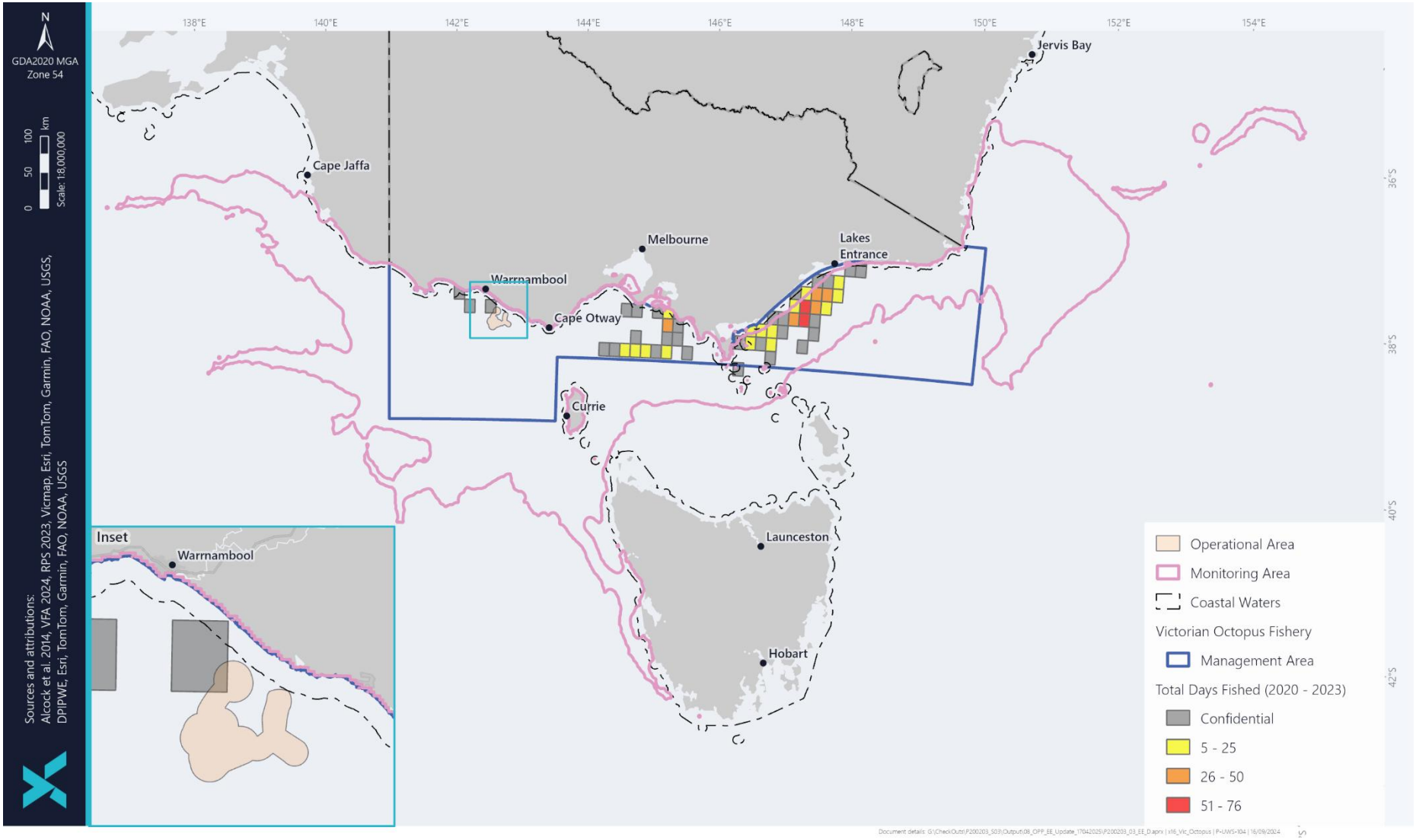



*Figure 6-82: Victorian Octopus Fishery and overlap with the monitoring area*

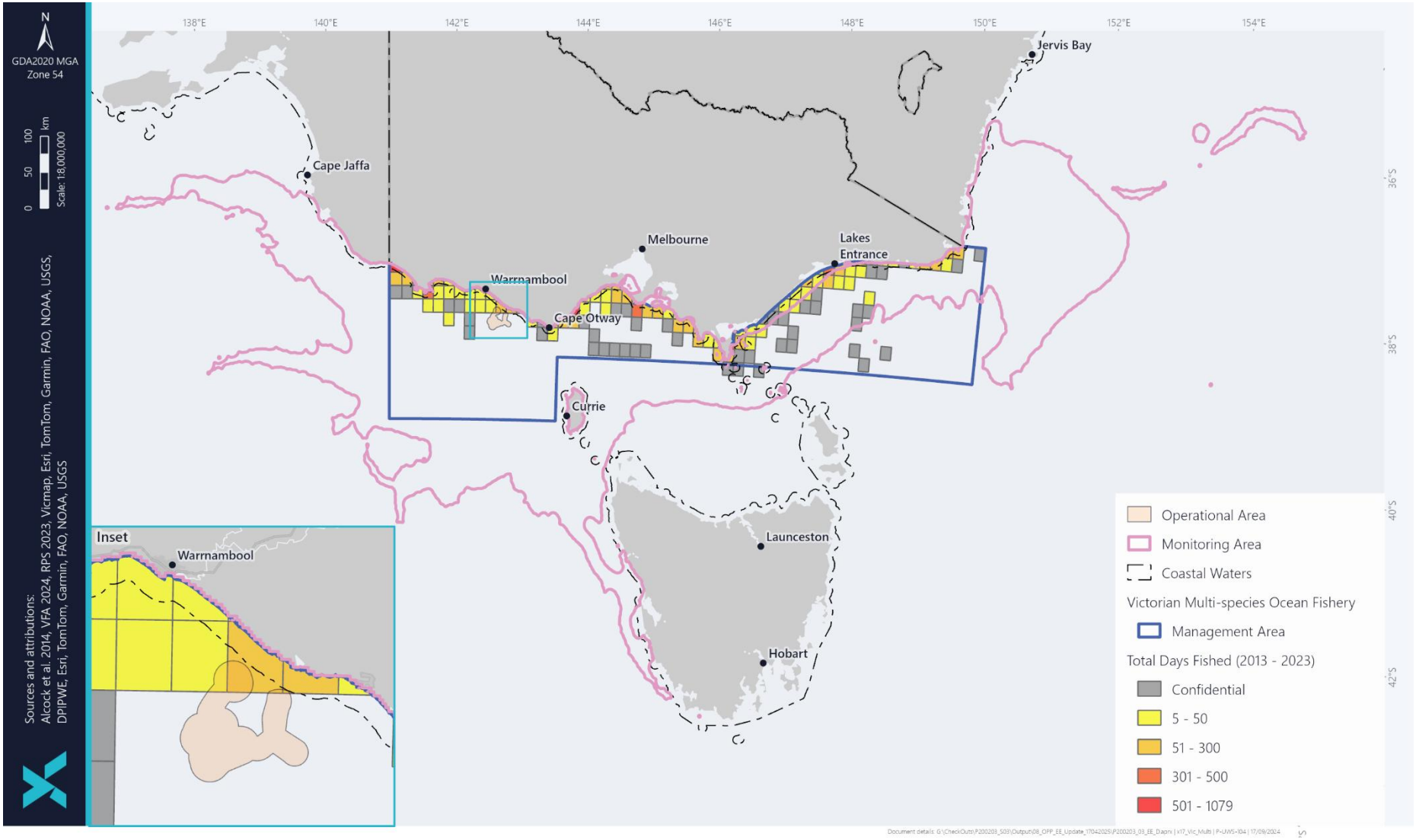



*Figure 6-83: Victorian Multi-species Ocean Fishery and overlap with the monitoring area*

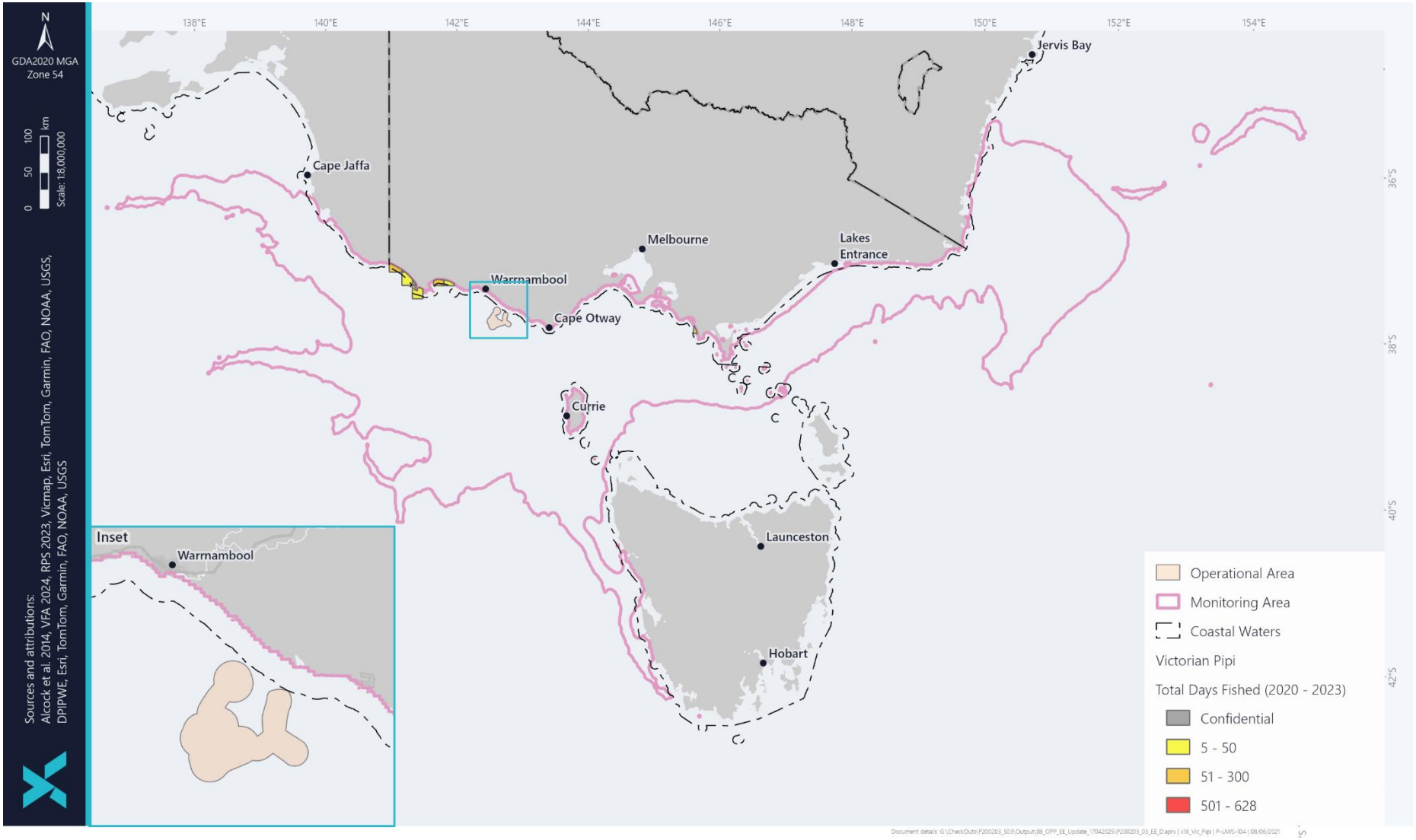



*Figure 6-84: Victorian Pipi Fishery and overlap with the monitoring area*

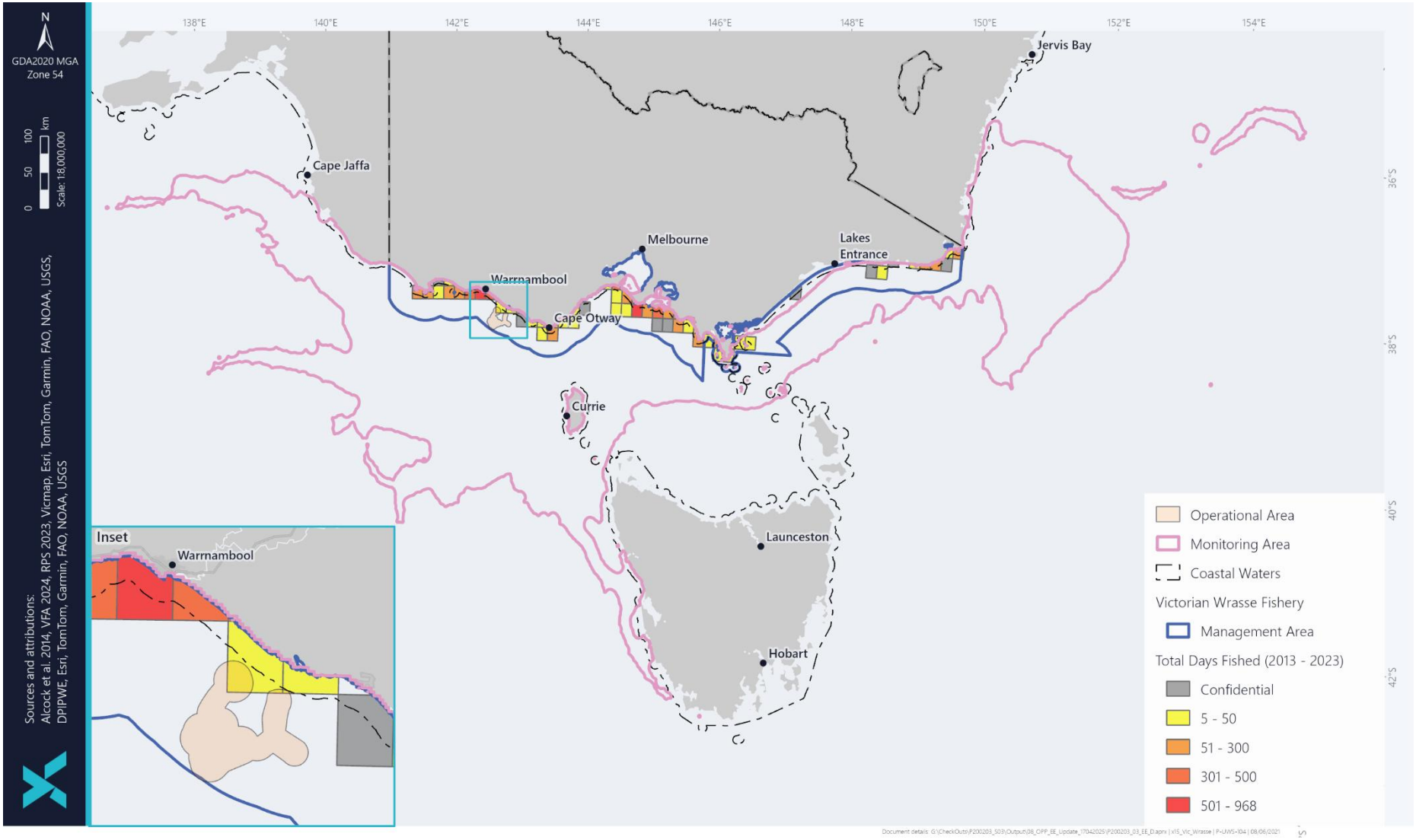



*Figure 6-85: Victorian Wrasse Fishery and overlap with the monitoring area*

*Table 6-21: Commercial Fisheries with Management Areas overlapped by the monitoring area – Tasmania*

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and licenses | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| **Abalone Fishery** | Blacklip abalone (*Haliotis rubra*) and greenlip abalone (*Haliotis laevigata*) | Commences 1 January each year.<br>Fishery closes once total allowable catch for each species is met. | There are 4 management zones in Tasmanian State Waters:<br>• Northern (overlaps monitoring area)<br>• Bass Strait (overlaps monitoring area)<br>• Western (overlaps monitoring area)<br>• Eastern | Hand collected by divers<br><br>121 fishing licenses (Abalone Dive)<br>*Source: McAllister and Mundy, 2023* | Predominantly occur within the littoral zone from depths of 5-30 m, though they can also be found down to 40 m. Blacklip abalone are distributed around Tasmania. Greenlip abalone are found along the north coast and around the Bass Strait islands (Bradshaw, 2018).<br>Important food source for Tasmanian Aboriginals.<br>Total allowable catch for the 2024 season was set at 756 kg. | None | Likely<br>(Figure 6-86) |
| **Commercial Dive Fishery** | Shortspined sea urchin (*Heliocidaris erythrogramma*), wavy periwinkles (*Lunella undulata*) and longspined sea urchin (*Centrostephanus rodgersii*) | Year-round<br><br>Periwinkle: peak Aug-Nov<br>Shortspined sea urchin: peak Aug- Jan<br>Longspined sea urchin: peak Dec-July | There are 5 management zones in Tasmanian State Waters:<br>• Northern (overlaps monitoring area)<br>• North-Eastern<br>• Central-Eastern<br>• South-Eastern<br>• Western (overlaps monitoring area) | Hand collected by divers<br>Limited (53) transferrable licenses<br><br>*Source: DNRET, 2024a* | Harvest occurs when the roe quality peaks just before spawning.<br><br>There are no commercial limits to the longspined sea urchin, however there are for native shortspined sea urchins and periwinkles.<br><br>Total allowable catch for the 2023/24 season of periwinkles and shortspined sea urchins are 54 t and 175 t, respectively.<br>*Source: DNRET, 2024a* | None | Likely<br>(Figure 6-86) |
| **Giant Crab Fishery** | Giant crab (*Pseudocarcinus gigas*) | Males – OPEN all year round.<br>Females – OPEN from 15 November in a year to 31 May the following year inclusive. | Operates in State and Commonwealth waters surrounding Tasmania in waters south of 39° 12', and out to 200 nm from the coastline | Baited pots/traps | Total allowable catch for the 2023/24 season is set at 20.7 t. As of August 2024, 9.7 t have been caught.<br>The fishery is linked to the Tasmanian Rock Lobster Fishery through the requirement to hold a rock lobster license as well as a giant crab license to target giant crab.<br>With an annual harvest of 20.7 t the high landed value of this fishery is ~2 million. | None | Likely<br>(Figure 6-87) |
| **Marine Plant Fishery** | Bull kelp (*Nereocystis luetkeana*) and wakame (*Undaria pinnatifida*) | Year-round | The Marine Plant Fishery is split into 6 zones:<br>• King Island Area (overlapped by monitoring area)<br>• North west Area (overlapped by monitoring area)<br>• Granville Area (overlapped by monitoring area)<br>• Unzoned Area (overlapped by monitoring area)<br>• Restricted *Undaria* Area<br>• *Undaria* Area | Handed harvested onshore<br>(*Undaria* sp. are an exception and may be hand collected through diving)<br><br>The North-West region is limited to eight licenses at any one time | To protect Tasmanian marine ecosystems, no marine plants may be harvested directly from the water, except in east coast waters under the *Undaria* fishery.<br><br>No further licenses are to be granted in King Island and Granville Harbour. | None | Likely<br>No figure provided due to data confidentiality. |
| **Rock Lobster Fishery** | Southern rock lobster (*Jasus edwardsii*) | Female – CLOSED from Wednesday, 1 May 2024 for all State waters.<br>Male – CLOSED from Sunday, 1 September 2024 all waters south of St Helens Pt around to Sandy Cape (41° 29').<br>Male – CLOSED from Tuesday, 1 October 2024 all other State waters. | Operates in State and Commonwealth waters surrounding Tasmania in waters south of 39° 12', and out to 200 nm from the coastline.<br>There are 2 zones in the Tasmanian Rock Lobster fishery. Mainland Tasmania is divided at Henty River on the west and Cape Pillar on the east to create the zones.<br>• Northern zone<br>• Southern zone<br>*Both zones are overlapped by the monitoring area | Baited pots<br>Licenses are limited to 312 | The majority of the commercial catch comes from the western half of the state.<br>Total allowable catch for the 2023/24 season is set at 1050.7 t. | None | Likely<br>(Figure 6-88) |
| **Scalefish Fishery** | Banded morwong (*Cheilodactylus spectabilis),* southern calmari (*Sepioteuthis australis),* | Year-round | The fishery is managed as one area – with the exception of Banded Morwong, Southern Calamari, Octopus and Rock Lobster.<br><br>Scalefish license holders can only operate in coastal state waters. | Multi-gear<br>As of 2024 there were 649 fishing licenses (vessel) renewed for the year. | The fishery is predominately made up of small owner operators.<br>There are many different licenses associated with the fishery:<br>• 10 gear type licenses | None | Likely<br>(Figure 6-89) |

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and licenses | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| | southern garfish (*Hyporhamphus melanochir*), wrasse (*Notolabrus* sp.), tiger flathead (*Neoplatycephalus richardsoni*), southern school whiting (*Sillago flindersi*) east Australian salmon (*Arripis trutta*), barracouta (*Thyrsites atun*), bastard trumpeter (*Latridopsis forsteri*), blue warehou (*Seriolella brama*) and Gould's squid (*Nototodarus gouldi*) | | | | • 3 species licenses<br>• 3 license types<br><br>*Source: DNRET, 2024b* | | |
| **Scallop Fishery** | Commercial scallop (*Pecten fumatus)* | OPEN – 5 July 2024<br>CLOSED – 31 December 2024. | Extends to 200 nm from the Tasmanian coast, except for Bass Strait, where its jurisdiction covers 3-20 nm offshore | Dredging | A scallop dredge can't be deployed in waters less than 20 m deep,<br><br>Total allowable catch for the 2024 season was set at 4,000.3t. As of August 2024 985.8 t has been caught.<br><br>The monitoring area overlaps the north west 2024 open area. | None | Likely<br>No figure provided due to data confidentiality. |

*Source: DNRET, 2024*

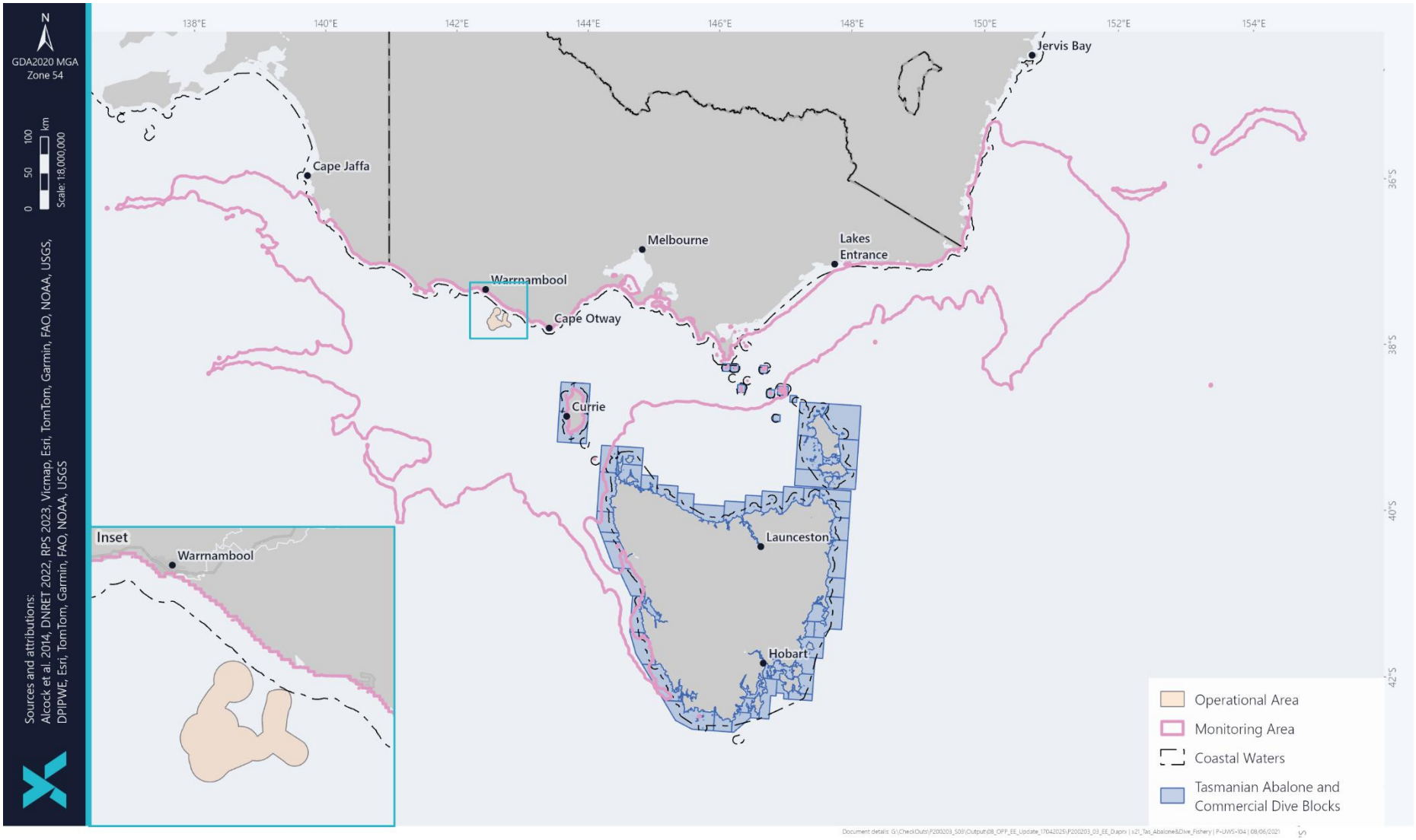



*Figure 6-86: Commercial dive blocks for the Tasmanian Abalone and Commercial Dive Fishery and overlap with the monitoring area*

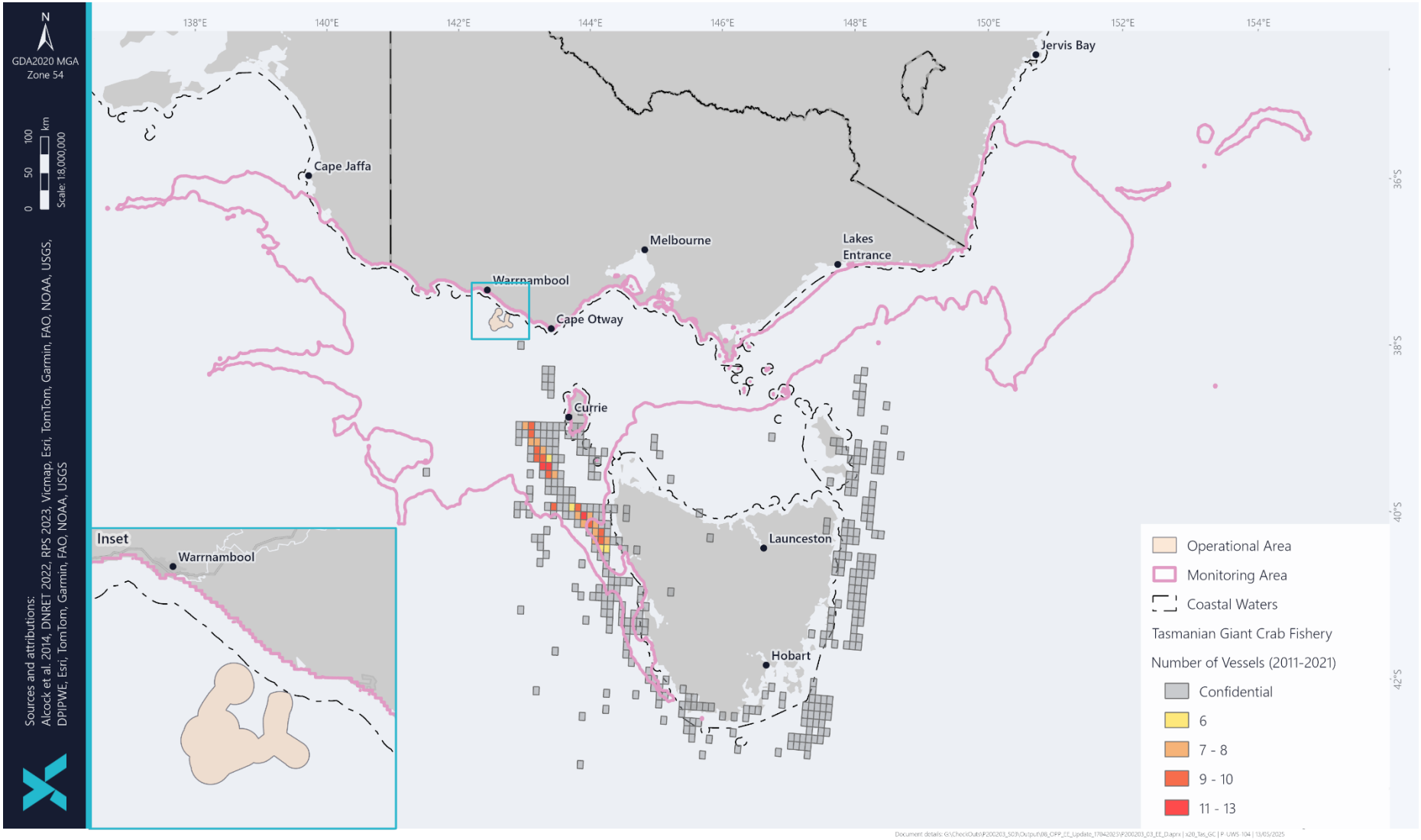



*Figure 6-87: Tasmanian Giant Crab Fishery and overlap with the monitoring area*

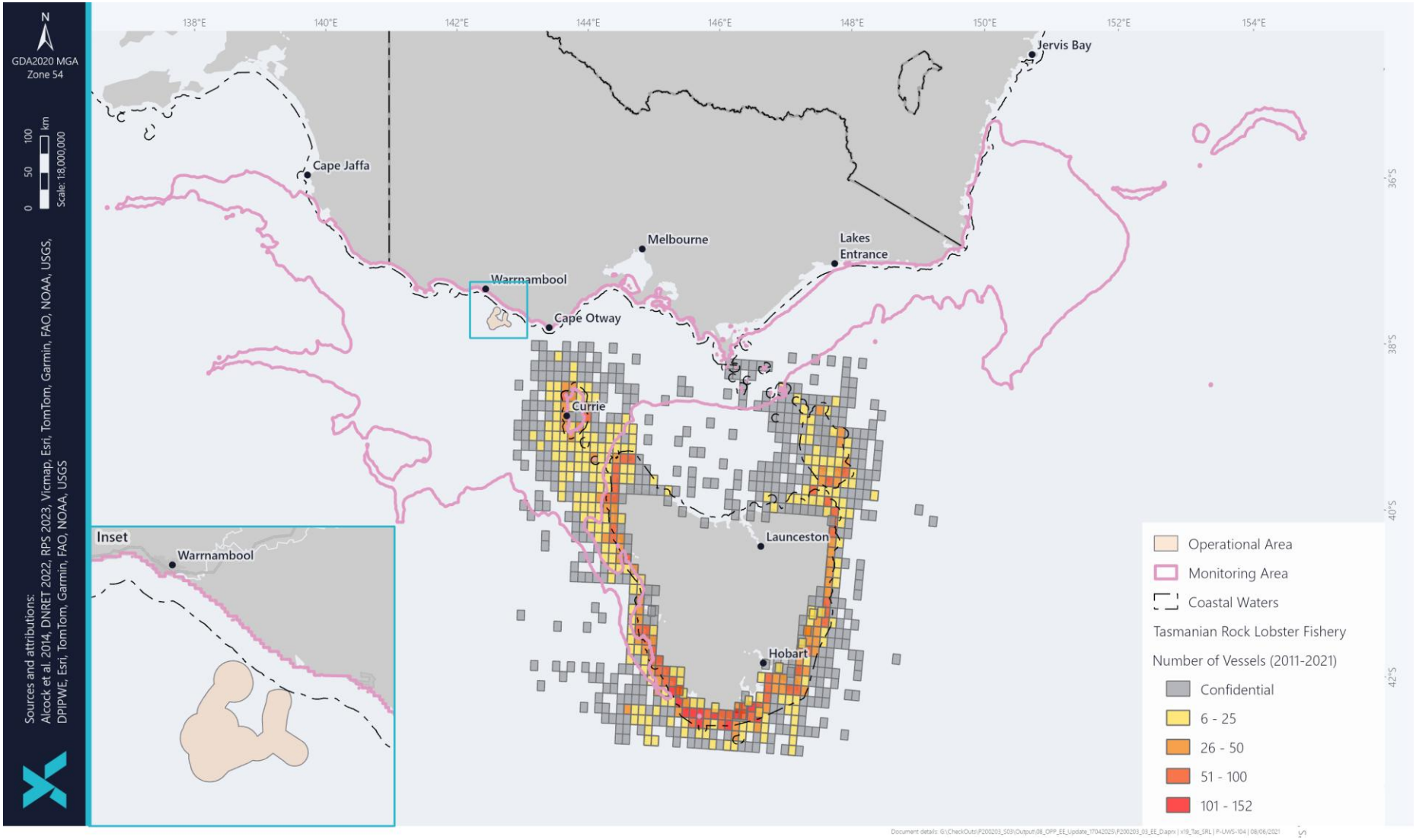



*Figure 6-88: Tasmanian Rock Lobster Fishery and overlap with the monitoring area*

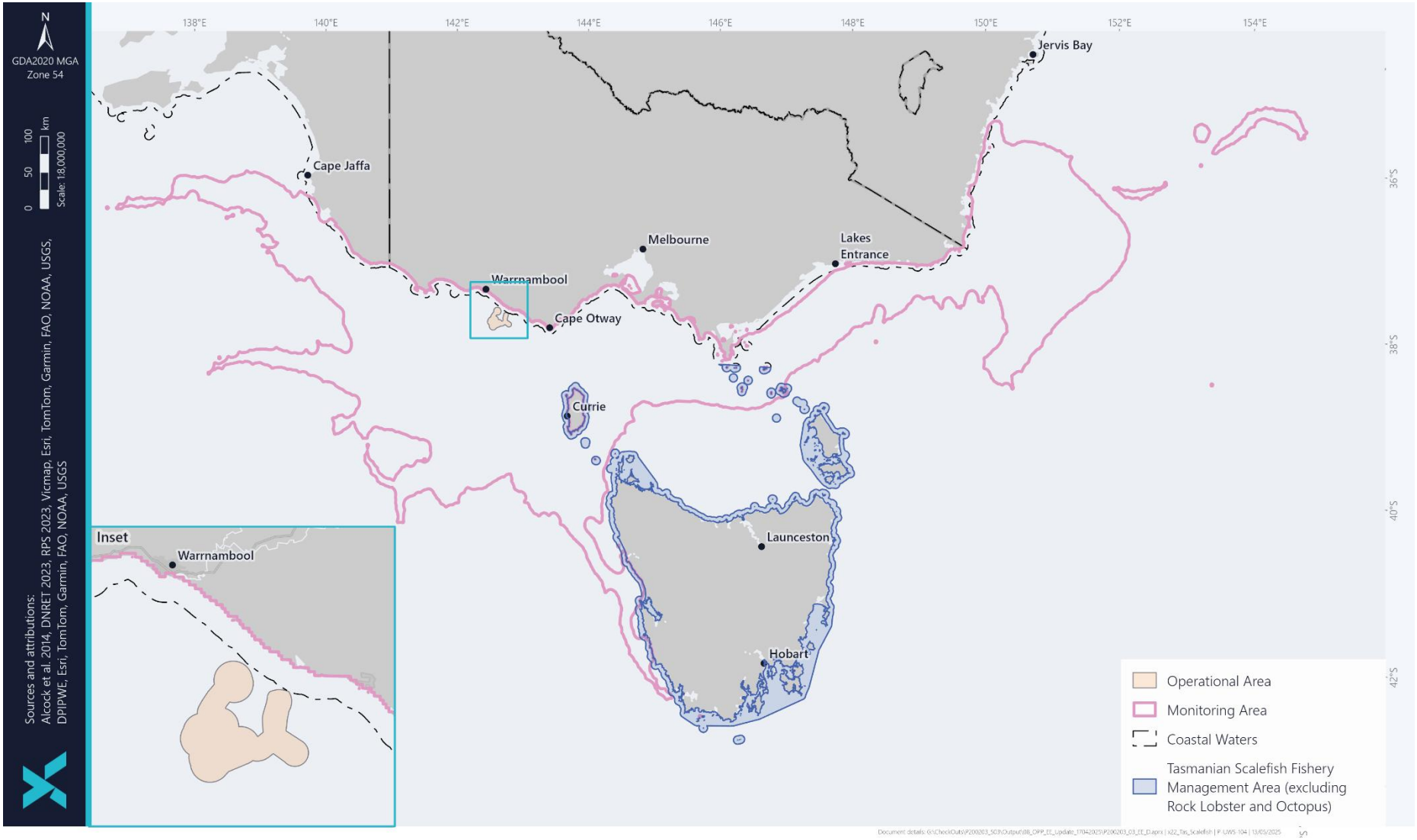



*Figure 6-89: Tasmanian Scalefish Fishery Management Area and overlap with the monitoring area*

*Table 6-22: Commercial Fisheries with Management Areas overlapped by the monitoring area – NSW*

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and licenses | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| **Abalone Fishery** | Blacklip abalone (*Haliotis rubra*) | Year-round | Operates along the coastline in NSW state waters | Hand collected by divers<br><br>There are 35 shareholders with the minimum number of shares to have an endorsement that authorizes the taking of abalone | Most commercial abalone fishing takes place on the south coast of NSW, primarily from Jervis Bay to the Victorian border, with most abalone found close to the shore.<br>A total allowable commercial catch for the 2024/25 season was set at 100 t.<br>In 2019/20, the Abalone fishery produced $3.6 million in gross value of production (at beach price) from a catch of 83 t.<br>*Source: TAFC, 2024a* | None | Likely<br>(Figure 6-90) |
| **Estuary General Fishery** | Multi species<br>The species that make up the top percentages of landings are listed below:<br>• Sea mullet (*Mugil cephalus*) 40%<br>• Luderick (*Girella tricuspidata*) 8%<br>• Yellowfin bream (*Acanthopagrus australis*) 8%<br>• School prawn (*Metapenaeus macleaya*) 5%,<br>• Blue swimmer crab (*Portunus pelagicus*) 4% | Year-round | Operates in 76 of the NSW's estuarine systems<br>It is a shared management fishery that is divided geographically into 7 regions from the Far North Coast to the Far South Coast of NSW.<br><br>The monitoring area overlaps portions of Region 6 and 7. | Multi-gear<br><br>Approximately 600 fishing businesses | There are 63 classes of share available in the fishery, comprised of 9 classes of share for each of the 7 regions. Endorsements specify the methods that may be used and the waters in which fishing may be conducted.<br>• Handline and hauling crew endorsement<br>• Meshing endorsement<br>• Prawning endorsement<br>• Trapping endorsement<br>• Eel trapping endorsement<br>• Mud crab trapping endorsement<br>• Hand gathering endorsement<br>• Category one hauling endorsement<br>• Category two hauling endorsement. | None | Likely<br>No figure provided due to data confidentiality. |
| **Lobster Fishery** | Eastern rock lobster (*Sagmariasus verreauxi*) | 2023/24 Season:<br>1 August 2023 – 31 July 2024 | Extends from the Queensland border to the Victorian border and includes all waters under jurisdiction of NSW to around 80 miles from the coast. | Traps<br><br>There are 96 shareholders in the fishery and 68 authorized fishers | A total commercial catch of 200 t was set for the 2024/25 season.<br><br>The Fishery is considered sustainable. Gross value of production for 2022/23 was estimated at ~$12 million.<br>*Source: TAFC, 2024b* | None | Likely<br>(Figure 6-91) |
| **Ocean Hauling Fishery** | Multi species<br>The species that make up the top percentages of landings are listed below:<br>• Pilchards (*Sardinops sagax*) 34%<br>• Sea mullet (*Mugil cephalus*) 30%<br>• Australian salmon (*Arripis trutta*) 17%<br>• Blue mackerel (*Scomber australasicus*) 8%<br>• Yellowtail scad (*Trachurus novaezelandiae*) 5% | Year-round | Extends from beaches to sea within 3 nm of the NSW coast.<br>It is a shared management fishery that is divided geographically into 7 regions from the Far North Coast to the Far South Coast of NSW.<br><br>The monitoring area overlaps portions of Region 6 and 7. | Commercial hauling and purse seine nets from beaches and in ocean waters<br><br>There were 69 active businesses in the 2019/20 season | The 5 ocean hauling endorsement types in NSW ocean waters are listed below. Endorsements specify the methods that may be used and the waters in which fishing may be conducted.<br>• General ocean hauling endorsement<br>• Hauling net (general purpose) endorsement<br>• Garfish net (hauling) endorsement<br>• Pilchard, anchovy and bait net (hauling) endorsement<br>• Purse-seine net endorsement<br>In 2019/20, the Ocean Hauling fishery produced $10 million in gross value of production (at beach price) from a catch of 3,886 t. | None | Likely<br>(Figure 6-92) |
| **Ocean Trap & Line Fishery** | Multi species<br>Listed species form the majority of the catch: Snapper (*Chrysophrys auratus*), yellowtail kingfish (*Seriola lalandi*), leatherjackets, bonito (*Sarda australis*) and silver trevally (*Pseudocaranz georgianus*)<br><br>A variety of shark species are also targeted by the fishery. | Year-round | Operates along the entire NSW coast and in the continental shelf and slope waters. | Mutli-method<br><br>There were 211 active businesses in the 2019/20 season | The 6 types of Ocean Trap and Line endorsements in NSW ocean waters are listed below. Endorsements specify the methods that may be used and the waters in which fishing may be conducted.<br>• Line fishing western zone endorsement<br>• Line fishing eastern zone endorsement<br>• Demersal fish trap endorsement<br>• School and gummy shark endorsement<br>• Spanner crab northern zone endorsement<br>• Spanner crab southern zone endorsement. | None | Likely<br>(Figure 6-93) |

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and licenses | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| | | | | | In 2019/20, the Ocean Trap & Line fishery produced $13 million in gross value of production (at beach price) from a catch of 1,352 t. | | |
| **S37 Permit Fishery** | Various | Year-round | Various | Various | A Section 37 permit (miscellaneous permit) is required for any activity that involves taking or possessing fish or marine vegetation that would otherwise be unlawful under the *Fisheries Management Act 1994*. This includes activities such as:<br>• Science or Research Collection<br>• Aquarium Collection<br>• Possessing Pacific Oysters<br>Collecting Marine Vegetation for Commercial Purposes. | None | Likely<br>(Figure 6-94) |
| **Sea Urchin & Turban Shell Fishery** | Black urchin (*Centrostephanus rodgersii) r*ed urchin (*Heliocidaris erythrogramma*), purple urchin (*Heliocidaris tuberculate*) and various turban shell species | Year-round | Operates along the entire NSW coast and is split into 5 regions:<br>• Tweed Heads to Newcastle<br>• Newcastle to Currarong<br>• Currarong to Brush Island<br>• Brush Island to Montague Island<br>• Montague Island to Cape Howe | Hand collected by divers<br><br>There are currently 37 fishing businesses | Commercial harvest of the turban shell is mainly restricted to NSW waters.<br><br>In 2019/20, the Sea Urchin & Turban Shell fishery produced $0.5 million in gross value of production (at beach price) from a catch of 126 t.<br>Regional catch limits are in place. | None | Likely<br>(Figure 6-95) |
| **Southern Fish Trawl Fishery** | N/A | N/A | N/A | N/A | In 2019 the Southern Fish Trawl Fishery was integrated into the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) due to the substantial overlap between the two fisheries.<br>*Source: DPI, 2018* | None | None |
| **Ocean Trawl Fishery** | Multi species<br>Major species taken include: stout and red spot whiting (*Sillago robusta* and *S.flindersi*), eastern king, school and royal red prawns (*Melicertus plebejus* and *M.macleayi*), tiger flathead (*Platycephalus richardsoni*), silver trevally (*Pseudocaranz georgianus*), various species of sharks and rays, squid, octopus and bugs | Year-round | Operates along the entire NSW coast and in the continental shelf and slope waters. | Otter trawl net<br><br>There were 96 active businesses in the 2019/20 season | There are two sectors to the NSW Ocean Trawl Fishery: the prawn trawl sector and the fish trawl sector.<br><br>In 2019/20, the Ocean Trawl fishery produced $26.2 million in gross value of production (at beach price) from a catch of 2,672 t. | None | Likely<br>(Figure 6-97) |

*Source: DPI 2025; BDO Australia, 2022*

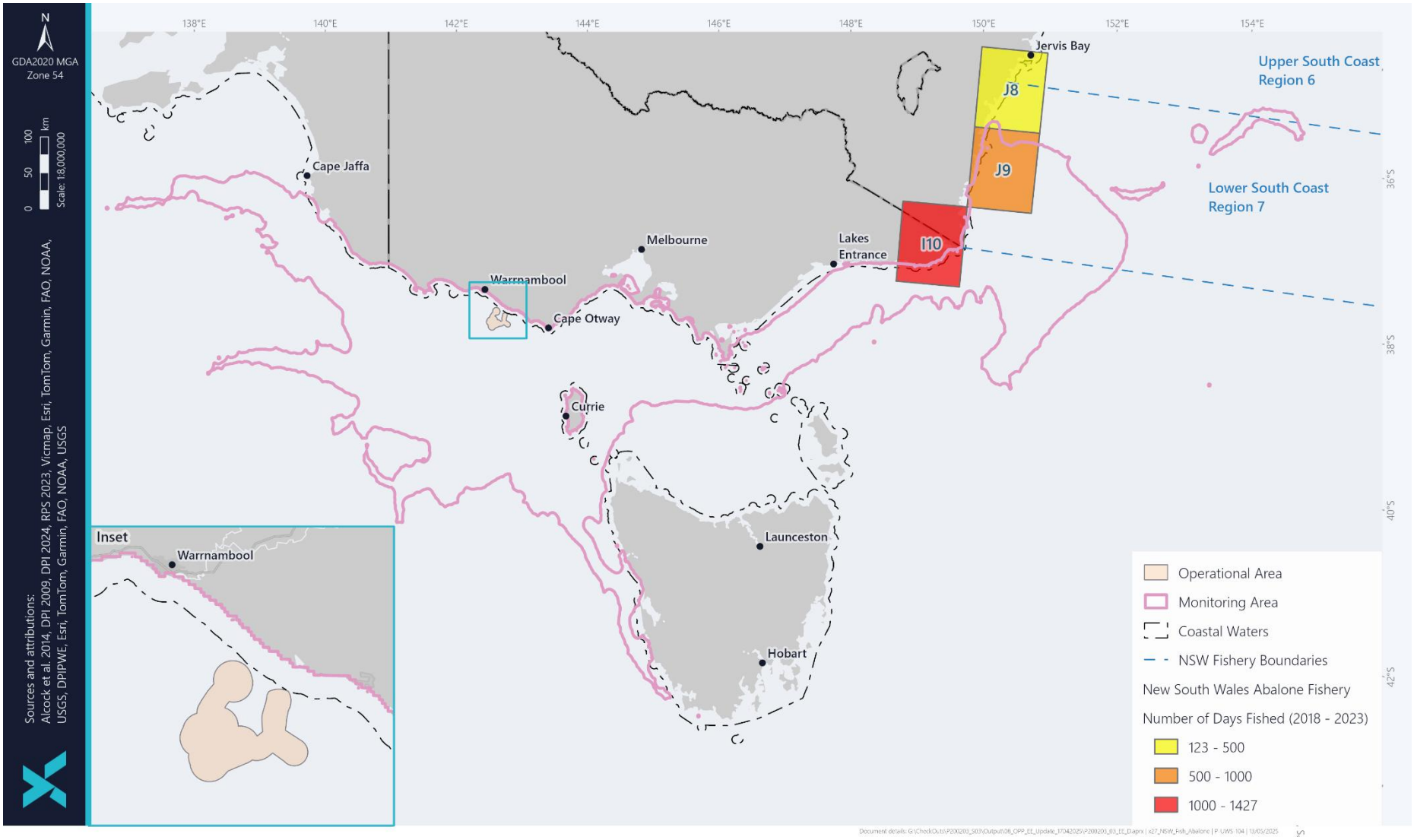



*Figure 6-90: NSW Abalone Fishery and overlap with the monitoring area*

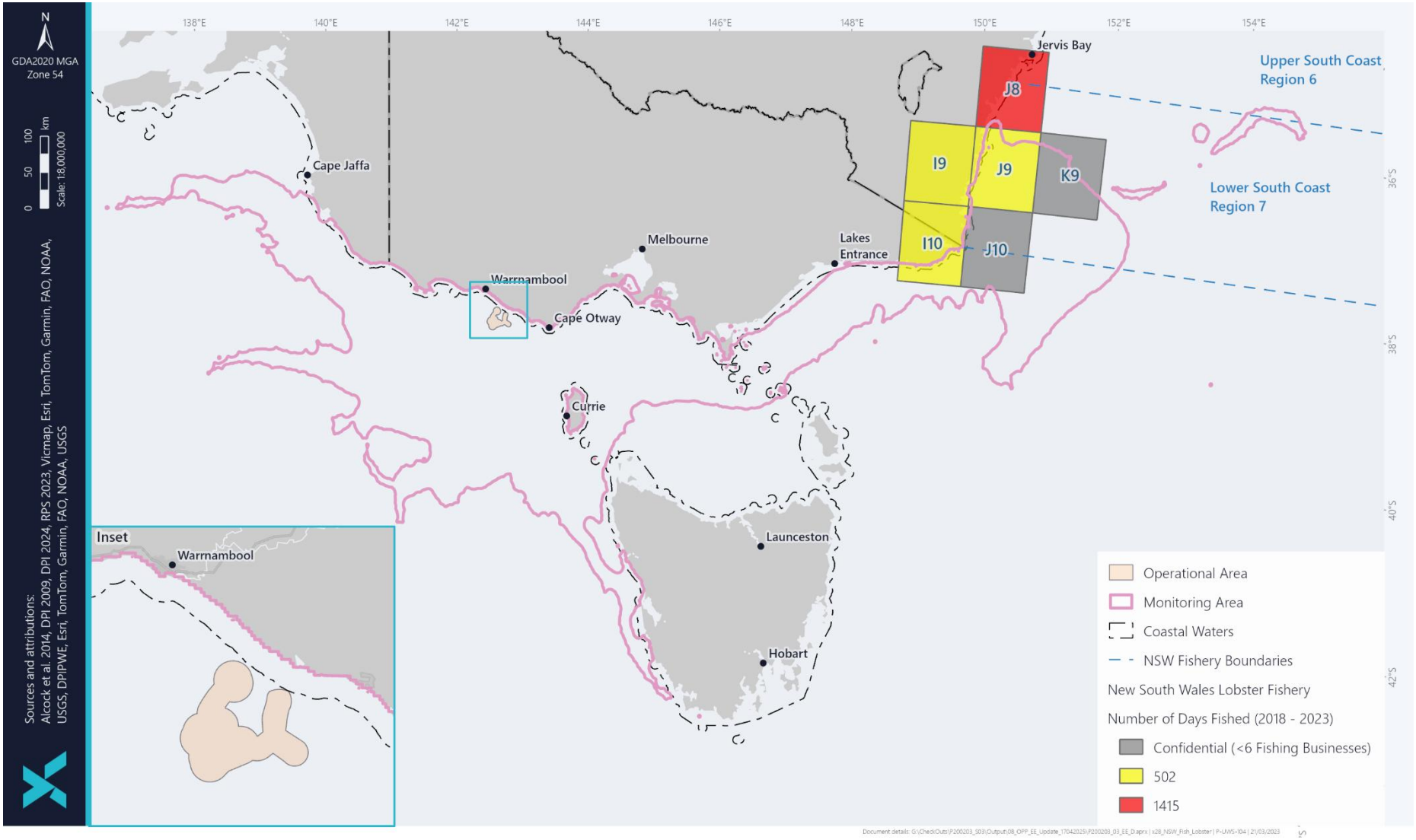



*Figure 6-91: NSW Lobster Fishery and overlap with the monitoring area*

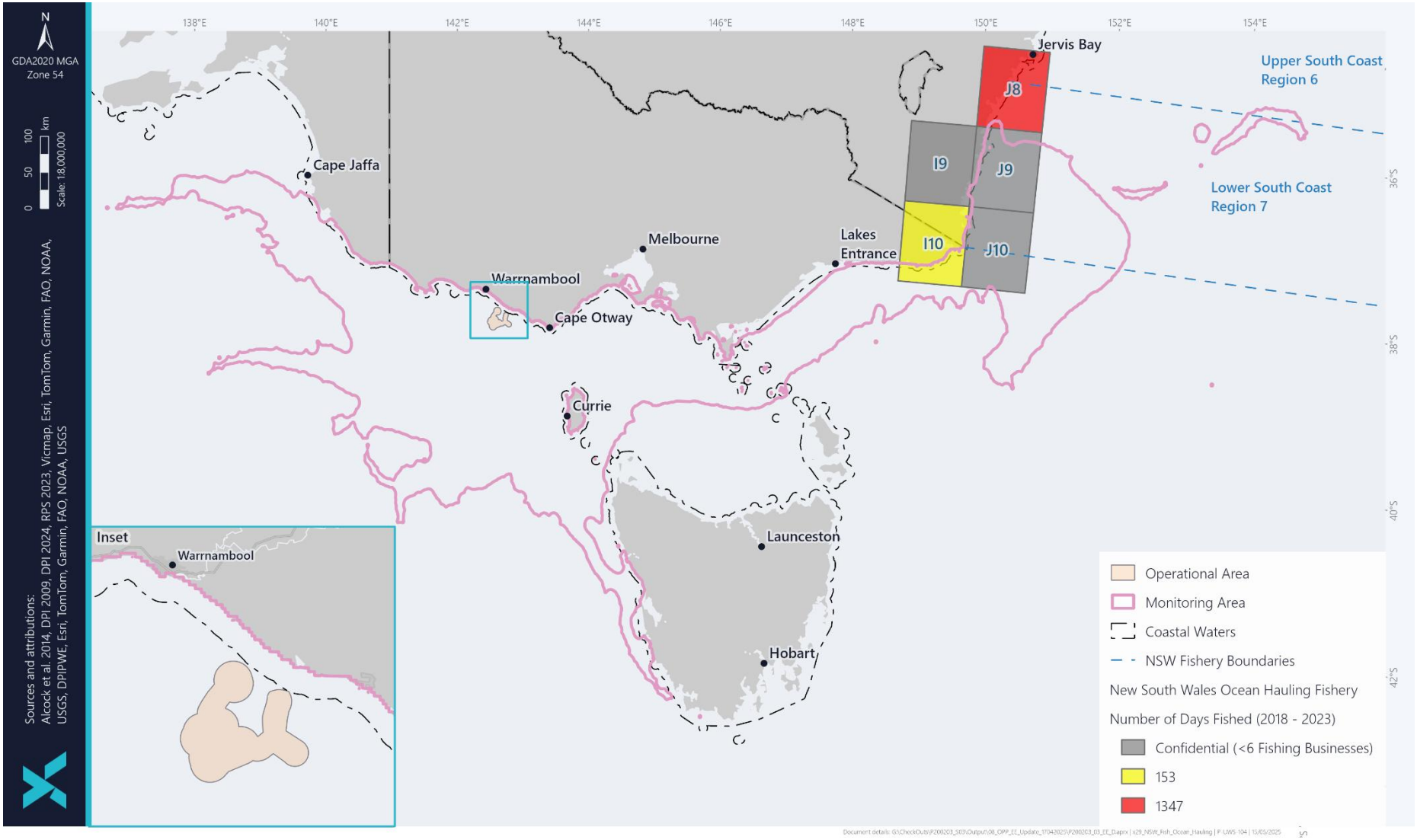



*Figure 6-92: NSW Ocean Hauling Fishery and overlap with the monitoring area*

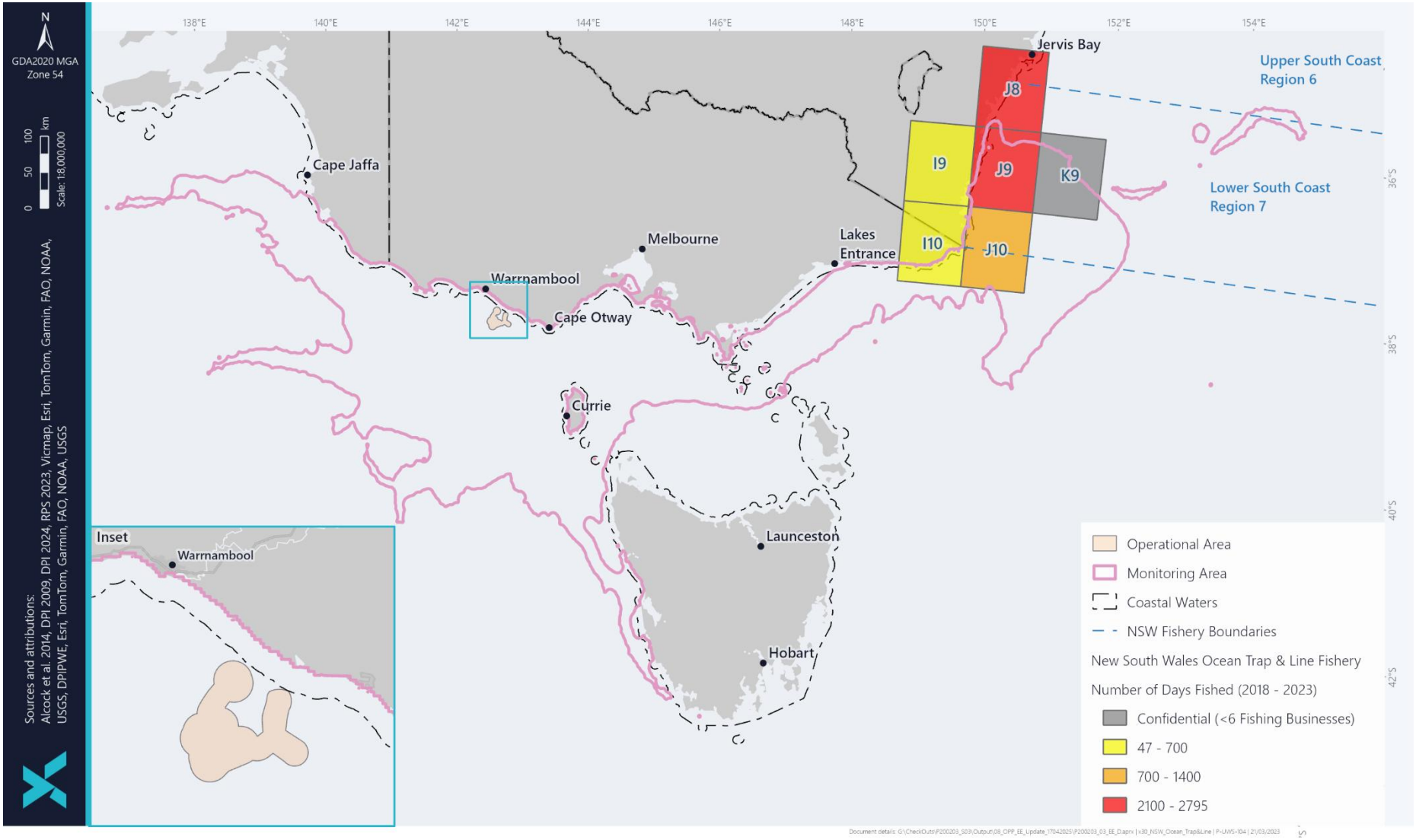



*Figure 6-93: NSW Ocean Trap & Line Fishery and overlap with the monitoring area*

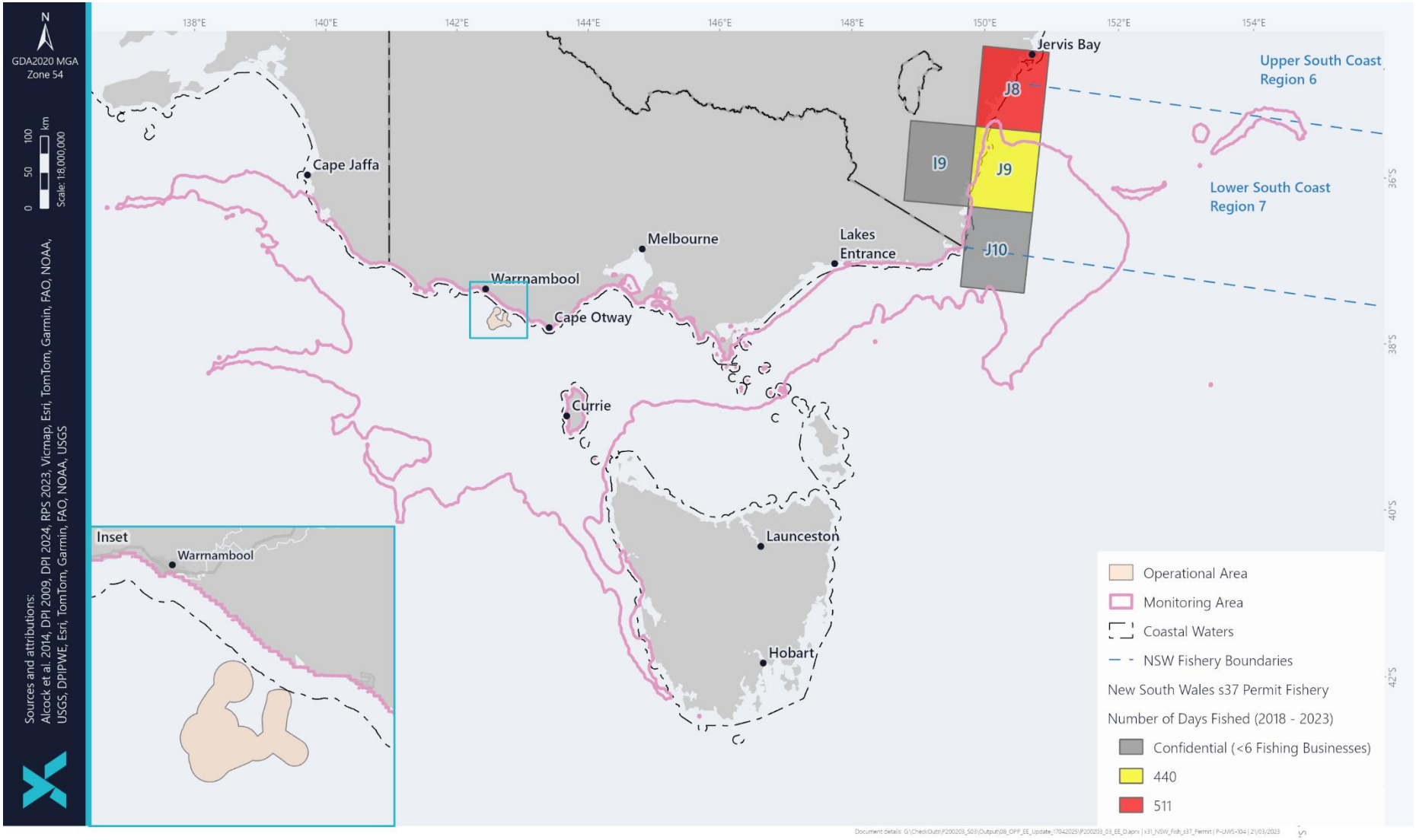



*Figure 6-94: NSW S37 Permit and overlap with the monitoring area*

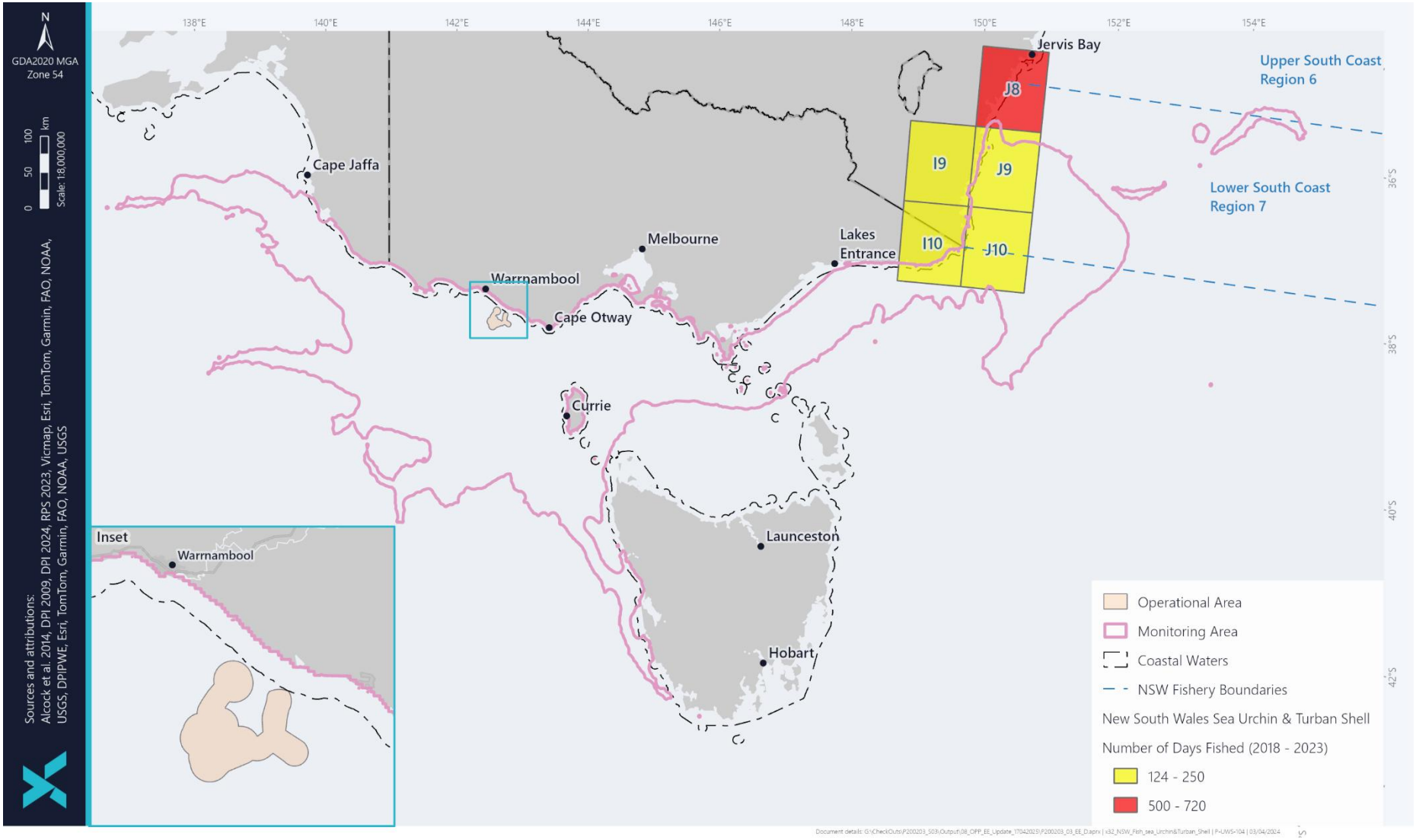



*Figure 6-95: NSW Sea Urchin and Turban Shell Fishery and overlap with the monitoring area*

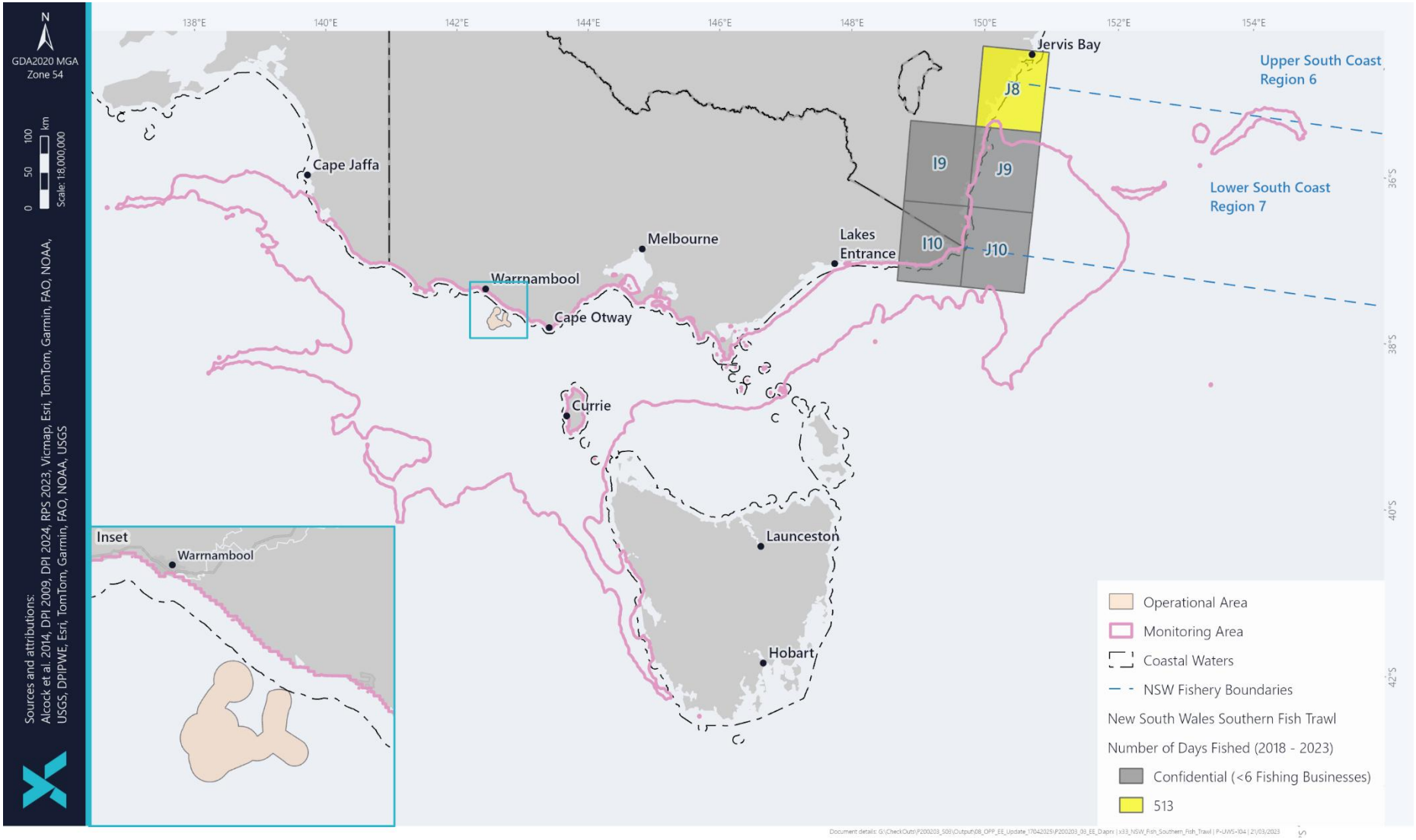



*Figure 6-96: NSW Southern Fish Trawl fishery and overlap with the monitoring area*

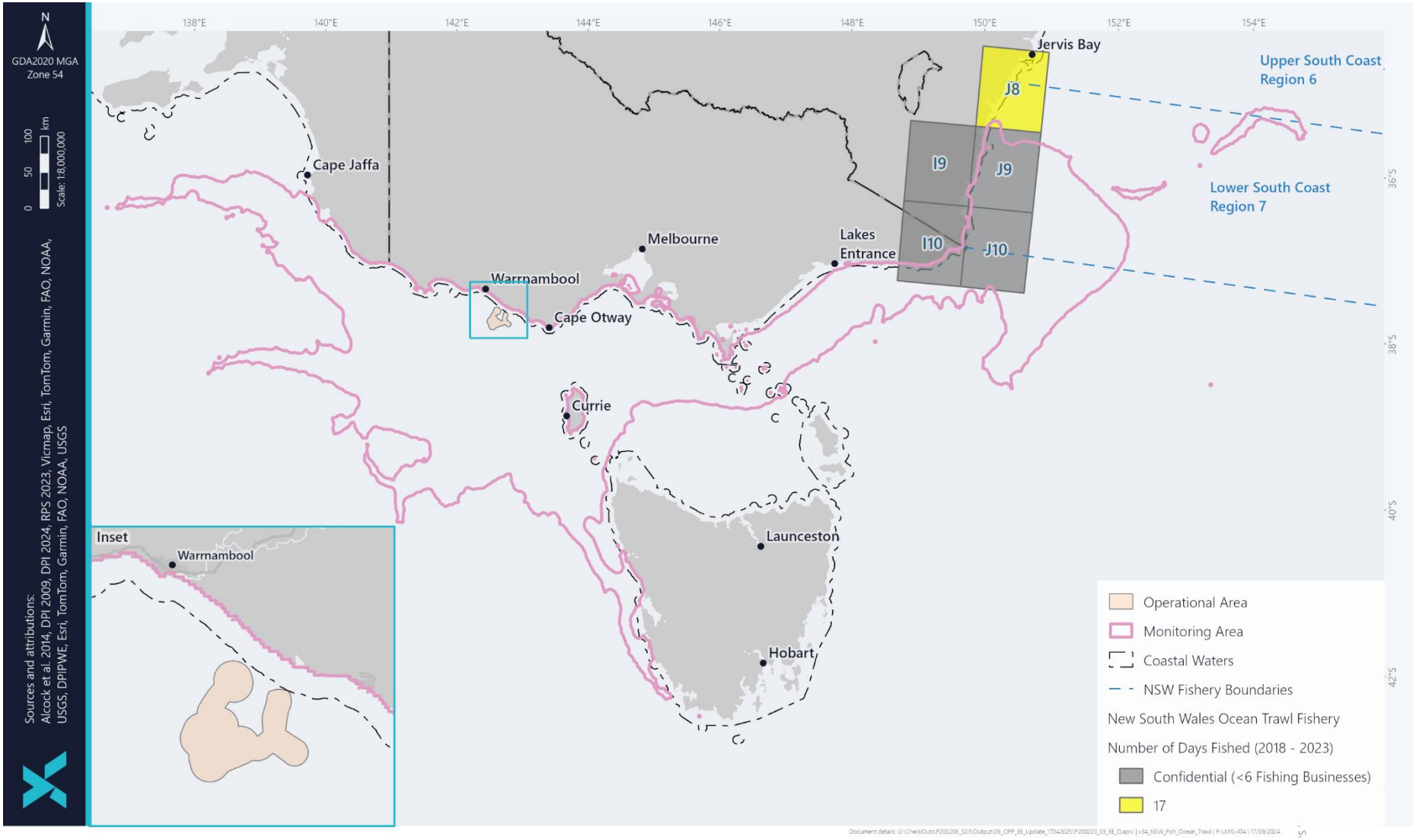



*Figure 6-97: NSW Ocean Trawl Fishery and overlap with the monitoring area*

*Table 6-23: Commercial Fisheries with Management Areas overlapped by the monitoring area – South Australia*

| Commercial Fishery | Target Species | Season | Management Area | Fishing Methods and licenses | Comments | Operational Area Presence | Monitoring Area Presence |
|---|---|---|---|---|---|---|---|
| **Abalone Fishery** | Blacklip abalone (*Haliotis rubra*) and greenlip abalone (*Haliotis laevigata*) | Year-round | There are 3 management zones in South Australian State Waters:<br>• Western<br>• Central<br>• Southern (overlaps with the monitoring area) | Hand collected by divers.<br><br>32 active licenses during the 2022/23 season | Important food source for First Nations Peoples.<br>Southern Zone:<br>• Total allowable catch for blacklip abalone in the 2022/23 season was set at 132 t for the southern zone. Greenlip abalone has no set total allowable catch in the southern zone.<br>• Blacklip abalone stock is assessed as sustainable. Greenlip abalone is assessed as undefined.<br>*Source: Burnell and Hogg, 2023* | None | Likely<br>No figure provided due to data confidentiality. |
| **Charter Boat Fishery** | Snapper (*Chrysophrys auratus*), King George whiting (*Sillaginodes punctatus*), southern bluefin tuna (*Thunnus maccoyii*) and nannygai (redfish, red snapper, swallowtail) (*Centroberyx gerrardi*) | Year-round | Operates throughout the coastal marine waters off South Australia | In 2022/23 there were 49 active licenses | Charter boat fishing is considered a commercial platform for recreational fishing, therefore all catch is regarded as recreational catch<br>The majority of charter boat fishing activities occur around reef, seagrass meadows, unvegetated soft bottom, sheltered beaches and tidal flats. | None | Likely<br>(Figure 6-98) |
| **Scalefish Fishery** | Over 60 species are taken under this license<br>Main species include: King George whiting (*Sillaginodes punctatus*), southern garfish (*Hyporhamohus melanochir*) and southern calamari (*Sepioteuthis australis*) | Year-round | Operates in all coastal waters, including bays and estuaries of South Australia between the Western Australian and Victorian border | Multi-gear<br><br>In 2022/23 there were 205 active licenses | The fishery provides for the commercial harvest of most commercially available aquatic resources, with the exception of southern rock lobster, prawns, abalone and freshwater fish species.<br>The majority of catches of these primary species comes from Spencer Gulf and Gulf St Vincent (outside of the EMBA).<br>*Source: PIRSA, 2013* | None | Likely<br>(Figure 6-99) |
| **Miscellaneous Fishery** | Includes species that are not in management arrangements of existing commercial fisheries (ex. Australian salmon, sea urchins, scallop, oysters)<br>Main species: Giant crab (*Pseudocarcinus gigas*) | Year-round<br>(dependent on target species) | Operates throughout the coastal marine waters off South Australia.<br><br>Giant Crab Fishery has 2 management zone:<br>• Southern zone<br>• Northern zone | Multi-gear<br>(dependent on target species)<br><br>Commercial access to the Giant Crab is limited to 245 license holders<br>*Source: PIRSA, 2024* | Miscellaneous dive fishing activities are currently used to harvest sea urchins, scallops, turbo, specimen shells and native oysters.<br>The giant crab is managed under a separate plan to other species covered by the Miscellaneous Fishery. Total allowable commercial catch for the 2022 season was set at 22.1 t. | None | Likely<br>(Figure 6-100)<br>*data only provided for the Giant Crab |
| **Rock Lobster Fishery** | Southern rock lobster (*Jasus edwardsii*) | Starting 2024:<br>Southern Zone<br>1 September to 31 May<br>Northern Zone:<br>Year-round<br>*Source: PIRSA, 2023c* | There are 2 management zones:<br>• Northern zone<br>• Southern zone (overlaps with monitoring area)<br>Zones extend from the low water mark out to edge of the Australian Fishing Zone 200 nm from shore | Pots<br><br>In 2022/23 there were 180 commercial licenses within the southern zone | Commercial license holders are permitted to land and sell giant crabs and octopus taken as by-product in rock lobster pots.<br>Densities of rock lobsters on the limestone reefs of the Southern Zone are generally higher than those of the granite reefs of the Northern Zone.<br>Total allowable catch was 1,320 t in the 2022/23 season within the southern zone.<br><br>*Source: PIRSA, 2020* | None | Likely<br>(Figure 6-101) |
| **Sardine Fishery** | Australian sardine (*Sardinops sagax*)<br>The take of Australian anchovy (*Engraulis australis*), maray (*Etrumeus teres*), blue sprat (*Spratelloides robustus*) and sandy sprat (*Hyperlophus vittatus*) are also permitted | Year-round | Operates in South Australian waters out to the 200 nm Australian Exclusive Economic Zone | Sardine net<br><br>In 2022/23 there were 14 licenses | The Sardine Fishery is a component of the Marine Scalefish Fishery.<br>Sardines are primarily used as feed for southern bluefin tuna, which are farmed by the aquaculture industry near Port Lincoln, South Australia.<br>*Source: PIRSA, 2023b* | None | Likely<br>No figure provided due to data confidentiality. |

*Source: PIRSA, 2023a; BDO Australia, 2024*

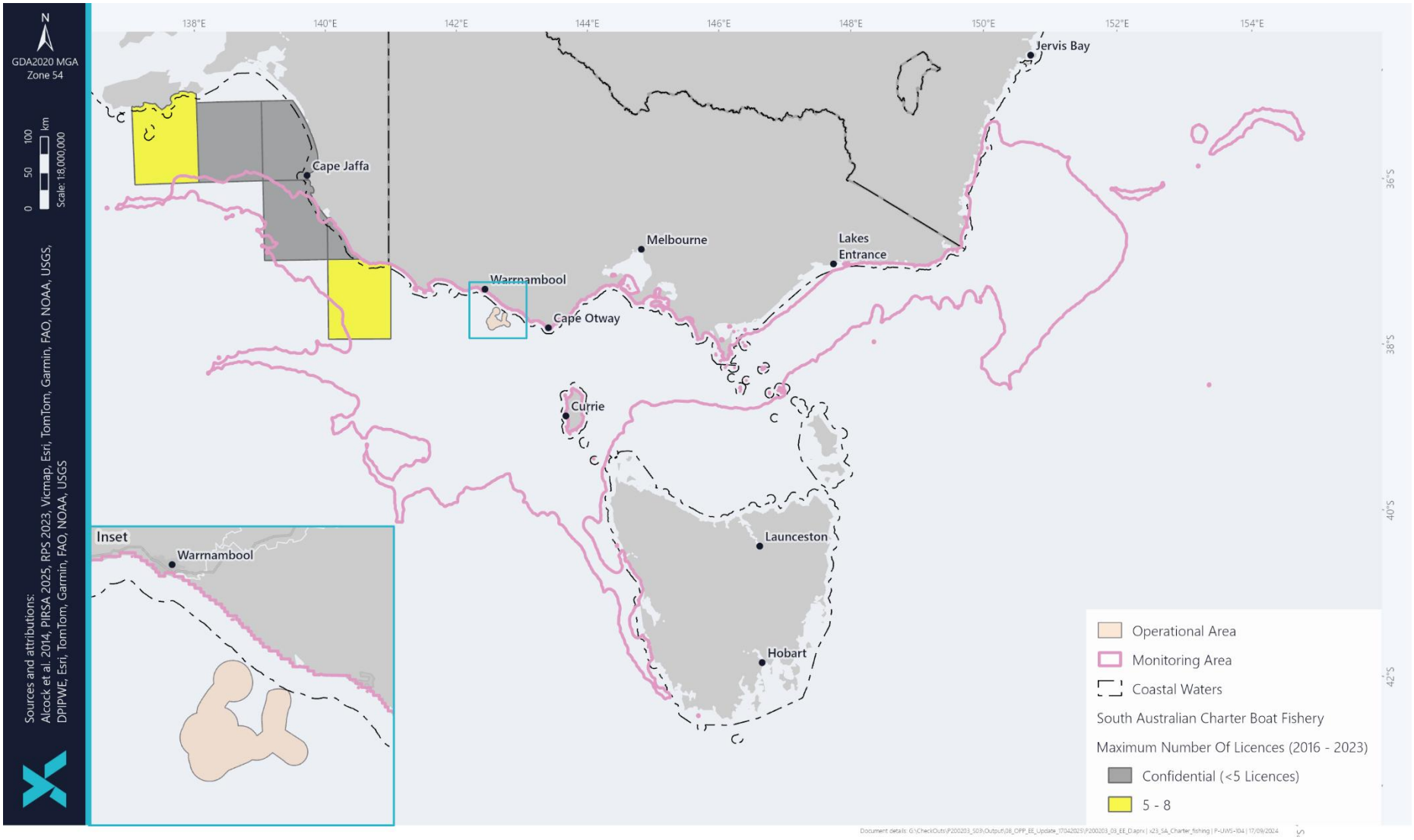



*Figure 6-98: South Australian Charter Boat Fishery and overlap with the monitoring area*

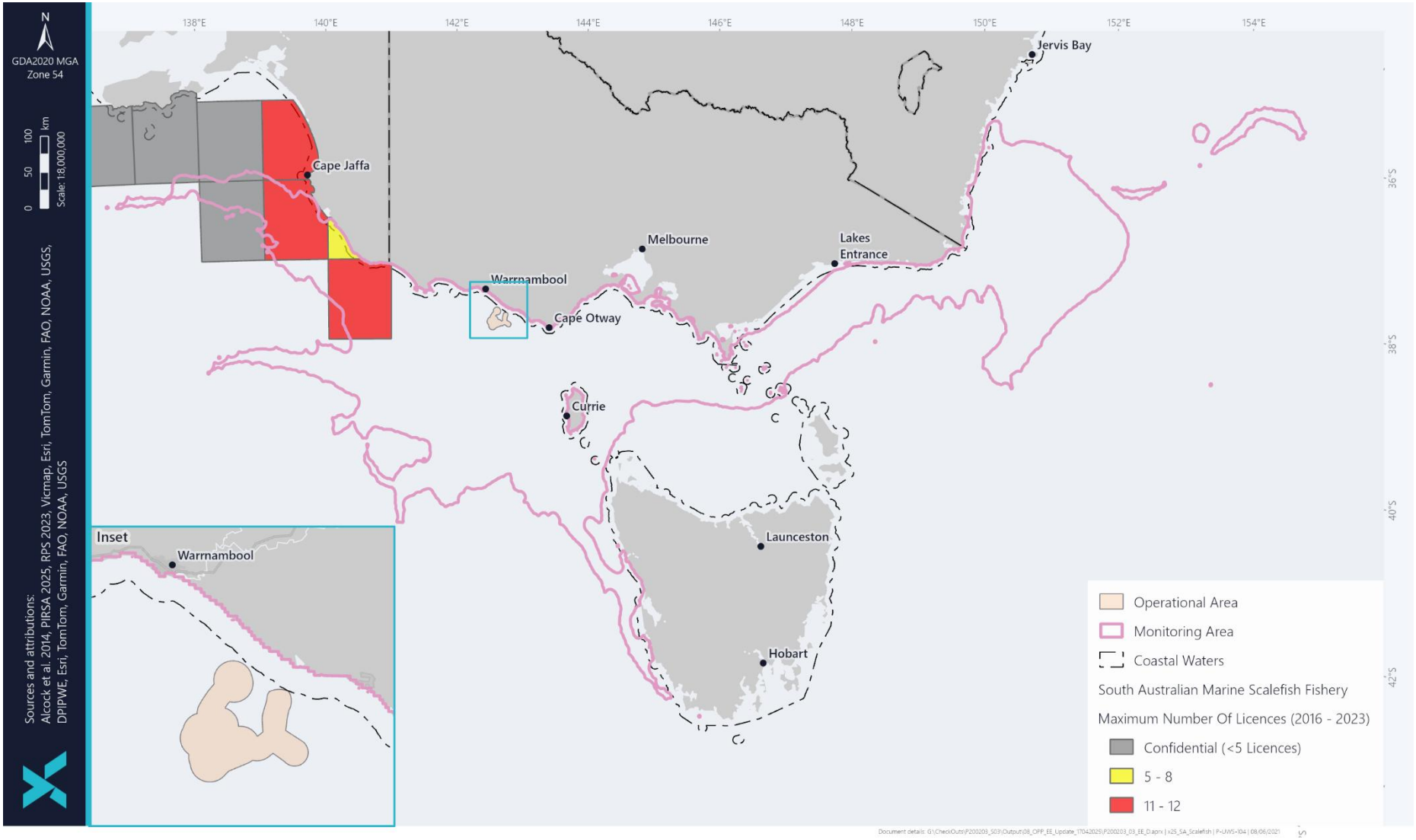



*Figure 6-99: South Australian Marine Scalefish Fishery and overlap with the monitoring area*

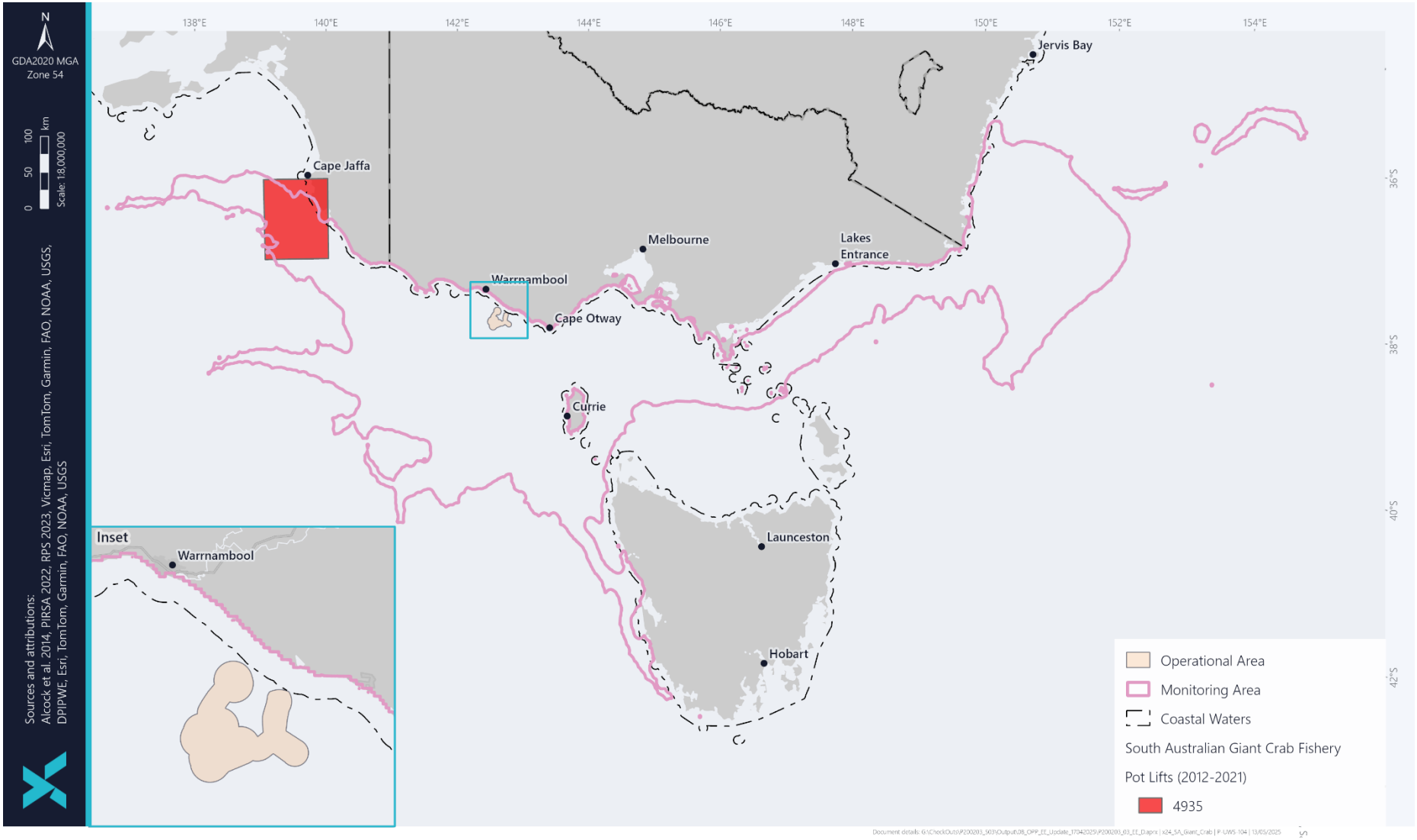



*Figure 6-100: South Australian Giant Crab and overlap with the monitoring area*

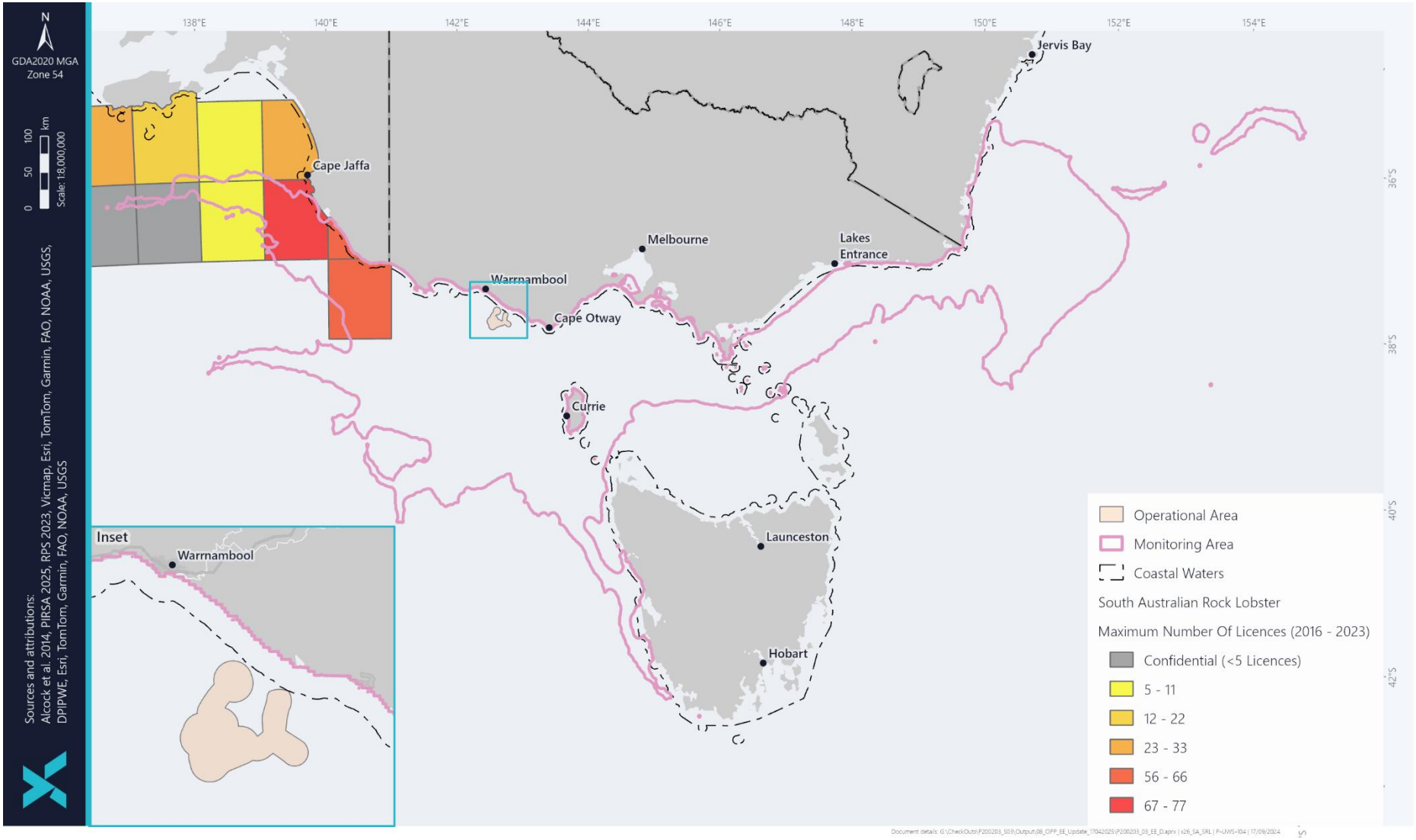



*Figure 6-101: South Australian Rock Lobster and overlap with the monitoring area*

### 6.7.3 Other Offshore Industry

#### *6.7.3.1 Shipping*

The South-east Marine Region is one of the busiest shipping regions in Australia and Bass Strait is one of Australia's busiest shipping routes. Commercial vessels use the route when transiting from international ports to ports on the east, south and west coasts of Australia; there are also regular passenger and cargo services between mainland Australia and Tasmania (NOO, 2004). Agricultural products and woodchips are transported from the Port of Portland to receiving ports in the Gulf of St Vincent, South Australia, and through Bass Strait to Melbourne and Sydney (NOO, 2004). Bass Strait is also transited by commercial vessels that may not call into ports on the south coast. There are also numerous smaller shipping routes in the area, such as those that service King Island.

The Australian Maritime Safety Authority (AMSA) indicates that the northern portion of shipping transects, ~75 km south of Warrnambool, are intersected by the southern portion of the operational area where moderate levels of vessel traffic may occur. This shipping transect is used by over 1,000 vessels per year which are travelling between major Australian and foreign ports. Additionally, the northern portion of the operational area is likely to be utilised by commercial fishing vessels frequently.

A total of 522 vessels intersected with the operational area in 2022 resulting in an average of 1.4 vessels per day utilising the area. Figure 6 102 provides an overview of the shipping traffic in the area. The East Coast Project is located at the northern extremity of areas with high traffic volumes.

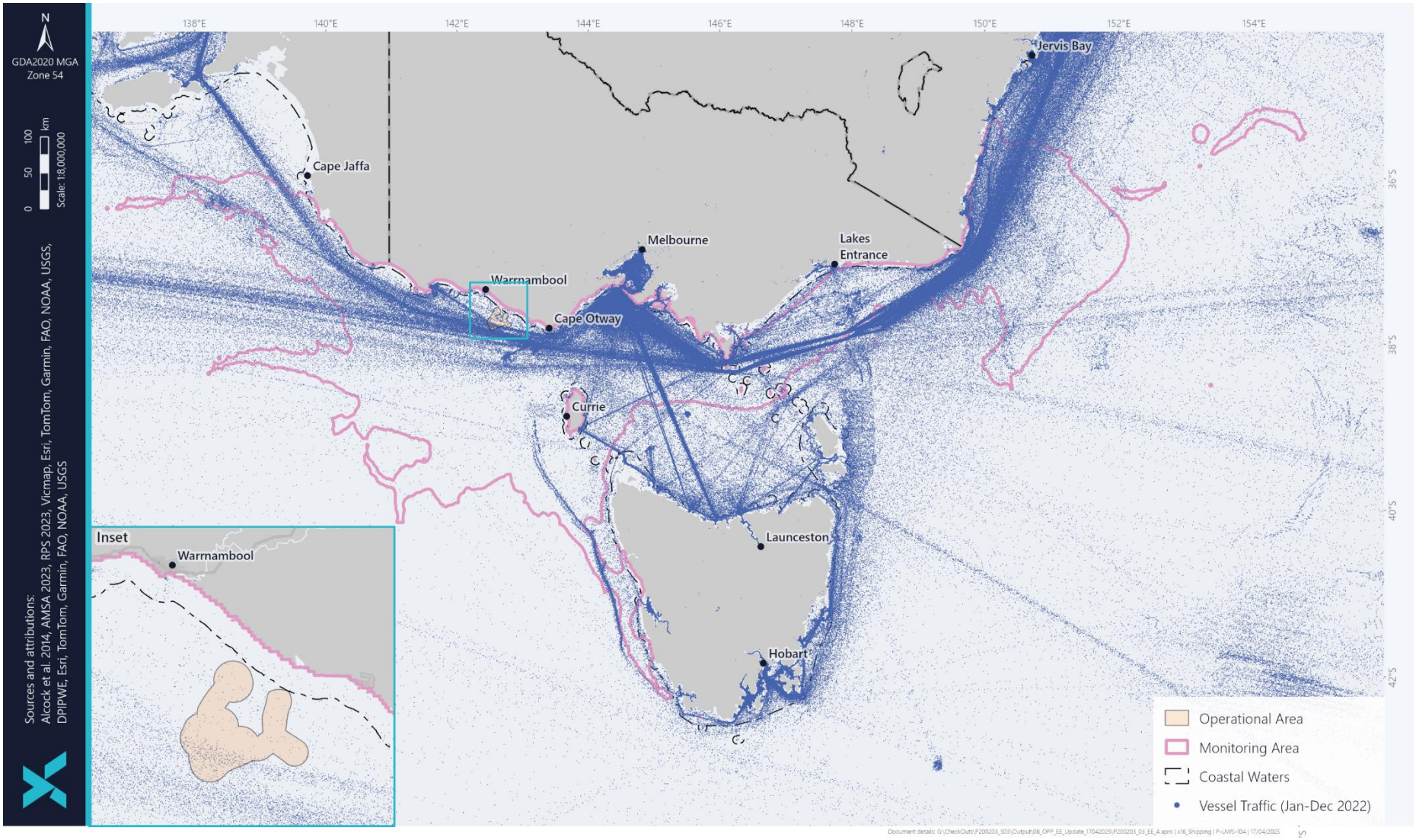



*Figure 6-102: Vessel traffic within the operational area and monitoring area over 1-month period*

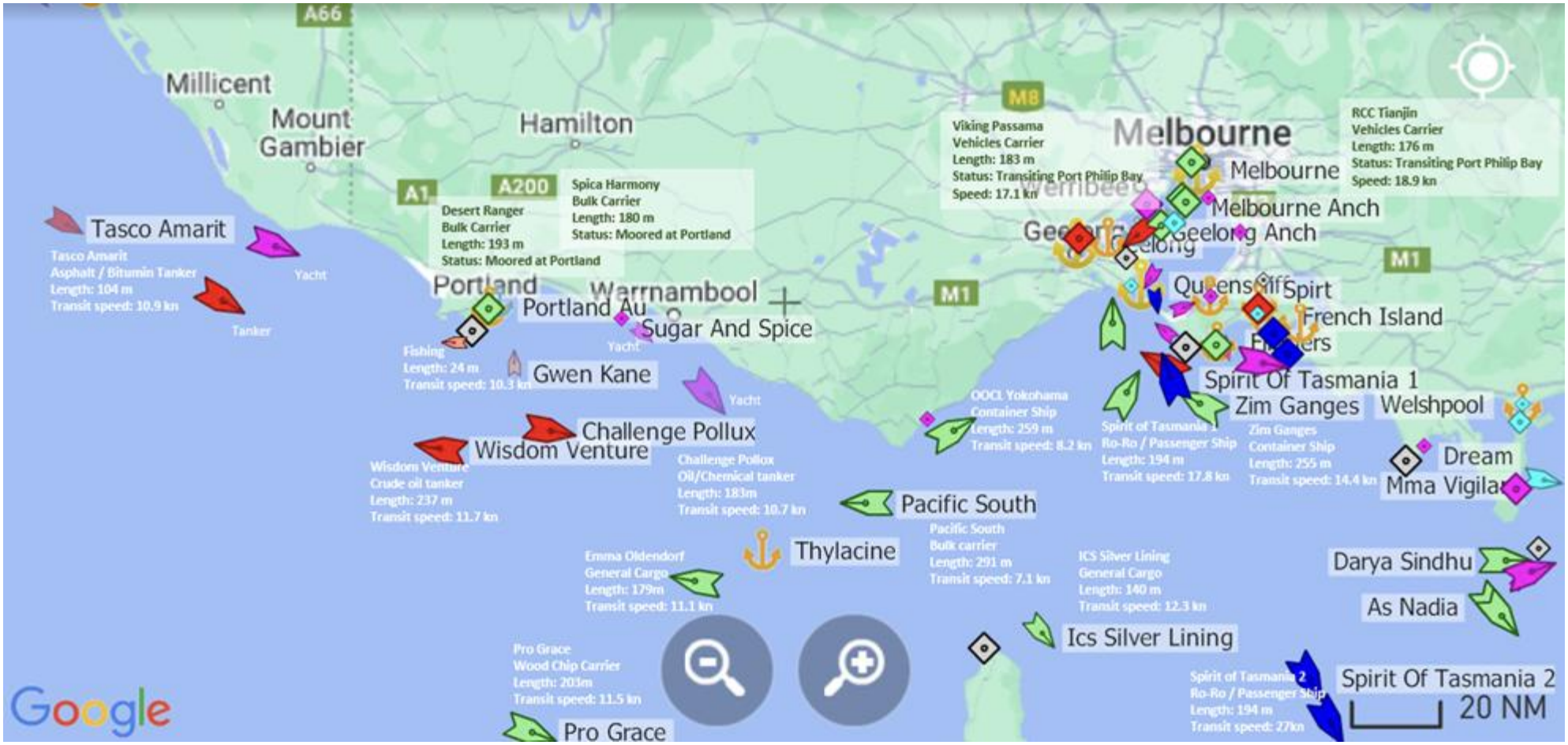



*Figure 6-103: Vessel traffic within the Otway Region and Central Bass Strait 19/01/2024*

**Image created from Marine Traffic app. Vessel positions received from coastal AIS receivers on 19/01/2024, approximate time 1600. Note, not all vessels report position via AIS.*

#### *6.7.3.2 Petroleum Exploration and Production*

Victoria's petroleum (oil and gas) exploration and production is concentrated in the offshore Commonwealth waters of the Otway and Gippsland basins as displayed in Figure 6-104.

The Otway Basin is an established gas producing region. Existing and historical offshore production in the Otway Basin includes the following oil and gas developments:

- CHN Development – Cooper Energy – previously described in Section 1.2
- Otway Gas Field Development – Operated by Beach Energy
  - The development consists of 6 wells, 4 of which are producing, tied back to a remotely operated platform (Thylacine), offshore and onshore pipelines and a gas processing plant (Otway Gas Plant) located 6.4 km north-east of Port Campbell.
- Minerva Gas Development – operated by Woodside
  - The development consists of two subsea wells in shallow waters (60 m depth), 10 km from the coast, these were tied back to shore, producing gas back to the Minerva Gas Plant gas plant (4.5 km inland) via a single pipeline. Production from the offshore wells ceased in 2019 and Woodside are in the process of decommissioning the offshore facilities.

Over the past few decades, numerous exploration and development wells have been drilled and seismic surveys have been undertaken in 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. At the time of writing, the following EPs are under development or assessment, and which propose to undertake activities in the Otway Region in the next 5-years:

- Otway Basin 3D Multi-client Marine Seismic Survey
- Regia MSS
- Beach Energy Otway Drilling Campaign
- Woodside Energy Minerva Facility Decommissioning
- Conoco Phillips Exploration Drilling

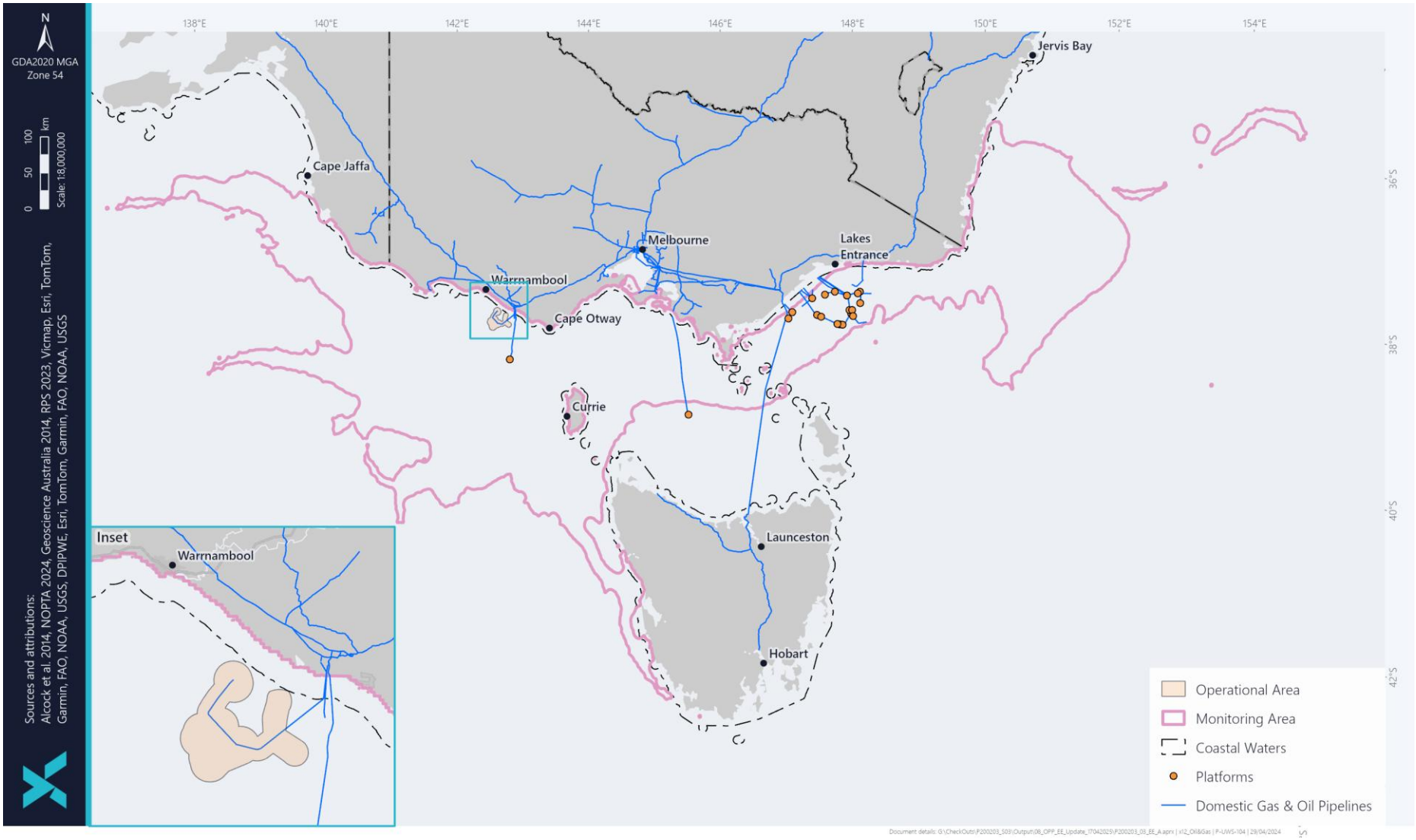



*Figure 6-104: Existing Petroleum Infrastructure south-east Australia*

#### *6.7.3.3 Other Offshore Infrastructure*

**Offshore Renewable Energies**

Australia released the Offshore Electricity Infrastructure Act 2021 which provided legislation on the development of offshore renewable energy projects. This Act was followed by the release of the Offshore Electricity Infrastructure Regulations 2022 and the announcement proposed areas in Australian Commonwealth waters where projects may occur. Since this announcement, 6 proposed areas have been declared, all of which are located outside of the operational area:

- Southern Ocean, Victoria
- Gippsland, Victoria
- Bass Strait, Tasmania
- Hunter, NSW
- Illawarra, NSW
- Bunbury, WA.

The Southern Ocean declared area is the closest to the East Coast Project, located ~5 km from the operational area (Figure 6-105). The Southern Ocean was declared in March 2024, with feasibility license applications closing July 2024. The declared area comprises an area 1,030 km$^2$ and is expected to support 2.9 GW.

One offshore wind farm (OWF), Spinifex OWF, was awarded a feasibility licence in March 2025 and is now in the pre-planning phase of development. The feasibility licence area for Spinifex OWF does not overlap the operational area but is within the monitoring area (Figure 6-105).

**Subsea Cables**

Submarine cables are underwater infrastructure which transfer communications or electricity from one area of Australia to another, and to other countries. The submarine communications cables carry the bulk of Australia's international voice and data traffic. In the South-east Marine Region there are a total of 6 subsea cables, which are listed below:

- Bass Strait-1, Bass Strait-2 – submarine transmission lines between mainland Australia and Tasmania (both Telstra fibre optic cables)
- Basslink – a subsea interconnector which joins the Tasmanian and national electricity grid
- INDIGO Central – a subsea interconnector, completed in 2019 offering direct, low latency connectivity from Sydney to Perth
- East Coast cable and Hawaiki Nui have a landing in Melbourne and are expected to be installed by 2024 and 2025, respectively
    - The East Coast Cable will connect two existing cable systems (the North West Cable System and the Australia-Singapore Cable)
    - Hawaiki Nui will connect Australia, New Zealand, American Samoa, Hawaii and the west coast of the United States

No subsea cables intersect with the operational area. Those within the monitoring area are displayed in Figure 6-106.

Under the *Telecommunications and Other Legislation Amendment (Protection of Submarine Cables and Other Measures) Act 2005*, the Australian Communications and Media Authority (ACMA) can propose cable protection zones over these assets if they are considered to be of national significance (DEWHA, 2009b). Currently, 2 protection zones have been declared in Sydney, outside of the monitoring area. No protection zones have been declared within the Otway region.

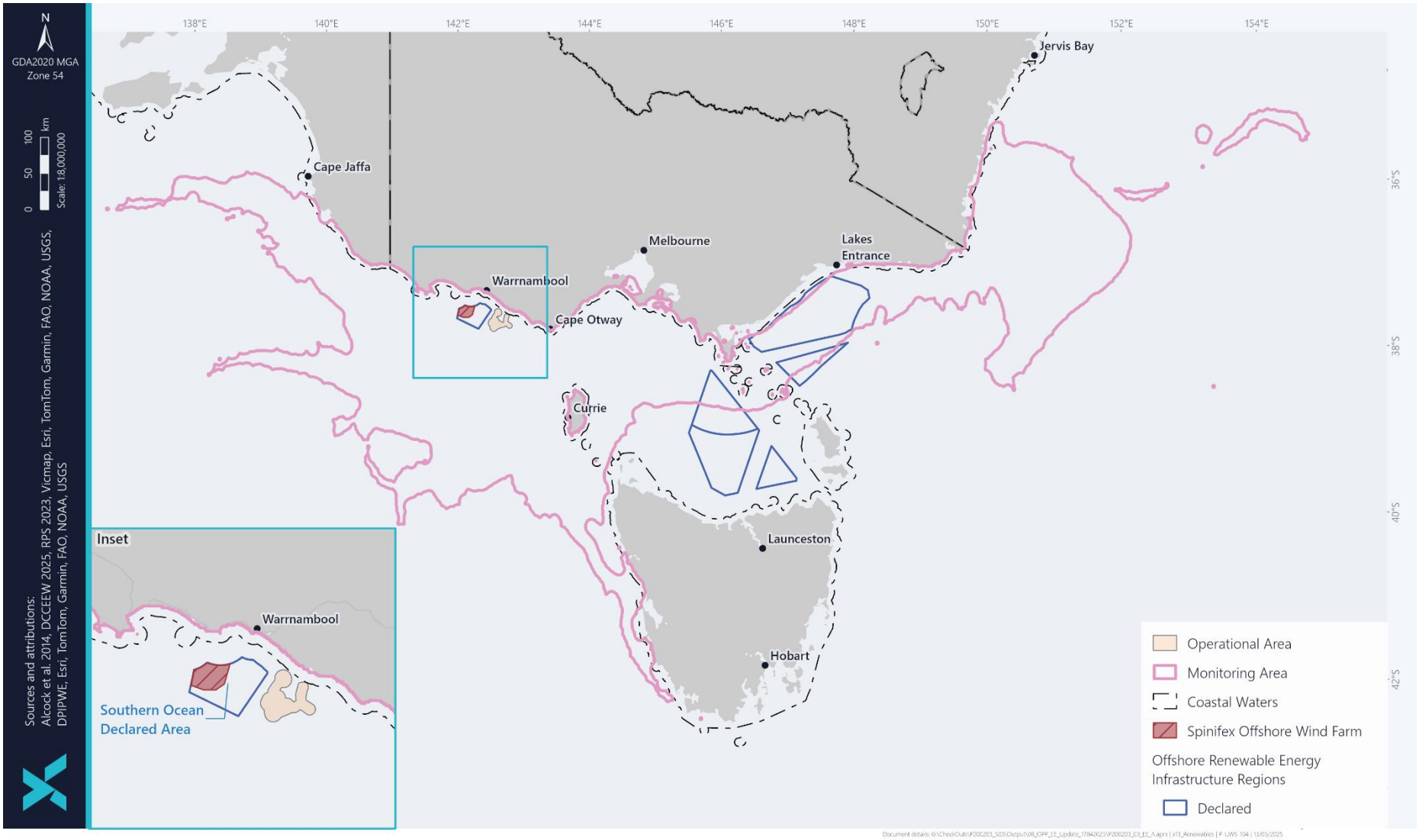



*Figure 6-105: Offshore Renewable Energy declared areas and proposed projects within the monitoring area*

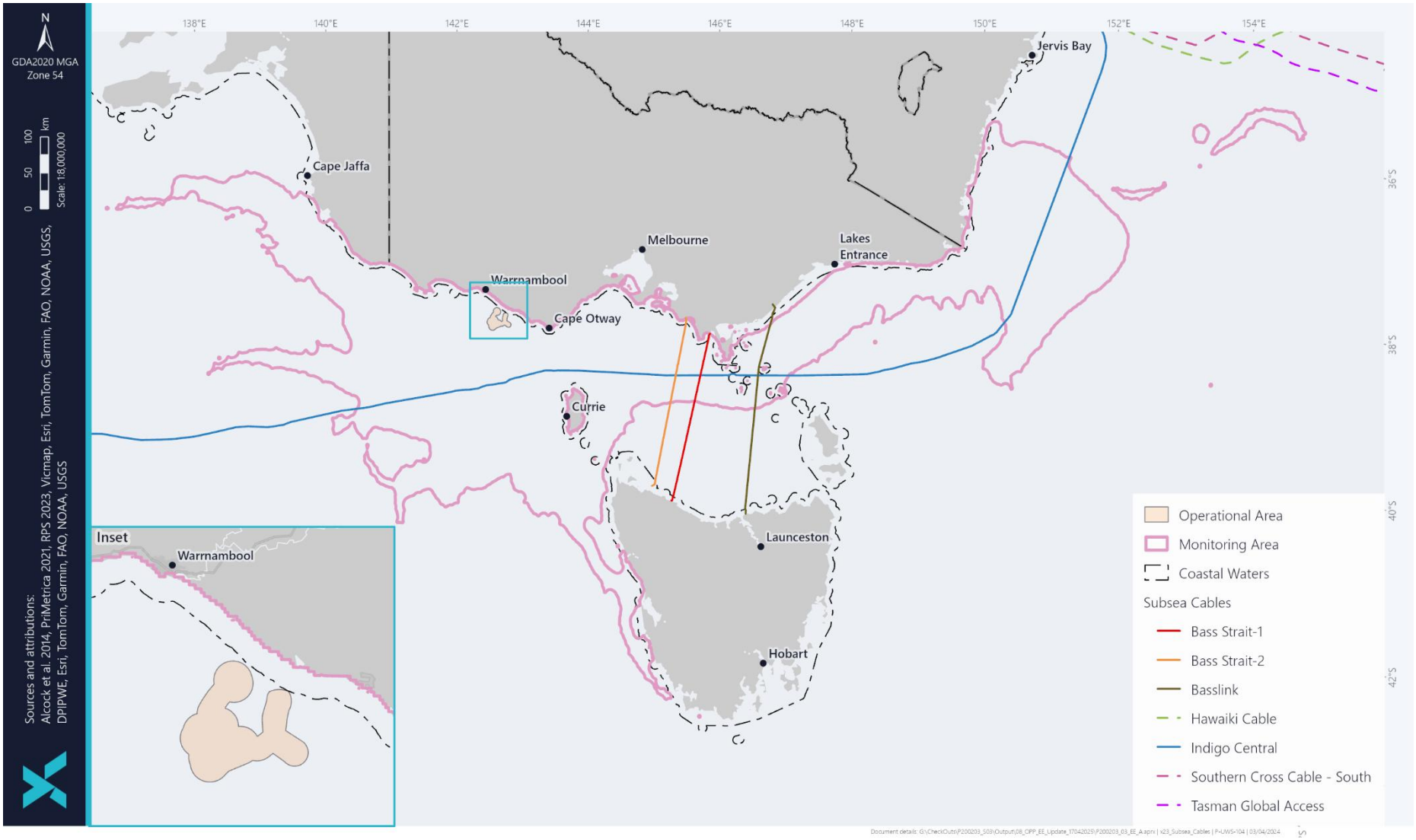



*Figure 6-106: Subsea cables located within the monitoring area*

#### *6.7.3.4 Defence*

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

Additionally, in World War II mine fields were laid in Australian waters. Unexploded ordinance (UXO) is a by-product of past training activities undertaken by the ADF. Post-war minefields were swept to remove mines and to make marine waters safe for maritime activities, however there is still potential for interaction with UXO in certain sections of Australian waters. The Department of Defence's (DoD) interactive UXO in Australia map (DoD, 2021) was used to determine locations that are at risk of hosting UXO within the vicinity of the operational area. Locations outside of the operational areas were not assessed as loss of well control (LOWC) impacts are not expected to affect UXO.

No training facilities, sea dumping sites, or sites with potential UXO interaction areas are overlapped by the operational area, although a number are located within the monitoring area, particularly around Melbourne, as displayed in Figure 6-107.

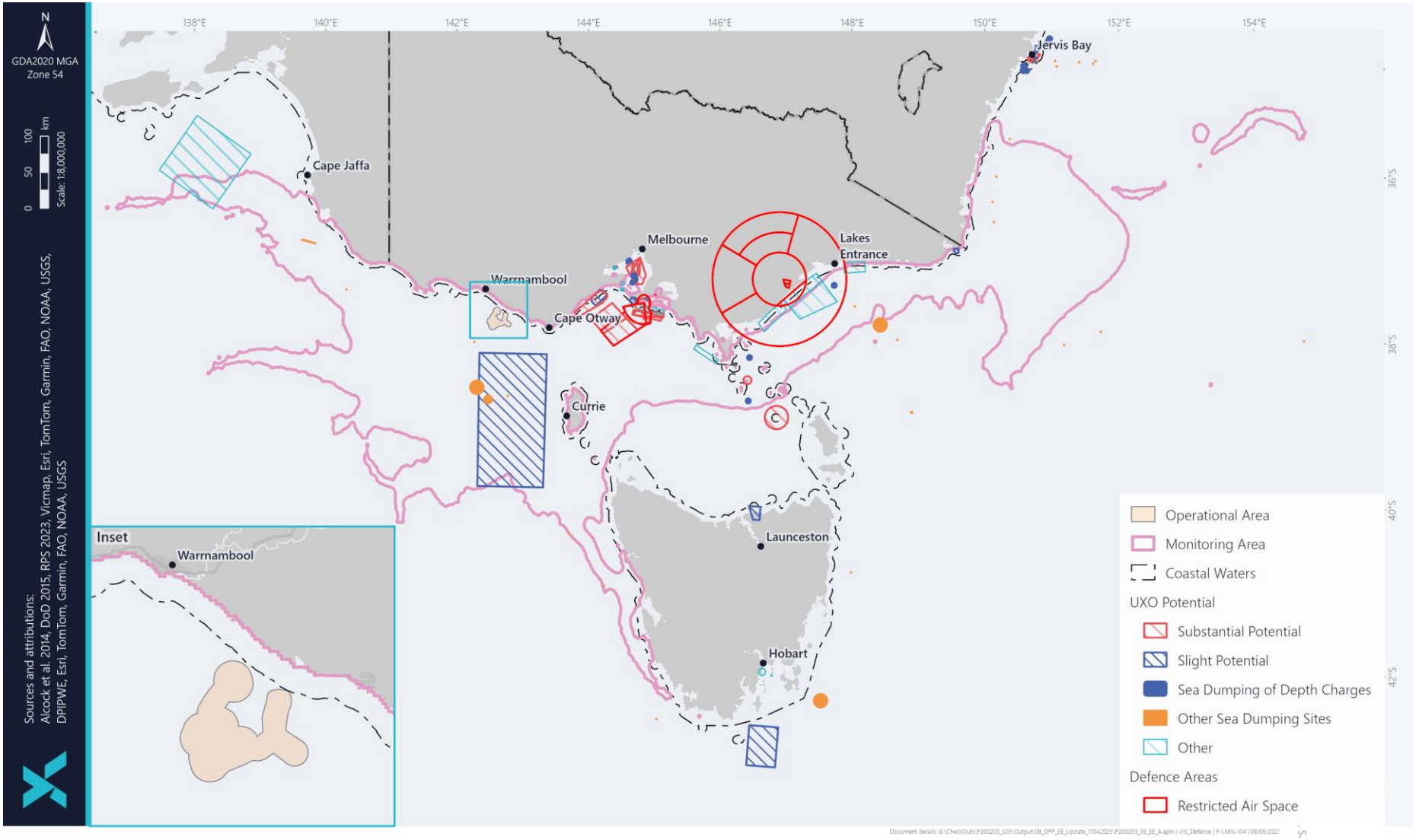



*Figure 6-107: DoD activities and potential UXO located within the monitoring area*

### 6.7.4 Recreation and Tourism

Recreational and tourism activities are extremely valuable foundations for the local and regional economy. In 2022-23 tourism in Victoria was estimated to be worth $28.2 billion to the economy in Gross State Product and generated approximately 257,500 jobs (Tourism Research Australia, 2024). The latest data from Tourism Research Australia shows that total tourism expenditure in Victoria was $35.0 billion in the year ending March 2023, an increase of 113% compared to the year ending March 2022. Total tourism spend has fully recovered and was back above the pre-pandemic level (+17%) (Business Victoria, 2023).

The Victorian coast and marine region provide a diverse range of land-based and near-shore tourism opportunities, including scuba diving, fishing, whale and wildlife watching, sailing, snorkelling and kayaking. The East Coast Project is located along an area of the coastline parallel to the Great Ocean Road, one of the most famous drives in the world which facilitates most tourist visits to the region. Numerous self-guided tours (e.g., Great South West Walk), picnic facilities and coastal lookouts are provided along the coast, with camping sites, caravan parks, guesthouses, motels and hotels encouraging tourism stays in the area.

Surfing in particular is a popular sport on the Victorian coastline that draws international attention. Popular surfing locations along the western Victorian coastline include Gibson Steps and Johanna Beach approximately 22 and 42 km, respectively (PV, 2023a). Whale watching is another popular past time that locals and tourists alike can enjoy along the western Victorian coastline. As discussed in Section 6.7.1 the ‘winter whale trail’ spans from Portland to Warrnambool and list’s locations where the southern right whale can be observed from the coast between May and October each year (Glenelg Shire Council, 2024).

#### *6.7.4.1 Recreational Fishing*

Recreational fishing in Australia is a multi-billion-dollar industry and includes rock, beach, boat and estuary fishing, using rod and line. Game fishing can include additional equipment such as fighting belts, gimbals and outriggers (Game Fishing Association Australia, 2025a). Most recreational fishing typically occurs in nearshore coastal waters (DAFF, 2024) (shore or inshore vessels), and within bays and estuaries. Between 2018-2019 3.81 million fishing events occurred within Victoria. It was found that Victorian fishers were less likely to fish in ocean areas than other states (75.3% compared to 85.0%) and that Victorian fishers are more likely to go fishing in freshwater than other states, with 80.6% of Victorian fishers reporting they went fishing in a freshwater location in the last year (Moore et al., 2023). Charter fishing operations were confirmed to occur in the monitoring area including from Port Campbell, Apollo Bay and Warrnambool by Victorian Recreational Fishing Peak Body during ongoing engagement. Game fishing occurs across the monitoring area from Port MacDonnell to Portland and Narooma (Game Fishing Association Australia, 2025b). The variation in recreational fishing intensity along the coast is illustrated in Source: CoA, 2015a

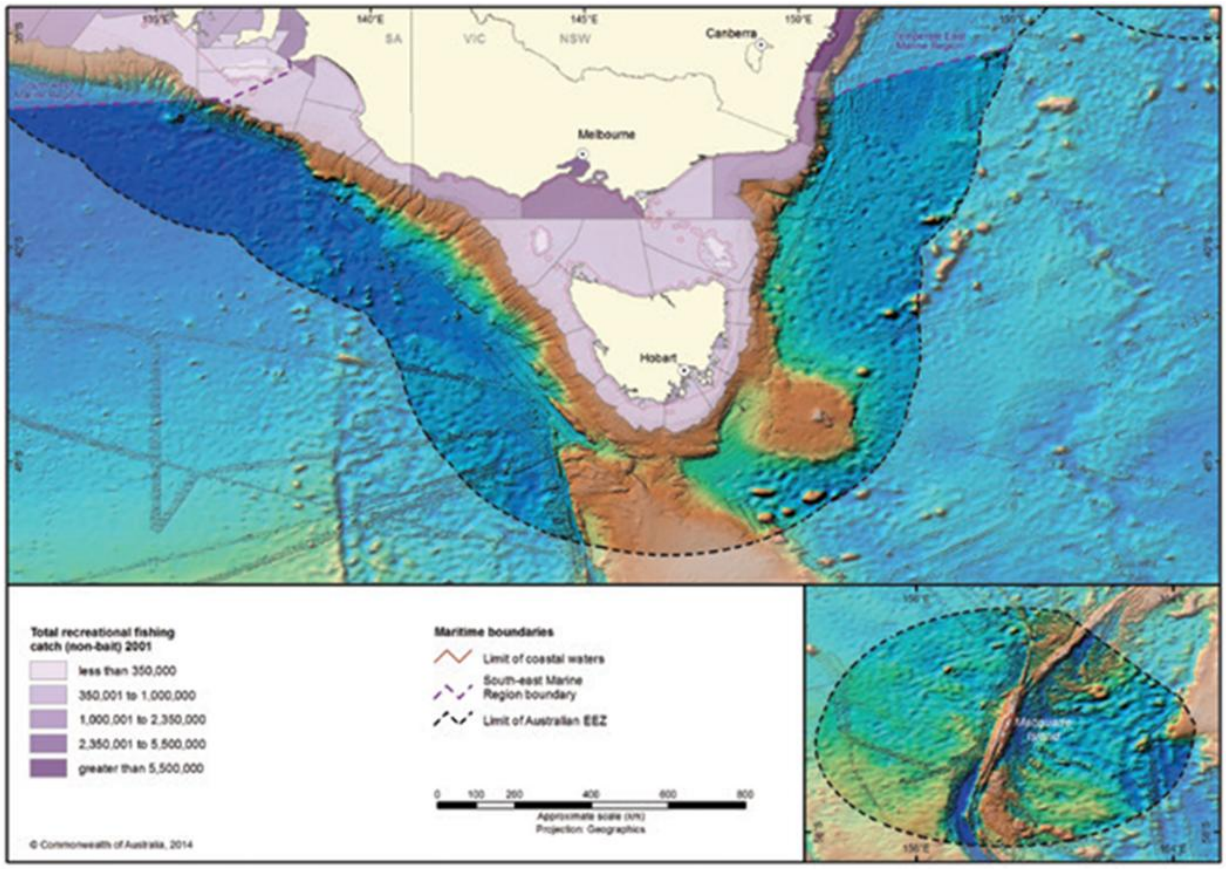
Figure 6-108. Common recreational fish species include tiger flathead, bream, snapper, Australian salmon, and lobster; and offshore catches can include mackerel, tuna, groper and shark.

A total of 15,287 recreational fishing trips were recorded from surveyed Victorian ramps in 2018 – 2019 (IMAS, 2020). 26% of these trips targeted southern bluefin tuna. Portland accounted for 82% of the southern bluefin tuna harvest. Five larger southern bluefin tuna were caught from Port Campbell during this period (IMAS, 2020).

Deep dropline fishing uses electric winches and heavy-duty rods. This fishing occurs within deeper waters e.g. over 250m with target species including (AFMA, 2023):

- Blue-eye trevalla
- Pink ling
- Ribaldo
- Ocean perch.

Recreational and game fishing activity is expected to be minimal in the operational area. Deep dropline fishing occurs in water waters deeper than those found in the operational area e.g. over 250m (AFMA, 2023)




*Source: CoA, 2015a*

*Figure 6-108: Recreational Fishing Catch in South-eastern Marine Region, 2001*

## 6.8 Cultural Environment

### 6.8.1 Underwater Cultural Heritage

In Australia, sunken aircraft, wrecks (>75 years old) and other underwater cultural heritage is protected within waters inside or outside Australian waters under the *Underwater Cultural Heritage Act 2018 (Cth)* and in Victorian waters under the *Heritage Act 1995 (Vic).*

The western Victorian coastline is known as the 'Shipwreck Coast' due to the number of wrecks present with most wrecked during the late nineteenth century. The strong waves, rocky reefs and cliffs of the region contributed to the loss of these ships. The wrecks represent significant archaeological, educational and recreational (i.e., diving) opportunities for tourism and local enjoyment.

The Australasian Underwater Cultural Heritage Database contains historical and environmental records of shipwrecks, aircraft, artefacts and other underwater sites. A search of this database resulted in the identification of one known site of underwater cultural heritage located within the operational area (DCCEEW, 2023n).

One shipwreck <75 years old, Alfred (ID 11052), was identified to be located near the border of the operational area:

- Latitude: -38.680000
- Longitude: 142.790000.

The search resulted in the identification of a handful of submerged aircrafts and a large number of historic (>75 years) and non-historic (<75 years) shipwrecks, within the monitoring area which are displayed in Figure 6-109.

However, coordinates of heritage listed within the Australasian Underwater Cultural Heritage Database are not necessarily the known coordinates. Where records are incomplete, general coordinates are assigned which may give a nominal location within the region (e.g., where the ship was last observed or understood to be sailing through or to). As in the case of the Alfred, the actual location of the heritage may be some distance from the location attributed on the heritage database.

For conservation, management or public safety reasons certain shipwrecks within Australia have additional protection zones than that established under the *Underwater Cultural Heritage Act 2018 (Cth).* Those within the monitoring area include:

- SS Glenelg (1900) – 500 m radius
- SS Federal (1901) – 800 m radius
- Clonmel (1841) – 50 m radius
- SS Alert (1893) – 500 m radius (DCCEEW, 2021d).

No underwater cultural heritage artifacts have been recorded in any seabed surveys completed within or proximal to the East Coast Project operational area.

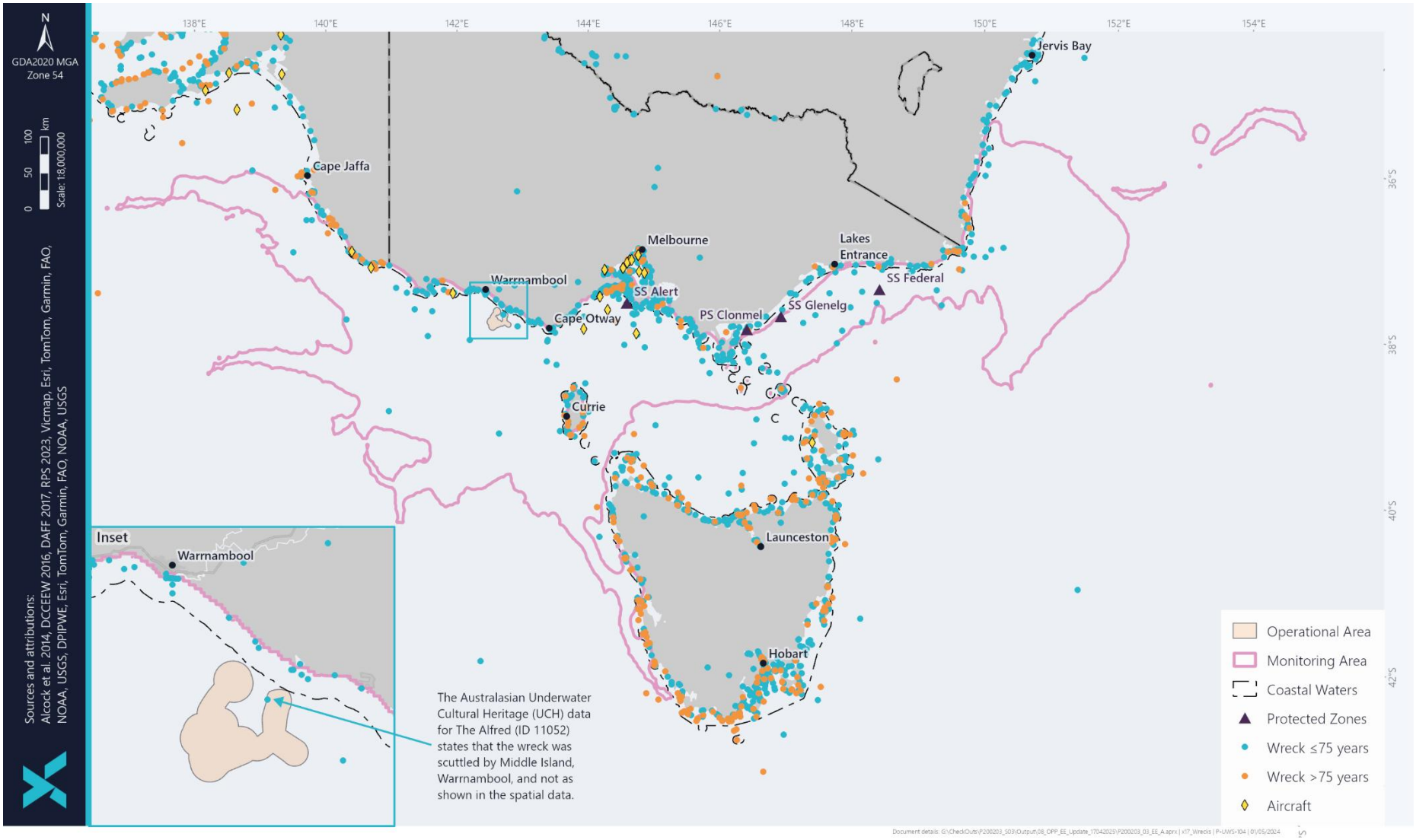



*Figure 6-109: Sites of Underwater Cultural Significance within the monitoring area*

### 6.8.2 Commonwealth Heritage Places

Commonwealth heritage places are owned or controlled by the Australian Government that are of Indigenous, historic or natural heritage. Places may also be connected to defence, maritime safety, communications, customs or other government activities that reflect Australia's development as a nation.

Several Commonwealth Heritage Places are located along the coastline and nearshore waters of Victoria, Tasmania, NSW and South Australia. There are no known Commonwealth Heritage Places located within the operational area, however a total of 12 were identified within the monitoring area:

- Cape Northumberland Lighthouse
- Cape Sorell Lighthouse
- Cape Wickham Lighthouse
- Fort Queenscliff
- Gabo Island Lighthouse
- HMAS Cerberus Central Area Group
- HMAS Cerberus Marine and Coastal Area
- Montague Island Lighthouse
- Sorrento Post Office
- Swan Island and Naval Waters
- Swan Island Defence Precinct
- Wilsons Promontory Lighthouse

Of those listed above, listed places with marine or shoreline features are described below and displayed in Figure 6-110.

#### *6.8.2.1 HMAS Cerberus Marine and Coastal Area*

The Sandy Point/ HMAS Cerberus area is a large sandy foreland extending east from Somers on the western shore of Western Port which is a Ramsar wetland (described in Section 6.6.4.1). The area has a diverse range of marine and coastal habitats, including tidal channels, fast tidal currents, tidal mudflats, seagrasses, mangroves, saltmarshes and sand beaches (DCCEEW, 2023o). This diversity in coastal habitat results in high marine invertebrate diversity and the extensive intertidal mudflats provide essential habitat to a number of listed migratory and resident shorebirds species. EPBC listed seabirds such as the Shy Albatross and the Southern Giant Petrel also utilise the area (DCCEEW, 2023o).

It is possible that cultural values, both Indigenous and non-Indigenous, of national estate significance may exist in this place, however none have currently been identified within publicly available literature.

#### *6.8.2.2 Swan Island and Naval Waters*

Swan Island is located off the Bellarine Peninsular close to the Port Phillip Bay heads and separated from Queenscliffe by a narrow artificial channel. Swan Island and Naval Waters is an integral part of Swan Bay, an internationally significant wetland which is important as wader and waterfowl habitat. The area provides habitat for 46 water bird species: of which 26 species are listed under the Japan-Australia and China-Australia migratory bird agreements; and 8 species are listed under the Bonn Convention on Migratory Species (DCCEEW, 2023o).

Swan Island itself is the largest emergent sand accumulation feature in Port Phillip Bay and has been built principally by wave actions rather than by aeolian forces. Swan Island has played a major role in determining the pattern of sedimentation in Swan Bay and contributes to the preservation of geomorphological evidence of changing Quaternary sea levels (DEECCW, 2023o). The eastern and northern shores of the eastern arm of Swan Island are of regional significance as an example of

active coastal depositional and erosional processes. The patterns of erosion and accretion on these shores provide a good indicator of sand movements into Port Phillip Bay (DCCEEW, 2023o).

A number of historic shipwrecks are known to have occurred within the vicinity of Swan Island, 6 of which are known within the Naval Waters. The area also contains a highly significant historic cultural landscape, as the Swan Island Defence Precinct, a network of defensive fortifications, was built for Victoria's protection by the Colonial government in 1879 (DCCEEW, 2023o).

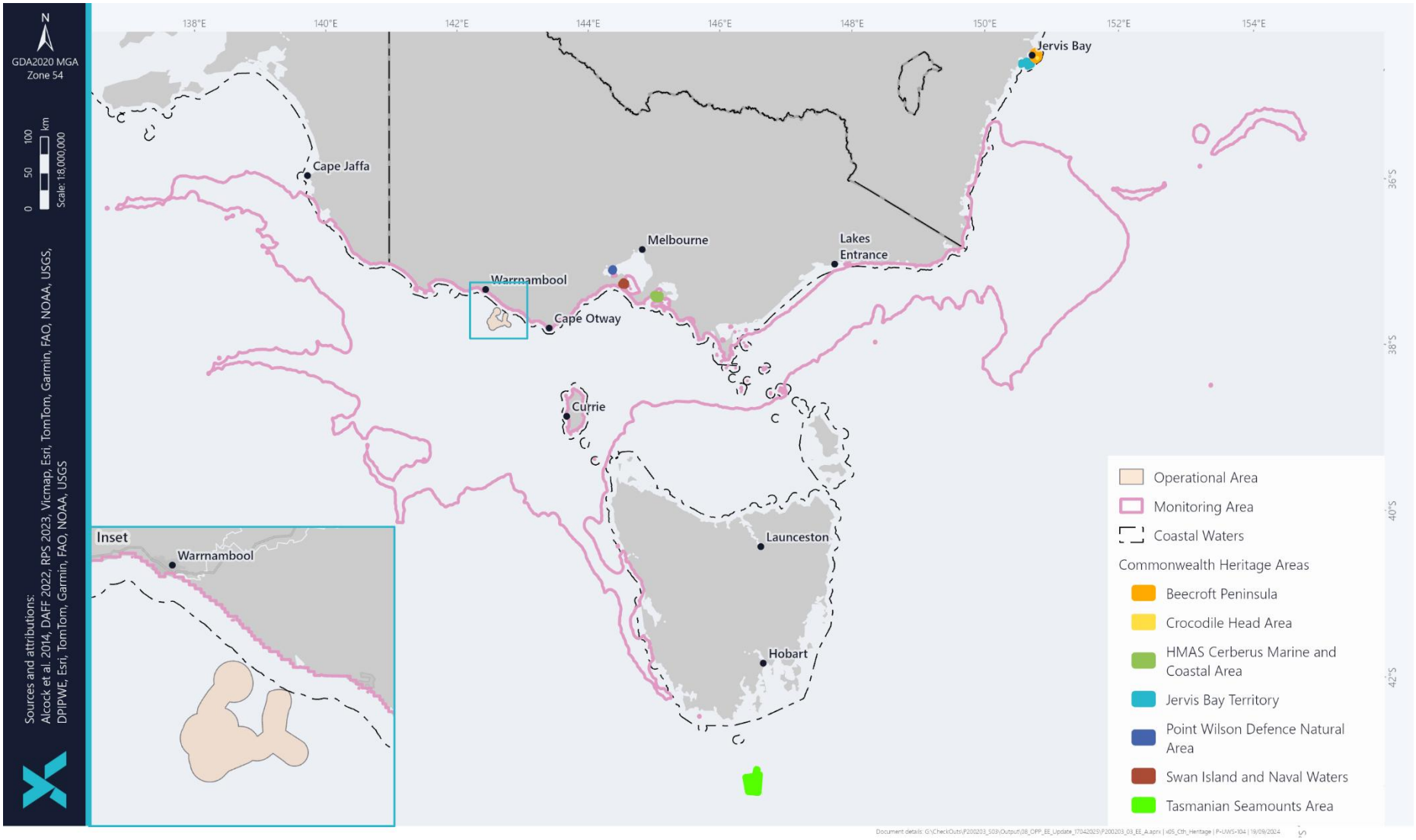



*Figure 6-110: Listed Commonwealth Heritage Places located within the EMBA*

### 6.8.3 First Nations People Cultural Heritage

First Nations people cultural heritage refers to the knowledge and lore, practices and people, objects and places that are valued, culturally meaningful and connected to identity and Country (Victorian Aboriginal Heritage Council, 2023).

To determine relevant First Nations cultural heritage within the monitoring area, the following sub-sections provide details on:

- Knowledge and lore:
  - History of Sea Country (Section 6.8.3.1),
  - Modern First Nations coastal uses and interests (Section 6.8.3.2),
- Practices and people:
  - Relevant First Nations groups (Section 6.8.3.3)
  - Native Title (Section 6.8.3.4)
  - Indigenous Land Use Agreements (Section 6.8.3.5)
  - Indigenous Protected Areas
- Objects and places that are valued, culturally meaningful and connected to identity and Country
  - Values and sensitivities (Section 6.8.3.7)

#### *6.8.3.1 History of Sea Country*

Sea Country is not distinguishable from land-based Country to First Nations Peoples. It includes parts of open ocean, beaches, land and freshwater on the coast and encompasses all living things, beliefs, values, creation spirits and cultural obligations connected to an area (The University of Adelaide, 2023). Water is of particular cultural significance to First Nations Peoples as an integral part of songs, ceremonies, hunting and collecting, and other activities that bind people to Country and each other, including fishing (Smyth, Egan and Kennett, 2018). Cooper Energy offshore activities overlap elements of Sea Country. These include the coast, open ocean and living things; these things are ecologically and spiritually connected to First Nations culture.

Indigenous groups hold strong connections to the south-east marine region, as occupation of coastal areas dates back over at least 40,000 years (DoE, 2015a). The coastal area of south-east Australia was amongst the most densely populated regions of pre-colonial Australia; these areas provided an abundance of marine and other resources that were not available away from the coast and oceans (NOO, 2002). First Nations Peoples relationship with offshore involved travel to islands in bark rafts and canoes, and the use and management of marine species (e.g., migratory short-finned eels and bull kelp) (NOO, 2002). During recent ice age periods (the last ending approximately 14,000 years ago), sea levels were significantly lower, and the coastline was a significant distance seaward of its present location, enabling occupation and travel across land that is now submerged.

It is likely that the palaeo shelf was exposed and incised by fluvial systems over glacial maximum periods from the time of Australia's First Nations Peoples (~60,000 years ago to present day) (De Decker et al., 2020). Areas now submerged within the Bass Strait would have provided for First Nations People of that time, and there are some landscape features now partially submerged which continue to have a place in culture and stories told today.

The Tyrendarra lava flow is a particular landscape and seabed feature which is linked to First Nations stories and deep continued connection with Country. The lava flow extends from Mt Eccles to ~15km offshore, just east of Portland. The Budj Bim aquaculture system was established within the lava flow. Evaluation of high-quality 3D seismic imagery has indicated there is no geological evidence of recent (500,000 years or less) volcanic or hydrothermal flow events within the sedimentary record within Cooper Energy's operated offshore acreage. Several crater complexes and lava flows are present within the greater onshore region, however, are unlikely to extend into the Cooper Energy acreage.

#### 6.8.3.2 *Modern Indigenous Coastal Uses and Interests*

First Nations people hold strong connections to the south-east marine region. The Victorian coast is of significance with respect to First Nations cultural heritage. This includes areas where there may be no physical evidence of past cultural activities but includes places of spiritual or ceremonial significance, places where traditional resource use occurs or trade and travel routes (Aboriginal Victoria, 2008).

Contemporary First Nations interests in the region are diverse and First Nations communities of the South-east Marine Region continue to strengthen First Nations cultural and spiritual connection to the ocean, and to use ocean resources for food, traditional purposes and income (CoA, 2015a). The Eastern Maar Country Plan describes the country's first peoples as continuing to utilise coastal resources – collecting tucker such as abalone and crayfish.

#### 6.8.3.3 *Relevant First Nations Groups*

The coastal areas of the Otway Basin, Bass Strait and Gippsland Basin are associated with a number of First Nations groups (Figure 6-111). The Victorian Aboriginal Heritage Council's Registered Aboriginal Parties (RAP) map was used to determine the formally recognised First Nations people of the Victorian coastline (VAHC, 2023). First Nations groups with connection to land and Sea Country in the monitoring area include:

- Gunditjmara people are the formally recognised First Nations people of the western coast of Victoria (Otway) from the SA border to Portland/Port Fairy.
  - the GMTOAC conveyed Gunditjmara's responsibility for protecting and healing Country in the event of an emergency response.
- Eastern Maar people are the formally recognised traditional owners of the western/central coastline of Victoria (Otway) from Portland/Port Fairy to Lorne.
- Wadawurrung people are the formally recognised traditional owners of the central coastline of Victoria (Bass Strait) from Lorne to Geelong
- Bunurong people are the formally recognised traditional owners of the central coastline of Victoria (Bass Strait) from Melbourne to Inverloch
- Gunaikurnai people are the formally recognised traditional owners of the eastern coastline of Victoria (Gippsland Basin) from Port Welshpool to Lakes Entrance.
  - the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC), has shared knowledge of some sites and types of artefacts known in the Orbost area. A strong desire to be involved in protecting Country was expressed, whether this be during operations (possibly supporting marine mammal observation programs), or during emergency events in providing local cultural advice to the response agency and potentially being able to support oiled wildlife response (under direction of DEECA).

The NSW Aboriginal Land Council's Local Aboriginal Land Council map and the National Native Title Tribunal website were used to identify First Nations people of the NSW and South Australian coastline. The First Nations groups with connection to land and Sea Country in the monitoring area include:

- Yuin people are the traditional custodians of the lands and waters from the south coast of New South Wales. The South Coast People have submitted a Native Title Determination Application relating to the lands and waters from Hacking River to Towamba River (Figure 6-112).
- First Nations of the South East people are the traditional custodians of the lands and waters in south east South Australia. The First Nations of the South West people have submitted a Native Title Determination Application extending from the Victorian border to the Kingston District Council – Coorong District Council boundary (Figure 6-113).

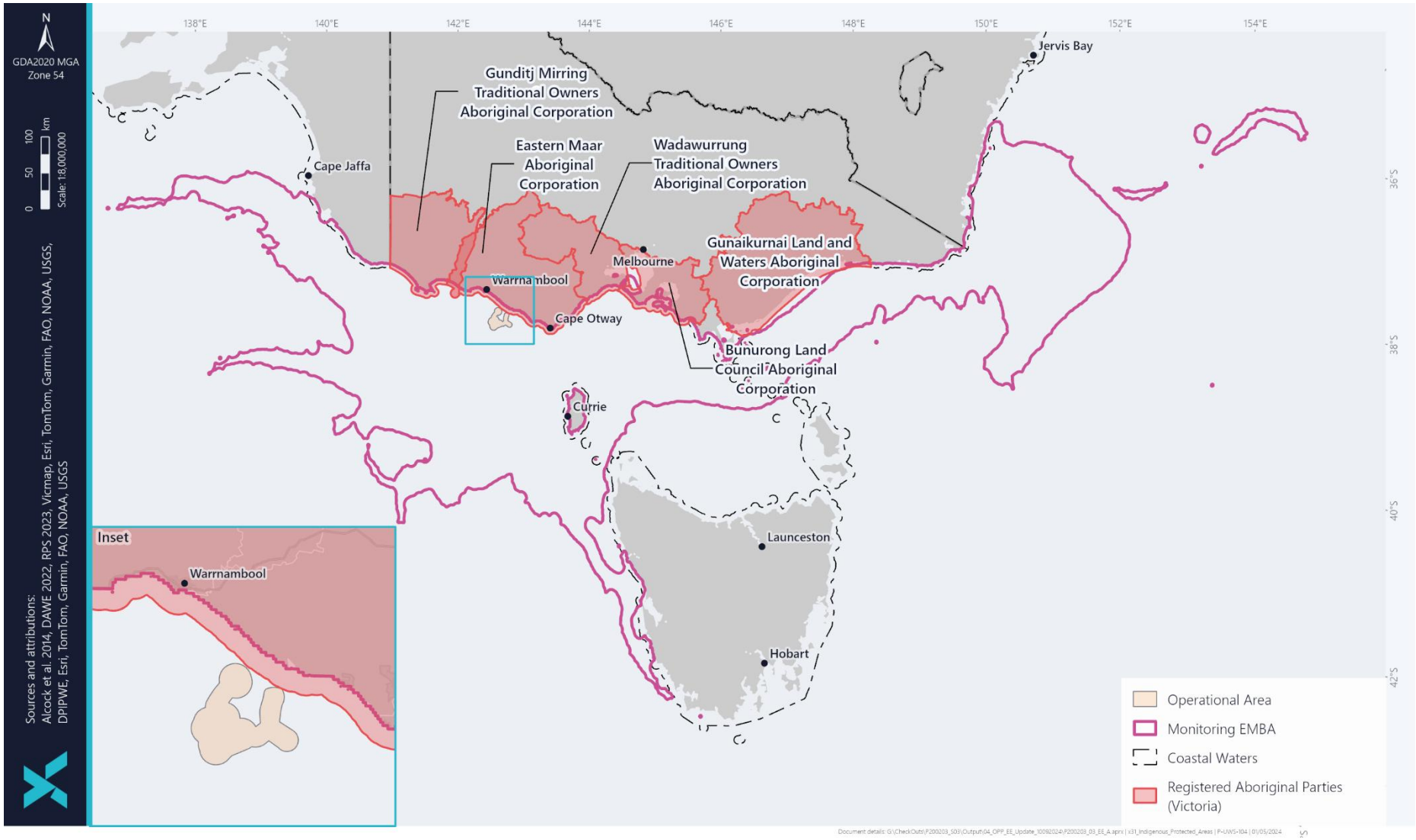



*Figure 6-111: Registered Aboriginal Parties relevant to the Victorian coastline*

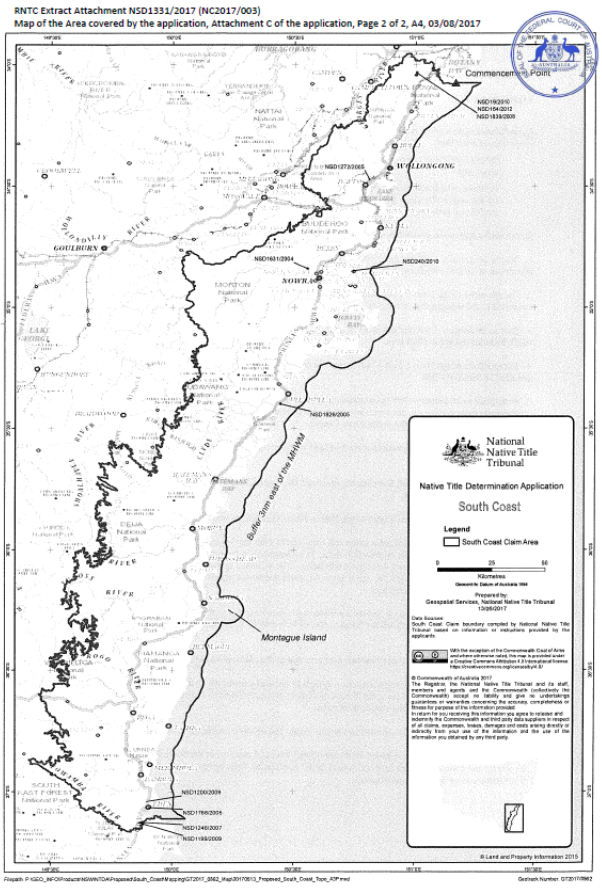



*Figure 6-112: Native Title Determination Application - South Coast People*




*Figure 6-113: First Nations of the South East No.1 Native Title Determination Application*

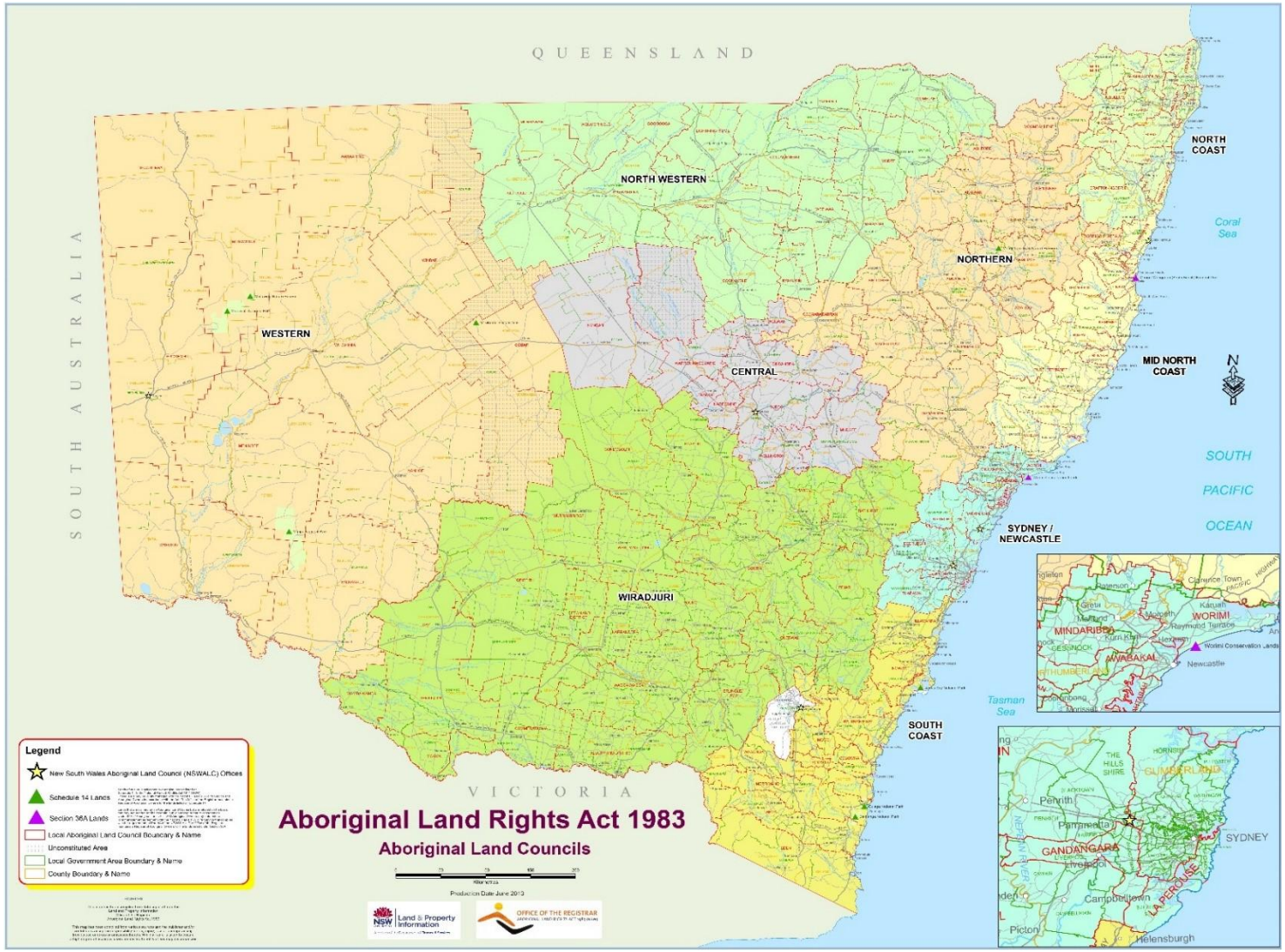



*Figure 6-114: New South Wales Local Aboriginal Land Councils*

#### 6.8.3.4 *Native Title*

Native Title is the recognition of First Nations people's rights to their traditional lands and waters, recognised by law (*Native Title Act 1993*). First Nations groups can make a native title claim that claims they hold native title rights and interests in an area according to their traditional laws and customs. Only once a native title is granted, or determined, that First Nations group/s will have recognised rights to the area which are specific to each determination. No native title determinations or claims overlap the operational area. Native Title Vision (NNTT, 2023a) was used to identify native title determinations along the coastline and nearshore waters of Victoria, Tasmania, NSW and SA. Those that are overlapped by the monitoring area will be discussed below and are displayed in Figure 6-115.

There is no overlap with native title determinations in either NSW or SA. Further, there have been no native title determinations made in Tasmania.

**Victoria**

- VCD2023/001 – Eastern Maar People. Eastern Maar Aboriginal Corporation Registered Native Title Body Corporate (RNTBC)
- VCD2011/001 – Gunditjmara & Eastern Maar. GMTOAC RNTBC, Eastern Maar Aboriginal Corporation RNTBC
- VCD2010/001 - Gunai/Kurnai People. Gunaikurnai Land & Waters Aboriginal Corporation RNTBC
- VCD2007/001 – Gunditjmara – Part A. Gunditj Mirring Traditional Owners Aboriginal Corporation RNTBC.

#### 6.8.3.5 *Indigenous Land Use Agreements*

Indigenous Land Use Agreements (ILUAs) are voluntary agreements regarding the management of portions of land agreed upon by native title parties and others. Native Title Vision (NNTT, 2023a) was used to identify ILUAs along the coastline and nearshore waters of Victoria, Tasmania, NSW and SA that are overlapped by the monitoring area will be discussed below.

There is no overlap with ILUAs in SA and no agreements have been made in Tasmania.

**Victoria**

- VIA1999/001 – BHPP – Minerva. ILUA between BHP Petroleum Pty Ltd and the Framlingham Aboriginal Trust and the Kirrae Whurrong Native Title Group for petroleum infrastructure (pipeline) installation.
- VI2005/006 – Gournditch Mara and Essential Petroleum Resources Ltd. ILUA between Essential Petroleum Resources and the Gunditjmara Native Title Group for hydrocarbon extraction.
- VI2006/004 – Gunditj Mirring people and the State of Victoria ILUA between GMTOAC and the State of Victoria to grant to Gunditj Mirring Crown land of the Lake Condah Area by private treaty.
- VI2010/001 – Gunditj Mirring Non-Extinguishment Principle. ILUA between the State of Victoria and Gunditj Mirring Traditional Owners Aboriginal Corporation RNTBC.
- VI2010/003 – Gunaikurnai Settlement. ILUA between the State of Victoria and the Gunaikurnai Land & Waters Aboriginal Corporation RNTBC.
- VI2013/008 – Gunaikurnai and Icon Energy. ILUA between Icon Energy and the Gunaikurnai Land & Waters Aboriginal Corporation RNTBC for petroleum exploration.
- VI2015/002 – Gunditjmara – SEAGAS Port Campbell VIC to Torrens Island SA Pipeline. ILUA between South East Australia Gas Pty Ltd, Eastern Maar Aboriginal Corporation and GMTOAC for hydrocarbon exploration and extraction.

Figure 6-116 displays ILUAs within the State of Victoria.

**New South Wales**

- NI2001/003 – Twofold Bay. ILUA between the Twofold Bay native title group and the Minister of Transport on behalf of the Waterways Authority for infrastructure development.

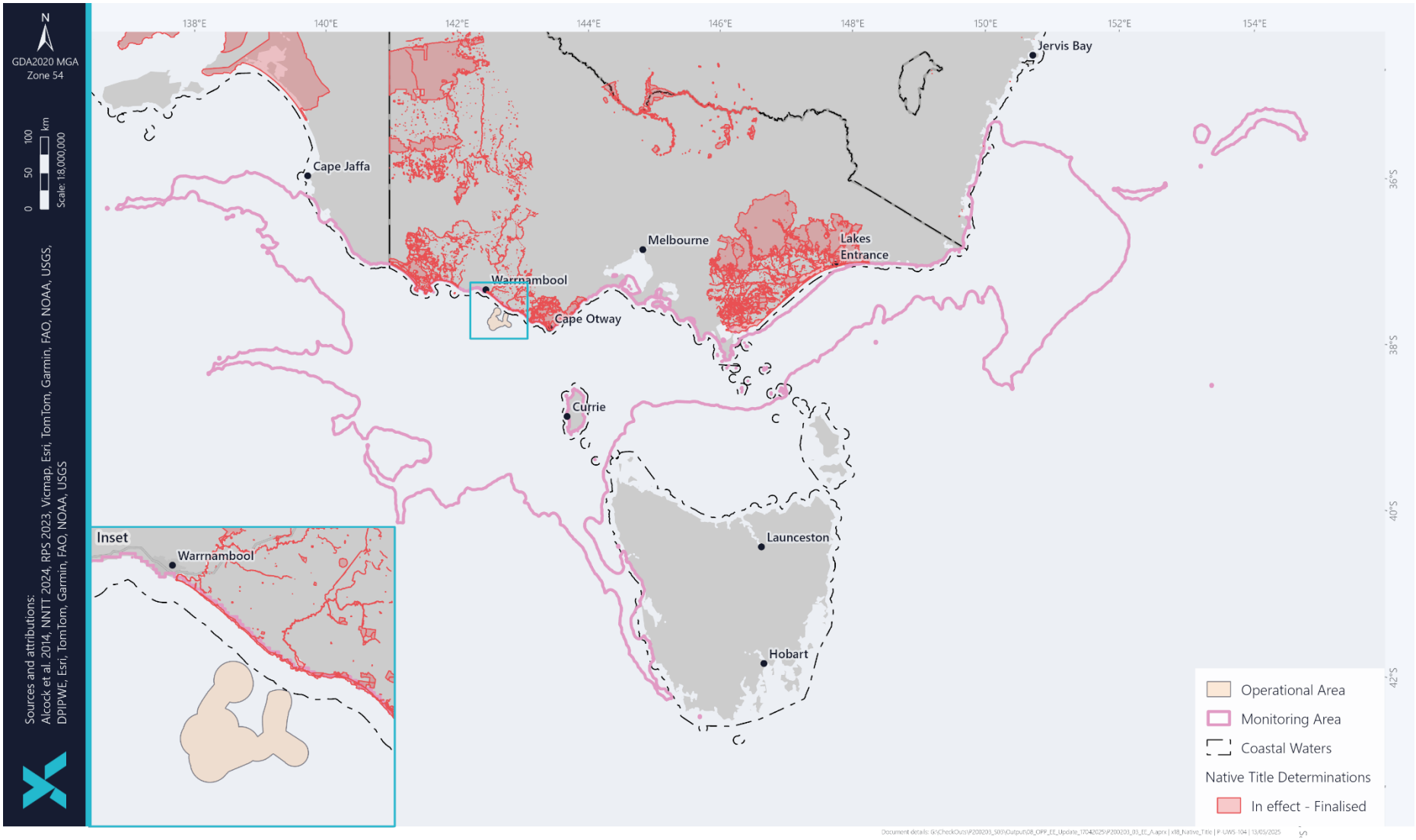



*Figure 6-115: Native Title Determinations overlapped by the monitoring area*

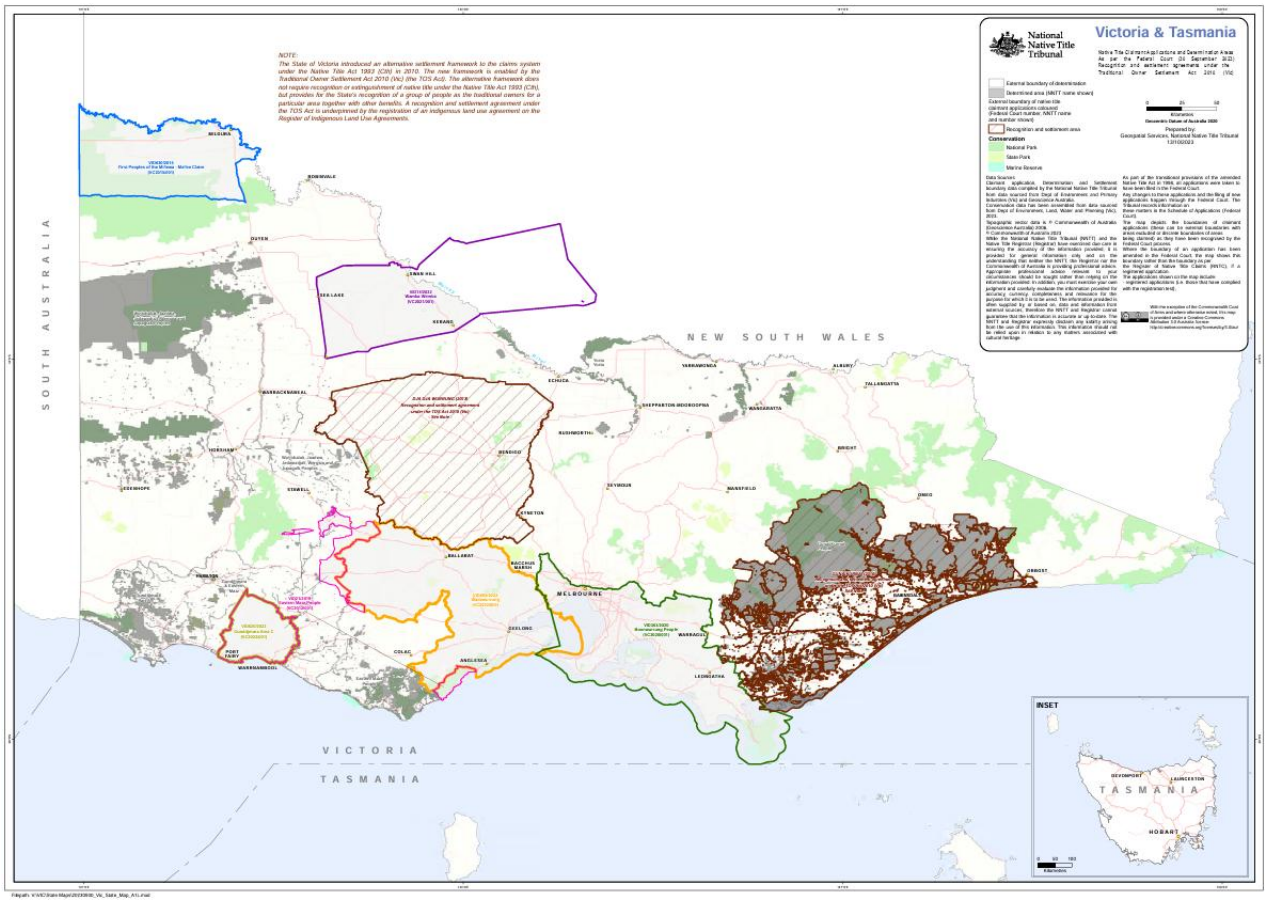



Figure 6-116: ILUAs within the State of Victoria (*NNTT, 2023b*)

### *6.8.3.6 Indigenous Protected Areas*

Indigenous Protected Areas (IPA) are a key element of Australia's National Reserve System (parks, reserves and protected areas) designed to protect the nation's biodiversity. IPAs protect cultural heritage, provide employment opportunities, education and training for Indigenous people. The program strengthens the conservation and protection of marine and coastal environments. On 7 May 2022 numerous Sea Country IPA consultation projects were announced to support Indigenous-led consultation with Traditional Owners and other stakeholders, management planning, and on-sea/on-land management with five of these included within the Otway and Gippsland Environment Sectors as shown in Figure 6-117.




*Source: (DCCEEW, 2022f)*

*Figure 6-117: Sea Country Indigenous Protected Areas Programs - Consultation Projects*

Indigenous land and sea management projects on coastal areas in the EMBA as shown by the National Indigenous Australians Agency include:

- Deen Maar IPA – sand dunes, limestone ridges, river, lake and wetlands proximate to Yambuk
- Preminghana IPA – 524 hectares of land in the north-west of Tasmania protecting historic Aboriginal engraving sites and the endangered Preminghana daisy.

and

- In 2022, GlaWAC signed an agreement with the Federal Government to start the process of establishing a Sea Country IPA from Nanjet east of Wilsons Promontory, to Mallacoota, on the Vic/NSW Border.

### *6.8.3.7 Values and Sensitivities*

The cultural features of the environment may include heritage sites, and values relating to First Nations people's traditional culture and customs (NOPSEMA, 2024). Values and sensitivities associated with cultural features of the environment have been identified based on the presence of heritage sites and First Nations people's values of Country in the monitoring area.

First Nations cultural heritage values and sensitivities are defined as follows:

- Values are the core principles, concerns and goals that guide First Nations people's way of life (Victorian Aboriginal Heritage Council, 2021; Smyth and Bahrdt Consultants, 2004; Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023; Eastern Maar Aboriginal Corporation, 2014; Gunaikurnai Land and Waters Aboriginal Corporation, 2015).
- Sensitivities comprise objects and places or 'areas of cultural heritage sensitivity' herein termed heritage sites:

- Objects as defined in the Burra Charter, are physical materials that contribute to the cultural significance of a place.
- Places as defined in the Burra Charter, area geographically defined areas. They may include elements, objects, spaces and views. Place may have tangible (physical or material) and intangible (spiritual connection to place) dimensions.
- 'Areas of cultural heritage sensitivity' are defined in the Victorian Aboriginal Heritage Regulations 2018 as landforms and soil types where First Nations cultural heritage places are more likely to be located (First Peoples – State Relations, 2021).

#### *6.8.3.7.1 Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values*

First Nations people are considered Cooper Energy's primary source for identifying relevant First Nations cultural heritage sites and values. Consultation with First Nations organisations has informed identification of particular values and sensitivities, as well as consultation with First Nations peoples, participation in cultural experiences and training led by Gunditjmara Guide on Gunditjmara Country[9]. Where direct communication has not been possible, publications produced by / in conjunction with First Nations people have been used as secondary sources.

Secondary sources include First Nations people Country Plans developed by RAPs that have application areas within the EMBA and The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Australia ICOMOS Burra Charter, 2013).

First Nations cultural heritage values are as diverse as the Victorian First Nations groups themselves. Guidance from the documents in Table 6-24 has informed identification of cultural features of the environment relating to First Nations people's heritage sites and values.

*Table 6-24: Guidance documents used to develop the First Nations people cultural heritage impact assessment*

| Guidance Document | Document Type | Relevance to the East Coast Project |
|---|---|---|
| **Gunditjmara Nyamat Mirring Plan 2023 – 2033 (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023)** | Gunditjmara Sea Country Plan | The Gunditjmara Sea Country Plan outlines concerns for Sea Country, and the changes needed for Gunditjmara to fulfil responsibilities to Country. It includes a framework that describes goals and priority actions to achieve those goals.<br>The plan was used to help define cultural heritage values. This has informed an assessment of potential impacts and risks, and helped define acceptability levels in this OPP. |
| **Eastern Maar Meerreengeeye Ngakeeppoorryeeyt (Eastern Maar Aboriginal Corporation, 2014)** | Eastern Maar Country Plan | The Eastern Maar Country Plan includes details on cultural knowledge, values and perspectives, and ideas and priorities. It defines the Eastern Maar vision for the future with identified goals and objectives.<br>The plan was used to help define cultural heritage values. This has informed an assessment of potential impacts and risks, and helped define acceptability levels in this OPP. |
| **Paleert Tjaara Dja Let's make Country good together 2020 – 2030 – Wadawurrung Country Plan (Wadawurrung Traditional Owners Aboriginal Corporation, 2020)** | Wadawurrung Country Plan | The Wadawurrung Country Plan consolidates information gathered from many Wadawurrung people including stories about Country. It articulates how Wadawurrung Sea Country is to be cared for and managed over the next 10 years. The plan lists particular values, and threats to those values.<br>The plan was used to help define cultural heritage values. This has informed an assessment of potential impacts and risks, and helped define acceptability levels in this OPP. |

9 *Cultural Tour led by Gunditjmara Guide, Kurtonitj Indigenous Protected Area: https://www.budjbim.com.au/visit/cultural-tours/*

| Guidance Document | Document Type | Relevance to the East Coast Project |
|---|---|---|
| **Gunaikurnai Whole-of-Country Plan (Gunaikurnai Land and Waters Aboriginal Corporation, 2015)** | Gunaikurnai Whole-of-Country Plan | The Gunaikurnai Whole-of-Country Plan provides a description of heritage, Country and threats to Country. It provides a strategic framework that contains principles, strategic goals, and success measures.<br>The plan was used to help define cultural heritage values. This has informed an assessment of potential impacts and risks, and helped define acceptability levels in this OPP. |
| **Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) Code of Ethics for Aboriginal and Torres Strait Islander Research (AIATSIS, 2020)** | Methodology guide | This AIATSIS code applies to all First Nations people research including planning, collection, analysis and dissemination of information or knowledge which is about or may affect First Nations people collectively or individually.<br>This OPP contains research that concerns First Nations people in the following ways:<br>• Information about First Nations people societies, culture and/or knowledge, and policies<br>• Impact assessment targeted on populations of First Nations people<br>• Contributions of First Nations people through consultation.<br>• Use of information relating to First Nations peoples in the impact assessment.<br>• Description and considerations of First Nations land and sea Country within the impact assessment. |
| **Australian Government Style Manual (Australian Public Service Commission (APSC), 2023)** | Terminology and style guide | The Australian Government Style Manual, in conjunction with respective Country Plans, was considered to help ensure culturally appropriate and respectful language was used when writing in relation to First Nations cultural heritage. |
| **The Burra Charter** | Terminology guide | The Burra Charter outlines the steps in planning for and managing a place of cultural significance. The Burra Charter also defines objects and places of cultural significance relevant to First Nations values and sensitivities. |

Identified cultural features of the environment relating to First Nations people's heritage sites and values based on review of the Country Plans, as well as consultation with First Nations peoples, participation in cultural experiences and training led by Gunditjmara on Gunditjmara Country, are detailed in Table 6-25.

*Table 6-25: Cultural features of the environment relating to First Nations people's heritage sites and values proximal to Cooper Energy Offshore Title Areas*

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| **Tangible Cultural Heritage** | | | | | | |
| **Gunditj Mirring** | Gunditjmara | Known coastal/ island places and objects | **Victoria Wide**<br>A search of the Victorian Aboriginal Heritage Register undertaken by Biosis identified 5,636 recorded Aboriginal places across the entire Victorian coastline (Biosis, 2023). The dominant Aboriginal places located in the study area are shell middens (46.82%), artefact scatters (39.21%) and low-density artefact distribution (LDADs) (5.70%). Shell middens, artefact scatters and LDADs are considered cultural heritage objects for the purposes of this OPP.<br>Review of relevant Country Plans found 5 known coastal/island places within Victoria that are considered significant locations:<br>**The Convincing Ground**<br>The 'Convincing Ground' in Allestree at Portland Bay, approximately 10 km from Portland, is a significant site of early conflict on Gunditjmara Country. This conflict may be the first recorded massacre of First Nations people. It is believed that the Convincing Ground will always hold the spirits of the Kilcarer Gunditj who were murdered there and as such is considered deeply significant for the Gunditjmara and other clans throughout south-west Victoria. Prior to the arrival of settlers, the site of the Convincing Ground held social values for association with Country as a place where Gunditjmara would gather and feast.<br>**Deen Maar**<br>Deen Maar includes Deen Maar IPA on mainland Victoria, near the town of Yambuk, and Deen Maar Island (Julia Percy Island), approximately 10km off the coast of Yambuk.<br>Deen Maar is Central to the creation of Country and has been important in burial rituals for First Nations Peoples (see below 'sacred sites' which Discusses the Intangible values of Deen Maar).<br>Dean Maar Island was formed by volcanic eruptions millions of years ago. The island comprises a grassy plateau above steep rocky shores that are exposed to the ocean. Access to Deen Maar Island requires a permit. A | 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 14 | - | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Eastern Maar** | Gunditjmara | | | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Bunurong** | Bunurong | | | | | |

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| | | | rabbit eradication program is currently planned for the island in a collaboration between Parks Victoria, EMAC and GMTOAC (ABC, 2023; Victoria State government, 2023). There is a large fur seal colony which inhabits the rocky shore, which are identified as a culturally significant species, and little penguins, that access the island via the exposed rocky shore.<br>The land above the shore around Yambuk on the mainland includes natural surface (rain-water collecting) wells used by First Nations Peoples, property run by first nations peoples, and wind turbines which have been developed around existing cultural features (AMCI (2010)).<br>**Discovery Bay Coastal Park**<br>Discovery Bay is an example of the continuous, connected landscape between Nyamat Mirring and Gunditjmara Country. The dune systems of Discovery Bay hold numerous cultural heritage sites such as middens. Discovery Bay Coastal Park is currently managed by Parks Victoria with an aim to establish a governance model enabling Gunditjmara to lead management as a priority Nyamat Mirring location.<br>**Wilsons Promontory and associated land bridge**<br>According to the Victorian Aboriginal Heritage Register, the area of Wilsons Promontory contains 384 registered sites which are predominantly comprised of shell middens, artefact scatters and earth features. Wilsons Promontory is also significant as a place of passing on cultural knowledge and practices and is thought to be a critical place for intergenerational knowledge sharing for the Gunaikurnai and Bunurong peoples. Gunaikurnai inhabited the area of Wilsons Promontory from at least 6,500 years ago including what were previously terrestrial habitats prior to the inundation of the Bassian Plain and Land Bridge. A spirit called Loän (or Kŭlŭngrŭk) protected its inhabitants from invasions. Prior to sea level rise, Gunaikurnai would have hunted and gathered terrestrial and aquatic animals, fruits, yams and eggs according to seasonal abundance. Bark canoes were used to harvest fish and travel around the area once the sea level rise began.<br>**Tyrendarra Lava Flow**<br>The Preminghana IPA in the north-west of Tasmania is a significant location for First Nations people of Tasmania. | | | |

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| | | | The Tyrendarra lava flow is related to both the tangible and intangible, in that it is both a physical thing that was and still is used by Gunditjmara, and it is linked to stories of creation.<br>Within the GMTOAC` Sea Country Plan, and during consultation, GMTOAC shared stories of the creation of the Tyrendarra lava flow which is associated with the World Heritage listed Budge Bim aquaculture system. This lava flow begins at Mt Eccles and extends across coastal plains and offshore 5-10km to the east of Portland at Julia Reef.<br>Recent lava flows (circa 30,000 y) are linked to stories of creation, and these landforms have been engineered by Gunditjmara for thousands of years into aquaculture systems, enabling the collection, fattening up, harvest and trade of Kooyong (short-finned eel). | | | |
| **Gunditj Mirring** | Gunditjmara | Known submerged sites | Review of relevant Country Plans identified potential known submerged sites significant to First Nations people including the ancient Land Bridge, submerged landscapes (lava flows), and underwater cultural heritage sites.<br>Sea Country is considered to extend beyond the formally defined RAP area to include sea and submerged lands to the edge of the continental shelf which may include submerged historical sites and landscapes and extensions to landscape features such as the Tyrendarra lava flow which extends offshore; these young (circa 30,000) lava flows are connected to stories of creation.<br>Within the Sea Country Plan, and during consultation, the Gunditjmara people shared stories of the creation of significant landscape features such as the Tyrendarra lava flow associated with the World Heritage listed Budge Bim aquaculture system. This lava flow begins at Mt Eccles and extends across coastal plains and offshore 5-10km to the east of Portland at Julia Reef. Julia Reef is a popular spot for recreational fishing, particularly yellowtail kingfish.<br>The potential for lava flows within Cooper Energy's operated offshore Otway acreage was investigated by evaluating high-quality 3D seismic | 1, 2, 3, 4, 5, 6, 9, 10 | - | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Eastern Maar** | Gunditjmara | | | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| **Bunurong** | Bunurong | | imagery. The review found no geological evidence of volcanic or hydrothermal flow events within the sedimentary record of the past 500,000 years within Cooper Energy's operated offshore Otway acreage. As a result, the presence of lava flows within the operational area is not expected.<br>The Gunaikurnai community have identified that 10,000 years ago, Victoria was connected to Tasmania by a land bridge. At this time, the marine parks and reserves around Wilsons Promontory were terrestrial habitats, inhabited by Gunaikurnai ancestors. It is estimated that rising sea levels at the end of the Ice Age (~14,000 years ago) flooded most of the Bassian Land Bridge, leaving the shallowest crossing readily passable on foot in an area east of Wilsons Promontory in Victoria and north of Hogan Island (located outside of the Otway Basin, in the Bass Strait). Based on bathymetric and topographic data of the land and seafloor of the Bass Strait, ~12,000 years ago, the Bassian Land Bridge was estimated to be completely submerged. The original surface of the Land Bridge is likely to have been eroded and removed, with any remaining artefacts likely buried beneath sediment deep below the ocean. Rising sea levels following the last glacial maximum and the known sea states of the Otway Coast (water depths and velocities) would make preservation of any "recently" buried anthropogenic structures or sites highly unlikely. | | | |
| **Intangible Cultural Heritage** | | | | | | |
| **Gunditj Mirring** | Gunditjmara | Sea Country | RAPs have defined area boundaries which extend to coastal waters. However, Sea Country is considered to extend beyond the formally defined RAP area to include sea and submerged lands to the edge of the continental shelf.<br>Sea Country is an intrinsic value to First Nations people. It includes parts of open ocean, beaches, land and freshwater on the coast, habitats and encompasses all living things, culturally significant species, beliefs, values, creation spirits and cultural obligations connected to an area. | 1, 2, 3, 4, 5, 6, 7, 11, 12, 15 | ✓ | ✓ |
| **Eastern Maar** | Gunditjmara | | | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Bunurong** | Bunurong | | | | | |
| **Gunditj Mirring** | Gunditjmara | | | | ✓ | ✓ |

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| **Eastern Maar** | Gunditjmara | Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings | Stories and Songlines link First Nations people to ancestors, culture, and Country. Dreaming stories further reinforce the memories and Songlines relating to the flooding associated with the last significant sea level rise and significant connection to Sea Country.<br>Dreaming Songlines link tribal kings such as Umbarra or King Merriman to Wallaga Lake, and Borun the pelican who created songlines and storylines as he walked through Gunaikurnai Country.<br>For Gunditjmara, sites important for Dreaming include Deen Maar. Deen Maar Island is believed to be the place where Bunjil the creator, left this world (Framlington Aboriginal Trust and Winda Mara Aboriginal Corporation (2004), AMCI (2010). Clark (2007) describes the story of a cave on the mainland, opposite Dean Maar Island, and of a passage between the two. The Cave and Deen Maar are both spiritually and visually connected. Grass found at the mouth of the cave provided proof that a good spirit had transferred the body of a recently buried person through the cave to Deen Maar Island and conveyed their spirit to the clouds. See known Coastal / Island / Places for a physical description of Deen Maar Island.<br>Ceremonial sites are places where Ceremonies are performed. Aboriginal people need access to Country to perform Ceremonies which is important for knowledge sharing and cultural practices. The Convincing Ground remains a place of ceremony for the Gunditjmara people who gather at the site annually to reflect on the ongoing impacts of colonisation on their people. | 1, 2, 3, 4, 5, 6, 12, 15 | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Bunurong** | Bunurong | | | | | |
| **Gunditj Mirring** | Gunditjmara | • Connection to Country<br>• Cultural obligations to care for Country<br>• Knowledge Systems | First Nations people may maintain strong spiritual ties to Country. Spiritual connection to Country includes how Country provides spiritual life-giving resources for species and landscapes, places where the spirits of Ancestors rest (Deen Maar) or where spirits reside including water bodies; where peace, direction and purpose originates. If First Nations peoples cannot access areas of Sea Country that they typically do access, this may affect Traditional Owners connection to Country. In the case of Deen Maar, access could be visual or physical access.<br>First Nations People may be culturally obligated and inherently responsible to care, protect and heal Country for present and future generations. The roles held relating to taking care of Country and | 1, 2, 3, 4, 5, 6, 11, 12, 13, 14 | ✓ | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Eastern Maar** | Gunditjmara | | | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Bunurong** | Bunurong | | | | | |

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| | | | knowledge holding may vary amongst individuals and within clans and family groups. Roles may include taking care of culturally significant species or habitats of significant species known to be important food resources, and culturally significant landscapes and places.<br>First Nations peoples ecological, spiritual, traditional and cultural knowledge may be passed through the generations using cultural practices (dreaming stories, ceremony, song and dance) where knowledge holders (Elders) are the custodians of knowledge. This knowledge may include culturally significant species, and landscape features that hold dreaming and creation stories or are events and ceremonial places critical for intergenerational knowledge sharing and cultural practice. Knowledge holders have responsibility for traditions, observances, customs or beliefs associated with specific areas. | | | |
| **Habitats and species** | | | | | | |
| **Gunditj Mirring** | Gunditjmara | Culturally significant species/ food resources:<br>Fish, sharks, rays, eels, shellfish and crustaceans collection from coastal and riverine environments. | Fish, sharks, rays, eels, crayfish, yabbies, mussels and oysters may be a valued source of food and hold significance for First Nations people.<br>GMOATC have highlighted short-finned eels (Kooyang) as of particular significance to Gunditjmara people, who developed complex aquaculture systems to trap and store eels. The aquaculture systems were engineered from the volcanic formations associated with the Tyrendarra Lava flow to create Budj Bim. The eels which are a valued source of food, were captured, fattened up, harvested, smoked and traded, and continue to hold cultural significance for Gunditjmara. Today there are cultural tours at Budj Bim, run by Gunditjmara peoples. The short-finned eel species migrates through State waters and Commonwealth Marine Area of the Otway Region between freshwater systems in Victoria including within Gunditjmara Country, to / from spawning grounds in the Coral Sea, thousands of km to the north. Based on the observed migratory route of short-finned eels, short-finned eels in adult and glass eel forms may pass the operational area during seasonal migrations. During late summer and autumn adult eels will enter the Otway Basin and Bass Strait to commence their migration to the Coral Sea. During mid-winter to late spring, the short-finned eel in larvae and glass eel forms will enter Victorian estuaries to complete the upstream migration. Upon entering the marine environment, eels disperse widely; individuals' migratory paths | 1, 2, 3, 4, 5, 6, 11, 12, 13 | ✓ | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Eastern Maar** | Gunditjmara | | | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Bunurong** | Bunurong | | | | | |

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| | | | are known to diverge widely, and timing of arrival in the Coral Sea is also variable. | | | |
| **Gunditj Mirring** | Gunditjmara | Culturally significant species:<br>Cetaceans | First Nations people around Australia may have a strong connection to whales, which are significant as totemic ancestors to some groups.<br>Karntubul (whales) in Sea Country hold deep cultural significance to the Gunditjmara and feature in Dreaming stories, ceremony, song and dance traditions.<br>Whale migration occurs through the operational area and EMBA. Whale migration is associated with the belief that whales are ancestors to some First Nations peoples and arrive to the coast, annually. Key whale species which would relate to 'calling in' are the southern right whale, which reproduce close to shore, and are often observable from shore. Multiple whale species have the potential to beach in the region, including, though not limited to the southern right whale, pygmy blue whale, and humpback whale.<br>Whale beaching events may be of significance to First Nations people, as parts of deceased whales were, and can still be used as a resource. Multiple whale species have the potential to beach in the region, including, though not limited to the southern right whale, pygmy blue whale, and humpback whale. | 1, 2, 3, 8, 12, 15 | ✓ | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Eastern Maar** | Gunditjmara | | | | | |
| **Gunditj Mirring** | Gunditjmara | Culturally significant species:<br>Pinnipeds | Koorn Moorn (seals) are culturally significant for Gunditjmara people. They feature in song and dance and were collected as a food resource in traditional times by Gunditjmara women along the coast.<br>The Australian sea-lion, southern elephant seal, New-Zealand fur seal, and Australian fur seal are known to occur within the monitoring area including a large colony of Fur Seals at Deen Maar Island that haul out on the island's rocky shores. This species may occur in the operational area (Table 6-9). | 1, 2, 4, 15 | ✓ | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Gunditj Mirring** | Gunditjmara | Culturally significant species:<br>Seabirds | Different avian species hold deep connections to lore and represent spiritual emblems or totems. Magpie gees and Cape Barren geese were harvested for food from wetland habitats. Wetland habitat loss has reduced numbers of these species and harvesting not permitted in Victoria. | 1, 2, 3, 4, 5, 6, 8 | ✓ | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Eastern Maar** | Gunditjmara | | | | | |

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Bunurong** | Bunurong | | | | | |
| **Gunditj Mirring** | Gunditjmara | Key Ecological Feature - Plankton | The Bonney upwelling system is valued by Gunditjmara for the cold waters and nutrients it brings to the region, which supports plankton growth, providing a food source for culturally significant species.<br>The Bonney upwelling is a large-scale oceanographic system and key ecological feature that influences the Otway coast (Appendix 3); the feature is active in Autumn and Summer depending on the strength and frequency of alongshore winds (Bulter et al., 2002). The area is significant as one of the largest and most predictable upwellings in south-eastern Australia, and most prominent upwelling system driven by prevailing south-easterly winds. | 1, 13 | - | ✓ |
| **Gunditj Mirring** | Gunditjmara | Water quality | Water including freshwater and marine, may be of particular cultural significance to First Nations people as an integral part of songs, ceremonies, hunting and collecting, and other activities that bind people to Country and each other. First Nations communities in Victoria may maintain strong connections to water and culture. Increased pollution from coastal communities, agriculture and industry, changes sea hydrology and impacts marine species and harms Country. Water is an intrinsic value to First Nations people. | 1, 2, 3, 4, 5, 6 | ✓ | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Eastern Maar** | Gunditjmara | | | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Bunurong** | Bunurong | | | | | |
| **Gunditj Mirring** | Gunditjmara | Benthic habitats | Nearshore reefs provide habitat for many culturally significant species such as macroalgal communities, fish, sharks and rays. Julia Reef is within sea country adjacent to Gunditj Mirring RAP and is an extension of the volcanic feature connected to Budj Bim. Julia Reef marks the seaward extent of the Tyrendarra lava flow, ending approximately 15 km offshore and 10-15km east of Portland (Builth, 2004). Julia Reef is a preferred fishing spot for recreational fishers (VFA, 2022). | 1, 16, 17 | - | ✓ |
| **Gunditj Mirring** | Gunditjmara | Intertidal communities and shorelines | Intertidal communities and shorelines include mangroves, macroalgae, seagrass, coastal saltmarsh, rocky and sandy shorelines. | 1, 2, 3, 4, 5, 6 | - | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |

| First Nations Group | Representing | Identified Cultural Features of the Environment relating to First Nations People's Heritage Sites and Values | Intrinsic link between Cultural Features and First Nations People's Heritage Sites and Values | Sources | Overlap of Operational Area | Potential for overlap of Monitoring Area |
|---|---|---|---|---|---|---|
| **Eastern Maar** | Gunditjmara | | Intertidal reefs and sandy shorelines are important cultural heritage sites and are important habitats for marine fauna and culturally significant species such as seabirds and migratory shorebirds, fish, sharks, rays, eels, and pinnipeds.<br>Sea Country for Wadawurrung people includes coastal habitats such as seagrass and saltmarsh. | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Bunurong** | Bunurong | | | | | |
| **Gunditj Mirring** | Gunditjmara | Marine Park/ coastal reserves / wetlands | The First Nations people residing within the EMBA have strong cultural associations with Sea Country and may have cultural responsibilities of the waters and Marine Parks and Reserves that are located within Country. Some First Nations groups including the Gunaikurnai people have joint management over the Marine Parks and reserves within Country.<br>Marine parks and reserves around Wilsons Promontory and Ninety Mile Beach National Park were inhabited Gunaikurnai ancestors.<br>Marengo Reef Marine Park holds cultural significance for the Eastern Maar people. The marine park includes rocky features with high structural diversity, and provides for numerous filter-feeding organisms, such as tube worms and barnacles, and are surrounded by bull kelp. Islands within the park are known as a haul out site for fur seals. Wadawurrung Country covers the Avalon Coastal reserve. | 1, 2, 3, 4, 5, 6, 11 | - | ✓ |
| **Wadawurrung** | Wadawurrung | | | | | |
| **Eastern Maar** | Gunditjmara | | | | | |
| **Gunaikurnai** | Gunaikurnai | | | | | |
| **Bunurong** | Bunurong | | | | | |

***Sources:***

*1. Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023*
*2. Wadawurrung Traditional Owners Aboriginal Corporation, 2020*
*3. Eastern Maar Aboriginal Corporation, 2014*
*4. Gunaikurnai Land and Waters Aboriginal Corporation, 2015*
*5. Biosis 2023*
*6. Bunurong Land Council Aboriginal Corporation, 2024*
*7. The University of Adelaide, 2023*
*8. Parks Victoria, 2019*
*9. Adeleye et al., 2021*
*10. Hamacher et al., 2023*
*11. Smyth, Egan, and Kennett, 2018*
*12. Nunn and Reid, 2016*
*13. CoA, 2015a*
*14. Victorian Aboriginal Heritage Council, 2021*
*15. Director of National Parks, 2025*
*16. VFA, 2022*
*17. Builth, 2004*

#### *6.8.3.7.2 First Nations People's Tangible Cultural Heritage*

First Nations people's tangible cultural heritage includes objects and places with intangible values, such as (PV, 2019):

- Ancestral remains
- Middens
- Flaked stone tools, ground edge axes, axe-grinding grooves and griding stones
- Historic and contemporary cultural harvesting of marine fauna and flora
- Sea and landscape features that hold dreamtime and creation stories, such as offshore islands (Deen Maar) and lava flows. Associated evidence of habitation and connection.
- Different marine and avian species that hold deep connections to lore and represent spiritual emblems or totems
  - Karntubul (whales) found in Sea Country hold deep cultural significance to the Gunditjmara and feature in Dreaming stories, ceremony, song and dance traditions
- Marine species that are valued sources of food
  - Shellfish such as mussels and oysters
  - Crustaceans such as crayfish and yabbies
  - Fish such as the short-finned eel.

Locations and landforms where Aboriginal burials may have been more likely to occur include sandy lunettes and alongside water, sand dunes near beaches, aboriginal middens, in bushland, near trees or rock shelters (PV, 2019). Earth features include mounds, rings and hearths which are the result of First Nations people living in particular places of the landscape. Stone arrangements comprise a construct of stones of boulders resulting in a place of cultural significance and are usually found in volcanic areas of Victoria. These include stone houses, fish or eel traps, ceremonial arrangements and rockwells (PV, 2019).

Middens are shell deposits that have built up over time, often as a result of Indigenous people gathering and eating shellfish and molluscs (PV, 2019). They can be found near water sources throughout Victoria and may be present alongside bones, grinding stones, charcoal and ancestral remains (PV, 2019). Coastal shell middens, charcoal and hearth stones from fires, and items such as bone and stone artefacts are typically located within sheltered positions in the dunes, coastal scrub and woodlands, within rock shelters or on exposed cliff tops with good vantage points (Aboriginal Victoria, 2008). Coastal shell middens are found as layers of shell exposed in the side of dunes, banks or cliff tops or as scatters of shell exposed on eroded surfaces. Threats to coastal shell middens include exposure by wind and water erosion; degradation by human or animal interference; burrowing animals; people destabilizing ground using unregulated tracks or off-road vehicles.

Stone tools are flakes of stone shaped into tools such as scrapers, blades or spears. These are found everywhere across Victoria and were made in many forms from many types of stone. Ground edge axes are stone axe-heads made from large flakes of hard stone. Axe-grinding grooves occur from the sharpening and shaping of stones axes along stone platforms or outcrops. They can be found in many places across Victoria, especially near water. Grinding stones are large slabs of abrasive rocks often left at camps. (PV, 2019).

In 2023, ConocoPhillips commissioned Biosis to develop an Otway Exploration Cultural heritage desktop assessment (Biosis, 2023). The study area for the Otway Exploration Cultural heritage desktop assessment is highly representative of the EMBA for the East Coast Project and therefore used to provide details on tangible First Nations cultural heritage sensitivities within the EMBA. The desktop assessment included a search of the Victorian Aboriginal Heritage Register undertaken by Biosis on the 21 December 2022 which identified 5,636

recorded Aboriginal places across the Victorian coastline (Biosis, 2023). The dominant Aboriginal places located in the study area are shell middens (46.82%), artefact scatters (39.21%) and low-density artefact distribution (LDADs) (5.70%).

Review of the 5,636 recorded Aboriginal places found 5 First Nations cultural heritage places within the EMBA that are significantly mentioned within relevant Country Plans:

- The Convincing Ground
- Deen Maar
- Discovery Bay Coastal Park
- Land Bridge and Submerged features
- Wilsons Promontory.

**The Convincing Ground**

The 'Convincing Ground' in Allestree at Portland Bay, approximately 10 km from Portland, is a significant site of early conflict on Gunditjmara Country (Biosis, 2023). Whalers and sealers visited Gunditjmara shores as early as 1810 leading to the establishment of one of Victoria's first whaling stations in Portland in 1829. Conflict arose when a whale beached at the site. The Kilcarer Gunditj clan gathered at the beached whale and whalers used the gathering to murder approximately 60 people, leaving only 2 surviving members of the clan. The exact date of the massacre is unknown but is estimated to have occurred between 1832 and 1833 (GMTOAC, 2023). This conflict may be the first recorded massacre of First Nations people. It is believed that the Convincing Ground will always hold the spirits of the Kilcarer Gunditj who were murdered there and as such is considered deeply significant for the Gunditjmara and other clans throughout south-west Victoria (Victorian Heritage Database, 2006). Prior to the arrival of settlers, the site of the Convincing Ground held social values for association with Country as a place where Gunditjmara would gather and feast (Heritage Council Victoria, 2010).

In 2006 the site was officially listed as a Heritage Place on the Victorian Heritage Register (VHR #H2079). Several land parcels at the site have since been returned to the Gunditjmara with an aim of creating a landscape for the space which adequately reflects the significance for the area. The Convincing Ground remains a place of ceremony for the Gunditjmara who gather at the site annually to reflect on the ongoing impacts of colonisation on their people (GMTOAC, 2023).

**Deen Maar**

Deen Maar Island holds deep significance for the Gunditjmara and Eastern Maar peoples, who jointly hold native title to the island and its surrounding waters (see Section 6.8.3.4).

The site is featured in the Gunditjmara creation story and is significant both spiritually and ecologically. As such, the site is considered a priority Nyamat Mirring location. Deen Maar is considered a dreaming place for the Gunditjmara as a resting place for the spirits of their Ancestors. As an island, Deen Maar connects Sea Country with other types of Country while hosting abundant resources of fish and coastal vegetation and is regarded as a place for Gunditjmara to access and practice culture (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023).

On the coast opposite Deen Maar, a cave 'Tarn Weerreeng' marks a path between Deen Maar and the mainland and serves as a burial place where bodies are wrapped in grass and placed inside the cave. When the grass is found at the mouth of Tarn Weerreeng, the body and its belongings are thought to have been carried to Deen Maar and the spirit carried to the clouds (Biosis, 2023; DTP, 2021).

The Eastern Maar often bury their people facing Deen Maar with the belief that after death, their spirits go to Deen Maar before going to the stars, as Bunjil had done (Eastern Maar Aboriginal Corporation, 2014).

**Discovery Bay Coastal Park**

Discovery Bay is an example of the continuous, connected landscape between Nyamat Mirring and Gunditjmara Country. The dune systems of Discovery Bay hold numerous cultural heritage sites such as middens which are under increasing threat from vehicle disturbance, including those associated with the commercial and recreational pipi fishery as well as recreational 4WDs. The remoteness of the area poses a challenge in protecting the area by making surveillance difficult and possibly lowering the level of compliance with regulations (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023).

Discovery Bay Coastal Park is currently managed by Parks Victoria with an aim to establish a governance model enabling Gunditjmara to lead management as a priority Nyamat Mirring location (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023).

Further details on the ecological and tourism values of Discovery Bay are provided in Section 6.6.5.1.

**Land Bridge and Submerged landscapes**

Between ~18,000 and ~12,000 years ago, the Bassian Land Bridge joined Tasmania with the mainland of Australia during periods of low sea level and potentially facilitated mass movement of Tasmanian Aboriginal (Palawa) people between these regions (Figure 6-118; Adeleye et al., 2021; Hamacher et al., 2023). It is estimated that rising sea levels at the end of the Ice Age (~14,000 years ago) flooded most of the Bassian Land Bridge, leaving the shallowest crossing readily passable on foot in an area east of Wilsons Promontory in Victoria and north of Hogan Island (located outside of the Otway Basin, in the Bass Strait). Based on bathymetric and topographic data of the land and seafloor of the Bass Strait, ~12,000 years ago, the Bassian Land Bridge was estimated to be completely submerged.

The original surface of the Land Bridge is likely to have been eroded and removed, with any remaining artefacts likely buried beneath sediment deep below the ocean (Biosis, 2023). Rising sea levels following the last glacial maximum and the known sea states of the Otway Coast (water depths and velocities) would make preservation of any “recently” buried anthropogenic structures or sites highly unlikely.

The area of the Land Bridge is also culturally significant to the Gunaikurnai peoples particularly as a place of intergenerational knowledge sharing (Gunaikurnai Land and Waters Aboriginal Corporation, 2015). Dreaming stories further reinforce the memories and songlines relating to the flooding and significant connection to Sea Country (Biosis, 2023; Nunn and Reid, 2016). These stories also serve as a testament to the longevity and significance of oral tradition in a global context (Nunn and Reid, 2016).

Within the Sea Country Plan, and during consultation, GMTOAC shared stories of the creation of significant landscape features such as the Tyrendarra lava flow associated with the World Heritage listed Budge Bim aquaculture system (GMTOAC, 2023). This lava flow begins at Mt Eccles and extends across coastal plains and offshore 5-10km to the east of Portland at Julia Reef (Builth, 2004). Julia Reef is a popular spot for recreational fishing, particularly yellowtail kingfish (VFA, 2022b)

Known cultural heritage sites are generally constrained to the shoreline and near shore limits, within state coastal waters (ACHRIS, 2023). Evaluation of high-quality 3D seismic imagery has indicated there is no geological evidence of recent (500,000 years or less) volcanic or hydrothermal flow events within Cooper Energy’s operated offshore Otway acreage. Several crater complexes and lava flows are present within the region, however, are unlikely to extend into the Cooper Energy acreage

**Wilsons Promontory**

According to the Victorian Aboriginal Heritage Register, the area of Wilsons Promontory contains 384 registered sites which are predominantly comprised of shell middens, artefact scatters and earth features (Biosis, 2023). Shell middens are scattered along the coast or otherwise near flowing water, with the largest cluster totalling 163 middens occurring along the western coast of the Promontory. Artefact scatter sites primarily follow water sources inland (Biosis, 2023).

Wilsons Promontory is also significant as a place of passing on cultural knowledge and practices and is thought to be a critical place for intergenerational knowledge sharing for the Gunaikurnai and Bunurong peoples.

Gunaikurnai inhabited the area of Wilsons Promontory from at least 6,500 years ago including what were previously terrestrial habitats prior to the inundation of the Bassian Land Bridge. A spirit called Loän (or Kŭlŭngrŭk) protected its inhabitants from invasions. Prior to sea level rise, Gunaikurnai would have hunted and gathered terrestrial and aquatic animals, fruits, yams and eggs according to seasonal abundance. Bark canoes were used to harvest fish and travel around the area once the sea level rise began (Gunaikurnai Land and Waters Aboriginal Corporation, 2015).

The modern-day terrestrial and marine protected areas of Wilsons Promontory recognise the significant natural and cultural values of the area. The Gunaikurnai aim to propose alternative management models to improve natural and cultural outcomes while providing benefits to Gunaikurnai people (Gunaikurnai Land and Waters Aboriginal Corporation, 2015). Further information regarding the ecological and tourism values of Wilsons Promontory is provided in Section 6.6.5.1.

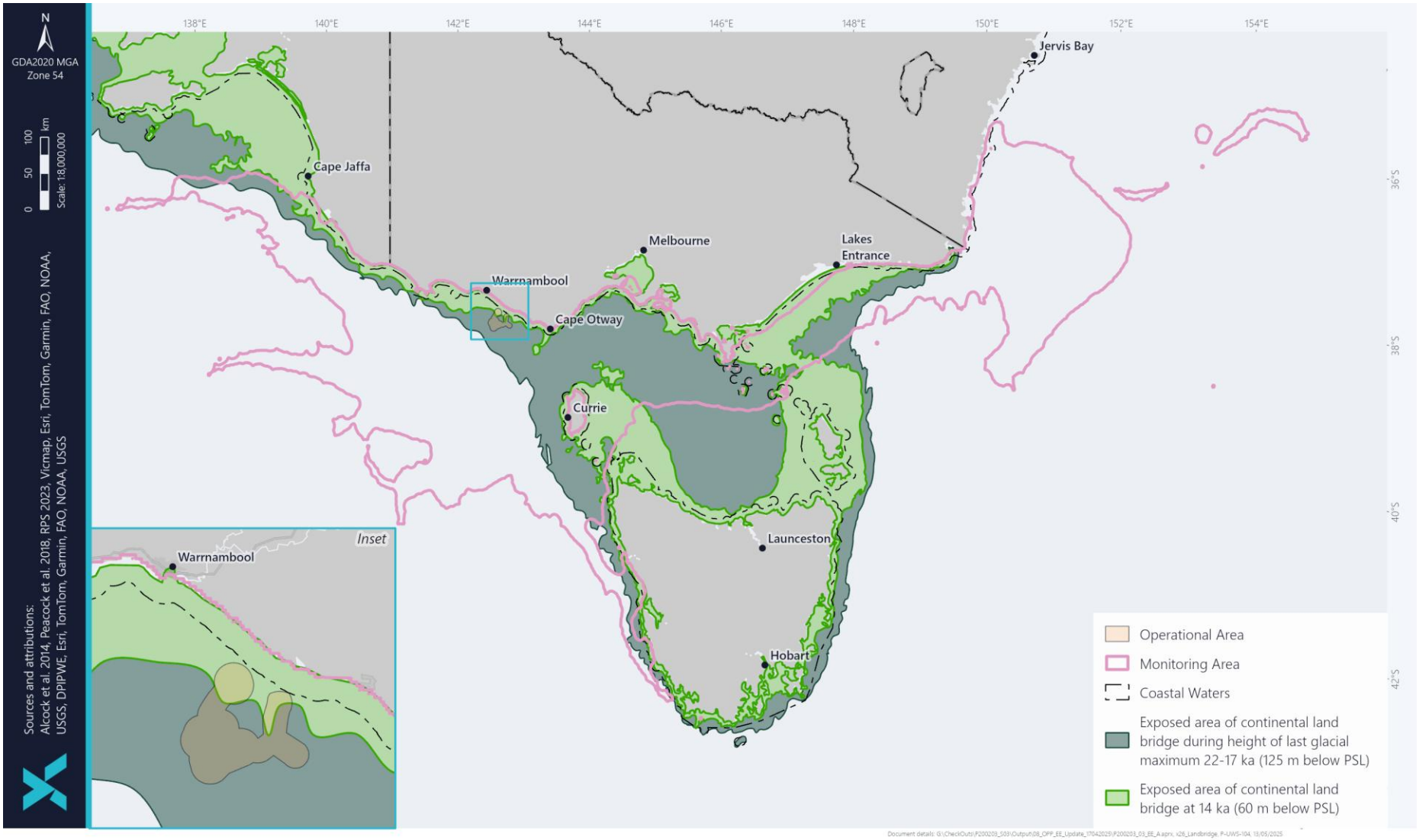



*Figure 6-118: Exposed area of continental land bridge between Tasmania and mainland Australia at 27-17 ka and 14 ka*

# 7 Impact and Risk Assessment

A description of the methodology used to identify and evaluate the environmental risks and impacts of the activities associated with the East Coast Project, as described in Section 4, is required by the OPGGS(E)R.

This OPP provides the environmental impact and risk evaluation for the activities associated with the East Coast Project 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 7-1 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 7-1: 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.

## 7.1 Definitions

A list of terminology and definitions applied during the impact and risk assessment process are defined below:

- **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.
- **Environmental Performance Outcome (EPO)** – 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.
- **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.

- **Cumulative impact**: Cumulative impacts and risks may include additive effects of activities within the same project, additive effects from other activities within the region or potentially affecting the same environmental receptors as the project or the long-term cumulative effects of a project lasting many years or decades. Refer to Section 10 for a detailed cumulative impact assessment methodology.
- **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.

## 7.2 Risk Management Process Steps

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

### 7.2.1 Establish the Context

All components of the petroleum activity relevant to this scope, described in detail in Section 4, are identified and individual aspects are evaluated in the impact and risk assessment. Outcomes from stakeholder consultation for Cooper Energy's activities which have been undertaken over several years, have also contributed to aspect identification. Regulatory requirements, government policies and guidelines, industry standards and stakeholder consultation outcomes all contribute to aspect identification and setting the Acceptable Levels (ALs) and Environment Performance Outcomes (EPOs).

#### *7.2.1.1 Petroleum Activity*

Petroleum activities associated with the East Coast Project, including potential emergency conditions, have been grouped into the following phases to allow for a clear description and evaluation:

- surveys
- well construction
- installation and commissioning
- operations
- decommissioning
- support activities (undertaken across all project phases).

Further detail of the phases and their associated activities is provided in Section 4.

#### *7.2.1.2 Environmental Values and Sensitivities*

The environment, along with the particular values and sensitivities, within the operational area and the monitoring area have been described in detail in Section 6. In accordance with Section

7(3) of the OPPGS (E)R, Cooper Energy has identified the particular values and sensitivities relevant to this OPP, as per the EPBC Act to be:

- presence of Listed migratory species
- presence of Listed threatened species and ecological communities
- values and sensitives that exist in, or in relation to, the Commonwealth marine area
- ecological character of a declared RAMSAR wetland
- values of a declared National heritage places
- values of a declared World heritage places
- other values, including social, economic and cultural values.

In addition to establishing the context of the environment, consideration for environmental legislation and other requirements is provided to guide decisions, manage impacts and demonstrate acceptability. Recovery and management plans, guidelines and conservation advice relating to the protection of threatened species and ecological communities are considered within the impact and risk assessment. These legislative requirements are described in Section 2.

#### *7.2.1.3 Relevant Environmental Aspects*

After describing the petroleum activity associated with the East Coast Project, an assessment was carried out to identify potential interactions between the East Coast Project and the environment. These assessments were attended by project personnel spanning operations, well engineering, subsea, HSEC disciplines and supported by other specialists. Potential interactions with safety and health of the workforce, and assets are addressed under separate regulatory approval documents, and are outside the scope of this OPP.

Environmental aspects included within the impact and risk assessment of the East Coast Project are scoped against activities in Table 7-1. These aspects have corresponding headings within Section 8 and Section 9.

*Table 7-1: Relationship between identified activities and aspects*

| Activity | Aspect: Physical Presence | | | Planned Emissions | | | Planned Discharges | | | Unplanned Impacts | | | Accidental Release | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Seabed Disturbance | Interaction with Other Marine Users | Light Emissions | Atmospheric Emissions | GHG emissions | Underwater Sound Emissions - Impulsive | Underwater Sound Emissions - Continuous | Planned Discharges - Operational | Planned Discharges - Drilling | Interaction with Marine Fauna | Introduction of IMS | Loss of Material or Waste Overboard | Minor Loss of Containment | Accidental Release - MDO | Accidental Release - LOWC |
| **Surveys** | | | | | | | | | | | | | | | |
| **Geophysical survey** | | | | | | ✓ | | | | | | | | | |
| **Geotechnical survey** | ✓ | | | | | | | | | | | | | | |
| **Well Construction** | | | | | | | | | | | | | | | |
| **MODU positioning** | ✓ | | | | | | | | | | | | | | |
| **Drilling operations** | ✓ | | | | | | ✓ | | ✓ | | | ✓ | | | ✓ |
| **BOP installation and testing** | | | | | | | | | ✓ | | | | | | |
| **Drilling cuttings and fluids** | ✓ | | | | | | | | ✓ | | | | | | |
| **Cementing operations** | ✓ | | | | | | | | ✓ | | | | | | |
| **Well completions** | | | | | | | | | ✓ | | | | | | |
| **Well clean-up / flow-back** | | | ✓ | ✓ | ✓ | | | | | | | | | | |
| **Well suspension** | | | | | | | | | ✓ | | | | | | |
| **Installation and Commissioning** | | | | | | | | | | | | | | | |
| **Pre-lay works** | ✓ | | | | | | | ✓ | | | | ✓ | | | |
| **Flowlines and umbilicals** | ✓ | | | | | | | | | | | ✓ | | | |
| **Installation of subsea structures** | ✓ | | | | | | | ✓ | | | | ✓ | | | |
| **Post-lay works** | ✓ | | | | | | | | | | | ✓ | | | |
| **Testing, preservation and start-up** | | | | ✓ | | | | ✓ | | ✓ | | ✓ | ✓ | | |
| **Operations** | | | | | | | | | | | | | | | |
| **Hydrocarbon extraction and transport** | | ✓ | | | ✓ | | ✓ | | | | | | | | ✓ |
| **Inspection, Maintenance and Repair** | ✓ | | | | | | | ✓ | | | ✓ | ✓ | ✓ | | |
| **Well Intervention** | | | ✓ | ✓ | ✓ | | | | ✓ | | | | | | ✓ |
| **Decommissioning** | | | | | | | | | | | | | | | |
| **Well abandonment** | ✓ | | ✓ | ✓ | ✓ | | | | ✓ | | | ✓ | | | ✓ |
| **Flowline and umbilical decommissioning** | ✓ | | | | | | | ✓ | | | ✓ | ✓ | | | |
| **Removal of remaining subsea infrastructure** | ✓ | | | | | | | ✓ | | | ✓ | ✓ | | | |
| **Support Operations** | | | | | | | | | | | | | | | |
| **MODU operations** | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| **Vessel operations** | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| **ROV operations** | ✓ | | | | | | ✓ | | | | ✓ | ✓ | ✓ | | |

| Activity | Aspect | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Physical Presence | | | Planned Emissions | | | Planned Discharges | | | Unplanned Impacts | | | Accidental Release | | |
| | Seabed Disturbance | Interaction with Other Marine Users | Light Emissions | Atmospheric Emissions | GHG emissions | Underwater Sound Emissions - Impulsive | Underwater Sound Emissions - Continuous | Planned Discharges - Operational | Planned Discharges - Drilling | Interaction with Marine Fauna | Introduction of IMS | Loss of Material or Waste Overboard | Minor Loss of Containment | Accidental Release - MDO | Accidental Release - LOWC |
| **Helicopter operations** | | | | ✓ | ✓ | | ✓ | | | ✓ | | | ✓ | | |
| **Diver operations** | | | | | | | | | | | | | ✓ | | |

### 7.2.2 Risk Analysis

Utilising the understanding of these environmental interactions, relevant impacts or risks resulting from each aspect have been defined. Identified impacts and risks are then analysed. Impact and risk analysis require assessing a level of consequence 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 (Table 7-3), 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 (Table 7-2)
- 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.

*Table 7-2: 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. Activity cannot proceed until the Managing Director approves treatment plans that eliminates or reduces Health, Safety and Environment risks to ALARP / SFARP and reduce risks in other categories in line with the Company's risk appetite. The Board must be informed of the risk and its treatment.
- **High (orange):** Inherent risk at this level requires the respective ELT Member to approve the treatment plans before the activity proceeds. Treatment plans are required to eliminate or reduce Health, Safety and Environment risks to ALARP / SFARP and reduce risks in other categories in line with the Company's risk appetite The Managing Director and the Board must be informed of the risk and its treatment.
- **Moderate (yellow):** Inherent risks at this level may be acceptable if they are in line with the Company's risk appetite. Except for Health, Safety and Environment risks which must be eliminated or demonstrated as reduced ALARP / SFARP. Appropriate Managers or Functional Leaders must approve treatment plans and risks should be reported during regular reporting.

- **Low (green):** This level of risk is broadly acceptable; however, Health, Safety and Environment risks must be eliminated or demonstrated as reduced ALARP / SFARP with treatment plans approved by assigned persons. For risks in other categories, as a minimum, a review of existing control measures should occur, and the risk should be regularly monitored for deterioration.

** Key descriptor words relating to duration, spatial extent and magnitude from these definitions, are used during the impact and risk assessment process for consideration of all elements of the environment, including biological, physical and social receptors. These receptors are identified within the existing environment section and integrated into the risk assessment through activity-aspect interaction scoping.*

### 7.2.3 Risk Evaluation

#### *7.2.3.1 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 a 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 are 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.

In future activity-specific EPs, an evaluation will be undertaken to ensure impacts and risks are reduced to as low as reasonably practicable (ALARP), in alignment with NOPSEMA's ALARP Guidance Note (N-04300-GN0166, June 2020).

*Table 7-3: Cooper Energy qualitative risk matrix*

| LIKELIHOOD | | | | | | CONSEQUENCE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Qualitative | | | | | Quantitative | | | | | |
| Rating | **Level** | **Probability** | **Time Period** | **Description** | | **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. | ≤ $10^{-2}$ | 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. | ≤ $10^{-3}$ | 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. This could occur during the activity. | ≤ $10^{-4}$ | 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. | ≤ $10^{-5}$ | Low | Low | Moderate | Moderate | High |
| F | Hypothetical | < 1% | Not in 100 years | Generally considered hypothetical or non-credible. Black Swan. | ≤ $10^{-6}$ | Low | Low | Low | Low | Moderate |

### 7.2.4 Risk Acceptability

The Environment Regulations Section 7 of the OPPGGS requires that the East Coast Project OPP must include:

*(5) The proposal must include:*

*(a) details of the environmental impacts and risks of the activities that are part of the project; and*

*(b) and evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk.*

Cooper Energy considers a range of factors when evaluating the acceptability of environmental impacts or risks associated with its activities. This evaluation is informed by NOPSEMA's Guidance Note for OPP Content Requirements (N-04790-GN1663, January 2024) and NOPSEMA's Guideline for Offshore Project Proposal Decision Making (N-04790-GL1816, January 2024).

The acceptability evaluation for each aspect associated with this activity is undertaken in accordance with Table 7-4 and through comparison between defined acceptable levels and predicted levels of impact and risk. This criteria is discussed further in the sections below.

*Table 7-4: Cooper Energy Acceptability Evaluation*

| Factor | Criteria / Test |
|---|---|
| **Cooper Energy Risk Management Protocol** | For Risks, 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)?<br>For impacts, is the Consequence Level 4 or 5?<br>The following predicted levels of impact and risk are considered generally acceptable:<br>• Risk severity Low and Moderate<br>• Impact Consequence Levels 1, 2 and 3. |
| **Principles of Ecologically Sustainable Development (ESD)**<br>**(Refer to Section 7.2.4.1 for further details)** | 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?<br>If yes: is there significant scientific uncertainty associated with the aspect?<br>If yes: has the precautionary principle been applied to the aspect? |
| **Legislative and Other Requirements**<br>**(Refer to Section 7.2.4.2 for further details)** | 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**<br>**(Refer to Section 7.2.4.3 for further details)** | Is the impact or risk provided for within Cooper Energy Management System (CEMS) Standards and Processes? If not, what additional provisions will be made? |
| **External Context**<br>**(Refer to Section 7.2.4.4 for further details)** | Was feedback from stakeholders received that informs the values and sensitivities / existing environment, impacts and risks, performance outcomes or mitigation measures? If yes, has it been considered? |

#### *7.2.4.1 Principles of Ecologically Sustainable Development*

The principles of Ecological Sustainable Development (ESD), as defined in Section 3A of the EPBC Act, are considered in Table 7-5 in relation to acceptability evaluations.

Under the EPBC Act, the Minister must also consider 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 7-5: Principles of ESD*

| ESD Principle | | Relevance to Acceptability |
|---|---|---|
| **A** | Integration Principle<br>Decision-making processes should effectively integrate long-term and short-term economic, environmental, social, and equitable considerations. | The Integration principle is met through a combination of Cooper Energy's risk management process and consultation.<br>Cooper Energy's risk management process describes the environmental values and sensitivities within the operational area and the monitoring area (described in Section 6) and assesses the potential short term and long term impacts and risks of the ECSP activities on these receptors. Using the risk management process, control measures are identified to reduce the predicted levels of impact and risk to the defined acceptable levels.<br>Cooper Energy stakeholders represent diverse sectors and perspectives to ensure feedback provides a range of insights to inform the environmental values and enable potential risks and impacts to be identified and managed early in the development planning process. Relevant feedback received from stakeholders is used to inform the risk management process (including the existing environment, potential interaction and proposed control measures).<br>There was limited stakeholder interest in the project during preliminary consultation or the formally advertised Public Comment period for the ECSP OPP and no comments were received through this process. However, given Cooper Energy's history operating and engaging as part of the Otway community, stakeholder feedback from other projects has been leveraged to ensure social considerations are addressed in the OPP. Specifically, feedback provided from stakeholders during the preparation of recently accepted Environment Plans for exploration drilling (Athena Supply Project) and operations (Otway Offshore Operations Casino Henry & Netherby (CHN) EP) has been considered in the risk management process and if specific to an aspect incorporated where relevant, into existing environment, impact assessment and the control measures. This feedback is relevant as these EPs provide for activities that spatially overlap and are similar in nature and scale with the East Coast Supply Project.<br>The feedback is incorporated in the assessment and considered when defining acceptable levels and managing impacts and risks to an acceptable level.<br>Future activity specific environment plans will be prepared using Copper Energy's risk management process and incorporate future and ongoing stakeholder feedback that is received.<br>The integration principle of ESD has been addressed in relation to each defined acceptable level and EPO, as outlined in Table 7-6 and is also considered in the evaluation of impact and risk acceptability presented in Sections 8 and 9. |
| **B** | Precautionary Principle<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. | This principle is met through the identification of and conservative evaluation of scientific uncertainty for all impacts and risks, including how the uncertainty is addressed in adopted controls to manage residual uncertainty throughout the project.<br>The precautionary principle of ESD is considered in all impact and risk acceptability demonstrations and environmental performance evaluations, provided in Sections 8 and 9. |
| **C** | Intergenerational principle | This principle is met through commitment to measures to avoid and minimise environmental impacts and risks such that they will be |

| | | |
|---|---|---|
| | The principle of inter-generational equity—is 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. | managed to be an acceptable level for the duration of the environmental impact(s) generated by project.<br>Through the impact assessment process, and description of control measures it is demonstrated how impacts and risks will be managed to acceptable levels, which are defined so as not to forego the health, diversity and productivity of the environment for future generations.<br>There is conservatism throughout the impact and risk assessment process, through the definition and evaluation of multiple different and/ or worst case scenario's, by consideration of environmental, social and cultural contexts, and by the application of the precautionary principle where there are threats of serious or irreversible environmental damage. |
| **D** | Biodiversity Principle<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making. | This principle is demonstrated through the evaluation of environmental impacts to the biodiversity and ecological values of the environment affected, including matters of National Environmental Significance; and the levels of performance for management. |
| **E** | Valuation Principle<br>Improved valuation, pricing and incentive mechanisms should be promoted | This principle is met through identifying the economic, social and ecological value of the existing environment (Section 6), and including provisions for Cooper Energy to bear the full cost of environmental management for the life of the project to ensure environmental impacts and risks are reduced to an acceptable levels. This is reflected in all impact and risk acceptability demonstrations and environmental performance evaluations, provided in Sections 8 and 9.<br>Cooper Energy incorporates market-based mechanisms such as carbon pricing (Section 8.5) where applicable, sets adaptive management frameworks (such as the whale disturbance protocol Section 8.2.6) and is required to hold financial assurance under Section 571(2) of the *OPGGS Act* to ensure the project aligns with the 'polluter pays' principle. |

#### *7.2.4.2 Legislative and Other Requirements*

The requirements identified in Section 2 relevant to environmental receptors were considered in acceptability evaluations. These include, but are not limited to:

- requirements from Commonwealth legislation and regulations
- relevant Commonwealth policies and guidance
- relevant international agreements and conventions
- relevant industry standards.

Matters protected under Part 3 of the EPBC Act are included in the acceptability evaluation such that impacts and/or risks are consistent with relevant objectives and actions of relevant policies, guidelines, recovery/management plans, conservation advice and bioregional plans.

#### *7.2.4.3 Internal Context*

The risk assessment process used to develop this OPP, and control measures adopted were undertaken within the Cooper Energy Management System (CEMS) Standards.

#### *7.2.4.4 External Context*

Cooper Energy has considered the environment and stakeholder consultation during the acceptability evaluation of impacts and risks. Consultation also informs the values and sensitivities described within the OPP.

Existing and new stakeholders for the East Coast Project and the existing CHN facilities were involved in consultation of this OPP (see Section 3). No public comments were received during the public comment period. Feedback provided from stakeholders during the preparation of accepted Environment Plans for exploration (Athena Supply Project) and operations (CHN

Development) activities spatially overlapping and similar in nature with the East Coast Supply Project has been incorporated where relevant.

## 7.3 Defined Acceptable Levels and Environmental Performance Outcomes

As described in NOPSEMA's Guidance Note for OPP Content Requirements (N-04790-GN1663, January 2024), the "acceptable level" is *the maximum level of change in environmental parameters before the environmental effects become unacceptable*. To define the acceptable level, regard should be given to all relevant factors, as described in above in Table 7-4. The level of impact, and whether that impact is significant, is specific to the sensitivity, vulnerability, recoverability of receptors.

As such, the defined acceptable levels are informed by:

- OPGGS Act
- EPBC Act
- Statutory instruments under the EPBC Act including management plans, bioregional plans and conservation advice (if relevant; Section 2.1.2.2)
- Acceptability criteria (Section 7.2.4), including:
    - the principles of ESD, specifically:
        - Integration principle (decision-making processes should effectively integrate long-term and short-term economic, environmental, social, and equitable considerations)
        - Intergenerational principle (ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations)
        - biodiversity (conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making)
    - legislative and other requirements
    - internal context
    - external context
- NOPSEMA Offshore project proposal decision making Guideline (N-04750-GL1721 A524696, Jan 2024), NOPSEMA Offshore project proposal content requirements Guidance Note (N-04790-GN1663 A473026, January 2024)
- Scientific literature.

Table 7-6 presents the defined acceptable levels for the East Coast Project and justification for these levels which are based on the above listed criteria.

EPOs are defined in Section 5 of the OPGGS(E)R as:

> *"specific to the particular activity and environment in which the activity is to be undertaken. Outcomes are required to be set so titleholders can demonstrate their environmental performance meets or betters the acceptable level of impacts or risks for the activity. Titleholders are required to set specific, measurable benchmarks for their environmental performance that can be monitored and can enable a determination as to whether those outcomes are being met".*

Cooper Energy has developed EPOs for the East Coast Project that are consistent with the principles of ESD (specifically the integration, intergenerational and biodiversity principles); encompass the relevant acceptable level and environmental impact and/ or risk; and establish environmental performance levels better than or below the defined acceptable levels, as per NOPSEMA's Guidance Note for OPP Content Requirements (N-04790-GN1663, January 2024). The EPOs for the East Coast Project will be achieved through implementing the control measures described and attributed to the impacts and risks.

Table 7-6 also provides a summary of the EPOs against the relevant defined acceptable levels and justification for the EPOs for consistency against the acceptable levels and the listed acceptability criteria.

The demonstration acceptability, including the comparison of predicted levels of impact and risk against defined acceptable levels, justification for how each aspect meets the principles of ESD and how the environmental performance outcomes are met (including control measures) is provided in the Demonstration of Acceptability and Environmental Performance sections within Section 8 and Section 9.

For unplanned aspects, the EPO is that the unplanned risk event ('top event') does not occur. As such, acceptable levels are defined for impacts and risks associated with planned aspects; and for impacts only for unplanned aspects.

*Table 7-6: Defined acceptable levels and environmental performance outcomes for each impact type including source justification*

| Impact type | Change in air quality |
|---|---|
| **Defined acceptable level of impact** | **AL1**: Activities defined in this OPP that generate atmospheric emissions resulting in localised change in air quality will comply with MARPOL Annex VI (Prevention of Air Pollution from Ships) enacted in the *Navigation Act 2012*, with any difference from regional baseline being temporary[10]. |
| **EPO (impacts)** | **EPO1:** Manage atmospheric emissions generated by activities defined in this OPP in accordance with MARPOL Annex VI (Prevention of Air Pollution from Ships) enacted in the *Navigation Act 2012*, with no impacts to amenity outside of the operational area. |
| **How the EPO is consistent with the defined acceptable level** | EPO1 is specific to relevant aspects of the East Coast Project with the potential to change air quality (non-GHG atmospheric emissions) as defined in Section 8.4.2. EPO1 is equivalent to AL1, as both refer to the compliance against MARPOL Annex VI. Cooper Energy's control measure - Marine Assurance Process will be implemented to ensure atmospheric emissions are managed accordance with MARPOL Annex VI (refer Section 8.4.5 and 8.4.6). This control measure (Marine Assurance Process) will ensure the EPO is achieved and the defined acceptable level is met. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |
| *Navigation Act 2012* | This Act invokes the requirements of MARPOL Annex VI (Prevention of Air Pollution from Ships). EPO1 and AL1 are based on the compliance of East Coast Project atmospheric emissions in accordance with MARPOL Annex VI (Prevention of Air Pollution from Ships) enacted in the *Navigation Act 2012*. The direct reference to MARPOL Annex VI and this Act in EPO1 and AL1 ensures atmospheric emissions from vessel operations during the East Coast Project meet these requirements. |
| National Environment Protection (Ambient Air Quality) Measure (CoA, 1998) | The National Environment Protection (Ambient Air Quality) Measure environmental performance outcome is for 'ambient air quality that allows for the adequate protection of human health and well-being'. EPO1 and AL1 ensures atmospheric emissions resulting in change in air quality is managed in accordance with MARPOL Annex VI. Compliance with MARPOL Annex VI during the East Coast Project will ensure ambient air quality for personnel on vessels will be protected in accordance with NEPM ambient air quality standards for the adequate protection of human health and well-being. |
| EPBC Act | The Commonwealth marine area, which includes the airspace over Commonwealth waters, is a protected matter under the EPBC Act. The EPBC Act requires an assessment of potential environmental impacts to protected matters which include impacts to the airspace of the Commonwealth marine area. The significant impact guidelines for MNES defines an action is likely to have a significant impact on the environment in a Commonwealth marine area if there is a real chance or possibility that the action will result in a substantial change in air quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. Compliance with MARPOL Annex VI during the East Coast Project, as well as the temporary nature of the sources of the emissions, will ensure changes in air quality will not result in impacts to EPBC Act listed fauna and all fauna in general as detailed in Section 8.4.4. By preventing a pathway to impacts to fauna, the objects of the EPBC Act to provide for the protection of the environment and to promote the conservation of biodiversity is met by achieving EPO1 and AL1. |

[10] *temporary based on the short-term duration of activities undertaken in the East Coast Project that may generate atmospheric emissions as defined in Section 8.4.2.*

| | |
|---|---|
| Principles of ESD (integration principle) | Stakeholders and the public have had the opportunity to provide feedback regarding impacts to air quality. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period. No feedback specific to air quality aspects was received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project.<br>The acceptable level has been defined based on the existing environment (Section 6.4.1) and the impact and risk evaluation (Section 8.4) which considers external context.<br>The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material imbalance between the long-term and short-term economic, environmental, social and equitable factors. This together with consideration of external context (embedded in) the risk management process to define these acceptable levels ensures consistency with the integration principle of ESD. |
| Principles of ESD (intergenerational principle) | EPO1 and AL1 are consistent with the intergenerational principle of ESD by ensuring the localised and temporary changes in air quality from atmospheric emissions is compliant with NEPM ambient air quality standards for human health and well-being. Potential impacts to air quality at or below this level will ensure the protection of air quality to conserve the health, diversity and productivity of the environment for future generations. |
| Principles of ESD (biodiversity principle) | EPO1 and AL1 are consistent with the biodiversity principle of ESD through alignment with NEPM and the objectives of the EPBC Act, which inherently protects offshore air quality which is considered to be included in the MNES of the Commonwealth marine area. Potential impacts to air quality at or below this level would prevent long-term air quality changes which may adversely affect conservation of biological diversity and ecological integrity. |
| **Impact type** | **Change in water quality** |
| **Defined acceptable level of impact** | **AL2:** Water quality beyond 1000 m of the discharge location is within the range for water typical of the wider Otway offshore marine environment, with any difference from regional baseline being temporary[11]. Planned project discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure.<br>**AL3:** Unplanned loss of containment (hydrocarbons and chemicals) is unacceptable. |
| **EPO (impacts)** | **EPO2:** Undertake drilling discharges management processes to reduce as far as practicable the overall volumes of WBDF discharged to the marine environment.<br>**EPO3:** Contingent use of SBDF only where technically required<br>**EPO4:** Only approved chemicals (which meet low ecotoxicity pre-screening criteria or are further justified as ALARP) will be discharged to sea.<br>**EPO5:** Use solids control equipment, when drilling with riser installed, to recover and limit discharge of excess drilling fluids (and SBDF on cuttings) to the environment<br>**EPO6:** Manage discharge of residual bulks materials to the marine environment in accordance with Cooper Energy's residual bulks management process. No bulk discharge of SBDF.<br>**EPO7:** Planned vessel/ MODU discharges will meet AMSA Discharge Standards for operating in Australian waters. |
| **EPO (risks)** | **EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment. |

*[11] temporary based on the short-term duration of activities undertaken in the East Coast Project that will generate the discharge as defined in Section 8.6 (Drilling Discharges) and Section 8.7 (Operational Discharges).*

| | |
|---|---|
| **How the EPO is consistent with the defined acceptable level** | The above listed EPOs are specific to aspects of the East Coast Project with the potential to change water quality including planned operational and drilling discharges, and unplanned releases associated with minor loss of containment of chemicals or hydrocarbons, the accidental release of MDO or release of hydrocarbons from a LOWC event.<br>Potential impacts to water quality from planned project discharges is limited to within 1000 m of the discharge location (Section 8.6.4.1 and 8.7.4.1). AL2 has therefore been defined based on this spatial extent, which is met when the EPOs 2 to 6 are achieved through the application of supporting control measures (Section 8.6.5).<br>Australia implements a range of international and domestic regulations and standards that must be followed when operating in Australian waters to protect the Australian environment from shipping-related pollution when operating in the maritime industry (https://www.amsa.gov.au/marine-environment/marine-pollution/discharge-standards). The EPO7 ensures consistency with these discharge standards. These standards are aligned to MARPOL which has been updated by amendments and informed by 'circulars' over the years accounting for new information, techniques and technologies for managing pollution from ships. MARPOL currently includes six technical Annexes with strict operational controls for operating in the marine environment.<br>Potential risks to water quality from unplanned releases associated with minor loss of containment, or the accidental release of MDO, or loss of hydrocarbons from a LOWC will not occur if these events are prevented. EPO8 describes no unplanned release of chemicals or hydrocarbons to the marine environment, therefore both AL2 and AL3 are met when EPO8 is achieved.<br>The above listed EPOs are therefore considered consistent with AL2 and AL3 such that if the EPOs are achieved, the acceptable level is met. Control measures which ensure the EPOs are achieved and impacts and risks are at or below the defined acceptable level are detailed in Sections 8.6.5, 8.7.5, 9.2.6, 9.5.6, and 9.6.6. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |
| Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) | The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) outline levels of protection for marine water quality. The operational area is considered a 'slightly to moderately disturbed system' for the purpose of defining an acceptable level of impact to water quality against these guidelines. This is defined as ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity and these are typically marine systems adjacent to metropolitan areas (ANZG, 2018). The guidelines state that the key objective is maintenance of biological diversity and advise a precautionary approach for assessment (ANZG, 2018).<br>AL2 limits the changes to water quality to within 1,000 m of the discharge location in offshore waters and the return to baseline conditions following planned discharges. AL2 is met by achieving EPOs 2 to 7 and ensure planned changes in water quality to be localised and temporary which will ensure the maintenance of biological diversity.<br>AL3 and EPO8 ensures the prevention of unplanned release of chemicals or hydrocarbons which will ensure the maintenance of biological diversity. |
| EPBC Act | The Commonwealth marine area, which includes Commonwealth waters, is a protected matter under the EPBC Act. The EPBC Act requires an assessment of potential environmental impacts to protected matters which includes impacts to water of the Commonwealth marine area. The significant impact guidelines for MNES defines an action is likely to have a significant impact on the environment in a Commonwealth marine area if there is a real chance or possibility that the action will result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.<br>AL2 limits changes to water quality to within 1,000 m of the planned discharge location in offshore waters and the return to baseline conditions following planned discharges. AL2 is met by achieving EPOs 2 to 7 and ensure planned changes in water quality to be localised and temporary; which ensures changes in water quality will not be substantial which may adversely impact on biodiversity, ecological integrity, social amenity or human health.<br>AL3 and EPO8 ensure the prevention of unplanned release of chemicals or hydrocarbons which ensures changes in water quality will not be substantial which may adversely impact on biodiversity, ecological integrity, social amenity or human health. |

| | |
|---|---|
| Principles of ESD (integration principle) | Stakeholders and the public have had the opportunity to provide feedback regarding impacts to water quality. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period. No feedback specific to water quality aspects was received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project.<br>The acceptable level has been defined based on the existing environment (Sections 6.4.6, 6.5, 6.7 and 6.8) and the impact and risk evaluation (Sections 8.6 and 8.7) which considers external context.<br>The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material imbalance between the long-term and short-term economic, environmental, social and equitable factors. This together with consideration of external context (embedded in) the risk management process to define these acceptable levels ensures consistency with the integration principle of ESD. |
| Principles of ESD (intergenerational principle) | AL2, AL3 and EPOs 2 to 8 are consistent with the intergenerational principle of ESD by ensuring the localised and temporary changes in water quality from drilling and operational discharges and the prevention of unplanned release of chemicals or hydrocarbons aligns with the EPBC Act to prevent a substantial change in water quality which may adversely affect biodiversity, ecological integrity, social amenity or human health. By achieving EPOs 2 to 8, which ensures AL2 and AL3 are met, this allows for the protection of water quality to conserve the health, diversity and productivity of the environment for future generations. |
| Principles of ESD (biodiversity principle) | AL2, AL3 and EPOs 2 to 8 are consistent with the biodiversity principle of ESD through alignment with the objectives of the EPBC Act and Australia and New Zealand Guidelines for Fresh and Marine Water Quality, which outline protection and promotion of biological diversity. Potential impacts to water quality at or below this level and the prevention of unplanned release of chemicals or hydrocarbons events would prevent substantial water quality changes which may adversely affect conservation of biological diversity and ecological integrity. |
| **Impact type** | **Change in sediment quality** |
| **Defined acceptable level of impact** | **AL4:** Sediment quality beyond 1000 m of the discharge location is within the range for sediments typical of the wider Otway offshore marine environment.<br>Planned project discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure. |
| **EPO (impacts)** | **EPO2:** Undertake drilling discharges management processes to minimise as far as practicable the overall volumes of WBDF discharged to the marine environment.<br>**EPO3:** Contingent use of SBDF only where technically required<br>**EPO4:** Only approved chemicals (which meet low ecotoxicity pre-screening criteria or are further justified as ALARP) will be discharged to sea.<br>**EPO5:** Use solids control equipment, when riser is installed, to recover and reduce discharge of excess drilling fluids (and SBDF on cuttings) to the environment<br>**EPO6:** Manage discharge of residual bulks materials to the marine environment in accordance with Cooper Energy's residual bulks management process. No bulk discharge of SBDF.<br>**EPO7:** Planned vessel/ MODU discharges will meet AMSA Discharge Standards for operating in Australian waters. |
| **How the EPO is consistent with the defined acceptable level** | EPOs 2 to 7 are specific to aspects of the East Coast Project with the potential to change sediment quality including planned operational and drilling discharges. |

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| | Potential impacts to sediment quality from planned discharges is limited to 1,000 m of the discharge location (Sections 8.6.4.2 and 8.7.4.2). AL4 has therefore been defined based on this spatial extent, which is met when the EPOs 2 to 7 are achieved through the application of supporting control measures (Section 8.6.5).<br>Australia implements a range of international and domestic regulations and standards that must be followed when operating in Australian waters to protect the Australian environment from shipping-related pollution when operating in the maritime industry (https://www.amsa.gov.au/marine-environment/marine-pollution/discharge-standards). EPO7 ensures consistency with these discharge standards. These standards are aligned to MARPOL which has been updated by amendments and informed by 'circulars' over the years accounting for new information, techniques and technologies for managing pollution from ships. MARPOL currently includes six technical Annexes with strict operational controls for operating in the marine environment. EPOs 2 to 7 are therefore considered consistent with AL4 such that if the EPOs are achieved, the acceptable level is met. Control measures which ensure the EPOs are achieved and impacts and risks are at or below the defined acceptable level are detailed in Sections 8.6.5 and 8.7.5. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |
| Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) | The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) identifies toxicants for sediment quality. The operational area is considered a 'slightly to moderately disturbed system' for the purpose of defining an acceptable level of impact to sediment quality against these guidelines. This is defined as ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity and these are typically marine systems adjacent to metropolitan areas (ANZG, 2018). The guidelines state that the key objective is maintenance of biological diversity and advise a precautionary approach for assessment (ANZG, 2018).<br>AL4 limits changes to sediment quality to within 1,000 m of the discharge location in offshore waters in sediments typical of the offshore marine environment in the wider Otway Basin area. AL4 is met by achieving EPOs 2 to 7. AL4 and these EPOs ensures planned changes in sediment quality to be localised and limited to sediments typical of the region which will ensure the maintenance of biological diversity. |
| EPBC Act | The Commonwealth marine area, which includes the seabed under Commonwealth waters, is a protected matter under the EPBC Act. The EPBC Act requires an assessment of potential environmental impacts to protected matters which includes impacts to the seabed of the Commonwealth marine area. The significant impact guidelines for MNES defines an action is likely to have a significant impact on the environment in a Commonwealth marine area if there is a real chance or possibility that the action will result changes to seabed quality that adversely affect biodiversity and ecological integrity, social amenity or human health. This significant impact criterion is incorporated into the acceptable level to meet the objects of the EPBC Act to provide for the protection of the environment and to promote the conservation of biodiversity.<br>AL4 limits changes to sediment quality to 1,000 m of the discharge location in offshore waters in sediments typical of the offshore marine environment in the wider Otway Basin area. AL4 is met by achieving EPOs 2 to 7. AL4 and these EPOs ensures planned changes in sediment quality to be localised and limited to sediments typical of the region which prevents changes to seabed quality that adversely affects biodiversity, ecological integrity, social amenity or human health. |
| Principles of ESD (integration principle) | Stakeholders and the public have had the opportunity to provide feedback regarding impacts to air quality. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period. No feedback specific to sediment quality aspects was received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project.<br>The acceptable level has been defined based on the existing environment (Sections 6.4.7, 6.5, 6.7 and 6.8) and the impact and risk evaluation (Sections 8.6 and 8.7) which considers external context.<br>The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material |

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| | imbalance between the long-term and short-term economic, environmental, social and equitable factors. This together with consideration of external context (embedded in) the risk management process to define these acceptable levels ensures consistency with the integration principle of ESD. |
| Principles of ESD (intergenerational principle) | AL4 and EPOs 2 to 7 are consistent with the intergenerational principle of ESD by ensuring the localised changes in sediment quality from drilling and operational discharges aligns with the EPBC Act to prevent a substantial change in sediment quality which may adversely affect biodiversity, ecological integrity, social amenity or human health. By achieving EPOs 2 to 6, which ensures AL4 is met, this allows for the protection of sediment quality to conserve the health, diversity and productivity of the environment for future generations. |
| Principles of ESD (biodiversity principle) | AL4 and EPOs 2 to 7 are consistent with the biodiversity principle of ESD through alignment with the objectives of the EPBC Act and Australia and New Zealand Guidelines for Fresh and Marine Water Quality, which outline protection and promotion of biological diversity. Potential impacts to sediment quality at or below this level would prevent substantial sediment quality changes which may adversely affect conservation of biological diversity and ecological integrity. |
| **Impact type** | **Change in ambient light** |
| **Defined acceptable level of impact** | **AL5**: Artificial light from project activities defined in this OPP will not exceed lighting levels required for navigation and safe operation, with any change in ambient light levels being temporary[12]. Lighting management measures will be applied during offshore campaigns and will be informed by the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k), to ensure biologically important behaviours of light sensitive species can continue. |
| **EPO (impacts)** | **EPO9:** Artificial light generated by the Activity will be managed to ensure biologically important behaviours of light-sensitive species that occur within the Activity light EMBA can continue while project activities are being undertaken, by applying relevant measures from the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k), whilst meeting lighting requirements for safe navigation and work at night. |
| **How the EPO is consistent with the defined acceptable level** | EPO9 is specific to relevant aspects of the East Coast Project with the potential to change ambient light (light emissions) as defined in Section 8.3.2. EPO9 is equivalent to AL5, as both refer to the application of the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k). EPO9 also provides for adherence to lighting requirements for safe navigation and work at night on board campaign vessels and MODU adhere to navigational and safety requirements, and are managed accordance with these guidelines. Section 8.3.5 outlines the control measures including CM1 Marine Assurance Process, and CM4 Light Management Measures, together with CM22, Modelling Review, ensure EPO9 will be met. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |
| EPBC Act | The Commonwealth marine area is a protected matter under the EPBC Act. The EPBC Act requires an assessment of potential environmental impacts to protected matters which includes modification of important or substantial areas of habitat within the Commonwealth marine area. The significant impact guidelines for MNES defines an action is likely to have a significant impact on the environment in a Commonwealth marine area if there is a real chance or possibility that the action will modify an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area. This significant impact criterion is incorporated into the acceptable level to meet the objects of the EPBC Act to provide for the protection of the environment and to promote the conservation of biodiversity. |

[12] *Temporary based on the short-term duration of activities undertaken in the East Coast Project that will generate artificial light as defined in Section 8.3 (Light Emissions)*

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| | EPO9 and AL5 ensures light emissions resulting in change in ambient light is managed to meet safe operations and working requirements whilst also applying the National Light Pollution Guidelines during the East Coast Project, to ensure ambient light will be managed so that light sensitive species can continue to undertake biologically important behaviours while project activities are being undertaken. |
| National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k) | The Guidelines outline the process to be followed where there is the potential for artificial lighting to affect wildlife. Applying the recommendations within Guidelines and implementing effective controls can reduce the impact of light to sensitive receptors. The recommendations within the Guidelines have been used to identify effective control measures that will be implemented reduce the potential impacts of light emissions from the East Coast Project.<br>EPO9 and AL5 are based on the compliance of East Coast Project light emissions in accordance with the Guidelines. The direct reference to the Guidelines in EPO9 and AL5 ensures light emissions during the East Coast Project meet these requirements. |
| Principles of ESD (integration principle) | Stakeholders and the public have had the opportunity to provide feedback regarding impacts to ambient light. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period. No feedback specific to ambient light aspects was received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project<br>The acceptable level has been defined based on the existing environment (Sections 6.4.8, 6.5, 6.7 and 6.8) and the impact and risk evaluation (Sections 8.3) considers external context. The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material imbalance between the long-term and short-term economic, environmental, social and equitable factors. |
| Principles of ESD (intergenerational principle) | EPO9 and AL5 are consistent with the intergenerational principle of ESD by ensuring the localised and temporary changes in ambient light levels from Project light emissions aligns with the EPBC Act to prevent a substantial change in ambient light levels which may adversely affect biodiversity, ecological integrity, social amenity or human health. Potential impacts to ambient light at or below this level will ensure the protection of light-sensitive receptors to conserve the health, diversity and productivity of the environment for future generations. |
| Principles of ESD (biodiversity principle) | EPO9 and AL5 are consistent with the biodiversity principle of ESD through alignment with the objectives of the EPBC Act and recommendations of the Guidelines, which outline protection and promotion of biological diversity. Potential impacts to ambient light at or below this level would prevent substantial changes to ambient light levels which may adversely affect conservation of biological diversity and ecological integrity. |
| **Impact type** | **Change in habitat** |
| **Defined acceptable levels of impact** | **AL3:** Unplanned loss of containment (hydrocarbons and chemicals) is unacceptable.<br>**AL4:** Sediment quality beyond 1000 m of the discharge location is within the range for sediments typical of the wider Otway offshore marine environment.<br>Planned project discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure.<br>**AL6:** No unrecoverable impacts to seabed including shelf rocky reef and hard substrate KEF values[13].<br>**AL7:** Seabed disturbance will not occur outside the Operational Area |

[13] *The values of the shelf rocky reefs and hard substrate are defined within the DCCEEW SPRAT database as: '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*

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| | **AL8:** Unplanned release of waste from project activities to the marine environment is unacceptable.<br>**AL9:** Introduction, establishment or spread of invasive marine species is unacceptable. |
| **EPO (impacts)** | **EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the *Underwater Cultural Heritage Act 2018*.<br>**EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts, including potential changes to seabed quality.<br>**EPO12:** Seabed disturbance is limited to the planned disturbance areas defined in this OPP* and within the Operational Area.<br>*Planned disturbance areas are described in Table 8-63.. |
| **EPO (risks)** | **EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment.<br>**EPO13**: No unplanned release of waste to the marine environment.<br>**EPO14**: No introduction, establishment or spread of invasive marine species |
| **How the EPO is consistent with the defined acceptable level** | EPOs 8 and 10 to 14 are specific to aspects of the East Coast Project with the potential to change habitat including:<br>• planned drilling discharges<br>• seabed disturbance<br>• loss of materials or waste overboard<br>• unplanned introduction, establishment and spread of IMS<br>• accidental release of MDO and LOWC.<br>Potential impacts to habitat from planned drilling discharges and seabed disturbance will not occur outside the Operational Area as defined in AL4 and AL7 respectively.<br>Potential impacts are expected to be limited to areas of patchy epifauna and hard substrates which represents the value of the not spatially delineated Shelf rocky reefs and hard substrates KEF (Section 8.6.4.3, 8.8.4.1). For seabed disturbance, installation of subsea equipment will provide additional hard and complex substrate for attachment, which will facilitate high levels of recovery of epifauna on areas of the seabed that would have been disturbed. AL6 has therefore been defined based on no permanent and unrecoverable impacts to shelf rocky reef and hard substrate KEF values[13], which is met when EPOs 10 to 14 are achieved through the application of supporting control measures (Section 8.6.5, 8.8.5).<br>Potential risks to habitat from IMS, the loss of materials or waste overboard, minor loss of containment and accidental release of MDO and LOWC will not occur if these events are prevented. EPOs 8, 13 and 14 describe no introduction of IMS or unplanned release of waste, chemicals or hydrocarbons to the marine environment. Therefore, AL3, AL8 and AL9 are met when EPOs 8, 13 and 14 are achieved through the application of supporting control measures (Section 9.1.5, 9.5.6, 9.6.6).<br>EPOs 8 and 10 to 12 are therefore considered consistent with ALs 3 and 6 to 9 such that if the EPOs are achieved, the acceptable level is met. Control measures which ensure the EPOs are achieved and impacts and risks are at or below the defined acceptable level are detailed in Sections 8.6.5, 8.8.5, 9.1.6, 9.5.6, and 9.6.6. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |

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| EPBC Act | The Commonwealth marine area is a protected matter under the EPBC Act. The EPBC Act requires an assessment of potential environmental impacts to protected matters which includes modification of important or substantial areas of habitat within the Commonwealth marine area. The significant impact guidelines for MNES defines an action is likely to have a significant impact on the environment in a Commonwealth marine area if there is a real chance or possibility that the action will modify an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area. KEFs are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity. Therefore, substantial modification of KEFs is considered a significant impact. This significant impact criterion is incorporated into the acceptable level to meet the objects of the EPBC Act to provide for the protection of the environment and to promote the conservation of biodiversity.<br>AL3, 7, 8 and 9 ensures no unplanned events resulting in change in habitat occurs. AL6 ensures no unrecoverable impacts to shelf rocky reef and hard substrate KEF values[1]. ALs 3 and 6 to 9 are met by achieving EPOs 8 and 10 to 14 which ensures planned localised impacts to shelf rocky reef and hard substrate KEF values[1] and the prevention of unplanned release of waste, chemicals or hydrocarbons to the marine environment, which will ensure the promotion and protection of biodiversity in the region. |
| Principles of ESD (integration principle) | Stakeholders and the public have had the opportunity to provide feedback regarding changes to habitats. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period. No feedback specific to habitat aspects was received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project<br>Feedback received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project has been incorporated where relevant to define ALs, EPOs, and control measures.<br>The acceptable level has been defined based on the existing environment (Sections 6.5.1, 6.5.2, 6.6 and 6.8) and the impact and risk evaluation (Sections 8.6,8.7,8.8,9.1,9.4,9.5 and 9.6) considers external context. The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material imbalance between the long-term and short-term economic, environmental, social and equitable factors. |
| Principles of ESD (intergenerational principle) | ALs 3 and 6 to 10 and EPOs 8 and 10 to 14 are consistent with the intergenerational principle of ESD by ensuring the localised changes in habitats and prevention of unplanned release of waste, chemicals or hydrocarbons to the marine environment aligns with the EPBC Act to prevent a substantial change which may adversely affect biodiversity, ecological integrity, social amenity or human health. By achieving EPOs 8 and 11 to 15, which ensures ALs 3 and 8 to 10 are met, thus allows for the protection of habitats to conserve the health, diversity and productivity of the environment for future generations. |
| Principles of ESD (biodiversity principle) | ALs 3 and 7 to 9 and EPOs 8 and 10 to 14 are consistent with the biodiversity principle of ESD through alignment with the objectives of the EPBC Act, which outline protection and promotion of biological diversity. Potential impacts to habitats at or below this level and prevention of unplanned release of waste, chemicals or hydrocarbons to the marine environment would prevent substantial changes to habitats which may adversely affect conservation of biological diversity and ecological integrity. |
| **Impact type** | **Increase in GHG emissions**<br>**Change in climate systems**<br>**Change in ecosystems**<br>**Change in socio-economic factors** |
| **Defined acceptable level of impact** | **AL10:** GHG Emissions from activities defined in this OPP will not interfere with Australia's greenhouse gas commitments under the Paris Agreement, enacted in the *Climate Change Act 2022* and managed by the safeguard mechanism. |

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| **EPO (impacts)** | **EPO15:** GHG emissions related to the Project, including (scope 1 [Inside Project Boundary], scope 1* [Outside Project Boundary] and scope 3) emissions are consistent with Australia's international GHG emissions commitments, as outlined in the *Climate Change Act 2022.* Emissions are to be determined based on the NGER scheme and managed by the Safeguard Mechanism. |
| **How the EPO is consistent with the defined acceptable level** | As per EPO15, direct and indirect GHG emissions from the East Coast Project will be consistent with Australia's international GHG emissions commitments, as outlined in the *Climate Change Act 2022.* This EPO is consistent with AL10 given emissions associated with the East Coast Project will have a minor contribution to carbon budgets in line with these commitments, as described in Section 8.5.5. Control measures which ensure EPO15 is achieved and therefore AL10 is met are outlined in Section 8.5.6. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |
| *Climate Change Act 2022* | The Australian Government is signatory to the Paris Agreement which set global long-term temperature goals. Under Article 2 a long-term temperature goal was set to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.<br>Australia's Nationally Determined Contribution (NDC) was updated under the *Climate Change Act 2022* (Cth). This commits Australia to a target of net zero emissions by 2050 and to reduce greenhouse gas emissions by 43% from 2005 levels. |
| Principles of ESD (integration principle) | Stakeholders have been consulted and the public has had the opportunity to provide feedback regarding GHG emissions and change in climate systems/ ecosystems and socio economic factors. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period. No feedback specific to GHG emissions aspects was received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project<br>The acceptable level has been defined based on the existing environment (Section 6) and the impact and risk evaluation (Section 8.5) which considers external context. The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material imbalance between the long-term and short-term economic, environmental, social and equitable factors. |
| Principles of ESD (intergenerational principle) | AL10 and EPO15 are consistent with the intergenerational principle of ESD by aligning with Australia's commitments under the *Climate Change Act 2022*, which are in line with the Paris Agreement. The intergenerational principle of ESD and the Paris Agreement uphold the protection of the environment for future generations by addressing climate change, preventing possible adverse effects to biodiversity, ecological integrity, social amenity or human health. AL10 and EPO15 ensure East Coast Project activities will not prevent Australia from meeting its GHG commitments, and thus contribute to conserving the health, diversity and productivity of the environment for future generations. |
| Principles of ESD (biodiversity principle) | AL10 and EPO15 are consistent with the biodiversity principle of ESD by aligning with Australia's commitments under the *Climate Change Act 2022*, which are in line with the Paris Agreement. The Agreement aims to safeguard biodiversity and upholds the protection of ecosystems, including oceans, through addressing climate change. AL10 and EPO15 ensure East Coast Project activities will not prevent Australia from meeting its GHG commitments and thus contribute to safeguarding biodiversity. |
| **Impact type** | **Change in ambient sound**<br>**Change in fauna behaviour**<br>**Injury / mortality to marine fauna**<br>**Auditory injury to marine fauna** |

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| **Defined acceptable level of impact** | **AL11:** Changes to ambient underwater sound from project activities will be characterised through modelling and/or monitoring, and impacts and risks will not be inconsistent with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species.<br>**AL12:** Impacts and risks to commercially targeted species will not threaten Australian commercial fish stocks.<br>**AL3:** Unplanned loss of containment (hydrocarbons and chemicals) is unacceptable.<br>**AL8:** Unplanned release of waste from project activities to the marine environment is unacceptable.<br>**AL13:** Unplanned vessel strike to EPBC Act listed threatened, migratory or cetacean species due to this project's activities is unacceptable. |
| **EPO (impacts)** | **EPO16:** Impacts to marine fauna from underwater anthropogenic noise emissions will be limited to temporary* behavioural change localised** to the noise source.<br>*Not exceeding the duration of the activity component (i.e. vessel campaign) (described in Section 8.1.2 and 8.2.2)<br>**Not exceeding the noise EMBA defined for the activity (described in Section 8.1.5 and 8.2.5)<br>**EPO17:** No death or injury[14] to EPBC Act listed threatened, migratory or cetacean species.<br>**EPO18:** Project related underwater noise within biologically important areas[14]and habitat critical to the survival of relevant species will be managed through the implementation of Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process, such that:<br>• Any blue whale continues to utilise biologically important areas without injury and is not displaced from a foraging area.<br>• Southern right whales are not prevented from utilising biologically important areas[15] or habitat critical to the survival of a species or cause auditory impairment.<br>• The risk of behavioural disturbance to southern right whales will be limited to temporary behavioural disturbance of individuals.<br>**EPO19:** Impacts to commercially targeted species will be limited to temporary[16] and localised[16] change in fauna behaviours.<br>**EPO20:** For activity specific environment plans undertake review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. |
| **EPO (risks)** | **EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment.<br>**EPO13**: No unplanned release of waste to the marine environment<br>**EPO21:** No vessel strike with EPBC Act listed threatened, migratory or cetacean species. |
| **How the EPO is consistent with the defined acceptable level** | EPOs 9 and 16 to 20 are specific to aspects of the East Coast Project with the potential to change ambient sound (impulsive and continuous underwater sound emissions) as defined in Sections 8.1.2 and 8.2.2.that may cause behavioural change, injury, auditory injury or mortality to EPBC Act listed threatened, migratory or cetacean species, including:<br>• underwater sound emissions<br>• light emissions |

[14] *Injury to cetaceans as defined as either auditory impairment (TTS or PTS) (DAWE 2021) or auditory injury (AUD INJ) i.e. Damage to the inner ear that can result in destruction of tissue, such as the loss of cochlear neuron synapses or auditory neuropathy (Houser 2021; Finneran 2024). Auditory injury may or may not result in a permanent threshold shift (PTS).*
[15] *Biologically important behaviours such as reproduction, feeding, migration and resting (DCCEEW, 2023).*
[16] *Temporary and localised change in fauna behaviours for commercially targeted species limited to activity durations and seabed disturbance footprint defined in Section 8.8.2.*

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| | • planned drilling and operational discharges<br>• loss of materials or waste overboard<br>• interactions with marine fauna<br>• accidental release of MDO and LOWC.<br>EPOs 9,16 and 18 ensures the potential risks of behavioural change to EPBC Act listed threatened, migratory or cetacean species from light and underwater sound emissions will be managed under Cooper Energy's Light Management Measures and Offshore Victoria Whale Disturbance Risk Management Process. Implementing these controls will achieve the EPOs to ensure impacts and risks to fauna from from light and underwater sound emissions comply with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. By achieving these EPOs, AL11 is met which proves EPOs 9, 16 and 18 are consistent with AL11. Control measures which ensure EPOs 9, 16 and 18 are achieved and AL11 is met are outlined in Sections 8.1.6 and 8.3.5.<br>Operational and maintenance advice for underwater radiated noise reduction, such as that described in MEPC.1/Circ.906 will be considered to assist in the reduction of underwater noise from campaign vessels (Sections 8.1.7 and 8.2.7). By achieving EPOs 16, 18 and 20 the spatial extent of potential risks of behavioural change, auditory injury, injury and mortality to EPBC Act listed threatened, migratory or cetacean species will be defined and therefore can be managed to ensure consistency with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. Therefore EPOs 16, 18 and 20 are consistent with AL11. Control measures which ensure EPOs 16, 18 and 20 are achieved and AL11 is met are outlined in Sections 8.1.6, 8.2.6, 8.3.5, 9.1.5, 9.3.5, 9.5.6 and 9.6.6.<br>EPO19 ensures the potential risks of behavioural change to commercially targeted marine fauna species will not lead to substantial adverse effects on the sustainability of commercial fish stocks. By achieving EPO19 the potential risk of exceeding AL12 is avoided.<br>Potential risks to marine fauna from vessel strike, the loss of materials or waste overboard, minor loss of containment and accidental release of MDO and LOWC will not occur if these events are prevented. EPOs 8, 13 and 21 describe no vessel strike or unplanned release of waste, chemicals or hydrocarbons to the marine environment. Therefore, AL3, AL8 and AL13 are met when EPOs 8, 13 and 21 are achieved through the application of supporting control measures (Section 9.1.5, 9.3.5, 9.5.6, 9.6.6).<br>EPOs 8,9 and 16 to 21 are therefore considered consistent with ALs 3, 8, 11 to 13 such that if the EPOs are achieved, the acceptable level is met. Control measures which ensure the EPOs are achieved and AL9 is met are detailed in Sections 8.1.6, 8.2.6, 8.3.5, 9.1.5, 9.3.5, 9.5.6 and 9.6.6. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |
| EPBC Act | The Commonwealth marine area is a protected matter under the EPBC Act. The EPBC Act requires an assessment of potential environmental impacts to protected matters which includes modification of important or substantial areas of habitat within the Commonwealth marine area. The significant impact guidelines for MNES defines an action is likely to have a significant impact on the environment in a Commonwealth marine area if there is a real chance or possibility that the action will modify an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area. This significant impact criterion is incorporated into the acceptable level to meet the objects of the EPBC Act to provide for the protection of the environment and to promote the conservation of biodiversity.<br>Primary or long-term objectives of species recovery plans and conservation advice include:<br>• Minimise anthropogenic threats to improve the population status of species, leading to the removal of the species from the threatened species list of the EPBC Act<br>• Ensuring that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future. |

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| | • Minimise further loss of habitat critical to the survival of species throughout Australia (including habitat predicted to become habitat critical in the future because of climate change).<br>These objectives of species recovery plans and conservation advice are created in accordance with the EPBC Act and principles of ESD.<br>ALs 3, 8, 11 to 13 ensures there will be no impact or risk to fauna that is inconsistent with published conservation advice, recovery plans or threat abatement plans. ALs 3, 8, 11 to 13 is met by achieving EPOs 8,9 and 16 to 21. ALs 3, 8, 11 to 13 and these EPOs ensure threatened, migratory and cetacean species are protected in line with the objectives of relevant EPBC management plans in addition to the prevention of vessel strikes and unplanned release of waste, chemicals or hydrocarbons to the marine environment, which upholds the promotion and protection of biodiversity in the region.<br>Adopting relevant and reasonably practicable approaches during the East Coast Project through implementation of Cooper Energy's Offshore Victoria Whale Disturbance Risk Management Process will ensure ambient sound is managed so that it will not result in an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area. |
| IMO's Revised Guidelines for the Reduction of Underwater Radiated Noise from Shipping to Address Adverse Impacts on Marine Life (MEPC.1/Circ.906) | Guidance on the reduction of underwater noise from any ship, taking into account their maintenance and operation.<br>Operational adjustments and maintenance measures should be considered as ways of reducing noise for existing ships. Operational approaches could be particularly important for ships that lack design features or technologies to reduce noise, or for all ships that operate in national and international designated protected areas where additional measures need to be taken to decrease the adverse impacts of shipping noise on marine wildlife.<br>Adopting relevant and reasonably practicable approaches to reduce underwater ambient sound during the East Coast Project through the maintenance of vessels under the Cooper Energy's Marine Assurance Process and the operation of vessels in accordance with Cooper Energy's Offshore Operational Procedures and Offshore Victoria Whale Disturbance Risk Management Process. |
| Principles of ESD (integration principle) | Stakeholders have been consulted and the public has had the opportunity to provide feedback regarding change in ambient underwater sound, change in fauna behaviour, auditory injury to marine fauna and injury / mortality to marine fauna. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period.<br>Feedback received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project has been incorporated where relevant to define ALs, EPOs, and control measures. During EP specific activity consultation, GMTOAC and members raised general concerns in relation to potential barriers to migration for whales and eels; during consultation day in February 2024, Cooper Energy described the mitigation measures applied during offshore vessel activities, including increased caution zones for whales. No further concerns have been raised with Cooper Energy on this aspect. Queries rather than objections, in relation to assessment of cumulative impacts of activities across the region have previously been raised, and these are further assessed in Section 11.<br>The acceptable levels have been defined based on the existing environment (Section 6) and the impact and risk evaluation (Sections 8.1 and 8.2) which considers external context. The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material imbalance between the long-term and short-term economic, environmental, social and equitable factors. |
| Principles of ESD (intergenerational principle) | ALs 3, 8, 11 to 13 and EPOs 8,9 and 16 to 21 are consistent with the intergenerational principle of ESD by:<br>• ensuring the localised and temporary changes in ambient sound levels from Project activities adopt relevant and reasonably practicable approaches with consideration to MEPC.1/Circ.906 to meet the objectives of the EPBC Act to prevent a substantial change in ambient sound levels which may adversely affect biodiversity, ecological integrity, social amenity or human health. Potential impacts to ambient sound at or below this level will ensure the protection of sound-sensitive receptors to conserve the health, diversity and productivity of the environment for future generations. |

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| | • aligning with the EPBC Act to provide for the protection of fauna which have the potential to be impacted by the East Coast Project. Achieving these EPOs ensures ALs 3, 8, 11 to 13 is met which upholds conservation of the health, diversity and productivity of the environment for future generations. |
| Principles of ESD (biodiversity principle) | ALs 3, 8, 11 to 13 and EPOs 8,9 and 16 to 21 are consistent with the biodiversity principle of ESD through:<br>alignment with the objectives of the EPBC Act, which outline protection and promotion of biological diversity. Potential impacts at or below these level and prevention of vessel strike and unplanned release of waste, chemicals or hydrocarbons to the marine environment would prevent substantial changes to fauna which may adversely affect conservation of biological diversity and ecological integrity. |
| **Impact type** | **Changes to the functions, interests and activities of other users** |
| **Defined acceptable level of impact** | **AL14:** No interference with other marine users to a greater extent than is necessary for the reasonable exercise of the rights and performance of duties as conferred by the titles granted to Cooper Energy.<br>**AL3:** Unplanned loss of containment (hydrocarbons and chemicals) is unacceptable.<br>**AL9:** Introduction, establishment or spread of invasive marine species is unacceptable. |
| **EPO (impacts)** | **EPO22**: Implement Fisheries Damages Protocol to provide a compensation mechanism to fishers who damage fishing equipment on East Coast Project infrastructure outside of the PSZ. |
| **EPO (risks)** | **EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment.<br>**EPO14:** No introduction, establishment or spread of invasive marine species.<br>**EPO23:** No unplanned interactions between the project vessels and other marine users. |
| **How the EPO is consistent with the defined acceptable level** | EPO22 is specific to aspects of the East Coast Project with the potential to cause changes to the functions, interests and activities of other users. EPO22 is consistent with AL14, as this EPO ensures other users of the marine environment have a means of raising concerns and being compensated if their activities or interests are impacted to a greater extent than is necessary for the project.<br>During the EP development process, and the Petroleum Safety Zone application process it is also necessary to consult with potentially impacted parties, and to have managed any ongoing objections. This is also relevant to meeting AL14, however, there is no EPO for this process because it is already established under the OPGGS Act Chapter 6, Part 6.6, and the Environment Regulations.<br>These EPOs and measures embedded within the OPGGS Act will ensure no interference with other marine users to a greater extent than is necessary, as defined in Section 8.8.6, and therefore is consistent with AL14. Control measures which ensure these EPOs are achieved and AL14 is met are outlined in Section 8.9.5.<br>EPOs 8, 14, 22 and 23 are specific to aspects which have the potential to impact the sustainability of commercial fisheries. These EPOs are consistent with ALs 15 given the prevention of IMS introduction and spread, unplanned release of chemicals and hydrocarbons, interactions between project vessels and other marine users, and implementation of Fisheries Damages Protocol will ensure no interference with other marine users to a greater extent than is necessary, as defined in Section 8.8.6. Control measures which ensure these EPOs are achieved and ALs 3, 9 and 14 are met are outlined in Section 8.8.5. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |

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| OPGGS Act | ALs 3, 9 and 14 and EPOs 8, 14, 22 and 23 are consistent with section 280(2)(a) and (b) of the OPGGS Act regarding the interference with navigation and fishing, respectively. This section outlines that a person (the first person) carrying on activities in an offshore area under the permit, lease, licence, authority or consent must carry on those activities in a manner that does not interfere with a range of other marine activities including navigation or fishing, to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person. ALs 3, 9 and 14 and EPOs 8, 14 to 23 are consistent with this requirement as impacts at or below the defined levels would not compromise the rights of other users or sustainability of commercial fisheries to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the Titleholder. |
| Principles of ESD (integration principle) | Stakeholders have been consulted and the public has had the opportunity to provide feedback regarding changes to the functions, interests and activities of other users. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period. Feedback received during recent Environment Plan consultations for the Otway Offshore CHN Operations and Athena Supply Project has not indicated that Cooper Energy's activities and associated exclusion zones in the Otway would result in objectives or claims.<br>The acceptable levels have been defined based on the existing environment (Section 6) and the impact and risk evaluation (Sections 8.9) which considers external context. The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material imbalance between the long-term and short-term economic, environmental, social and equitable factors. |
| Principles of ESD (intergenerational principle) | ALs 3, 9 and 14 and EPOs 8, 14, 22 and 23 are consistent with the intergenerational principle of ESD by preventing unnecessary interactions with other marine users. Through avoiding all unnecessary interference with other marine users, their functions, interests and activities are protected thus upholding conservation of the health, diversity and productivity of the environment for future generations. |
| Principles of ESD (biodiversity principle) | The biodiversity principle of ESD is not considered relevant to ALs 3, 9 and 14 and EPOs 8, 14, 22 and 23, as the functions, interests and activities of other marine users is focused on human activities rather than the ecological integrity of the environment. |
| **Impact type** | **Change in cultural heritage value** |
| **Defined acceptable level of impact** | **AL7:** Seabed disturbance will not occur outside the Operational Area<br>**AL14:** No interference with other marine users to a greater extent than is necessary for the reasonable exercise of the rights and performance of duties as conferred by the titles granted to Cooper Energy.<br>**AL15:** Evaluations of potential risks to intangible and tangible cultural heritage values from activities defined in this OPP remains current and accurately reflected.<br>**AL16:** Impacts and risks from activities defined in this OPP will not prevent the protection and conservation of underwater cultural heritage as defined under the *Underwater Cultural Heritage Act 2018*.<br>**AL17:** Impacts and risks from activities defined in this OPP will not lead to injury or desecration of objects or areas declared for protection under the *Aboriginal* and *Torres Strait Islander Heritage Protection Act 1984*.<br>**AL18:** Impacts and risks from activities defined in this OPP will not interfere with native title rights or interests as defined under Section 233 of the *Native Title Act 1993* (Cth), to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the Titleholder. |
| **EPO (impacts)** | **EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the *Underwater Cultural Heritage Act 2018*. |

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| | **EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts including potential changes to seabed quality.<br>**EPO12:** Seabed disturbance is limited to the planned disturbance areas defined in this OPP and within the Operational Area.<br>**EPO24**: No impact to underwater cultural heritage<br>**EPO25:** Undertake Ongoing Engagement with relevant First Nations groups to ensure identified tangible and intangible cultural heritage and potential risks to cultural heritage values remains current and its protection is provided for within EPs for the activity. |
| **How the EPO is consistent with the defined acceptable level** | EPOs 10, 11, 12, 24 and 25 are specific to all aspects of the East Coast Project with the potential to change cultural heritage values. As per the EPOs, the activity will be managed to prevent the disturbance of underwater cultural heritage and to ensure maintenance of the potential impact and risk evaluations against intrinsic links between First Nations people and cultural heritage values and Sea Country.<br>EPOs 10, 11, 12 are consistent with ALs 7, 14, and 16 as meeting these EPOs ensure impacts and risks will not exceed levels which prevent protection and conservation of underwater cultural heritage, which is consistent with the objective of the UCH Act to protect and conserve Australia's underwater cultural heritage, as demonstrated in Sections 8.6.5, 8.8.5, 9.1.5, and 10.4. Control measures which ensure the EPOs are achieved and impacts and risks are at or below the defined acceptable level are outline in Sections 8.6.6, 8.8.6, 9.1.6 and 10.5.<br>EPOs 24 and 25 are consistent with AL15 and 17 as meeting these EPOs ensures impacts and risks will not lead to injury or desecration of objects or areas declared for protection under the ATSHIP Act, of which significant Aboriginal areas or objects are considered elements of the environment which is a cultural feature, as demonstrated in Sections 8.8.5, 9.1.5, and 10.4. Control measures which ensure the EPOs are achieved and impacts and risks are at or below the defined acceptable level are outline in Sections 8.8.6, 9.1.6 and 10.5.<br>EPOs 12, 24 and 25 are consistent with AL15 and 19 as meeting these EPO ensures impacts and risks will not (excessively) interfere with native title rights or interests as defined under Section 233 of the *Native Title Act 1993* where interest in relation to land or waters means a restriction of the use of the land or waters, as demonstrated in Sections 8.8.5, 9.1.5, and 10.4. Control measures which ensure the EPO is achieved and impacts and risks are at or below the defined acceptable level are outlined in Sections 8.8.6, 9.1.6 and 10.5. |
| **Source of Acceptable Level/EPO Definition** | **Justification** |
| *Underwater Cultural Heritage Act 2018* (UCH Act)<br>Guidelines on the application of the UCH Act | The objective of the UCH Act is to provide for the identification, protection and conservation of Australia's underwater cultural heritage. The Act protects remains of vessels and aircraft (including Aboriginal and Torres Strait Islander traditional watercraft) that have been wholly or partially submerged in Australian waters for 75 years or longer. Other types of underwater cultural heritage, including First Nations archaeological heritage associated with dry-land habitation on the submerged Pleistocene landscapes on the Australian continental shelf and remains of shipwrecks or aircraft younger than 75 years, can also be declared by the Minister upon discovery (DCCEEW, 2024n). Protections are further defined under the UCH Act (DCCEEW, 2024n).<br>EPOs 10, 11 and 12 and ALs 7, 14, and 16 will ensure the protection of underwater cultural heritage in accordance with this Act. |
| *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (ATSHIP Act) | The ATSHIP Act provides protection to places and objects of particular significance from injury or desecration (DCCEEW, 2023s). The Commonwealth Minister for the Environment and Water can use the ATSIHP Act to make a declaration to protect an area or object for a specified period of time. The ATSHIP Act states that an area will be taken to be injured or desecrated if:<br>• it is used or treated in a manner inconsistent with Aboriginal tradition<br>• by reason of anything done in, on or near the area, the use or significance of the area in accordance with Aboriginal tradition is adversely affected, or<br>• passage through or over, or entry upon, the area by any person occurs in a manner inconsistent with Aboriginal tradition'<br>EPOs 24 and 25 and AL15 and 17 will ensure identification and protection of places and objects in accordance with this Act. |

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| *Native Title Act 1993*<br>OPGGS Act Section 280(2) | The acceptable level is consistent with the *Native Title Act 1993*, as this Act recognises and protects the rights and interests of native title holders. Section 280(2) of the OPGGS Act allows for a level of impact and risk within reason for the exercise of the Titleholders rights and duties.<br>No native title determinations or claims overlap the operational area. EPOs 12, 24 and 25 are consistent with AL15 and 18 will ensure the protection of the rights and interests of native title holders in accordance with this Act. |
| Principles of ESD (integration principle) | Stakeholders have been consulted and the public has had the opportunity to provide feedback regarding changes to the functions, interests and activities of other users. No concerns or feedback relating to this aspect were received during either the preliminary OPP consultation, or the Stage 2 public comment period.<br>The acceptable levels have been defined based on the existing environment (Section 6) and the impact and risk evaluation (Sections 8.9) which considers external context. The lack of objections raised through consultation and the public comment period, compared to other projects in the region, indicates that the nature and scale of the project activities, which tie back to pre-existing facilities to supply domestic gas for use now and for the duration of the project, are not of the level that triggered significant concerns in the wider community. It is therefore considered reasonable to conclude that stakeholders do not see a material imbalance between the long-term and short-term economic, environmental, social and equitable factors. |
| Principles of ESD (intergenerational principle) | EPOs 10, 11, 12, 24 and 25 and ALs 7, 14 to 18 are consistent with the intergenerational principle of ESD by aligning with the UCH Act, ATSHIP Act and *Native Title Act 1993*, respectively. Upholding the preservation of underwater cultural heritage and particularly significant areas and objects provides for the protection of these values for current and future generations. The protection of the rights and interests of native title holders ensures these values are maintained for current and future generations. |
| Principles of ESD (biodiversity principle) | EPOs 10, 11, 12, 24 and 25 and ALs 7, 14 to 18 align with the biodiversity principle of ESD by safeguarding Aboriginal cultural heritage values that are inherently connected to biodiversity. |

# 8 Impact Evaluation

## 8.1 Underwater Sound Emissions – Impulsive

### 8.1.1 Cause of Aspect

Surveys and well construction activities associated with the East Coast Project will generate impulsive underwater noise emissions that will temporarily introduce impulsive sounds and increase ambient underwater sound levels in the marine environment.

The impulsive noise emissions that will occur as a result of the East Coast Project activities are identified in Table 8-1, and described in further detail in subsections below.

*Table 8-1: Activities undertaken during the East Coast Project that may generate impulsive sound emissions*

| Cause of Aspect / Phase | Activity component |
|---|---|
| **Surveys** | Geophysical survey |
| **Well Construction** | MODU positioning / Installation<br>Logging |
| **Installation and Commissioning** | Installation of subsea structures |

### 8.1.2 Aspect Characterisation

#### *8.1.2.1 Survey*

Geophysical surveys will introduce localised and temporary impulsive sound into the marine environment of the operational area.

Most geophysical survey techniques use acoustics, generating short, pulsed underwater sound, such as MBES, SSS, SBP and SVP. Each survey may take ~7 days to complete and a survey campaign is expected to take up to ~3 weeks. The sound source characteristics of these acoustic positioning systems are shown in Table 8-2, based on a literature review by McPherson and Koessler (2021) and acoustic modelling for an Otway exploration drilling program (Welch et al., 2023) undertaking similar geophysical survey techniques to those identified within Section 4.3.1. Assessment of these were conducted to ensure the most conservative and applicable sound sources were utilised. At this stage in the planning process, the source frequencies and sound levels for example equipment identified within Table 8-2 are considered to be comparable and representative to those expected for the East Coast Project. Activity specific modelling of confirmed survey techniques and known frequencies and sound levels will be undertaken in future EPs, if required. SVP and CTD techniques are anticipated to have sound source levels like MBES given the operation principle is similar to an echosounder (Makar, 2022).

*Table 8-2: Positioning and survey equipment source frequencies and sound levels*

| Emission source | Example equipment | Source frequency range | Source sound level |
|---|---|---|---|
| **MBES** | R2Sonic 2024<br>Reson SeaBat 8101 | 200–400 kHz | SPL: 221 dB re 1 µPa @ 1 m<br>$SEL_{SS}$: 130 dB re 1 $\mu Pa^2s$ @ 40 m<br>PK: 170 dB re 1 µPa @ 40 m |
| **Sidescan sonar** | EdgeTech 4200 | 70–400 kHz | SPL: 205 dB re 1 µPa @ 1 m<br>$SEL_{SS}$: 176 dB re 1 $\mu Pa^2s$ @ 1 m<br>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<br>$SEL_{SS}$: 172.6 dB re 1 $\mu Pa^2s$ @ 1 m |

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| **Sub-bottom profiler (with CHIRP)** | Edgetech X-star system CHIRP<br>Applied Acoustics AA301 | 2–16 kHz | SPL: 191.7 dB re 1 µPa<br>PK: 215 dB re 1 $\mu Pa^2m^2$ |

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

#### *8.1.2.2 Well Construction*

Transponders may be used during well construction activities to assist with the positioning of the MODU.

When required for positioning, transponders will introduce localised and temporary impulsive sound into the marine environment. General positioning will emit one chirp every five seconds (estimated to be required for 4 hours at a time) and precise positioning will emit one chirp every second (estimated to be required for 2 hours at a time). The chirps are short in duration between 3 and 40 milliseconds. Transponders will not emit any sound when on standby. Austin et al. (2012) calculated the distances to SPL isopleths for a typical USBL system in open water and found the distance to 160 dB re 1 µPa (SPL) to be 36 m, and thus incidental to, and lower than underwater noise from other project impulsive and continuous noise sources.

During well completions, the case and perforate process may be used to puncture the steel casing and cement using specialist tools (e.g. perforating guns) which could result in the generation of localised and temporary impulsive sound at the location of case perforations. Well perforations will occur at positions on the casing aligned with the location of the target reservoir, and therefore, will vary between wells. Waarre C and Waarre A reservoirs are encountered between ~1,600 m and 2,350 m MDRT (Measured Depth Relative to the Rotary Table), respectively. As outlined in Section 4.1.3 all wells in the development area access hydrocarbons from the Waarre A or Waarre C formation reservoirs, as such any casing perforations required would occur at a depth greater than 1.5 km below seabed. The acoustic energy of the impulsive sound generated from casing perforations at these depths are expected to be absorbed by the seabed materials surrounding the sound source, including the hydrocarbons of the reservoirs and stratified marine sediments (Geoscience Australia, 2022). Previous studies have found that density variations associated with inhomogeneous seabed materials, such as those present with the Otway basin at these depths, have a strong effect on sound energy loss (attenuation) (Godin, 2021). This seabed attenuation (energy loss) is expected to prevent impulsive noise from case perforations being discernible within the overlying ocean. As a result, impulsive noise during well completions including perforation activities are not expected to be a source of disturbance to marine fauna.

Well logging is expected to take up to 24-48 hours for wireline operations and 5-10 days for LWD operations. Logging while drilling (LWD) and logging via wireline may use acoustic transducers to transmit localised and temporary impulsive sound into the rock surrounding the near wellbore, from a device lowered around 2 km below the seabed. Noise from logging activities are not anticipated to be audible within the overlying ocean. Studies which have recorded sound during a range of drilling and logging activities did not identify a discernible increase in subsea noise levels over general vessel noise when logging was underway (Jimenez-Arranz, 2020). Logging, therefore, is not assessed further.

#### *8.1.2.3 Installation and Commissioning*

Transponders may be used during installation and commissioning activities to assist with the positioning of infrastructure and equipment.

See Section 8.1.2.2 above for an overview of the underwater noise emissions introduced from transponders.

### 8.1.3 Underwater Noise Modelling

To determine the spatial extent for impact and risk evaluation, a review of comparative underwater sound modelling was undertaken to define relevant impulsive sound EMBAs:

- McPherson, C, and M Koessler. 2021. Empirical estimation of underwater noise and effect from survey equipment. Memo, Capalaba, Queensland, Australia: JASCO Applied Sciences for Cooper Energy
- Welch, S.J., M.-N. R. Matthews, D.H. Stroot, A.M. Muellenmeister, and C.R. McPherson. 2023. Otway Exploration Drilling Program: Acoustic Modelling for Assessing Marine Fauna Sound Exposures. Document 02760, Version 3.0 FINAL. Technical report by JASCO Applied Sciences for Xodus Group (ConocoPhillips Australia).

Modelling by Welch et al. (2023) produced for ConocoPhillips' Otway Exploration Drilling Program and used 3 sound propagation models (MONM-BELLHOP, FWRAM and VSTACK), for a SBP sound source located approximately 18 km south of the operational area.

Empirical estimation by McPherson and Koessler (2021) reviewed literature and used a simple spreading loss calculation where there were gaps in literature.

Comparing the predicted underwater sound level increases from both studies found results of modelling by Welch et al. (2023) to provide the most relevant estimates of impulsive sound propagation ranges relevant to all sources of impulsive sound generated by the East Coast Project. The modelling by Welch et al. (2023) was conducted at two locations at varying depths within VIC/P79 off the coast of Warrnambool within the Otway Basin (see Table 8-3). The modelling used a conservative AP3000 triple-plated boomer SBP system with a verified source level of 169dB 1 µPa2m2s, which has been considered to provide conservative approximations of the potential sound fields and ranges of the SEL24h impact criteria for the range of SBP boomers (Wood and McPherson, 2019).

Further, the seabed lithology, a key factor in sound propagation, is described as silty carbonate sand overlaying limestone within the study by Welch et al (2023), whereby more sand results in further propagation. Based on modelling conducted for the East Coast Project (Appendix 4; Connell et al., 2025) for continuous sound emissions, the seabed lithology within the East Coast Project includes some areas of bare limestone, and some areas with overlying sand as described in Connell et al. (2025).

Furthermore, the range of water depths, another factor which influences sound propagation, modelled by Welch et al. (2023) encompass the water depths considered for this Project: 55-85 m. Welch et al. (2023) is therefore considered as providing an appropriate (and conservative) basis for an EMBA by impulsive sound associated with the East Coast Project. Where empirical estimations provide a more conservative estimate, predictions by McPherson and Koessler (2021) were used, where appropriate.

*Table 8-3: Description of the scenarios modelled for impulsive sound relevant to the Project (Welch et al., 2023)*

| Scenario | Description | Location | | Water Depth |
|---|---|---|---|---|
| | | Latitude | Longitude | |
| 1 | Boomer type Sub-Bottom Profiling (SBP) 24 h scenario survey lines | 38° 30' 06.3724" S | 142° 07' 55.49" E | 45 m |
| 2 | | 39° 02' 00.8251" S | 142° 34' 07.53" E | 110 m |

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 noise effect thresholds used in the modelling studies above (Welch et al., 2023; McPherson and Koessler, 2021) have been accepted by regulatory agencies and represent best available science at the time of modelling.

The US National Oceanic and Atmospheric Administration has recently published updated guidance for exposure thresholds for the onset of PTS and TTS for marine mammals (NMFS, 2024). The updated thresholds now consider both the weighting function shape and the weighted threshold value. These new thresholds present a more conservative frequency-weighted accumulated sound exposure levels compared to those previously used, those suggested by Southall et al. (2019).

Cooper Energy have tested the difference that these new thresholds make for the continuous sound emission scenarios (Appendix 4; Connell et al., 2025), compared to previous thresholds, and incorporated the results into Section 8.2. The new modelling results demonstrate that the thresholds have some effect on the size of the TTS and AUD INJ (including PTS)[17] sound contours, however, these changes were not significant. Changes were in the order of 40% (increase) and which were of no consequence to the impact risk management measures applied offshore which are based around the larger behavioural sound contours.

Accomando et al. (2025) has also recently suggested updates to the underwater sound exposure thresholds for marine turtles. Cooper Energy have accounted for these new thresholds for the continuous sound emission scenarios (Appendix 4; Connell et al., 2025) and incorporated the results into Section 8.2.

### 8.1.4 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impacts from impulsive noise emissions are:

- Change in ambient sound.

Potential risk:

- Change in fauna behaviour, including:
  - Marine mammals
  - Marine turtles
  - Fish including eggs and larvae
- Auditory impairment (masking, temporary threshold shift (TTS), recoverable injury), or auditory injuries (mortality or potential mortal injuries, permanent threshold shift (PTS)) to marine fauna, including:
  - Marine mammals
  - Marine turtles
  - Fish including eggs and larvae.

Socio-economic impacts on commercial fisheries have not been evaluated further, as there are no discernible impacts to behaviour and distribution expected at the population level given the limited nature and scale of activities and associated impulsive underwater sound emissions.

The noise effect criteria for the thresholds identified by Day et al. (2016a; 2016b; 2017; 2019) and Payne et al. (2008) relevant to impacts to marine invertebrates, such as cephalopods and crustaceans were not reached within the modelling results (Welch et al., 2023).

### 8.1.5 Impact and Risk Evaluation

#### *8.1.5.1 Impacts: Change in Ambient Sound*

Ambient underwater sound is the level of sound which exists in the environment without the presence of the activity. Ambient underwater sound refers to the background level in a soundscape and can include physical, biological and anthropogenic sound (Erbe et al., 2016a). Ambient underwater sound levels in the operational area are expected to range between 110 and 161 dB re 1 µPa. The ambient levels are inferred from passive acoustic monitoring, commissioned by Origin, conducted 5 km offshore from the coastline east of Warrnambool (Duncan et al., 2013).

*17 The updated technical guidance (NMFS, 2024) details the inclusion of the term "auditory injury (AUD INJ)" to replace "PTS". AUD INJ is defined as 'damage to the inner ear that can result in destruction of tissue, such as the loss of cochlear neuron synapses or auditory neuropathy. Auditory injury may or may not result in a permanent threshold shift (PTS)' (NMFS 2024). TTS is not considered injury under the NMFS 2024, but a precursor to injury. This section refers to both PTS and TTS and considers the potential impacts of both.*

Underwater sound modelling predicted increased levels of underwater sound up to 110 dB re 1 µPa would extend 3.37 km from a SBP sound source in the Otway Basin (Welch et al., 2023).

Given that impulsive sound sources of the East Coast Project are related to activities that are intermittent, of a short-term duration and highly localised (change above an SPL of 110 dB re 1 µPa approximately 3.37 km from the SBP sound source), 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.

#### *8.1.5.2 Risk: Change in Fauna Behaviour – Marine Mammals*

**Inherent Consequence Evaluation**

Impulsive sound emissions may cause behavioural changes to marine mammals depending on the frequency and sound levels received, such that:

- Impulsive sound levels greater than 160 dB re 1 µPa (SPL) is the behavioural threshold for marine mammals including otariid seals, high-frequency cetaceans and very high-frequency cetaceans (NOAA 2019)
- Impulsive sound levels greater than 140 dB re 1 µPa (SPL) has a 50% probability of causing behavioural changes to migrating mysticetes which have been applied to southern right whales and therefore is conservatively defined as the behavioural threshold for low-frequency cetaceans (Wood et al., 2012 cited in Welch et al., 2023).

Underwater sound modelling predicted the impulsive behavioural threshold for otariid seals, high-frequency cetaceans and very high-frequency cetaceans was not reached at any distance from a SBP sound source in the Otway Basin (Welch et al., 2023). This infers East Coast Project impulsive underwater sound emissions do not have the potential to cause behavioural changes to otariid seals, high-frequency cetaceans and very high-frequency cetaceans.

However, underwater sound modelling predicted the impulsive behavioural threshold for low-frequency cetaceans could be reached within 130 m of a SBP source in the Otway Basin (Welch et al., 2023). This infers East Coast Project impulsive underwater sound emissions from some sources have the potential to cause behavioural changes to low-frequency cetaceans, if they are in very close proximity.

A 130 m buffer around the operational area defines the behavioural EMBA for low-frequency cetaceans exposed to impulsive sounds. Table 8-4 provides details on the presence of low-frequency cetaceans, the potential behavioural changes that may occur and the resulting inherent consequence level for each low-frequency cetacean species.

*Table 8-4: Inherent Consequence Levels - Impulsive Sound - Behavioural Changes to Marine Mammals*

| Low-frequency cetacean (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| **Minke whale**<br>**EPBC Act listed**<br>• Cetacean | May occur.<br>No BIAs overlapped. | Exposure from sonar resulting in horizontal avoidance or ceasing to call (Durbach et al., 2021). | Minor local (small, variable, temporary behavioural changes within 130 m from the source) potential impacts or disturbances to fauna. Not expected to result in population level impacts. | Level 1 |
| **Sei whale**<br>**EPBC Act listed**<br>• Vulnerable<br>• Cetacean<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Movement away from impulsive source and call cessation/ modification inferred from studies of other baleen cetaceans. | Localized (130 m from the source) and short-term (~3-week SBP survey) potential impacts to species of recognized conservation value not affecting local ecosystem function. Not expected to result in population level impacts. | Level 2 |

| Low-frequency cetacean (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| **Pygmy Blue whale**<br>**EPBC Act listed**<br>• Endangered<br>• Cetacean<br>• Migratory | Known to occur.<br>Foraging and distribution BIAs overlapped.<br>During January to June, pygmy blue whales migrate through the operational area. | Cessation of deep feeding (deep feeding at water depths of 75 to 175 m) to increased swimming speed and directed travel away from the sound source (from 160 to 210 dB re 1 µPa RMS) (Goldbogen et al., 2013). | Localized (130 m from the source) and short-term (~3-week SBP survey) potential impacts to species of recognized conservation value not affecting local ecosystem function.<br>The risk of stopping blue whale individuals from deep feeding within the behavioural EMBA is not expected to result in population level impacts. | Level 2 |
| **Fin whale**<br>**EPBC Act listed**<br>• Vulnerable<br>• Cetacean<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Modify song characteristics under increased background noise conditions, and temporary displacement (Castellote et al., 2012). | Localized (130 m from the source) and short-term (~3-week SBP survey) potential impacts to species of recognized conservation value not affecting local ecosystem function. Not expected to result in population level impacts. | Level 2 |
| **Pygmy right whale**<br>**EPBC Act listed**<br>• Cetacean<br>• Migratory | May occur.<br>No BIAs overlapped. | Movement away from impulsive source and call cessation/ modification inferred from studies of other baleen cetaceans. | Minor local (small, variable, temporary behavioural changes within 130 m from the source) potential impacts or disturbances to fauna. Not expected to result in population level impacts. | Level 1 |
| **Southern right whale**<br>**EPBC Act listed**<br>• Endangered<br>• Cetacean<br>• Migratory | Known to occur.<br>Migration BIA overlapped.<br>During May-June and September-October southern right whales pass through the operational area to move to and from coastal aggregation areas. | Behaviours inferred from related species (North Atlantic right whale), immediately stopped foraging (abandoned their current foraging dive prematurely), quickly approached the surface when exposed to amplitude modulated signals with a maximum source level of 173 dB re 1 µPa at 1 m, 2 minutes after tagging a whale (Nowacek et al., 2004; Matthews and Parks, 2021).<br>Changes to vocalisations including call cessation/ modification is inferred from studies of other baleen cetaceans. | Localized (130 m from the source) and short-term (~3-week SBP survey) impacts to species of recognized conservation value not affecting local ecosystem function.<br>The risk of behavioural change to migrating southern right whale individuals within highly localized area within the behavioural EMBA is not expected to result in population level impacts.<br>Logans beach is ~24km from the operational area; no overlap with behavioural disturbance contours from activity vessels is predicted considering the limited extent of contours associated with survey equipment. | Level 2 |
| **Humpback whale**<br>**EPBC Act listed**<br>• **Cetacean**<br>• **Migratory** | Likely to occur.<br>No BIAs overlapped. | When exposed to an active seismic array, the magnitude and rate of behavioural change were small, variable, temporary when compared with typical behaviours, such as their movement patterns, | Minor local (small, variable, temporary behavioural changes within 130 m from the source) potential impacts or disturbances to fauna. Not expected to result in population level impacts. | Level 1 |

| Low-frequency cetacean (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| | | dive/respiratory parameters and rates of breaching (Dunlop et al., 2017). Based on exposure to greater impulsive sound source levels from seismic array, it is inferred that behavioural changes to humpback whales from exposure to lower impulsive sound source levels from geophysical surveys may also result in small, variable, temporary behavioural changes. | | |

**Inherent Likelihood**

The likelihood of behavioural changes to marine mammals depends on the impulsive sound source used, the potential presence of low-frequency cetaceans within the behavioural EMBA, and the relative sensitivity of different species and individuals to noise.

SBP operating frequencies overlap vocalisation frequencies of low-frequency cetaceans (McPherson and Koessler, 2021). This overlap could potentially mask vocalisations from low-frequency cetaceans causing behavioural changes.

MBES and SSS operating frequencies do not overlap vocalisation frequencies of low-frequency cetaceans. As a result, there is no likelihood of behavioural change to low-frequency cetaceans during MBES and SSS operations.

For the risk event of behavioural changes to marine mammals to occur, the following combination of factors are required:

- Impulsive underwater sound emissions (i.e. from SBP operations)
- Low-frequency cetaceans present within 130 m of the impulsive sound source.

With the combination of the above factors there is a 50% probability impulsive sounds will cause small, variable, temporary behavioural changes (Wood et al., 2012, Table 8-4). As a result, the likelihood of the impact occurring is based on the potential presence of low-frequency cetaceans within a very small radius (130 m) of the impulsive sound source at the same time it is in use.

Table 8-5 provides details on the frequency of recorded sighting of low-frequency cetaceans in the Otway Basin to infer presence within the behavioural EMBA, description of likelihood and the resulting inherent likelihood level for each low-frequency cetacean species.

*Table 8-5: Inherent Likelihood Levels - Impulsive Sound - Behavioural Changes to Marine Mammals*

| Low-frequency cetacean | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood level |
|---|---|---|---|
| **Minke whale** | May occur.<br>No BIAs overlapped.<br>Between 2002 and 2013, 123 aerial surveys recorded one sighting of an individual minke whale (Gill et al., 2015). | A freak combination of factors would be required for a minke whale to be present within the behavioural EMBA (within 130m of the sound source) during activities generating impulsive sound emissions. Behavioural changes to minke whales are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |

| Low-frequency cetacean | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood level |
|---|---|---|---|
| **Sei whale** | Likely to occur.<br>No BIAs overlapped.<br>Between 2002 and 2013, 123 aerial surveys recorded 12 sightings of 14 individual sei and like sei whales (Gill et al., 2015 ). | A freak combination of factors would be required for a sei whale to be present within the behavioural EMBA (within 130m of the sound source) during activities generating impulsive sound emissions. Behavioural changes to sei whales are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |
| **Pygmy Blue whale** | Known to occur.<br>Foraging and distribution BIAs overlapped.<br>Between June 2012 and March 2013, a cetacean survey recorded 120 individual pygmy blue whales in the Otway Basin (Origin, 2018).<br>Between 1887 and 2018, 159 observation and occurrence records of pygmy blue whales were identified off the coast of Victoria (Atlas of Living Australia, 2024). | A rare combination of factors would be required for a pygmy blue whale to be present within the behavioural EMBA (within 130m of the sound source) during activities generating impulsive sound emissions. Any individuals proximal to the activities may or may not alter behaviour. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Fin whale** | Likely to occur.<br>No BIAs overlapped.<br>Between 2002 and 2013, 123 aerial surveys recorded 7 sighting of 8 individual fin and like fin whales (Gill et al., 2015 ). | A rare combination of factors would be required for a fin whale to be present within the behavioural EMBA (within 130m of the sound source) during activities generating impulsive sound emissions. Any individuals proximal to the activities may or may not alter behaviour. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Pygmy right whale** | May occur.<br>No BIAs overlapped.<br>Between 2002 and 2013, 123 aerial surveys recorded one sighting of 100 individual pygmy right whales (Gill et al., 2015). | A freak combination of factors would be required for a pygmy right whale to be present within the behavioural EMBA (within 130m of the sound source) during activities generating impulsive sound emissions. Behavioural changes to pygmy right whales are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |
| **Southern right whale** | Known to occur.<br>Migration BIA overlapped.<br>Between 1993 and 2018, 375 individual southern right whales (including 48 breeding females) were identified in south-eastern Australia (east of the SA/Victorian border) (Watson et al., 2021). | A rare combination of factors would be required for a southern right whale to be present within the behavioural EMBA (within 130m of the sound source) during activities generating impulsive sound emissions. Any individuals proximal to the activities may or may not alter behaviour. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Humpback whale** | Likely to occur.<br>No BIAs overlapped.<br>Between 2002 and 2013, 123 aerial surveys recorded 10 sightings of 18 individual humpback whales (Gill et al., 2015). | A rare combination of factors would be required for a humpback whale to be present within the behavioural EMBA (within 130m of the sound source) during activities generating impulsive sound emissions. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Remote (E) |

**Inherent Risk Severity**

The highest inherent risk severity of behavioural changes to marine mammals from impulsive sound emissions is considered **Low**.

Table 8-6 lists the inherent risk severity for each low-frequency cetacean.

*Table 8-6:Inherent Risk Severity - Impulsive Sound - Behavioural Changes to Marine Mammals*

| Low-frequency cetacean | Inherent consequence level | Inherent likelihood level | Inherent Risk Severity |
|---|---|---|---|
| **Minke whale** | 1 | E | **Low** |
| **Sei whale** | 2 | E | **Low** |
| **Pygmy Blue whale** | 2 | D | **Low** |
| **Fin whale** | 2 | D | **Low** |
| **Pygmy right whale** | 1 | E | **Low** |
| **Southern right whale** | 2 | D | **Low** |
| **Humpback whale** | 1 | E | **Low** |

### *8.1.5.3 Risk: Auditory Injury to Marine Mammals*

**Inherent Consequence Evaluation**

Auditory injury is defined by DCCEEW (formally DAWE, 2021) as both permanent and temporary hearing impairment and any other form of physical harm arising from anthropogenic sources of underwater noise (DAWE, 2021). Permanent and temporary hearing impairment for the purposes of this evaluation is the onset of PTS and TTS, respectively. PTS and TTS thresholds defined by Southall et al. (2019) have been used to determine the range in which the onset of auditory injury will occur to marine mammals from exposure to impulsive sound (Table 8-7).

*Table 8-7:Impulsive underwater sound PTS and TTS onset thresholds for 24-hour sound exposure level ($SEL_{24h}$) and peak (PK) (Southall et al., 2019)*

| Hearing Group | PTS onset thresholds | | TTS onset thresholds | |
|---|---|---|---|---|
| | Weighted $SEL_{24h}$ (db re 1 $\mu Pa^2.s$) | PK (db re 1 µPa) | Weighted $SEL_{24h}$ (db re 1 $\mu Pa^2.s$) | PK (db re 1 µPa) |
| **Low-frequency cetaceans** | 183 | 219 | 168 | 213 |
| **High-frequency cetaceans** | 185 | 230 | 170 | 224 |
| **Very high-frequency cetaceans** | 155 | 202 | 140 | 196 |
| **Otariid seals** | 183 | 232 | 168 | 226 |

Underwater sound modelling of a SBP activity in the Otway Basin was based on a AP3000 triple-plate boomer system towed at a depth of 2 m, where the specifications for the operating frequency (broadband) and per-pulse SEL source level were 200 Hz to 16 kHz and 169 dB 1µPa2m2s, respectively (Welch et al., 2023). This SBP boomer system is considered representative of the geophysical survey operations as defined in Table 8-2. Please note the difference in units used for the modelling study. MBES and SSS are considered point-like sources, whereas SBP boomer is not a point-like source and expected to emit sound waves over a larger area (Welch et al., 2023).

Results of this study predicted the onset of TTS for very high-frequency cetaceans, based on $SEL_{24h}$ thresholds, if very high frequency cetaceans remain within 20 m of an SBP sound source for 24 hours (Welch et al., 2023). $SEL_{24h}$ thresholds for other hearing groups were not reached. PK thresholds for all hearing groups were also not reached. $SEL_{24h}$ is a cumulative metric representing the total noise exposure over 24 hours. It assumes continuous exposure at a fixed point, providing a worst-case scenario. Realistically, very high-frequency cetaceans are mobile and would not remain in an injury inducing ensonified area for 24 hours. As a result, distances to potential injurious accumulated SEL thresholds does not guarantee injury to marine mammals.

Review of the EPBC listed marine mammal species (or species habitat) that may occur within the operational area (Table 6-9) indicates no presence of any very high-frequency cetaceans such as true porpoises, river dolphins, pygmy/dwarf sperm whales or some oceanic dolphins (Southall et al., 2019). In the event highly mobile oceanic dolphins pass the very localised ensonified area where sound may exceed the TTS threshold, it is unlikely oceanic dolphins would remain within in close proximity for 24 hours for the onset of TTS to occur. Oceanic dolphins traveling through the area might experience brief exposure, however this exposure is not expected to not cause injury. As such, auditory injury to marine mammals from East Coast Project impulsive sound emissions are not credible and not evaluated further.

**Inherent Likelihood**

Not applicable.

**Inherent Risk Severity**

Not applicable.

#### *8.1.5.4 Risk: Change in Fauna Behaviour - Marine Turtles*

Impulsive sound emissions may cause behavioural changes to turtles depending on the frequency and sound levels received, such that:

- Impulsive sound levels greater than 166 dB re 1 µPa (SPL) is the behavioural threshold for turtles (McCauley et al., 2000).

Results of underwater modelling of a SBP activity in the Otway Basin did not predict the potential onset of behavioural change to turtles (Welch et al., 2023).

However, empirical estimates predicted the impulsive behavioural threshold for turtles is reached within 130 m of the sound source (McPherson and Koessler, 2021). 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). This infers East Coast Project impulsive underwater sound emissions have the potential to cause behavioural changes to turtles. Though there is some small inherent uncertainty in defining behavioural effects to the exact meter; additional effort to characterise the effect radius is not considered warranted given the low sensitivity of marine turtle species and their populations to impulsive noise from the project.

A 130 m buffer around the operational area defines the behavioural EMBA for turtles exposed to impulsive sounds. Table 8-8 provides details on the presence of EPBC listed turtles within the behavioural EMBA, potential behavioural changes that may occur and the resulting inherent consequence level for marine turtles.

*Table 8-8: Inherent Consequence Levels – Impulsive Sound – Behavioural Changes to Turtles*

| Turtle (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Loggerhead turtle** | Likely to occur.<br>No BIAs overlapped. | Interrupted basking behaviour and dove in response to sound generated during airgun | Localized (130 m from the source) and short-term (~3-week SBP survey) impacts to species of recognized | Level 1 |

| Turtle (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **EPBC Act listed**<br>• Endangered<br>• Marine<br>• Migratory | | operations (DeRuiter and Doukara, 2012). | conservation value not affecting local ecosystem function. As there are no BIA's for the species within the temperate south east region, only small numbers (if any) may occur in the area over the life of the project. No discernible effects are expected. | |
| **Green turtle**<br>**EPBC Act listed**<br>• Vulnerable<br>• Marine<br>• Migratory | May occur.<br>No BIAs overlapped. | Displayed increased swimming speed and erratic behaviour when exposed sound generated by pile driving, airguns, and sonar (Papale et al., 2020). | Localized (130 m from the source) and short-term (~3-week SBP survey) impacts to species of recognized conservation value not affecting local ecosystem function. As there are no BIA's for the species within the temperate south east region, only small numbers (if any) may occur in the area over the life of the project. No discernible effects are expected. | Level 1 |
| **Leatherback turtle**<br>**EPBC Act listed**<br>• Endangered<br>• Marine<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Increase swimming speeds, induce diving and erratic behaviour inferred from studies of other turtle species. | Localized (130 m from the source) and short-term (~3-week SBP survey) impacts to species of recognized conservation value not affecting local ecosystem function. As there are no BIA's for the species within the temperate south east region, only small numbers (if any) may occur in the area over the life of the project. No discernible effects are expected. | Level 1 |

**Inherent Likelihood**

The likelihood of behavioural changes to turtles depends on the impulsive sound source used and the potential presence of turtles within the behavioural EMBA, as well as the relative sensitivity of different species and individuals to noise.

Only SBP operating frequencies overlap hearing frequencies of turtles (McPherson and Koessler, 2021). This overlap could potentially mask turtle hearing causing behavioural changes.

MBES and SSS operating frequencies are outside of hearing frequencies of turtles (McPherson and Koessler, 2021). As a result, there is no likelihood of behavioural change to turtles during MBES and SSS operations.

For the risk event of behavioural changes to turtles to occur, the following combination of factors are required:

- SBP operations
- Turtles present within 130 m of the SBP sound source.

Table 8-9 provides details on the frequency of recorded sighting of EPBC Act listed turtles in the Otway Basin to infer presence within the behavioural EMBA, description of likelihood and the resulting inherent likelihood level for each turtle species.

*Table 8-9: Inherent Likelihood Levels - Impulsive Sound - Behavioural Changes to Turtles*

| Turtle | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood level |
|---|---|---|---|
| **Loggerhead turtle** | Likely to occur.<br>No BIAs overlapped.<br>The Victorian Biodiversity Atlas (VBA) showed no observations or occurrences of loggerhead turtles in the behavioural EMBA (Victorian Department of Environment, Land, Water and Planning, 2023). | A freak combination of factors would be required for a loggerhead turtle to be present within the behavioural EMBA during activities generating impulsive sound emissions. Behavioural changes to green turtles are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |
| **Green turtle** | May occur.<br>No BIAs overlapped.<br>The VBA showed no observations or occurrences of green turtles in the behavioural EMBA (Victorian Department of Environment, Land, Water and Planning, 2023). | A freak combination of factors would be required for a green turtle to be present within the behavioural EMBA during activities generating impulsive sound emissions. Behavioural changes to green turtles are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |
| **Leatherback turtle** | Likely to occur.<br>No BIAs overlapped.<br>The VBA showed no observations or occurrences of green turtles in the behavioural EMBA (Victorian Department of Environment, Land, Water and Planning, 2023). | A freak combination of factors would be required for a leatherback turtle to be present within the behavioural EMBA during activities generating impulsive sound emissions. Behavioural changes to green turtles are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |

**Inherent Risk Severity**

The highest inherent risk severity of behavioural changes to turtles from impulsive sound emissions is **Low**.

Table 8-10 lists the inherent risk severity for each turtle.

*Table 8-10: Inherent Risk Severity - Impulsive Sound - Behavioural Changes to Marine Mammals*

| Turtle | Inherent consequence level | Inherent likelihood level | Inherent Risk Severity |
|---|---|---|---|
| **Loggerhead turtle** | 1 | E | **Low** |
| **Green turtle** | 1 | E | **Low** |
| **Leatherback turtle** | 1 | E | **Low** |

### *8.1.5.5 Risk: Auditory Injury to Marine Turtles*

**Inherent Consequence Evaluation**

Results of underwater modelling of a SBP activity in the Otway Basin did not predict the potential onset of auditory injury to marine turtles (Welch et al., 2023). This risk is not evaluated further.

**Inherent Likelihood**

Not applicable.

**Inherent Risk Severity**

Not applicable.

### *8.1.5.6 Risk: Change in Fauna Behavioural – Fish*

**Inherent Consequence Evaluation**

Behavioural changes to fish including eggs and larvae from East Coast Project impulsive sound emissions will generally be within tens of metres of the source based on the qualitative guidelines by Popper et al. (2014). As such, the behavioural EMBA is has been conservatively defined as a 130 m radius around the operational area of the East Coast Project. Though there is some small inherent uncertainty in defining behavioural effects to the exact meter; additional effort to characterise the effect radius is not considered warranted given the low sensitivity of the fish species and their populations to impulsive noise from the project.

Table 8-11 provides details on the presence of fish species that are EPBC Act listed, or which have been identified as culturally significant through consultation, within the behavioural EMBA, potential behavioural changes that may occur and the resulting inherent consequence level for each fish species.

*Table 8-11: Inherent Consequence Levels - Impulsive Sound - Behavioural Changes to Fish*

| Fish (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| **White shark**<br>**EPBC Act listed**<br>• Vulnerable<br>• Migratory | Known to occur.<br>BIA overlapped.<br>Seasonal presence in southern Australia during early summer. | Showed no significant difference in behaviour when exposed to artificial irregularly pulsed sound (Chapius et al., 2019). | Despite the conservation status of the white shark, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **School shark**<br>**EPBC Act listed**<br>• Critically endangered | May occur.<br>No BIAs overlapped. | Inferred behavioural changes based on coastal sharks less inquisitive behaviours when exposed to irregularly pulsed sound (Chapius et al., 2019). | Despite the conservation status of the school shark, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Shortfin mako**<br>**EPBC Act listed**<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Inferred behavioural changes based on coastal sharks less inquisitive behaviours when exposed to irregularly pulsed sound (Chapius et al., 2019). | Minor local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Mackerel shark**<br>**EPBC Act listed**<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Inferred behavioural changes based on coastal sharks less inquisitive behaviours when exposed to irregularly pulsed sound (Chapius et al., 2019). | Minor local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |

| Fish (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| **Australian grayling**<br>**EPBC Act listed**<br>• Vulnerable | May occur.<br>No BIAs overlapped. | Inferred behavioural changes based on coastal pelagic fish schools dispersing or change in depth when exposed to sonar/echosounder (Hawkins et al., 2014). | Despite the conservation status of the Australian grayling, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Blue warehou**<br>**EPBC Act listed**<br>• Critically endangered | Known to occur.<br>No BIAs overlapped. | Inferred behavioural changes based on coastal pelagic fish schools dispersing or change in depth when exposed to sonar/echosounder (Hawkins et al., 2014). | Despite the conservation status of the blue warehou, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Southern bluefin tuna**<br>**EPBC Act listed**<br>• Critically endangered | Likely to occur.<br>No BIAs overlapped. | Inferred behavioural changes observed by seabass exposed to impulsive sound including startle responses, increased swimming speed, increased group cohesion, and diving to the bottom (Neo et al., 2014). | Despite the conservation status of southern bluefin tuna, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Pipefish, pipehorse, seadragon and seahorse species**<br>**EPBC Act listed**<br>• Marine | May occur.<br>No BIAs overlapped. | Inferred behavioural changes including startle responses, increased swimming speed, increased group cohesion, and diving to the bottom (Neo et al., 2014). | Minor local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Short-finned eels**<br>**Culturally significant to First Nations people (Koster et al., 2021)** | Seasonal presence in the Otway Basin and Bass Strait during spawning migration i.e. downstream migration of adult eels during late summer and autumn. Upstream migration of larvae and glass eels, where glass eels enter estuaries during mid-winter to late spring (VFA, 2017). | A study on Anguillid eels under experimental conditions demonstrated that acoustic stimuli induced behavioural avoidance (increased swimming, speed and movements away from the source) in some European eel and river lamprey (Deleau et al., 2019).<br>Studies on Sandeels revealed minor reactions to seismic shootings (Popper et al., 2014). | This species was identified through consultation as of particular cultural significance. Because of the negligible potential behavioural changes, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |

**Inherent Likelihood**

The likelihood of behavioural changes to fish including eggs and larvae depends on the impulsive sound source used, the potential presence of fish including eggs and larvae within the behavioural EMBA, and the relative sensitivity of different species and individuals to noise.

SBP operating frequencies overlap hearing frequencies of fish (McPherson and Koessler, 2021). This overlap could potentially mask fish hearing causing behavioural changes.

MBES and SSS operating frequencies are outside of hearing frequencies of fish (McPherson and Koessler, 2021). As a result, it is expected that there will be no discernible behavioural change to fish during MBES and SSS operations.

For the risk event of behavioural changes to fish to occur, the following combination of factors are required:

- Impulsive underwater sound emissions (i.e. SBP operations)
- Fish species present within 130 m of the impulsive sound source.

Table 8-12 provides details on the frequency of recorded sighting of EPBC Act listed fish in the Otway Basin to infer presence within the behavioural EMBA, description of likelihood and the resulting inherent likelihood level for each fish species.

*Table 8-12: Inherent Likelihood Levels - Impulsive Sound - Behavioural Changes to Fish*

| Fish | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood level |
|---|---|---|---|
| **White shark** | Known to occur.<br>BIA overlapped. | The risk event could happen when additional factors are present, such that a white shark is present within the behavioural EMBA during activities generating impulsive sound emissions. White sharks are known to occur within the behavioural EMBA; therefore, it is easy to postulate a scenario for the occurrence but considered doubtful. | Possible (C) |
| **School shark** | May occur.<br>No BIAs overlapped. | A freak combination of factors would be required for a school shark to be present within the behavioural EMBA during activities generating impulsive sound emissions. Behavioural changes to school sharks are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |
| **Shortfin mako** | Likely to occur.<br>No BIAs overlapped. | A rare combination of factors would be required for a shortfin mako to be present within the behavioural EMBA during activities generating impulsive sound emissions. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Mackerel shark** | Likely to occur.<br>No BIAs overlapped. | A rare combination of factors would be required for a mackerel shark to be present within the behavioural EMBA during activities generating impulsive sound emissions. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Australian grayling** | May occur.<br>No BIAs overlapped. | A freak combination of factors would be required for an Australian grayling to be present within the behavioural EMBA during activities generating impulsive sound emissions. Behavioural changes to the Australian grayling are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |
| **Blue warehou** | Known to occur.<br>No BIAs overlapped. | The risk event could happen when additional factors are present, such that a blue warehou is present within the behavioural EMBA during activities generating | Possible (C) |

| Fish | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood level |
|---|---|---|---|
| | | impulsive sound emissions. Blue warehou are known to occur within the behavioural EMBA; therefore, it is easy to postulate a scenario for the occurrence but considered doubtful. | |
| **Southern bluefin tuna** | Likely to occur.<br>No BIAs overlapped. | A rare combination of factors would be required for southern bluefin tuna to be present within the behavioural EMBA during activities generating impulsive sound emissions. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Pipefish, pipehorse, seadragon and seahorse species** | May occur.<br>No BIAs overlapped. | A freak combination of factors would be required for syngnathidae to be present within the behavioural EMBA during activities generating impulsive sound emissions. Behavioural changes to syngnathidae are not expected to occur from East Coast Project impulsive underwater sound emissions. | Remote (E) |
| **Short-finned eels**<br>**Culturally significant to First Nations people (Koster et al., 2021)** | Seasonal presence in the Otway Basin and Bass Strait during spawning migration i.e. downstream migration of adult eels during late summer and autumn. Upstream migration of larvae and glass eels, where glass eels enter estuaries during mid-winter to late spring (VFA, 2017). | The risk event could happen when additional factors are present, such that short-finned eels as adults during downstream spawning migration or as larvae / glass eels during upstream spawning migration is present within the behavioural EMBA during use of SBP operations. Based on known distributions during migration it is assumed some short-finned eels may migrate through the behavioural EMBA. Therefore, it is easy to postulate a scenario for the occurrence but considered doubtful that there would be a discernible behavioural change. | Possible (C) |

### Inherent Risk Severity

The highest inherent risk severity of behavioural changes to fish including eggs and larvae from impulsive sound emissions is **Low**.

Table 8-13 lists the inherent risk severity for each EPBC Act listed fish.

*Table 8-13: Inherent Risk Severity - Impulsive Sound - Behavioural Changes to Fish*

| Fish | Inherent consequence level | Inherent likelihood level | Inherent Risk Severity |
|---|---|---|---|
| **White shark** | 1 | C | **Low** |
| **School shark** | 1 | E | **Low** |
| **Shortfin mako** | 1 | D | **Low** |
| **Mackerel shark** | 1 | D | **Low** |
| **Australian grayling** | 1 | E | **Low** |
| **Blue warehou** | 1 | C | **Low** |
| **Southern bluefin tuna** | 1 | D | **Low** |
| **Pipefish, pipehorse, seadragon and seahorse species** | 1 | E | **Low** |
| **Short-finned eels** | 1 | C | **Low** |

#### *8.1.5.7 Risk: Auditory Injury to Fish*

**Inherent Consequence Evaluation**

Results of underwater modelling of a SBP activity in the Otway Basin did not predict the potential onset of auditory injury to fish, nor eggs and larvae (Welch et al., 2023). This risk is not evaluated further.

**Inherent Likelihood**

Not applicable.

**Inherent Risk Severity**

Not applicable.

### 8.1.6 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 8-14.

*Table 8-14: Impulsive Sound Emissions Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: Change in ambient sound | Consequence: Level 1 |
| | Risk: Change in fauna behaviour | Risk: Low – marine mammals<br>Risk: Low – marine reptiles<br>Risk: Low – fish |
| | Risk: Auditory impairment (masking, TTS, recoverable injury), or auditory injuries (mortality or potential mortal injuries, PTS) to marine fauna | N/A |
| Principles of ESD | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (section 8.1.5); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered by stakeholders to be balanced, demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the impacts and risks from underwater sound emissions – impulsive was identified as:<br>• Level 1 consequence for change in ambient sound<br>• Low risk for change in fauna behaviour.<br>The above predicted levels of impact and risks due to underwater sound emissions – impulsive from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.37.3). | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology and the Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process.<br>• The highest consequence ranking for impulsive underwater sound emissions was evaluated as Level 2, specifically for marine mammals, and the highest inherent risks for impulsive underwater sound emissions was evaluated as Low; therefore, impulsive underwater sound emissions from the East Coast Project will not result in serious or irreversible environmental damage.<br>• There is a broad set of literature on the subject of underwater noise; whilst there remain some uncertainties as to exactly how and when individual whales may react to noise of different sources, the potential population level effects from impulsive noise are able to be relatively well characterised through existing knowledge of species distribution and population studies overlayed with published literature on impact thresholds, and an understanding of the levels of noise produced by project equipment. There is little scientific uncertainty associated with predicted environmental impact and the anticipated effectiveness of management measures.<br>• The potential impacts and risks from impulsive underwater sound emissions are well-understood, and management measures are well established and regulated in Australian waters.<br>• Any uncertainty surrounding the suitability of noise modelling scenarios and thresholds will be addressed by EPO20, which establishes a modelling review to | |

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| | ensure that scenarios and thresholds remain appropriate for activity specific environment plans. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risks for impulsive underwater sound emissions were evaluated as Low and therefore will not forego the health, diversity and productivity of the environment for future generations through protection of environmental values.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.1.7). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to impulsive underwater sound emissions were evaluated in Section 8.1.5 and the highest inherent risk for impulsive underwater sound emissions was evaluated as Low.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.1.7). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained through protection of the values of the Commonwealth Marine Area as per the objectives of bioregional plans. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans | Objective: Ensure whales and dolphins are not harmed by offshore interactions with vessels.<br>Management action: Vessels adhere to the distances and vessel management practices of EPBC Regulations (Part 8) with caution zone of 300 m between whales and project vessels. | Adoption of the following control measures:<br>CM1: Marine Assurance Process<br>Equipment generating impulsive sound emissions will be operated and maintained in accordance with manufacturer's instructions to ensure efficient operation.<br>CM2: Offshore Operational Procedures<br>All vessels will adhere to the distances and vessel management practices of EPBC Regulations (Part 8 Division 8.1 interacting with cetaceans) as a minimum.<br>CM3: Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process<br>The Cooper Energy Offshore Victoria Whale Disturbance Risk |
| | EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales: Industry Guidelines, adapted for SBP operations | Objective: Ensure whales are not harmed during offshore seismic activities. The following actions are adapted to the nature and scale of the ECP SBP operations.<br>Management action: Precaution zones surrounding SBP acoustic source (adjusted according to equipment acoustic characteristics relative to sensitivity of Threatened whale species) source:<br>• Observation zone: horizontal radius from the SBP acoustic source.<br>• If a whale is sighted within the SBP observation zone, then activation will be delayed until the source is at least the distance of the observation zone from the | |

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| | | whale, or 30 minutes has lapsed since the last whale sighting within the observation zone.<br>• SBP survey will not commence at night if there have been three or more delays to the start-up of the equipment due to whales in the previous 24 hours.<br>• Use of suitably trained personnel to observe for whales.<br>• Once the survey has commenced EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans applies where a caution zone of 300 m radius applies to whales. | Management Process acknowledges legislative requirements and establishes the criteria and methods by which potential disturbance to relevant whale species is identified. The process identifies management measures for different types of offshore activity, accounting for nature and scale of the potential impacts and risks, to ensure they remain within acceptable levels, and are managed to ALARP. Provisions within the process include consideration for vulnerable species during sensitive life stages most susceptible to noise emissions via a planning-phase risk review, integrating latest published Government Plans and scientific literature. This risk review will consider scheduling of activities outside of higher sensitivity period where practicable, and review of control measures to ensure levels of impact and risk remain ALARP. The risk review also requires the identification and selection of control measures, including new techniques and technologies, where their use is proven, provides benefit, and is practicable for the campaign. The use of new techniques and technologies is informed by research, engaging engagement with expert third parties such as specialist consultants, and participation in industry forums such as the AEP marine noise working group. Section 12.9 provides a holistic overview of how the process is applied on a campaign-by-campaign basis to ensure that acceptable levels of impact are not exceeded during that campaign, and accounts for new information, practices and requirements. |
| | Blue Whale Conservation Management Plan 2015 – 2025 (2015) | Recovery objective: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list.<br>Interim objective 4: Anthropogenic threats are demonstrably minimised.<br>Management action A.2.2: Assessing the effect of anthropogenic noise on blue whale behaviour.<br>Section 8.1.5.2 assesses the effects of anthropogenic noise from the East Coast Project on blue whale behaviour.<br>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.<br>The Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process provides details on level of whale observation effort, triggers for actions and the actions to be taken to manage potential impacts to endangered whales with BIAs in the region (blue whales and southern right whales).<br>Management Action A.2.3 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 Conservation Management Plan. This will involve:<br>Application of conservative criteria including suitable thresholds to establish parameters for impact and risk assessment.<br>Actions and adaptive management measures, will be implemented as described and adapted for SBP operations from 'EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales: Industry Guidelines', to | |

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| | | reduce the risk of blue whale injury and/or displacement within foraging BIA. | The process also provides details on:<br>• level of whale observation effort<br>• triggers for actions<br>• actions to be taken to avoid injuring whales and avoid behavioural disturbance to endangered whale species (blue whales and southern right whales),<br>• actions to be taken to ensure any southern right whale is not prevented from utilising BIA's or HCTS<br>• actions to be taken to reduce the risk of displacement of a foraging blue whale, and minimise the risk of disturbance to a southern right whale in a migration and/or reproduction area.<br><br>The Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process provides for the environment performance requirements that apply to the East Coast Project which are described in Section 8.2.7.<br>The requirements have been developed to account for the loudest noise sources during the activity. As such, the requirements are based on the distances predicted from the modelling of continuous noise emissions (see Section 8.2) and are therefore considered conservative for activities which produce lower levels of noise including impulsive sources.<br>CM20: Campaign Risk Review<br>The Cooper Energy Environmental Protocol describes how environmental impact and risk management, including risk assessments, is undertaken for activities |
| | National Recovery Plan for the Southern Right Whale (DCCEEW, 2024l) | Long term recovery objective: is that the population has increased in size to a level that the conservation status has improved, and the species no longer qualifies for listing as threatened under any of the EPBC Act listing criteria.<br>Interim Objective 2: Anthropogenic threats are managed consistent with ecologically sustainable development principles to facilitate recovery of southern right whales.<br>Management action A.5: Assess, manage, and mitigate impacts from anthropogenic noise.<br>Management action A.5.2: Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that it does not prevent any southern right whale from utilising the area or cause auditory impairment.<br>Management action A.5.3: Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that the risk of behavioural disturbance is minimised.<br>The Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process provides details on level of whale observation effort, triggers for actions and the actions to be taken to manage potential impacts to endangered whales with BIAs and HCTS in the region (blue whales and southern right whales).<br>Management action A.5.4: Ensure environmental assessments associated with underwater noise generating activities include consideration of national policy (e.g., EPBC Act Policy Statement 2.1) and guidelines related to managing anthropogenic underwater noise and implement appropriate mitigation measures to reduce risks to southern right whales to the lowest possible level.<br>Actions and adaptive management measures will be implemented as described and adapted for SBP operations from 'EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales: Industry Guidelines', to ensure that actions do not prevent any southern right whale from utilising the BIA and HCTS area, cause auditory impairment, and risks to behavioural disturbance are minimised. | |

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| | Conservation Advice *Balaenoptera borealis* Sei Whale (TSSC, 2015e) | Identifies anthropogenic noise acoustic disturbance as a minor threat.<br>The advice contains no relevant management actions. | including offshore campaigns.<br>As part of pre-campaign planning a risk review (refer Figure 12-5) will be undertaken to re-assess campaign environmental impacts and risks to ensure acceptability criteria are met and that impacts and risks are reduced to ALARP.<br>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.<br>CM22: Modelling Review<br>Modelling studies used to inform the Activity Environment Plan will use scenarios that are representative of the activity, and current, published thresholds that are suitable for sensitive receptors. Seabed surveys for fields where the seabed has not been characterised will be undertaken prior to well construction activities being undertaken, this will form an input into the Risk Review process described in Section 12.9.<br>Further information on the Whale Disturbance Risk Management Process is within Section 12.9, including the provisions within the process that ensure that acceptable levels of impact are not exceeded. |
| | Conservation Advice *Balaenoptera physalus* Fin Whale (TSSC, 2015f) | Identifies anthropogenic noise acoustic disturbance as a minor threat.<br>The advice contains no relevant management actions. | |
| | Listing Advice *Megaptera novaeangliae* Humpback Whale (TSSC, 2022) | Identifies anthropogenic noise as a concern.<br>The advice contains no relevant management actions. | |
| | Recovery plan for marine turtles in Australia 2017–2027 | 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.<br>Interim objective 3: Anthropogenic threats are demonstrably minimised.<br>The recovery plan contains no relevant management actions. | |
| | Recovery Plan for the White Shark (*Carcharodon carcharias*) 2013 | Recovery objective: Ensure that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future.<br>The recovery plan contains no relevant management actions. | |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | Cooper Energy has previously sought advice from the Australian Antarctic Division (AAD) in relation to the management of impacts from noise. The consultation outcomes are presented within the BMG Closure Project Phase 1 EP (NOPSEMA ID: 6825) and are not repeated here. The AAD advice has informed the assessment and definition of management measures for the ECP such as adjusting processes within MS09 to | | |

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| | consider vessel noise during tendering, development of a Whale Disturbance Risk Management Process and within that, the allocation of dedicated marine mammal observers and shut-down criteria for particular activities. |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to impulsive sound emissions is AL11 identified in Table 8-15. These acceptable levels defined for change in ambient underwater sound, a change in fauna behaviour and auditory injury are defined in Table 7-6.<br>The worst-case predicted impacts assessed in Section 8.1.4 are:<br>• Change in ambient sound from impulsive sound emissions is limited to intermittent and short-term geophysical survey activities (i.e. ~3 week SBP survey and will be managed to reduce underwater radiated noise with consideration to *MEPC.1/Circ.906* guidance approaches on maintenance of moving parts and machinery on-board vessels and lowering of vessel speeds. These specific items will be considered through the implementation of CM1: Marine Assurance Process (maintenance of equipment generating impulsive sound emissions in accordance with manufacturers instructions to ensure efficient operation) and CM2: Offshore Operational Procedures (application of vessel management practices of EPBC Regulations (Part 8 Division 8.1 interacting with cetaceans)).<br>• Behavioural changes to fish (including eggs and larvae) are predicted to be generally within tens of metres of the source; and for marine mammals and marine reptiles, predicted to be within 130 m of the source (i.e. SBP).<br>• Impulsive sound sources are short-term (i.e. ~3 week SBP survey) and will cause small, variable, temporary behavioural changes, not affecting local ecosystem function; with no population level impacts.<br>• Results of underwater modelling of a SBP activity did not predict the potential onset of auditory injury to marine turtles or fish.<br>• For marine mammals, in the event highly mobile oceanic dolphins pass the very localised ensonified area where sound may exceed the TTS threshold, it is unlikely they would remain within in close proximity for 24 hours for the onset of TTS to occur. As such, auditory injury to marine mammals from East Coast Project impulsive sound emissions are not credible and not evaluated further.<br>• The highest consequence ranking for impulsive underwater sound emissions was evaluated as Level 2, specifically for marine mammals, and the highest inherent risks for impulsive underwater sound emissions was evaluated as Low.<br>Therefore, at its worst-case, the predicted impact from impulsive sound emissions would not:<br>• Modify an important or substantial area of habitat which may adversely impact on biodiversity and ecological integrity<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species<br>• Lead to loss of habitat critical to the survival of species.<br>Therefore, the predicted level of impact due to impulsive sound emissions from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to impulsive sound emissions are acceptable, based on:<br>• Predicted levels of impact (evaluated in Section 8.1.5) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES<br>• Relevant historical feedback from stakeholders (AAD) for activities of similar nature and scale to the East Coast Project has been used to inform mitigation measures.<br>To manage impacts to receptors to at or below the defined acceptable levels the following EPOs have been applied: |

| | |
|---|---|
| | **EPO16:** Impacts to marine fauna from underwater anthropogenic noise emissions will be limited to temporary* behavioural change localised** to the noise source.<br>*Not exceeding the duration of the activity component (i.e. vessel campaign) (described in Section 8.1.2 and 8.2.2)<br>**Not exceeding the noise EMBA defined for the activity(described in Section 8.1.5 and 8.2.5)<br>**EPO17:** No death or injury[14] to EPBC Act listed threatened, migratory or cetacean species.<br>**EPO18:** Project related underwater noise within biologically important areas[14] and habitat critical to the survival of relevant species will be managed through the implementation of Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process, such that:<br>• Any blue whale continues to utilise biologically important areas without injury and is not displaced from a foraging area.<br>• Southern right whales are not prevented from utilising biologically important areas[15] or habitat critical to the survival of a species or cause auditory impairment.<br>• The risk of behavioural disturbance to southern right whales will be limited to temporary behavioural disturbance of individuals.<br>**EPO20:** For activity specific environment plans undertake review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. |

### 8.1.7 Environmental Performance

Table 8-15 lists the acceptable level and EPO defined for impulsive sound emissions and the adopted control measures to achieve the outcome.

*Table 8-15: Environmental Performance Summary – Impulsive sound emissions*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL11:** Changes to ambient underwater sound from project activities will be characterised through modelling and/or monitoring, and impacts and risks will not be inconsistent with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. | **EPO16:** Impacts to marine fauna from underwater anthropogenic noise emissions will be limited to temporary* behavioural change localised** to the noise source.<br>*Not exceeding the duration of the activity component (i.e. vessel campaign) (described in Section 8.1.2 and 8.2.2).<br>**Not exceeding the noise EMBA defined for the activity (described in Section 8.1.5 and 8.2.5).<br>**EPO17:** No death or injury[14] to EPBC Act listed threatened, migratory or cetacean species.<br>**EPO18:** Project related underwater noise within biologically important areas[14] and habitat critical to the survival of relevant species will be managed through the implementation of Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process, such that:<br>• Any blue whale continues to utilise biologically important areas without injury and is not displaced from a foraging area.<br>• Southern right whales are not prevented from utilising biologically important areas[15] or habitat critical to the survival of a species or cause auditory impairment.<br>• The risk of behavioural disturbance to southern right whales will be limited to temporary behavioural disturbance of individuals. | CM1: Marine Assurance Process<br>CM2: Offshore Operational Procedures<br>CM3: Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process<br>CM20: Campaign Risk Review<br>CM22: Modelling Review |

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| | **EPO20:** For activity specific environment plans undertake review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. | |

## 8.2 Underwater Sound Emissions – Continuous

### 8.2.1 Cause of Aspect

The East Coast Project well construction, operations and support activities phases will generate continuous noise emissions that will increase ambient underwater sound levels in the marine environment.

Relevant continuous noise emitting activities for each phase are identified in Table 8-16, which are described in further detail in subsections below.

*Table 8-16: Activities undertaken during the East Coast Project that may generate continuous sound emissions*

| Cause of Aspect / Phase | Activity component |
|---|---|
| **Well Construction** | Drilling operations |
| **Operations** | Hydrocarbon extraction and transport |
| **Decommissioning** | Well abandonment<br>Removal of subsea infrastructure |
| **Support Operations** | MODU operations |
| | Vessel operations |
| | Helicopter operations |
| | ROV / AUV Operations |

### 8.2.2 Aspect Characterisation

#### *8.2.2.1 Well Construction*

Well construction operations will introduce localised and temporary continuous sound into the marine environment of the operational area.

During drilling operations, onboard equipment vibrations and the rotating drill string will transmit continuous sound into the water column (Austin et al., 2018).

Drilling operations will be temporary. Up to 15 production wells may be drilled within the scope of this OPP. Each well is expected to take up to 60 days to drill or up to 300 days for drilling campaigns with multiple wells (up to 5 wells). A maximum of 7 drilling campaigns are expected during the East Coast Project.

The sound source characteristics of drilling operations representative of a MODU which is anchored, and drilling is defined in Table 8-17 (Connell et al., 2025).

*Table 8-17: Drilling operation source frequencies and sound level*

| Emission source | Example equipment | Source frequency range | Source sound level |
|---|---|---|---|
| **MODU while anchored and drilling** | Ocean Onyx MODU | 10 Hz to 31 kHz | SPL: 175.4 dB re 1 µPa m |

#### 8.2.2.2 Operations

Hydrocarbon extraction and transport operations will introduce localised and ongoing continuous sound into the marine environment of the operational area.

The transport of gas through pipes and valves may generate continuous underwater sound from cavitation i.e. formation or collapse of bubbles in extracted gas transported through subsea infrastructure (Salgado-Kent et al., 2016; Wang et al., 2021).

Hydrocarbon extraction and transport operations will be ongoing during the operations phase of the East Coast Project. The estimated duration of the operations phase is 5-12 years. The sound source characteristics of hydrocarbon extraction and transport operations is defined in Table 8-18 (Salgado-Kent et al., 2016). Ambient underwater sound levels in the operational area are expected to range between 110 and 161 dB re 1 µPa (Duncan et al., 2013). The sound source level for hydrocarbon extraction and transport operations.

The sound source from flaring has not been modelled for the East Coast Project as it is low level and generally accepted as indistinguishable from vessel and MODU activities. Acoustic energy produced from flaring transmits through the air/water boundary due to the surface of water acting as a reflective plane and a significant component of acoustic energy reflecting into the air. While underwater received sound pressure level during flaring is estimated to be 136 dB re 1µPa at 1m (SPL) below the sea surface it is expected to attenuate to ambient levels within a very short distance (within metres) (Woodside 2024) and therefore expected to have no additive effect on the activity behavioural EMBAs; and has not been evaluated further.

*Table 8-18: Hydrocarbon extraction and transport operations source frequencies and sound level*

| Emission source | Example equipment | Source frequency range | Source sound level |
|---|---|---|---|
| **An operating wellhead and pipelines** | Wellhead and pipelines associated with Cossack Pioneer FPSO operations is referred to as a proxy | 100 Hz to 2.5 kHz<br>Wellhead noise probably extended to higher frequencies. | SPL: 113 dB re 1 µPa RMS |

#### 8.2.2.3 Decommissioning

Continuous sound emissions may be generated by the removal of subsea infrastructure and well abandonment methods such as mechanical cutting and wellhead cutting. Localised and temporary continuous sound emissions will be introduced into the marine environment of the operational area during these activities. Previous studies have found that the continuous noise generated during well cutting, using a diamond wire cutting of a 32-inch conductor in approximately 80 m of water, was largely indistinguishable from background vessel sound at lower frequencies (Pangerc et al., (2016). Modelling by Connell et al. (2021) for the BMG decommissioning project in offshore Victoria also found that an ROV and cutting activity had no influence on the extent or duration of potential behavioural noise impacts for the activity, which were driven by sound from vessel DP.

As the wellhead cutting will not be distinguishable from the drilling underwater sound emissions, it is considered inherently part of the assessment of drilling sound emissions.

#### 8.2.2.4 Support Operations

MODU, vessel, helicopter and ROV / AUV operations will introduce localised and temporary continuous sound into the marine environment of the operational area.

All East Coast Project phases require the temporary use of support operations at varying durations (Table 4-10).

Continuous underwater sound radiated from support operations is primarily produced from propeller and thruster cavitation (Connell et al., 2023). Review of sound source characteristics of support operations determined the highest sound levels will be generated from contracted vessels whilst

they are using thrusters for dynamic positioning (DP).The sound source characteristics of support operations used during the East Coast Project is defined in Table 8-19 (Connell et al., 2023; Jimenez-Arranz et al., 2020; Griffiths et al., 2001; Connell et al., 2025).

*Table 8-19: Support operations source frequencies and sound level*

| Emission source | Example equipment | Source frequency range | Source sound level |
|---|---|---|---|
| **MODU operations** | MODU while anchored and drilling | 10 Hz to 31 kHz | Energy Source Level (ESL): 175 dB re 1 $\mu Pa^2m^2.s$ |
| | MODU under DP whilst positioning | 10 Hz to 25 kHz | SPL: 186.7 dB re 1 µPa @ 1 m |
| **Vessel operations** | Anchor Handling Tug Supply (AHTS) stationary under DP | Decidecade frequency-band | ESL: 194 dB re 1 $\mu Pa^2m^2.s$ |
| | AHTS slow transit | Decidecade frequency-band | ESL: 173 dB re 1 $\mu Pa^2m^2.s$ |
| | Infield Support Vessel (ISV) pipelaying | Decidecade frequency-band | ESL: 188 dB re 1 $\mu Pa^2m^2.s$ |
| | Dive Support Vessel (DSV) stationary under DP | Decidecade frequency-band | ESL: 187 dB re 1 $\mu Pa^2m^2.s$ |
| **Helicopter operations** | Medium Utility Helicopter | Dominant 22 Hz tone | SPL: 151 dB re 1 µPa @ 1 m |
| **ROV / AUV operations** | AUV autosub | 100 Hz to 5 kHz | SPL: 124 dB re 1 µPa @ 1 m |

The sound source from helicopter operations has not been modelled for the East Coast Project as it is low level and generally accepted as indistinguishable from vessel and MODU activities. Richardson et al. (1995) reported helicopter sound (for Bell 214 type) being audible in air for four minutes before it passed over receivers, but only detectable underwater for 38 seconds at 3 m depth and for 11 seconds at 18 m depth for the same flight path. This would be a brief ~daily occurrence. Noise levels for typical helicopters used for offshore transfers (Eurocopter Super Puma AS332) at 150 m separation distance has been measured at a maximum of 90.6 dB (BMT Asia Pacific, 2005).The majority of the sound is not expected to transfer from air to water, and the portion that does, would attenuate to ambient levels within a very short distance (within metres) and therefore expected to have no additive effect on the activity behavioural EMBAs and is not evaluated further.

#### *8.2.2.5 Concurrent activities*

Concurrent activities may occur during the East Coast Project. This means that for example, campaigns relating to well construction and installation and commissioning phases have the potential to occur at the same time during the East Coast Project (refer to Section 4.1.2).

Where activities do occur concurrently, and which result in multiple vessels operating in field at the same time, may result in a larger noise footprint, but for less time compared to if those same activities were to occur sequentially.

For the purposes of this evaluation, scoping between Cooper Energy and JASCO Applied Sciences (Australia) Pty Ltd (JASCO) was undertaken to define realistic cases for concurrent operations and identified the largest expected ensonified area over the course of the East Coast Project, accounting for from multiple simultaneous sound sources.

The largest case identified for concurrent activities included the following continuous sound sources:

- Elanora-1 well construction operations:
  - 1x MODU anchored while drilling
  - 1x AHTS stationary (on DP)

- 1x AHTS slow transit.

- Flowline installation between Annie-2 and Casino-5:
  - 1x ISV pipelaying (on DP).

The sound source characteristics of each continuous sound source is detailed in Table 8-19.

### 8.2.3 Underwater Noise Modelling

Cooper Energy commissioned JASCO to undertake a modelling study of underwater sound levels associated with drilling and support operations to define relevant continuous sound EMBAs (Connell et al., 2025).

Results of the study define the spatial extent of potential acoustic impact to ambient sound and the spatial extent of potential impact thresholds to marine mammals, turtles and fish including eggs and larvae. The predicted spatial extent for the onset of relevant impact thresholds is detailed in the following subsections.

The MODU under DP will be used infrequently during the campaign, for initial manoeuvring over a well centre during the mooring process; and if necessary, during severe weather events to provide additional positioning redundancy to prevent, or respond to, a mooring failure.

Table 8-20 lists the continuous sound model scenarios applied in the study, including consideration of the MODU as anchored or under DP.

*Table 8-20: Description of the scenarios modelled for continuous sound*

| Scenario | Description | Number of continuous sound sources per scenario |
|---|---|---|
| 1 | **Pre-lay activity** represented by a single AHTS pre-laying anchors for drilling operations.<br>Modelled separately at Annie-2 and Elanora-1 well sites. | 1x AHTS under DP |
| 2 | **MODU positioning / installation** represented by a MODU generating no noise, assisted by 3 AHTS.<br>Modelled separately at Annie-2 and Elanora-1 well sites. | 2x AHTS slow transit<br>1x AHTS under DP |
| 3 | **Drilling operations** represented by an anchored MODU drilling.<br>Modelled separately at Annie-2 and Elanora-1 well sites. | 1x MODU anchored and drilling |
| 4 | **Drilling operations** represented by an anchored MODU drilling, assisted by a single AHTS.<br>Modelled separately at Annie-2 and Elanora-1 well sites. | 1x MODU anchored and drilling<br>1x AHTS under DP |
| 5 | **Drilling operations** represented by an anchored MODU drilling, assisted by 2 AHTS.<br>Modelled separately at Annie-2 and Elanora-1 well sites. | 1x MODU anchored and drilling<br>1x AHTS slow transit<br>1x AHTS under DP |
| 6 | **Installation of an EHU** represented by an ISV pipelaying.<br>Modelled between Annie-2 and Casino-5 well sites. | 1x ISV pipelaying |
| 7 | **Installation of other subsea infrastructure** represented by a single DSV.<br>Modelled at Annie-2 well site only. | 1x DSV stationary under DP |
| 8 | **Concurrent activities** represented by an anchored MODU drilling, assisted by 2 AHTS and an ISV pipelaying.<br>Modelled drilling operations at Elanora-1 well site.<br>Modelled ISV pipelaying between Annie-2 and Casino-5 well sites. | 1x MODU anchored and drilling<br>1x AHTS slow transit<br>1x AHTS under DP<br>1x ISV pipelaying |
| 9 | **MODU under DP** over well centre.<br>Modelled separately at Annie-2 and Elanora-1 well sites. | 1x MODU under DP |

| Scenario | Description | Number of continuous sound sources per scenario |
|---|---|---|
| 10 | **MODU positioning / installation under DP** maneuvering over well centre, assisted by 3 AHTS.<br>Modelled separately at Annie-2 and Elanora-1 well sites. | 1x MODU under DP<br>1x Anchor Handler on bridle<br>2x Anchor Handler within 2 km of location (hooking up anchors) |

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 noise effect thresholds used in the modelling study and impact and risk assessment are based on current best available science, such as:

- Frequency-weighted accumulated sound exposure levels (SEL24h) from the NOAA Technical Guidance (NMFS, 2024) and Southall et al. (2019) for the onset of auditory injury (AUD INJ) (which includes PTS) and TTS in marine mammals.
- Un-weighted SPL for behavioural threshold for marine mammals based on NOAA (2024).
- Frequency-weighted accumulated sound exposure levels (SEL24h) from Accomando et al. (2025) for the onset of PTS and TTS in marine turtles.
- Sound exposure guidelines for fish, fish eggs, and larvae (Popper et al., 2014).

### 8.2.4 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impacts from continuous noise emissions are:

- Change in ambient sound.

Potential risk:

- Change in fauna behaviour, including:
  - Marine mammals
  - Marine turtles
  - Fish
- Auditory impairment (masking, temporary threshold shift (TTS), recoverable injury), or auditory injuries (mortality or potential mortal injuries, permanent threshold shift (PTS)) to marine fauna, including:
  - Marine mammals
  - Marine turtles
  - Fish including eggs and larvae.

Socio-economic impacts on commercial fisheries have not been evaluated further, as there are no discernible impacts to behaviour and distribution expected at the population level given the limited nature and scale of activities and associated underwater sound emissions.

### 8.2.5 Impact and Risk Evaluation

#### *8.2.5.1 Impacts: Change in Ambient Sound*

**Inherent Consequence Evaluation**

Ambient underwater sound levels in the operational area are expected to range between 110 and 161 dB re 1 µPa (Duncan et al., 2013).

Underwater sound modelling (Connell et al., 2025) predicted increased levels of underwater sound to 110 and 160 dB re 1 µPa would extend:

- 92 km to 0.07 km from the concurrent operation (Scenario 8: inclusive of 4 sound sources).

- 90 km to 0.06 km from anchor hook up to the MODU under DP represented by a MODU under DP with 3 AHTs under DP (Scenario 10: inclusive of 4 sound sources).

Drilling operations and concurrent operation scenarios would be intermittent and temporary. The consequence of a short-term change in ambient sound within (up to) 92 km of the project activities 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.

#### *8.2.5.2 Risk: Change in Fauna Behaviour – Marine Mammals*

**Inherent Consequence Evaluation**

Continuous sound emissions may cause behavioural changes to marine mammals depending on the frequency and sound levels received.

Continuous sound levels greater than 120 dB re 1 µPa (SPL) is adopted as a conservative behavioural change threshold for marine mammals including otariid seals, low- frequency cetaceans, high-frequency cetaceans and very high-frequency cetaceans (NOAA, 2024). The 120 dB re 1 µPa threshold is associated with continuous sources and was derived based on studies examining behavioural responses to drilling and dredging (NOAA 2018b), 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 noise did not produce clear evidence of disturbance or avoidance for levels below 110 dB re 1 µPa (SPL), 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. It has been shown that both received level and proximity of the sound source is a contributing factor in eliciting behavioural reactions in humpback whales (Dunlop et al., 2017; Dunlop et al., 2018).

Figure 8-1 illustrates the frequency (how regular) and duration of DP operations over a nominal well construction campaign as described within this OPP.

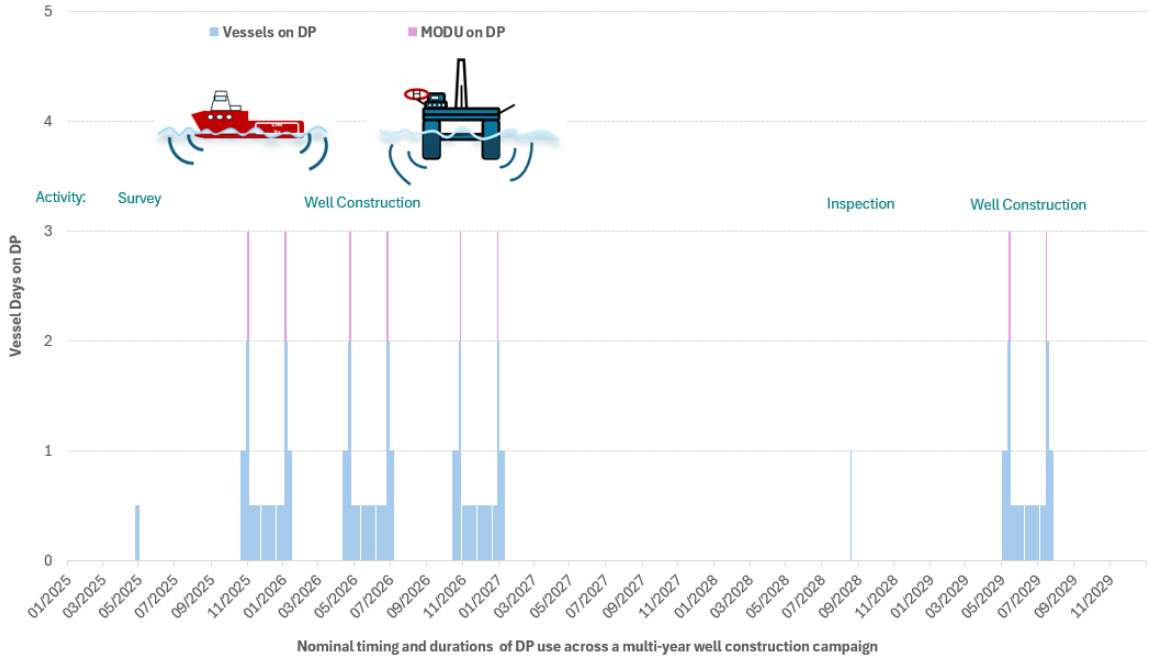



*Figure 8-1: Indicative vessel days on DP during a nominal well construction campaign*

For nearshore activities, underwater sound modelling predicted the behavioural threshold for marine mammals was reached within:

- 0.44 km for a single continuous vessel sound source at offshore locations (Scenario 1: single support vessel at Annie-2),

- 2.59 km for a single continuous vessel sound source at nearshore locations (Scenario 6: single support vessel (ISV) at Annie-2),
- 5.36 km for a single continuous MODU sound source at nearshore locations (Scenario 9: MODU under DP at Annie-2),
- 1.13 km for 2 continuous sound sources at nearshore locations (Scenario 4: MODU drilling with a single support vessel at Annie-2),
- 7.87 km for 3 continuous sound sources at nearshore locations (Scenario 2: MODU positioning with 3 support vessels at Annie-2)
- 8.02 km for 4 continuous sound sources at nearshore locations (Scenario 10: MODU under DP with 3 support vessels at Annie-2) (Appendix 4; Connell et al., 2025).

For offshore activities, underwater sound modelling predicted the behavioural threshold for marine mammals was reached within:

- 0.75 km for a single continuous vessel sound source at offshore locations (Scenario 1: single support vessel at Elanora-1),
- 12 km for a single continuous MODU sound source at offshore locations (Scenario 9: MODU under DP at Elanora-1),
- 2.91 km for 2 continuous sound sources at offshore locations (Scenario 4: MODU drilling with a single support vessel at Elanora-1),
- 21.7 km for 3 continuous sound sources at offshore locations (Scenario 2: MODU positioning with 3 support vessels and Scenario 5: MODU drilling with 2 support vessels both at Elanora-1)
- 24.8 km for 4 continuous sound sources at offshore locations (Scenario 10: MODU anchoring under DP with 3 support vessels at Elanora-1) (Appendix 4; Connell et al., 2025).

For concurrent activities, underwater sound modelling predicted the behavioural threshold for marine mammals was reached within:

- 30.70 km* for 4 continuous sound sources at both nearshore and offshore locations during concurrent activity (Scenario 8: concurrent operations – combination of Scenario 5 modelled at Elanora-1 and Scenario 6 modelled between Annie-2 and Casino-5) (Appendix 4; Connell et al., 2025).

*Note: The modelling results predicted for the credible concurrent operations (Scenario 8) differ from the other scenarios modelled, as the ensonified field is not a uniform radius from the sound source. Instead the distance is based off the maximum horizontal distance to reach the behavioural response thresholds between the 2 combined scenarios. As such, it is the maximum distance between the offshore extent of Scenario 5 and the furthest nearshore extent from Scenario 6.

Summary

Assessment of the underwater sound modelling report (Appendix 4; Connell et al., 2025) determined that the ensonified areas produced from Scenarios 2, 5, and 10 at Annie-2 have the potential to overlap the reproduction BIA for the southern right whale; these activities present the worst-case scenarios. Figure 8-2 presents the behavioural EMBA for scenarios 2, 5 and 10 at Annie-2 in relation to the southern right whale BIAs. See Appendix 4 for further details of the modelling report (Connell et al., 2025. Further consideration of the overlap has been provided in the impact assessment below.

The difference in sound propagation is due to the differences in substrate compositions found at the nearshore and offshore locations. The geoacoustic profiles for Elanora-1, and Annie-2 were generated using lithographic descriptions (Section 6.4.7; Figure 6-14) from the environmental sampling survey conducted in association with the existing CHN infrastructure (Fugro 2020a, 2020b) and previous underwater acoustic modelling and measurement studies (Connell et al., 2023; 2025). Connell et al. (2025) describes the difference in the sound attenuation levels for Annie-2 and Elanora-1 (see Appendix 4;). The substrate type which is found at Annie-2, exposed caprock with little sand coverage (Fugro 2020a, 2020b), has been shown to attenuate sound more than the sandy substrate type that is expected at the Elanora-1 location; the sand coverage above the caprock does

not attenuate sound to the same degree as exposed caprock. This effect has also previously been reported by Duncan et al. (2009) and measured recently during drilling operations in the Otway Region (McPherson et al., 2021b). Due to the water depths, proximity to the coastline, and available site-information the nearshore locations, such as Pecten East, Juliet and Nestor, Netherby, and Henry are treated as analogous of Annie-2, and the offshore locations, Heera and Isabella, are assumed to be analogous with Elanora-1 for conservatism. The sand cover at Elanora is patchy and it is therefore considered conservative to model the entire field as if it has a sandy (and therefore reflective) seabed.

Prior well construction activities are undertaken, seabed surveys for those fields that are not already characterised will be undertaken. The results will be input into the Risk Review process as described in Section 12.9.

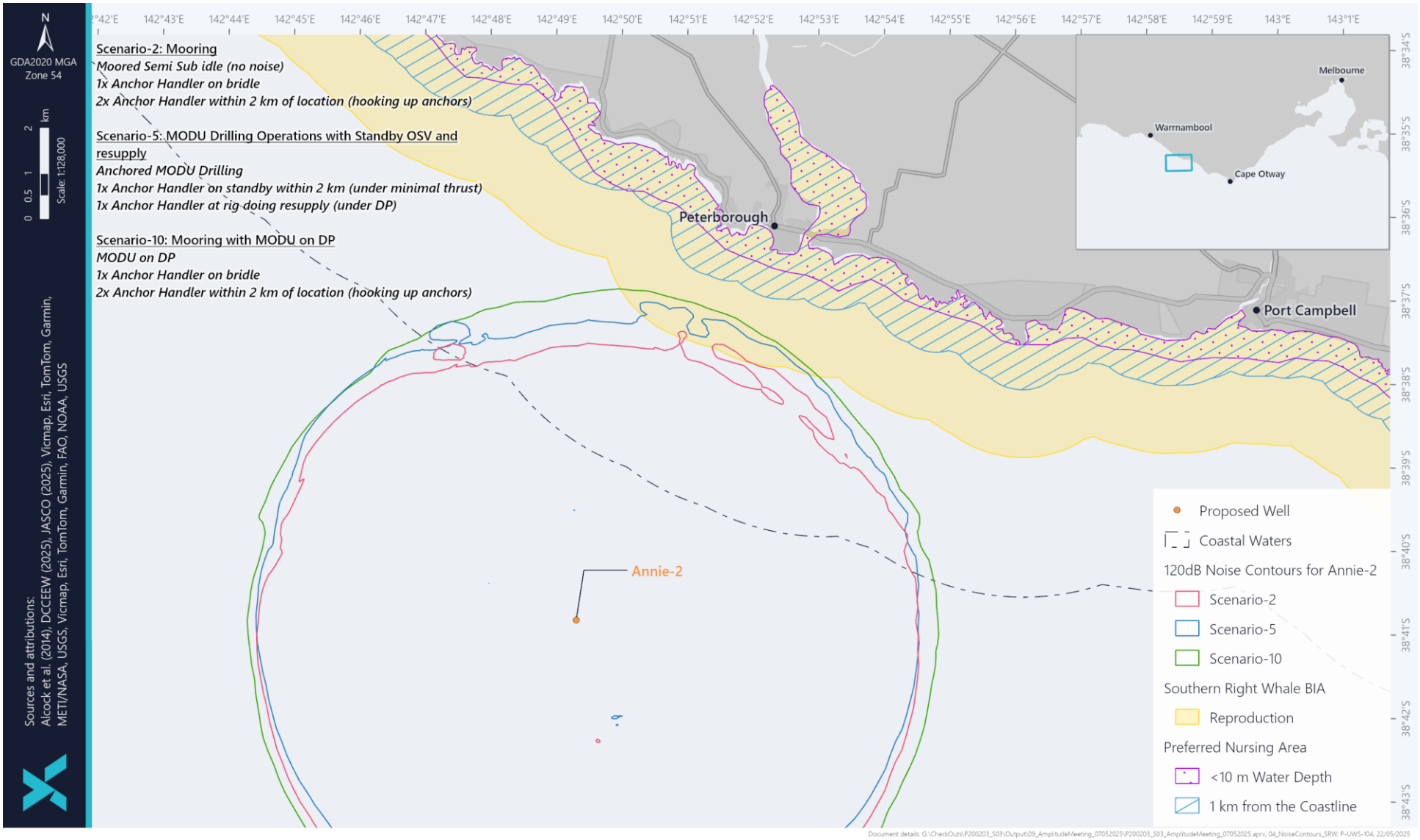



*Figure 8-2: Scenario 2, 5 and 10 at Annie-2: Noise EMBA and southern right whale BIAs*

Table 8-21 provides details on the presence of marine mammals that are EPBC Act listed. Though there are a range of potential incidental impacts associated with vessel noise, including attraction, avoidance, and changes to vocalisation, the assessment below focuses on the potential behavioural changes which may be detrimental; this informs the inherent consequence level attributed below.

*Table 8-21: Inherent Consequence Levels - Continuous Sound - Behavioural Changes to Marine Mammals*

| Marine mammals (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| **Pinnipeds** | | | | |
| **New Zealand fur-seal**<br>**Australian fur-seal**<br>**Australian sea-lion**<br>EPBC Act listing<br>• Marine (All)<br>• Endangered (Australian Sea-lion) | May occur as per PMST report, however, are considered known to occur based on occurrence records available for the Otway (ALA, 2024) and sightings by marine mammal observers during offshore campaigns (e.g. Seiche Environmental, 2020)<br>No BIAs overlap. | Section 8.2.5.2 describes nominal behavioural responses associated with the behavioural response threshold. Seals are frequently observed offshore and around vessels; hundreds of sightings of seals were recorded in close proximity to vessels on DP over the course of the BMG Closure Project – Phase 1 in offshore Gippsland during 2024. Marine mammal observers for the project reported behaviours including foraging, milling and swimming. | Despite the conservation status of the Australian sea-lion, because of the insignificance of behavioural change to pinnipeds, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Very High-frequency cetaceans** | | | | |
| **Pygmy sperm whale** | May occur.<br>No BIAs overlapped. | Section 8.2.5.2 describes nominal behavioural responses associated with the behavioural response threshold. Minor behavioural changes (avoidance, no response, and attraction) have the potential to occur | Minor local (small, variable, temporary behavioural changes within the behavioural EMBA) impacts or disturbances to fauna. | Level 1 |
| **High-frequency cetaceans** | | | | |
| **Dolphins (Risso's, dusky, common, Indian Ocean bottlenose, bottlenose)**<br>**Toothed whales (killer, false killer)**<br>EPBC Act listed<br>• Cetacean<br>• Migratory | May or likely to occur.<br>No BIAs overlapped. | Section 8.2.5.2 describes nominal behavioural responses associated with the behavioural response threshold. Dolphins are frequently observed offshore and around vessels; hundreds of sightings of dolphins were recorded in close proximity to vessels on DP over the course of the BMG Closure Project – Phase 1 in offshore Gippsland during 2024. Marine mammal observers for the project reported behaviours including foraging, milling | Minor local (small, variable, temporary behavioural changes within the behavioural EMBA impacts or disturbances to fauna. | Level 1 |

| Marine mammals (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| | | and swimming. Minor behavioural changes (avoidance, no response, and attraction) have the potential to occur. | | |
| **Low-frequency cetaceans** | | | | |
| **Minke whale**<br>EPBC Act listed<br>• Cetacean | May occur.<br>No BIAs overlapped. | Section 8.2.5.2 describes nominal behavioural responses associated with the behavioural response threshold. Minor behavioural changes (avoidance, no response, and attraction) have the potential to occur. | Minor local (small, variable, temporary behavioural changes within the behavioural EMBA) impacts or disturbances to fauna. | Level 1 |
| **Sei whale**<br>EPBC Act listed<br>• Vulnerable<br>• Cetacean<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Section 8.2.5.2 describes nominal behavioural responses associated with the behavioural response threshold. Minor behavioural changes (avoidance, no response, and attraction) have the potential to occur. | Localized (the behavioural EMBA) and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |
| **Blue whale**<br>EPBC Act listed<br>• Endangered<br>• Cetacean<br>• Migratory | Known to occur.<br>Foraging and distribution BIAs overlapped.<br>During January to June, blue whales migrate through the operational area.<br>Given the nature of the activities, and the long durations blue whales are present in the region, there will likely be some temporal overlap between the activities and the times of year when blue whales are expected in the region; the risk assessment considers the activities will overlap with the presence of blue whales in the region. | Section 8.2.5.2 describes nominal behavioural responses associated with the behavioural response threshold. Minor behavioural changes (avoidance, no response, and attraction) have the potential to occur.<br>Change in blue whale song due to presence of ships increasing background noise levels (Melcon et al., 2012). Vocalisations of blue whales may continue in the presence of vessels, however changes in call level and rate may occur (McKenna, 2011).<br>Inferred modification of foraging efficiency because of effects on masking. | The risk of changing blue whale individuals foraging behaviour is not expected to result in population level impacts. There is limited and spatial area (within the behavioural EMBA) potentially affected which is slight compared to the total area available for foraging (Figure 6-44). There are no barriers or potential stressors introduced by the activity which would be expected to have a discernible effect on prey or predator distribution given the natural broad scale and dynamic distribution of both prey and predator. Overall opportunities for foraging would not therefore be expected to be discernible from inherent variability. The potential impacts to individuals are therefore assessed as localized and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |
| **Fin whale** | Likely to occur. | Section 8.2.5.2 describes nominal behavioural | Localized (the behavioural EMBA) and short-term | Level 2 |

| Marine mammals (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| EPBC Act listed<br>• Vulnerable<br>• Cetacean<br>• Migratory | No BIAs overlapped. | responses associated with the behavioural response threshold.<br>Modify song characteristics under increased background noise conditions, and temporary displacement (Castellote et al., 2012). | impacts to species of recognized conservation value not affecting local ecosystem function. | |
| **Pygmy right whale**<br>EPBC Act listed<br>• Cetacean<br>• Migratory | May occur.<br>No BIAs overlapped. | Section 8.2.5.2 describes nominal behavioural responses associated with the behavioural response threshold. Minor behavioural changes (avoidance, no response, and attraction) have the potential to occur. | Minor local (small, variable, temporary behavioural changes within the behavioural EMBA) impacts or disturbances to fauna. | Level 1 |
| **Southern right whale**<br>EPBC Act listed<br>• Endangered<br>• Cetacean<br>• Migratory | Known to occur.<br>Reproduction and migration BIAs overlapped.<br>During May-June and September-October southern right whales pass through the operational area to move to and from coastal reproduction areas.<br>Given the nature of the activities, and the long durations southern right whales are present in the region, there will likely be some temporal overlap between the activities and the times of year when southern right whales are expected in the region; the risk assessment considers the activities will overlap with the presence of southern right whales in the region. | Section 8.2.5.2 describes nominal behavioural responses associated with the behavioural response threshold.<br>Potential increase in stress levels and vocal adaptation in response to increased background noise from shipping, inferred from studies of right whales in the northern hemisphere (Parks et al., 2010; Rolland et al., 2012). Note among southern right whale populations in preferred reproduction habitats, vocalisations are low amplitude and relatively infrequent, inferred as a strategy to decrease the risk of acoustically alerting predators (e.g. killer whales) of their presence (DCCEEW 2022s).<br>Disturbance to resting southern right whales nearshore (within preferred calving/resting habitat) has been reported as being triggered by close encounters with humans, including surfers (e.g. ABC News, 2023), with mother and calf subsequently travelling 20km within a few hours.<br>As subsea noise generated by surfers is likely to be negligible, this may illustrate disturbance triggers could be both | Much of the Australian coastline, particularly within the south-east marine region, has been identified as a reproduction BIA for southern right whale (DCCEEW 2024). The Draft National Recovery plan for the southern right whale (DCCEEW, 2022s) proposes this reproduction BIA as habitat critical to the survival of the southern right whale (DCCEEW, 2022a).<br>Noise produced when peak breeding behaviours (i.e. mating calving and nursing) are occurring (May and October) could result in behavioural disturbances to females within the reproduction BIA. Behavioural responses to breeding females, could therefore, affect the body conditions of calving and lactating mothers, subsequently impacting the fitness of the offspring (DCCEEW, 2024l).<br>Noise modelling of various activity scenarios indicates behavioural change thresholds may be exceeded within the reproduction BIA during resupply, MODU positioning and mooring activities at the location closest to shore; Annie-2 (see Appendix 4 and further | Level 2 |

| Marine mammals (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| | | audible and/or visual (i.e. something observed as approaching which results in a threat response). Within Portland Harbour, which resides the Otway region, within the designated Reproduction BIA for southern right whales, and is an active hub for large international merchant ships, there are recurring sightings during the migration and reproduction seasons (ALA, 2024).<br>Noise generated by shipping activities is comparable to the noise generated by vessels likely to be used for the East Coast Project activities (Section 6.4.9).<br>Potential behavioural responses also includes avoidance behaviours by breeding females within the reproduction BIA leading to changes to breeding behaviours. Breeding females are known to have the greatest energy demands due to the energy associated with gestation and lactation (DCCEEW, 2024l). The act to avoid an area could increase the energy requirements of the individual, potentially depleting the finite energy stores, and subsequently the ability to undertake breeding behaviours. | noise modelling analysis provided in footnote[1] ). Further review of the reproduction BIA overlap found the preferred reproduction habitat (within the shallow waters of <10m and within <1 km from shore) is not overlapped.<br>In the unlikely event that southern right whales are present nearby during activities, the highly mobile migratory species, which travel thousands of kilometres between habitats used for essential life functions, may avoid the area where the behavioural disturbance criteria are reached. However, given their mobility, this is unlikely to result in stopping their movements to/from the preferred reproduction habitat located including coastal aggregation areas. The East Coast Project activities are outside of the preferred reproduction habitat of southern right whales but are within the Migratory BIA which encompasses the majority of the ocean off the southern coasts of Australia (Figure 6-47).<br>Noise from vessels including their visible presence) could elicit a behavioural response, such as avoidance. This could increase the energy requirements of whales at a time when their energy budgets are reduced. The activities are not of the nature or scale that could present a barrier to migration and the sound from project vessels would not be expected to significantly alter overall migration distances, which can be multiple thousands of km during the reproduction season (Watson et al., 2021).<br>Logans beach is ~24km from the closest edge of the operational area; no | |

| Marine mammals (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of potential consequence | Inherent consequence |
|---|---|---|---|---|
| | | | overlap with behavioural disturbance contours from activity vessels is expected to occur considering smaller radii of modelled contours closer to shore, applicable to the shallower well sites, and larger radii of modelled contours further offshore, applicable to the deeper well sites.<br>Relatively slight (if any) adjustments in migratory course around temporary project vessels is not expected to result in population level impacts.<br>The potential impacts to individuals are therefore assessed as localized (~8 km to ~25 km from the source) and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | |
| **Humpback whale**<br>EPBC Act listed<br>• Cetacean<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Short-term behavioural impacts include alterations of dive patterns, swim speeds, swim orientation, group cohesiveness, behavioural state and changes in acoustic behaviour (Sprogis et al., 2020; Arranz et al., 2021). | Marine Mammal Observers were offshore throughout Cooper Energy's recent BMG subsea wells decommissioning campaign in 2023/24. These activities were completed in the Gippsland basin, offshore Victoria, and are of similar nature and scale to the East Coast Project well construction campaigns. MMOs reported whales near to and approaching vessels whilst on DP, no indications of disturbance were observed. Conservatively, potential impacts to Humpback whales are assessed as Minor local (small, variable, temporary behavioural changes within the behavioural EMBA). Impacts are not expected to result in population level effects. | Level 1 |

Noise modelling of resupply, MODU positioning and mooring activity scenarios at Annie-2 (the location closest to shore) predicts behavioural change thresholds may be exceeded within the reproduction BIA (see Appendix 4). All noise modelling scenarios at the offshore location (Elanora-1) did not predict the behavioural thresholds to overlap the reproduction BIA.

Evaluation of the sound level contour maps produced for these activity scenarios at Annie-2 (Appendix 4: Figures 7-27) demonstrates that the behavioural change threshold overlaps only a small portion of the reproduction BIA:

- Scenario 2 (MODU positioning activities at Annie-2), which extends 7.87 km from the sound sources,
- Scenario 5 (resupply activities at Annie-2) which extends 7.46 km from the sound sources,
- Scenario 10 (MODU mooring activities at Annie-2) which extends 8.02 km from the sounds sources (Connell et al., 2025).

As such, the maximum extent to reach the behavioural change threshold within the reproduction BIA will be from the conservative Scenario 10 modelled at Annie-2, which will extend ~8 km from the sound sources.

Given the East Coast Project activities are within Commonwealth waters with the nearest well to the coastline, Annie-2, being ~10.4 km offshore, and ~7 km from the edge of the reproduction BIA; the noise from short-term resupply, MODU positioning and mooring activities at Annie-2 has the potential to result in a change in behaviour of southern right whales utilising the reproduction BIA.

Previous studies have indicated that during the time of peak aggregations in reproductive areas the southern right whale shows a preference to reproduction habitat; <10 m depth (DSEWPC, 2012; Charlton et al., 2019) and within the shallow waters <1 km from shore (DCCEEW, 2024l).

Given the Annie-2 well location is ~7 km from the reproduction BIA, and the maximum extent to the behavioural threshold was modelled as ~8 km from Annie-2; it is anticipated that in the worst-case scenario approximately 1 km inside the edge of the reproduction BIA may be temporarily overlapped during activities.

The reproduction BIA extends approximately >3 km from the coastline; as such, the preferred reproduction habitat (<10 m of water depth and <1 km from the coastline) would be outside the area that may potentially be overlapped by the behavioural EMBA.

Therefore, in the event that the temporary noise sources overlap the reproduction BIA during the time of peak aggregations in reproductive areas; it is highly unlikely that the preferred reproduction habitat would be overlapped

This is supported by the sound level contour maps produced for Scenario 10 (Appendix 4: Figure 26) which demonstrate that the potential spatial area overlapped by the furthest behavioural EMBA from Annie-2 is slight when compared to the total area within the boundaries of the reproduction BIA (See Figure 8-2).

As such, a change in behaviour of southern right whales utilising the reproduction BIA is considered unlikely, and the risk of behavioural change limited to individuals moving through the area, rather than aggregations of whales, or resting/nursing mother and calves inside preferred habitat. Due to the potential sensitivity of the reproduction BIA, a precautionary approach has been taken and specific control measures have been implemented (see Table 8-34) to ensure activities are consistent with the southern right whale National Recovery Plan (DCCEEW, 2024l).

**Inherent Likelihood**

The likelihood of behavioural changes to marine mammals depends on the continuous sound source used, the potential presence of low-frequency cetaceans within the behavioural EMBA as well as the relative sensitivity of different species and individuals.

Sound source levels of underwater continuous sound from hydrocarbon extraction and transport operations is below the behavioural change threshold for marine mammals. As a result, there is no likelihood of behavioural change to marine mammals during hydrocarbon extraction and transport operations.

For the risk event of behavioural changes to marine mammals to occur, the following combination of factors are required:

- Continuous underwater sound emissions (i.e. from drilling operations, MODU operations and / or vessel operations)

- Marine mammals present within the behavioural disturbance range of the of continuous sound source.

Table 8-22 provides details on the frequency of recorded sightings of EPBC Act marine mammals in the Otway Basin to infer presence within the behavioural EMBA, description of likelihood of incidental detrimental behavioural impacts and the resulting inherent likelihood level assessed for each marine mammal species.

*Table 8-22: Inherent Likelihood Levels - Continuous Sound - Behavioural Changes to Marine Mammals*

| Marine Mammals (EPBC Act listing) | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood |
|---|---|---|---|
| **Pinnipeds** | | | |
| • **New Zealand fur-seal**<br>• **Australian fur-seal**<br>• **Australian sea-lion** | May occur as per PMST report, however, are considered known to occur based on occurrence records available for the Otway (ALA, 2024) and sightings by marine mammal observers during offshore campaigns (e.g. Seiche Environmental, 2020)<br>No BIAs overlap. | Fur seals are likely to occur within the behavioural EMBA; however behavioural changes are not certain to happen. Cooper Energy Marine Mammal Observers made hundreds of observations of fur seals proximal to vessels on DP during the BMG Phase 1 wells decommissioning campaign (2023/24). Minor behavioural changes (ranging from avoidance, no response, and attraction) to high-frequency cetaceans could occur. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Very high-frequency cetaceans** | | | |
| Pygmy sperm whale, | May occur.<br>No BIAs overlap.<br>There are <50 records for pygmy sperm whales across the Otway between 1988 and 2024. None of these sightings occurred proximal to the East Coast Project operational area. | A freak combination of factors would be required for very high frequency cetaceans to be present within the behavioural EMBA during activities generating continuous sound emissions and for noise from the project to have a discernible effect. Any individuals proximal to the activities may or may not alter behaviour. | Remote (E) |
| **High-frequency cetaceans** | | | |
| • **Dolphins** (Risso's, dusky, common, Indian Ocean bottlenose, bottlenose)<br>• **Toothed whales** (killer, false killer) | May occur.<br>No BIAs overlap.<br>Between 2002 and 2013, 123 aerial surveys recorded 390 dolphin sightings and 83 sightings of toothed whales (Gill et al., 2015). | High-frequency cetaceans are likely to occur within the behavioural EMBA; however behavioural changes are not certain to happen. Cooper Energy Marine Mammal Observers made hundreds of observations of dolphins including, common and bottlenose dolphins, and pilot whales proximal to vessels on DP during the BMG Phase 1 wells decommissioning campaign (2023/24). Minor behavioural changes (ranging from avoidance, no response, and attraction) to high-frequency cetaceans could occur. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Low-frequency cetaceans** | | | |
| **Minke whale** | May occur.<br>No BIAs overlap.<br>There are no records of minke whale within the Otway region within the ALA (2024). Between 2002 and 2013, 123 aerial surveys off | A freak combination of factors would be required for a minke whale to be present within the behavioural EMBA during activities generating continuous sound emissions, and for noise from the project to have a discernible effect. Any individuals proximal to the activities may or may not alter behaviour. Behavioural change to | Remote (E) |

| Marine Mammals (EPBC Act listing) | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood |
|---|---|---|---|
| | western Victoria and SA recorded one sighting of a minke whale (Gill et al., 2015). | minke whales is not expected to occur from East Coast Project continuous underwater sound emissions. | |
| **Sei whale** | Likely to occur.<br>No BIAs overlapped.<br>The ALA (2024) holds 3 records of sei whales between the Otway and King Island. Between 2002 and 2013, 123 aerial surveys off western Victoria and SA recorded 12 sighting of sei whales (Gill et al., 2015 ). | A rare combination of factors would be required for a sei whale to be present within the behavioural EMBA during activities generating continuous sound emissions and for noise from the project to have a discernible effect. Any individuals proximal to the activities may or may not alter behaviour. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Blue whale** | Known to occur.<br>Foraging and distribution BIAs overlapped.<br>The ALA (2024) holds over 300 records of blue whale sightings between the Otway and King Island between 1990 and 2021; this includes sightings of groups and individuals. Between June 2012 and March 2013, a cetacean survey recorded 120 individual blue whales in the Otway Basin (Origin, 2018). | The risk event could happen when additional factors are present, such that a blue whale is present within the behavioural EMBA during activities generating continuous sound emissions. Blue whales are known to occur within the behavioural EMBA; any individuals proximal to the activities may or may not alter behaviour. Therefore, it is easy to postulate a scenario for the occurrence but considered doubtful. | Possible (C) |
| **Fin whale** | Likely to occur.<br>No BIAs overlapped.<br>Between 2002 and 2013, 123 aerial surveys recorded 7 sighting of sei whales off western Victoria and SA (Gill et al., 2015 ). | A rare combination of factors would be required for a fin whale to be present within the behavioural EMBA during activities generating continuous sound emissions, and for noise from the project to have a discernible effect. Any individuals proximal to the activities may or may not alter behaviour. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Pygmy right whale** | May occur.<br>No BIAs overlap.<br>The ALA (2024) holds <15 records of pygmy right whale sightings in the Otway since 1946. Between 2002 and 2013, 123 aerial surveys recorded one sighting of a pygmy right whale (Gill et al., 2015). | A freak combination of factors would be required for a pygmy right whale to be present within the behavioural EMBA during activities generating continuous sound emissions, and for noise from the project to have a discernible effect. Any individuals proximal to the activities may or may not alter behaviour. Behavioural changes to pygmy right whales are not expected to occur from East Coast Project continuous underwater sound emissions. | Remote (E) |
| **Southern right whale** | Known to occur.<br>Reproduction and migration BIAs overlapped.<br>The ALA (2024) holds >4000 records of southern right whale sightings in the Otway, with most reported in the years since 1980, with the | The risk event could happen when additional factors are present, such that a southern right whale is present within the behavioural EMBA during activities generating continuous sound emissions. Southern right whales are known to occur within the behavioural EMBA; any individuals proximal to the activities may or may not alter behaviour. Therefore, it is easy to | Possible (C) |

| Marine Mammals (EPBC Act listing) | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood |
|---|---|---|---|
| | vast majority of sightings in coastal waters. | postulate a scenario for the occurrence but considered doubtful. | |
| **Humpback whale** | Likely to occur as per PMST report, however, is considered known to occur based on ALA sightings data and in field observations.<br>No BIAs overlap. | The risk event could happen when additional factors are present, such that a blue whale is present within the behavioural EMBA during activities generating continuous sound emissions. Humpback whales are known to occur within the behavioural EMBA; any individuals proximal to the activities may or may not alter behaviour. Therefore, it is easy to postulate a scenario for the occurrence but considered doubtful. | Possible (C) |

### Inherent Risk Severity

The highest inherent risk severity of behavioural changes to marine mammals from continuous sound emissions is considered **Moderate**.

Table 8-23 lists the inherent risk severity for each marine mammal species.

*Table 8-23: Inherent Risk Severity - Continuous Sound - Behavioural Changes to Marine Mammals*

| Low-frequency cetacean | Inherent consequence level | Inherent likelihood level | Inherent Risk Severity |
|---|---|---|---|
| **Pinnipeds** | | | |
| • **New Zealand fur-seal**<br>• **Australian fur-seal**<br>• **Australian sea-lion** | 1 | D | **Low** |
| Very high-frequency cetaceans | | | |
| • **Pygmy sperm whale** | 1 | E | **Low** |
| **High-frequency cetaceans** | | | |
| • **Dolphins** (Risso's, dusky, common, Indian Ocean bottlenose, bottlenose)<br>• **Toothed whales** (killer, false killer) | 1 | D | **Low** |
| **Low-frequency cetaceans** | | | |
| **Minke whale** | 1 | E | **Low** |
| **Sei whale** | 2 | D | **Low** |
| **Blue whale** | 2 | C | **Moderate** |
| **Fin whale** | 2 | D | **Low** |
| **Pygmy right whale** | 1 | E | **Low** |
| **Southern right whale** | 2 | C | **Moderate** |
| **Humpback whale** | 1 | D | **Low** |

#### 8.2.5.3 *Risk: Auditory Injury to Marine Mammals*

Auditory injury is defined by DCCEEW (formally DAWE, 2021) as both permanent and temporary hearing impairment and any other form of physical harm arising from anthropogenic sources of underwater noise (DAWE, 2021).

Depending on the sound levels received, continuous sound emissions may cause hearing effects to marine mammals, such that:

- Temporary auditory impairment is where there is a temporary and reversible increase in an animal's hearing threshold. This is also referred to as an auditory temporary threshold shift (TTS) (NMFS, 2024).
- Auditory injury (AUD INJ) has been defined as 'damage to the inner ear that can result in destruction of tissues, such as the loss of cochlear neuron synapses or auditory neuropathy', which includes, but is not limited to, permanent threshold shift (PTS) (NMFS, 2024).
- Permanent auditory impairment is where there is a permanent and irreversible increase in an animal's hearing threshold. This is also referred to as an auditory permanent threshold shift (PTS).

Modelling of continuous underwater sound sources from the activity (vessel thrusters) predicted the TTS and AUD INJ thresholds for marine mammals was reached within distances listed in Table 8-24 (Connell et al., 2023). TTS and AUD INJ thresholds for marine mammals are based on a cumulative metric that assumes a receptor is consistently exposed to a defined sound exposure level for a 24-hour period (SEL24h). Distances predicted for the onset of TTS and AUD INJ thresholds (SEL24h) listed in Table 8-24 infers that the East Coast Project continuous underwater sound emissions have, in theory, the potential to cause:

- TTS within marine mammals within a maximum range of ~<8 km
- AUD INJ within marine mammals within a maximum range of 670 m.

The range where the potential onset of auditory impairment and injury may occur is within the operational area. As a result, the operational area is used to define the potential auditory impairment and injury EMBA for marine mammals.

*Table 8-24: Distance to TTS and AUD INJ Thresholds for Marine Mammals*

| Marine Mammal Hearing Group | Threshold ($SEL_{24h}$, dB re 1 $\mu Pa^2 \cdot s$) (NMFS, 2024) | Maximum Distance (km) | Relevant Scenario/s |
|---|---|---|---|
| **TTS** | | | |
| **Low-frequency cetaceans** | 177 | 7.92 | Scenario 10: MODU anchoring under DP with 3 AHTS at Elanora-1 |
| **High-frequency cetaceans** | 181 | 0.90 | Scenario 8: Concurrent operations |
| **Very high-frequency cetaceans** | 161 | 1.15 | Scenario 10: MODU anchoring under DP with 3 AHTS at Elanora-1 |
| **Otariid Seals (pinnipeds)** | 179 | 0.82 | Scenario 10: MODU anchoring under DP with 3 AHTS at Elanora-1 |
| **AUD INJ** | | | |
| **Low-frequency cetaceans** | 197 | 0.67 | Scenario 10: MODU anchoring under DP with 3 AHTS at Elanora-1 |

| Marine Mammal Hearing Group | Threshold ($SEL_{24h}$, dB re 1 $\mu Pa^2 \cdot s$) (NMFS, 2024) | Maximum Distance (km) | Relevant Scenario/s |
|---|---|---|---|
| **High-frequency cetaceans** | 201 | 0.04 | Scenario 2: MODU positioning / installation at Elanora-1<br>Scenario 10: MODU anchoring under DP with 3 AHTS at Elanora-1 |
| **Very high-frequency cetaceans** | 181 | 0.12 | Scenario 8: Concurrent operations |
| **Otariid Seals (pinnipeds)** | 199 | 0.03 | Scenario 2: MODU positioning / installation at Elanora-1 and Annie-2<br>Scenario 8: Concurrent operations<br>Scenario 10: MODU anchoring under DP with 3 AHTS at Elanora-1 and Annie-2 |

The exposure criteria identified by Southall et al., (2019) shown in Table 8-34 are based on a cumulative SEL over a period of 24 h. Therefore, the AUD INJ and TTS criteria are only relevant to those receptors that have potential to be within the area of exposure for a period of 24 hours. Subsequently, marine mammals that may be undertaking biologically important activities, such as breeding behaviours (i.e., mating, calving and nursing), foraging, and migrating, which would cause them to remain within the area of exposure for a period of 24 hours or longer have had the AUD INJ and TTS criteria applied in the assessment below.

Table 8-25 provides details on the presence of EPBC Act listed marine mammals within the operational area, potential impairment or injury that may occur and the resulting inherent consequence level for each marine mammal species.

*Table 8-25: Inherent Consequence Levels - Continuous Sound - Auditory Impairment or Injury to Marine Mammals*

| Marine mammals | Presence within behavioural EMBA | Potential auditory impairment or injury | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Pinnipeds** | | | | |
| • **New Zealand fur-seal**<br>• **Australian fur-seal**<br>• **Australian sea-lion** | May occur as per PMST report, however, are considered known to occur based on occurrence records available for the Otway (ALA, 2024) and sightings by marine mammal observers during offshore campaigns (e.g. Seiche Environmental, 2020)<br>No BIAs overlap. | For the onset of TTS and AUD INJ to occur, pinnipeds would need to remain in-water within 820 m and 30 m (respectively) of continuous subsea sound sources for 24-hours (Table 8-24).<br>Seals have been observed to dive and stay submerged for up to two hours (Brix, 2018). Seals will then surface from dives to breath and rest. The longer the dive the longer the surface recovery time required (Brix 2018).<br>It is not credible for seals to remain submerged in-water for 24-hours for the onset of TTS and AUD INJ to occur based on the limited dive duration. | Not credible | Not applicable |
| **Very High Frequency Cetaceans** | | | | |

| Marine mammals | Presence within behavioural EMBA | Potential auditory impairment or injury | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| • **Pygmy sperm whale** | May occur.<br>No BIAs overlap. | For the onset of TTS and AUD INJ to occur, very high-frequency cetaceans would need to remain within 1.15 km and 120 m of continuous sound sources for 24-hours, respectively (Table 8-24).<br>TTS and AUD INJ values do not incorporate animal movement within the region. Given no BIAs were identified, any individuals present would be transiting through the area, with movements that would likely preclude reaching the range required for auditory impairment and injury to occur.<br>Therefore, it is not credible for very high-frequency cetaceans to remain within 1.15 km and 120 m of continuous sound sources for 24-hours for the onset of TTS and PTS to occur given the species' oceanic range and highly mobile behaviours.<br>Cooper Energy have observed during the BMG Closure Project – Phase 1 in offshore Gippsland during 2024 dolphins approach DP vessels whilst undertaking foraging behaviours. However, observations indicate that groups and individuals transit quickly through the area, and do not remain in the area long enough for TTS and AUD INJ to occur | Not credible | Not applicable |
| **High-frequency cetaceans** | | | | |
| • **Dolphins** (Risso's, dusky, common, Indian Ocean bottlenose, bottlenose)<br>• **Toothed whales** (killer, false killer) | May or likely to occur.<br>No BIAs overlapped. | For the onset of TTS and AUD INJ to occur, high-frequency cetaceans would need to remain within 900 m and 40 m of continuous sound sources for 24-hours, respectively (Table 8-24).<br>TTS and AUD INJ values do not incorporate animal movement within the region. Given no BIAs were identified, any individuals present would be merely transiting through the area, with movements that would likely preclude reaching the range required for auditory impairment and injury to occur.<br>Therefore, it is not credible for high-frequency cetaceans to remain within 900 m and 40 m of continuous sound sources for 24-hours for the onset of TTS and AUD INJ to occur given the species oceanic range, highly mobile behaviours.<br>Cooper Energy have observed during the BMG Closure Project – Phase 1 in offshore Gippsland during 2024 dolphins approach DP vessels whilst | Not credible | Not applicable |

| Marine mammals | Presence within behavioural EMBA | Potential auditory impairment or injury | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | undertaking foraging behaviours. However, observations indicate that groups and individuals transit quickly through the area, and do not remain in the area long enough for TTS and AUD INJ to occur | | |
| **Low-frequency cetaceans** | | | | |
| • **Minke whale**<br>• **Sei whale**<br>• **Fin whale**<br>• **Pygmy right whale**<br>• **Humpback whale** | May or likely to occur.<br>No BIAs overlapped. | For the onset of TTS and AUD INJ to occur, low-frequency cetaceans need to remain within 7.92 km and 670 m of continuous sound sources for 24-hours, respectively (Table 8-24).<br>TTS and AUD INJ values do not incorporate animal movement within the region. Given no BIAs were identified, any individuals present would be merely transiting through the area, with movements that would likely preclude reaching the range required for auditory impairment and injury to occur.<br>For example, previous studies which tracked humpback whales recorded average swimming speeds to range from 2.5 – 4.0 km/h, with some individuals swimming rapidly up to 15.6 km/h (Noad and Cato, 2007). As the operational area does not support habitats that encourage sedentary behaviours given the absence of BIAs in the operational area, individuals are anticipated to move through the TTS zone well before TTS onset.<br>Therefore, it is not credible for minke, sei, fin, pygmy right and humpback whales to remain within 7.92 km and 670 m of continuous sound sources for 24-hours for the onset of TTS and AUD INJ to occur given the absence of BIAs in the operational area and highly mobile movements outside of foraging and reproduction BIAs. | Not credible | Not applicable |
| **Blue whale**<br>EPBC Act listed<br>• Endangered<br>• Cetacean<br>• Migratory | Known to occur.<br>Foraging and distribution BIAs overlapped.<br>During January to June, Blue Whales migrate through the operational area. | Despite the overlap with foraging and distribution BIAs, it is not credible for blue whales to remain within 7.92 km and 670 m of continuous sound sources for 24-hours for the onset of TTS and AUD INJ to occur based on the following reasons:<br>A type of foraging behaviour (observed in tagged blue whales) involving area restricted searches (ARS) was reported by Bailey et al. (2009). The area that the ARS occurred over ranged from 10 km up to 360 km in radius. Owen et al. (2016) also reported on ARS occurring across an area of 220 km$^2$ | Not credible | Not applicable |

| Marine mammals | Presence within behavioural EMBA | Potential auditory impairment or injury | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | for a satellite tagged blue whale on the west coast of Australia. The maximum project TTS contours extend to a radius of 7.92 km. Therefore if ARS were to occur it could be expected to extend beyond any project TTS contour and preclude the onset of TTS.<br>If whales were to stop and feed within the TTS zone to feed on a discrete patch of krill for >24 hours, the movement of plankton (and 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 April (RPS, 2024, Section 6.4.5.1). 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.<br>Blue whales have been recorded swimming at mean speeds of 2.8 km/hr +/- 2.2 km/hr whilst migrating and foraging (Owen, Jenner and 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.<br>Recent activities within the Otway have overlapped pygmy blue whale foraging periods and blue whales were observed during the activity. Reported behaviours were in line with published information on foraging behaviours and movements, 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). | | |
| **Southern right whale**<br>EPBC Act listed<br>• Endangered<br>• Cetacean<br>• Migratory | Known to occur.<br>Migration BIAs overlapped.<br>During May-June and September-October southern right whales pass through the operational area to move to and from coastal reproduction areas. | Despite the overlap with the migration BIA, it is not credible for southern right whales to remain within 7.92 km and 670 m of continuous sound sources for 24-hours for the onset of TTS and AUD INJ to occur based on the following reasons:<br>TTS and AUD INJ values do not incorporate animal movement (necessary for migration) which prevent southern right whales reaching the range required for auditory impairment and injury to occur. | Not credible | Not applicable |

| Marine mammals | Presence within behavioural EMBA | Potential auditory impairment or injury | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | Southern right whales are highly mobile species and are known to move throughout the region. Connecting range movements will prevent southern right whales to remain within the range for over 24-hours required for auditory impairment and injury to occur. The longest movements are undertaken by non-calving whales, though calving whales have also been recorded at locations up to 700 km apart within a single season (DSEWPaC, 2012a).<br>There is limited research on the swimming speeds of southern right whales. However, tagging studies conducted on the comparable North Atlantic right whale (a species in the same family as the southern right whale) recorded average swimming speeds of ~1.2 – 1.8 km/h across all activity types, including females with calves. The fastest swimming speed recorded for a migrating adult individual was 5.4 km/h (Hain et al., 2013).<br>Noise modelling of various activity scenarios indicate that TTS and AUD INJ sound contours from the activity do not overlap the southern right whale reproduction BIA (HTCS) (Connell et al., 2025; Appendix 4) or the preferred reproduction habitat (calving/nursing) for southern right whales (<10 m water depth and within 1 km of shore) (DCCEEW, 2024l). There is no evidence of high-site fidelity for southern right whales within the operational area, or within the TTS or AUD INJ radii of the activity, as a result, southern right whales, that may occur in the vicinity of the activity, would be expected to be migrating through the area before auditory impairment / injury can manifest.<br>Logans beach (calving area) is ~24km from the operational area and does not overlap PTS or TTS contours from the activity. | | |

Details in Table 8-25 suggests that the presence of marine mammals for extended (≥24 hour) periods, and consistently within close proximity to continuous sound sources will not occur.

**Inherent Likelihood**

Not applicable.

**Inherent Risk Severity**

Not applicable.

#### 8.2.5.4 *Risk: Change in Fauna Behaviour - Marine Turtles*

**Inherent Consequence Evaluation**

Continuous sound emissions may cause behavioural changes to marine turtles depending on the distance between individual turtles and a continuous sound source. Relative risk criteria proposed by Popper et al. (2014) suggests that continuous sound sources have a high chance of causing behavioural change to turtles within the near (tens of metres), and a moderate chance within the intermediate (hundreds of metres), vicinity of a sound source. The relative risk reduces to a low chance of behavioural change within the far (thousands of metres) vicinity of a sound source (Popper et al., 2014). This infers that the East Coast Project continuous underwater sound emissions have the potential to cause behavioural changes to turtles. Though there is some small inherent uncertainty in defining behavioural effects to the exact meter; additional effort to characterise the effect radius is not considered warranted given the low sensitivity of marine turtle species and their populations to noise from the project.

The operational area is used as a conservative behavioural EMBA for turtles exposed to continuous sounds. Table 8-26 provides details on the presence of EPBC listed turtles within the operational area, potential behavioural changes that may occur and the resulting inherent consequence level for each turtle species.

*Table 8-26: Inherent Consequence Levels - Continuous Sound - Behavioural Changes to Marine Turtles*

| Turtle (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Loggerhead turtle**<br>EPBC Act listed<br>• Endangered<br>• Marine<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Increase swimming speeds, and induce diving inferred from studies of other turtle species. | Localized (high chance within tens of metres from the source) and short-term impacts to species of recognized conservation value not affecting local ecosystem function. As there are no BIAs for the species within the temperate south east region, only small numbers (if any) may occur in the area over the life of the project. No discernible effects are expected. | Level 1 |
| **Green turtle**<br>EPBC Act listed<br>• Vulnerable<br>• Marine<br>• Migratory | May occur.<br>No BIAs overlapped. | Observed green turtles flee (increase swim speed and induce diving) from approaching vessels travelling at speeds less than 4 m/s in open waters (Hazel et al., 2007). | Localized (high chance within tens of metres from the source) and short-term impacts to species of recognized conservation value not affecting local ecosystem function. As there are no BIAs for the species within the temperate south east region, only small numbers (if any) may occur in the area over the life of the project. No discernible effects are expected. | Level 1 |
| **Leatherback turtle**<br>EPBC Act listed<br>• Endangered<br>• Marine<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | Increase swimming speeds, and induce diving inferred from studies of other turtle species. | Localized (high chance within tens of metres from the source) and short-term impacts to species of recognized conservation value not affecting local ecosystem function. As there are no BIAs for the species within the temperate south east region, only small numbers (if any) may occur in the area over | Level 1 |

| Turtle (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | | the life of the project. No discernible effects are expected. | |

### Inherent Likelihood

The likelihood of behavioural changes to turtles depends on the temporal overlap of the potential presence of turtles whilst continuous sound sources are in the operational area, and the sensitivity of different species and individuals to noise.

For a high chance of the risk event of behavioural changes to turtles to occur, the following combination of factors are required:

- Drilling operations, support vessel operations (vessel noise)
- Turtles present within tens of metres of continuous sound source.

Table 8-27 provides details on the frequency of recorded sighting of EPBC Act listed turtles in the Otway Basin to infer presence within the operational area, description of likelihood and the resulting inherent likelihood level for each turtle species.

*Table 8-27: Inherent Likelihood Levels - Continuous Sound - Behavioural Changes to Marine Turtles*

| Turtle | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood level |
|---|---|---|---|
| **Loggerhead turtle** | Likely to occur.<br>No BIAs overlapped.<br>The Victorian Biodiversity Atlas (VBA) showed no observations or occurrences of loggerhead turtles in the operational area (Victorian Department of Environment, Land, Water and Planning, 2023). | A rare combination of factors would be required for a loggerhead turtle to be present within the operational area during activities generating continuous sound emissions. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Green turtle** | May occur.<br>No BIAs overlapped.<br>The VBA showed no observations or occurrences of green turtles in the behavioural EMBA (Victorian Department of Environment, Land, Water and Planning, 2023). | A freak combination of factors would be required for a green turtle to be present within the operational area during activities generating continuous sound emissions. Behavioural changes to green turtles are not expected to occur from East Coast Project continuous underwater sound emissions. | Remote (E) |
| **Leatherback turtle** | Likely to occur.<br>No BIAs overlapped.<br>The VBA showed no observations or occurrences of leatherback turtles in the behavioural EMBA (Victorian Department of Environment, Land, Water and Planning, 2023). | A rare combination of factors would be required for a leatherback turtle to be present within the operational area during activities generating continuous sound emissions. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |

### Inherent Risk Severity

The highest inherent risk severity of behavioural changes to turtles from continuous sound emissions is Low.

Table 8-28 lists the inherent risk severity for each turtle.

*Table 8-28: Inherent Risk Severity - Continuous Sound - Behavioural Changes to Marine Turtles*

| Turtle | Inherent consequence level | Inherent likelihood level | Inherent Risk Severity |
|---|---|---|---|
| **Loggerhead turtle** | 1 | D | **Low** |
| **Green turtle** | 1 | E | **Low** |
| **Leatherback turtle** | 1 | D | **Low** |

### *8.2.5.5 Risk: Auditory Injury to Marine Turtles*

**Inherent Consequence Evaluation**

Depending on the sound levels received, continuous sound emissions may cause auditory injury to turtles from the onset of TTS and PTS, respectively.

Underwater sound modelling predicted the continuous TTS and PTS thresholds for turtles was reached within distances listed in Table 8-29 (Connell et al., 2025). TTS and PTS thresholds for turtles are based on SEL24h which assumes a turtle is consistently exposed threshold levels for a 24-hour period (Accomando et al., 2025). Distances predicted for the onset of TTS and PTS thresholds (SEL24h) listed in Table 8-29 infers East Coast Project continuous underwater sound emissions have the potential to cause:

- Potential TTS to turtles within 290 m.
- Potential PTS to turtles within 50 m.

The EMBA for turtles exposed to continuous sounds is small (290 m radius from the noise source that can operate throughout the operational area).

*Table 8-29: Distance to TTS and PTS Threshold for Marine Turtles*

| Threshold Type | Threshold ($SEL_{24h}$, dB re 1 $\mu Pa^2 \cdot s$) (Accomando et al., 2025) | Maximum Distance (km) | Relevant Scenario/s |
|---|---|---|---|
| **TTS** | 178 | 4.45 | Scenario 10: MODU anchoring under DP with 3 AHTS at Elanora-1 |
| **PTS** | 198 | 0.5 | Scenario 10: MODU anchoring under DP with 3 AHTS at Annie-2 |

It is not considered credible for turtles to remain within 4.45 km and 500 m of continuous sound sources for 24-hours for the onset of TTS and PTS to occur given the absence of BIAs in the operational area and wider south-east marine region. Any individuals which do occur within the area would be migrating and likely on the move. As such, auditory injury to turtles from East Coast Project continuous sound emissions is not evaluated further.

**Inherent Likelihood**

Not applicable.

**Inherent Risk Severity**

Not applicable.

### *8.2.5.6 Risk: Change in Fauna Behaviour - Fish*

**Inherent Consequence Evaluation**

Continuous sound emissions may cause behavioural changes to fish including eggs and larvae depending on the distance between fish and a continuous sound source. Relative risk criteria proposed by Popper et al. (2014) suggests a moderate risk of behavioural change 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. Whereas fish with swim bladders involved in hearing have a high risk of behavioural change within the near (tens of metres), and a moderate chance within the intermediate (hundreds of metres) vicinity of a sound (Popper et al., 2014).

There is risk of change in fish behaviour within hundreds of metres of vessels operating within the operational area. As a conservative approach to identify fish BIAs and habitats the operational area is used as a conservative behavioural EMBA for fish including eggs and larvae exposed to continuous sounds. Table 8-30 provides details on the presence of fish species that are EPBC listed within the behavioural EMBA, potential behavioural changes that may occur and the resulting inherent consequence level for each fish species.

*Table 8-30: Inherent Consequence Levels - Continuous Sound - Behavioural Changes to Fish*

| Fish (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **White shark**<br>EPBC Act listed<br>• Vulnerable<br>• Migratory | Known to occur.<br>BIA overlapped.<br>Seasonal presence in southern Australia during early summer. | No detectable relationship between vessel activity and shark residency for any species. This observation infers habituation of sharks to high levels of vessel activity (Rider et al., 2021). Anthropogenic underwater sounds may trigger investigative or aversive behaviour in some species of shark (Chapius et al., 2019). No significant behavioural change to sharks from continuous sound is anticipated. | Despite the conservation status of the white shark, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **School shark**<br>EPBC Act listed<br>• Critically endangered | May occur.<br>No BIAs overlapped. | No detectable relationship between vessel activity and shark residency for any species. This observation infers habituation of sharks to high levels of vessel activity (Rider et al., 2021). No significant behavioural change to sharks from continuous sound is anticipated. | Despite the conservation status of the school shark, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Shortfin mako**<br>EPBC Act listed<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | No detectable relationship between vessel activity and shark residency for any species. This observation infers habituation of sharks to high levels of vessel activity (Rider et al., 2021). No significant behavioural change to sharks from continuous sound is anticipated. | Minor local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Mackerel shark**<br>EPBC Act listed<br>• Migratory | Likely to occur.<br>No BIAs overlapped. | No detectable relationship between vessel activity and shark residency for | Minor local (small, variable, temporary behavioural changes within tens of | Level 1 |

| Fish (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | any species. This observation infers habituation of sharks to high levels of vessel activity (Rider et al., 2021). No significant behavioural change to sharks from continuous sound is anticipated. | metres of the source) impacts or disturbances to fauna. | |
| **Australian grayling**<br>EPBC Act listed<br>• Vulnerable | May occur.<br>No BIAs overlapped. | Vessels can change fish behaviour (e.g., induce avoidance, alter swimming speed and direction, and alter schooling behaviour) (Popper et al., 2014). | Despite the conservation status of the Australian grayling, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Blue warehou**<br>EPBC Act listed<br>• Critically endangered | Known to occur.<br>No BIAs overlapped. | Vessels can change fish behaviour (e.g., induce avoidance, alter swimming speed and direction, and alter schooling behaviour) (Popper et al., 2014). | Despite the conservation status of the blue warehou, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Southern bluefin tuna**<br>EPBC Act listed<br>• Conservation dependent | Likely to occur.<br>No BIAs overlapped. | Vessels can change fish behaviour (e.g., induce avoidance, alter swimming speed and direction, and alter schooling behaviour) (Popper et al., 2014). | Despite the conservation status of southern bluefin tuna, because of the insignificance of behavioural change, the consequence is considered minor and local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |
| **Pipefish, pipehorse, seadragon and seahorse species**<br>EPBC Act listed<br>• Marine | May occur.<br>No BIAs overlapped. | A study on seahorses in an aquarium found loud ambient noise to result in behavioural responses (Anderson et al., 2011). Noise from vessels may also be a disturbance to syngnathidae fish (Reef Watch 2014). Based on these observations, it is inferred that vessels can change syngnathidae fish behaviour (e.g., induce avoidance, alter swimming speed and direction, and | Minor local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |

| Fish (EPBC Act listing) | Presence within behavioural EMBA | Potential behavioural changes | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | alter schooling behaviour) (Popper et al., 2014). | | |
| **Short-finned eels**<br>**Culturally significant to First Nations people (Koster et al., 2021)** | Seasonal presence in the Otway Basin and Bass Strait during spawning migration i.e. downstream migration of adult eels during late summer and autumn. Upstream migration of larvae and glass eels, where glass eels enter estuaries during mid-winter to late spring (VFA, 2017). | A study on Anguillid eels under experimental conditions demonstrated that acoustic stimuli induced behavioural avoidance (increased swimming, speed and movements away from the source) in some European eel and river lamprey (Deleau et al., 2019). | Minor local (small, variable, temporary behavioural changes within tens of metres of the source) impacts or disturbances to fauna. | Level 1 |

### Inherent Likelihood

The likelihood of behavioural changes to fish including eggs and larvae depends on the temporal overlap of the potential presence of fish with continuous sound sources in the operational area, and the sensitivity of the species and individual.

For a moderate chance of the risk event of behavioural changes to fish to occur, the following combination of factors are required:

- Continuous underwater sound emissions (i.e. from drilling operations, MODU operations and / or vessel operations) where fish are present within tens of metres of continuous sound source.

Table 8-31 provides details on the frequency of recorded sighting of EPBC listed fish in the Otway Basin to infer presence within the behavioural EMBA, description of likelihood and the resulting inherent likelihood level for each fish species.

*Table 8-31: Inherent Likelihood Levels - Continuous Sound - Behavioural Changes to Fish*

| Fish | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood level |
|---|---|---|---|
| **White shark** | Known to occur.<br>BIA overlapped. | The risk event could happen when additional factors are present, such that a white shark is present within the behavioural EMBA during drilling and support operations. White sharks are known to occur within the behavioural EMBA; therefore, it is easy to postulate a scenario for the occurrence but considered doubtful. Expected to occur once during the East Coast Project. | Possible (C) |
| **School shark** | May occur.<br>No BIAs overlapped. | A freak combination of factors would be required for a school shark to be present within the behavioural EMBA during activities generating continuous sound emissions, and which result in the onset of discernible behavioural changes. Behavioural changes to school sharks are not expected to occur from East Coast Project continuous underwater sound emissions. | Remote (E) |

| Fish | Presence within behavioural EMBA | Description of likelihood | Inherent likelihood level |
|---|---|---|---|
| **Shortfin mako** | Likely to occur.<br>No BIAs overlapped. | A rare combination of factors would be required for a shortfin mako to be present within the behavioural EMBA during activities generating continuous sound emissions and which result in the onset of discernible behavioural changes. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Mackerel shark** | Likely to occur.<br>No BIAs overlapped. | A rare combination of factors would be required for a mackerel shark to be present within the behavioural EMBA during activities generating continuous sound emissions, and which result in the onset of discernible behavioural changes. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Australian grayling** | May occur.<br>No BIAs overlapped. | A freak combination of factors would be required for an Australian grayling to be present within the behavioural EMBA during activities generating continuous sound emissions, and which result in the onset of discernible behavioural changes. Behavioural changes to the Australian grayling are not expected to occur from East Coast Project continuous underwater sound emissions. | Remote (E) |
| **Blue warehou** | Known to occur.<br>No BIAs overlapped. | The risk event could happen when additional factors are present, such that a blue warehou is present within the behavioural EMBA during activities generating continuous sound emissions. Blue warehou are known to occur within the behavioural EMBA; therefore, it is easy to postulate a scenario for the occurrence but considered doubtful. | Possible (C) |
| **Southern bluefin tuna** | Likely to occur.<br>No BIAs overlapped. | A rare combination of factors would be required for southern bluefin tuna to be present within the behavioural EMBA during activities generating continuous sound emissions, and which result in the onset of discernible behavioural changes. The risk event is considered conceivable and could occur at some time during the East Coast Project. | Unlikely (D) |
| **Pipefish, pipehorse, seadragon and seahorse species** | May occur.<br>No BIAs overlapped. | A freak combination of factors would be required for syngnathidae to be present within the behavioural EMBA during activities generating continuous sound emissions, and which result in the onset of discernible behavioural changes. Behavioural changes to syngnathidae are not expected to occur from East Coast Project continuous underwater sound emissions. | Remote (E) |
| **Short-finned eels**<br>**Culturally significant to First Nations people (Koster et al., 2021)** | Seasonal presence in the Otway Basin and Bass Strait during spawning migration i.e. downstream migration of adult eels during late summer and autumn.<br>Upstream migration of larvae and glass eels, where glass eels enter estuaries during mid-winter to late spring (VFA, 2017). | The risk event could happen when additional factors are present, such that short-finned eels as adults during downstream spawning migration or as larvae / glass eels during upstream spawning migration is present within the behavioural EMBA during drilling and support operations. Short-finned eels are known to occur within the behavioural EMBA; therefore, it is easy to postulate a scenario for the occurrence but considered doubtful. | Possible (C) |

### Inherent Risk Severity

The highest inherent risk severity of behavioural changes to fish including eggs and larvae from continuous sound emissions is **Low**.

Table 8-32 lists the inherent risk severity for each EPBC Act listed fish.

*Table 8-32: Inherent Risk Severity- Continuous Sound - Behavioural Changes to Fish*

| Fish | Inherent consequence level | Inherent likelihood level | Inherent Risk Severity |
|---|---|---|---|
| **White shark** | 1 | C | **Low** |
| **School shark** | 1 | E | **Low** |
| **Shortfin mako** | 1 | D | **Low** |
| **Mackerel shark** | 1 | D | **Low** |
| **Australian grayling** | 1 | E | **Low** |
| **Blue warehou** | 1 | C | **Low** |
| **Southern bluefin tuna** | 1 | D | **Low** |
| **Pipefish, pipehorse, seadragon and seahorse species** | 1 | E | **Low** |
| **Short-finned eels** | 1 | C | Low |

### *8.2.5.7 Risk: Auditory Injury to Fish*

**Inherent Consequence Evaluation**

Depending on the sound levels received, continuous sound emissions may cause auditory injury to fish including eggs and larvae from the onset of TTS and recoverable injury, respectively.

Underwater sound modelling predicted the continuous TTS and recoverable injury thresholds for fish including eggs and larvae was reached within distances listed in Table 8-33 (Connell et al., 2025). TTS threshold for fish is based on SEL12h which assumes a fish is consistently exposed threshold levels for a 12-hour period. Whereas, recoverable injury thresholds for fish are based on SEL48h which assumes a fish is consistently exposed threshold levels for a 48-hour period (Popper et al., 2014). Distances predicted for the onset of TTS and recoverable injury thresholds listed in Table 8-33 infers East Coast Project continuous underwater sound emissions have the potential to cause:

- Potential TTS to fish within 130 m.
- Potential recoverable injury to fish within 30 m.

A 130 m buffer at proposed well locations and associated flowline routes defines the impairment and injury EMBA for fish exposed to continuous sounds.

*Table 8-33: Distance to TTS and PTS Thresholds for Fish*

| Threshold Type | Threshold (Popper et al., 2014) | Maximum Distance (m) | Relevant Scenario/s |
|---|---|---|---|
| **TTS** | 158 dB SPL for 12 hours | 130 | Scenario 5: Drilling operations with 2 AHTS at Annie-2 or Elanora-1 |
| **Recoverable injury** | 170 dB SPL for 48 hours | 30 | Scenario 5: Drilling operations with 2 AHTS at Annie-2 or Elanora-1 |

It is not credible for fish to remain within 130 m and 30 m of continuous sound sources for 48-hours and 12-hours for the onset of TTS and recoverable injury, respectively. The impairment and injury EMBA does not support habitats that encourage site fidelity for fish including eggs and larvae. As

such, auditory impairments or injuries to fish from East Coast Project continuous sound emissions is not evaluated further.

**Inherent Likelihood**

Not applicable.

**Inherent Risk Severity**

Not applicable.

### 8.2.6 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 8-34.

*Table 8-34: Continuous Sound Emissions Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: Change in ambient sound | Consequence: Level 1 |
| | Risk: Change in fauna behaviour | Risk: Moderate – marine mammals<br>Risk: Low – marine reptiles<br>Risk: Low – fish |
| | Risk: Auditory impairment (masking, TTS, recoverable injury), or auditory injuries (mortality or potential mortal injuries, PTS) to marine fauna | N/A |
| **Principles of ESD** | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (section 8.2.5); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the impacts and risks from underwater sound emissions – continuous was identified as:<br>• Level 1 consequence for change in ambient sound<br>• Low to moderate risk for change in fauna behaviour.<br>The above predicted levels of impact and risk due to underwater sound emissions – continuous from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology and the Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process. Specialist modelling was conducted, tailored to this particular area of the Otway. This modelling factored in the specific attenuation characteristics of the seabed in this area, which have been measured in | |

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|---|---|
| | situ in this region; these studies reduce uncertainty around the potential extent of noise EMBAs.<br>• The highest consequence ranking for continuous underwater sound emissions was evaluated as Level 2, specifically for marine mammals, and the highest inherent risks for continuous underwater sound emissions was evaluated as Moderate; therefore, continuous underwater sound emissions from the East Coast Project will not result in serious or irreversible environmental damage.<br>• There is scientific uncertainty with regards to swimming speeds of southern right whales. The impact evaluation uses swimming speeds of the southern right whale's northern counterpart, the North Atlantic right whale, to infer southern right whale swimming speeds. The southern right whale and Northern Atlantic right whale are comparable species given both are right whales of the genus *Eubalaena* and share the same characteristics of being found close to shore and are slow swimming (Best et al., 2001; IWC, 2024). The uncertainty relating to southern right whale swimming speeds does not affect the predictions of environmental impacts and risks and the anticipated effectiveness of management measures in controlling the impacts and risks. The use of comparable data to predict environmental impacts is considered appropriate and acceptable given the National Recovery Plan for the Southern Right Whale also uses comparable data of other whale species to define potential impacts, such as behavioural responses of humpback whales from vessels infers there is potential disturbance to southern right whales from vessels, (DCCEEW, 2024).<br>• There is a broad set of literature on the subject of underwater noise; whilst there remain some uncertainties as to exactly how and when individual whales may react to noise of different sources, the potential population level effects from impulsive noise are able to be relatively well characterised through existing knowledge of species distribution and population studies overlayed with published literature on impact thresholds, and site-specific modelling.<br>• The potential impacts and risks from continuous underwater sound emissions are well-understood, and management measures are well established and regulated in Australian waters.<br>• Any residual uncertainty surrounding the suitability of noise modelling scenarios and thresholds will be addressed by EPO20 which commits a modelling review to ensure that scenarios and thresholds remain appropriate for activity specific environment plans. |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risks for continuous underwater sound emissions were evaluated as Moderate and therefore will not forego the health, diversity and productivity of the environment for future generations through protection of environmental values.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.2.7). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to continuous underwater sound emissions were evaluated in Section 8.2.5 and the highest inherent risk for continuous underwater sound emissions was evaluated as Moderate.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.2.7). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and |

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|---|---|---|---|
| | ecological integrity is maintained through protection of the values of the Commonwealth Marine Area as per the objectives of bioregional plans. | | |
| | E) 'Valuation principle'<br>The East Coast Project is consistent with the principle of ESD (e) for this aspect by adopting controls such as the Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process which includes provision for adaptive management to ensure acceptable levels and EPOs are met. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans | Objective: Ensure whales and dolphins are not harmed during offshore interactions with vessels.<br>Management action: 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. | Adoption of the following control measures:<br>CM1: Marine Assurance Process<br>Power generation and propulsion systems on vessels will be operated in accordance with manufacturer's instructions and ongoing maintenance in accordance with vessel planned maintenance system, to ensure efficient operation.<br>CM2: Offshore Operational Procedures<br>All helicopters and vessels will adhere to the distances and vessel management practices of EPBC Regulations (Part 8 Division 8.1 interacting with cetaceans).<br>CM3: Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process<br>The Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process provides a framework for minimising noise impacts to whales and details specific measures to be implemented that will ensure impacts and risks meet or are better than AL11. The process acknowledges legislative requirements and establishes the criteria and methods by which potential disturbance to relevant whale species is identified. The process identifies management measures for different types of offshore activity, accounting for nature and scale of the potential impacts and risks, to ensure they remain within acceptable levels, and are managed to ALARP. Provisions within the process include:<br>• Consideration for vulnerable species during sensitive life stages most susceptible to noise emissions via a planning-phase risk review, integrating latest published Government Plans and scientific literature. This will consider scheduling of activities outside of higher |
| | IMO's Revised Guidelines for the Reduction of Underwater Radiated Noise from Shipping to Address Adverse Impacts on Marine Life (MEPC.1/Circ.906)<br><br>*These guidelines are not a requirement but will be considered as part of the marine assurance process* | Guidance on the reduction of underwater noise from any ship, taking into account their maintenance and operation.<br>Operational adjustments and maintenance measures should be considered as ways of reducing noise for existing ships. Operational approaches could be particularly important for ships that lack design features or technologies to reduce noise, or for all ships that operate in national and international designated protected areas where additional measures need to be taken to decrease the adverse impacts of shipping noise on marine wildlife. | |
| | Blue Whale Conservation Management Plan 2015 – 2025 (2015) | Recovery objective: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list.<br>Interim objective 4: Anthropogenic threats are demonstrably minimised.<br>Management action A.2.2: Assessing the effect of anthropogenic noise on blue whale behaviour.<br>Section 8.2.5.3 assesses the effects of anthropogenic noise from the East Coast Project on blue whale behaviour. | |

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|---|---|---|---|
| | | 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.<br>The Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process provides details on level of whale observation effort, triggers for actions and the actions to be taken to manage potential impacts to endangered whales with BIA's in the region (blue whales and southern right whales).<br>Management Action A.2.3 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 Conservation Management Plan. This will involve:<br>Application of realistic conservative criteria including suitable thresholds to establish parameters for impact and risk assessment.<br>Actions and adaptive management measures, as detailed in the Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process, will be implemented for vessel activities to reduce the risk of blue whale injury and/or displacement. | sensitivity period where practicable, and review of control measures to ensure levels of impact and risk remain ALARP.<br>Where there is a risk of TTS or AUD INJ to whales, or a risk of behavioural disturbance to southern right whales or blue whales, the following adaptive management provisions apply:<br>• The extent of potential TTS, Injury and behavioural disturbance are defined through subsea noise modelling by subsea acoustics specialist.<br>• A monitoring program is established to observe for whales within the potential impact areas defined by the modelling.<br>• Monitoring informs activity modification (where safe to do so) to prevent the occurrence of unacceptable levels of impact and reduce the risk of their occurrence.<br>• Monitoring is implemented through conventional methods such as marine mammal observation by trained and competent marine mammal observers, or by other methods and technologies where they have been demonstrated as being effective for mitigation purposes.<br>• Establishment of a communications protocol between monitoring team, vessel master and project team.<br>CM20: Campaign Risk Review<br>The Cooper Energy Environmental Protocol describes how environmental impact and risk management, including risk assessments, is undertaken for activities including offshore campaigns.<br>As part of pre-campaign planning a risk review (refer Figure 12-5) will be undertaken to re-assess campaign environmental impacts and risks to ensure acceptability criteria are met and that impacts and risks are reduced to ALARP.<br>The assessment of environmental impacts and risks will focus on aspect: subsea noise, and risks to endangered whale species, |
| | National Recovery Plan for the Southern Right Whale (DCCEEW, 2024l) | Long term recovery objective: is that the population has increased in size to a level that the conservation status has improved, and the species no longer qualifies for listing as threatened under any of the EPBC Act listing criteria.<br>Interim Objective 2: Anthropogenic threats are managed consistent with ecologically sustainable development principles to facilitate recovery of southern right whales.<br>Management action A.5: Assess, manage, and | |

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| | | mitigate impacts from anthropogenic noise.<br>Management action A.5.2: Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that it does not prevent any southern right whale from utilising the area or cause auditory impairment.<br>Management action A.5.3: Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that the risk of behavioural disturbance is minimised.<br>Actions and adaptive management measures, as detailed in the Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process, will be implemented for vessel activities to reduce the risk of southern right whale impacts from anthropogenic noise. | specifically pygmy blue whales, and southern right whales.<br>CM22: Modelling Review<br>Modelling studies used to inform the Activity Environment Plan will use scenarios that are representative of the activity, and current, published thresholds that are suitable for sensitive receptors. Seabed surveys for fields where the seabed has not been characterised will be undertaken prior to well construction activities being undertaken, this will form an input into the Risk Review process described in Section 12.9. |
| | Conservation Advice *Balaenoptera borealis* Sei Whale (TSSC, 2015e) | Identifies anthropogenic noise acoustic disturbance as a minor threat.<br>No relevant management actions. | |
| | Conservation Advice *Balaenoptera physalus* Fin Whale (TSSC, 2015f) | Identifies anthropogenic noise acoustic disturbance as a minor threat.<br>No relevant management actions. | |
| | Listing Advice *Megaptera novaeangliae* Humpback Whale (TSSC, 2022) | Identifies anthropogenic noise as a concern.<br>No relevant management actions. | |
| | Recovery plan for marine turtles in Australia 2017–2027 | 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.<br>Interim objective 3: Anthropogenic threats are demonstrably minimised.<br>No relevant management actions. | |
| | Recovery Plan for the White Shark (*Carcharodon carcharias*) 2013 | Recovery objective: Ensure that anthropogenic activities do not hinder recovery in the near future, or impact on | |

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|---|---|---|---|
| | | the conservation status of the species in the future.<br>No relevant management actions. | |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | Cooper Energy has previously sought advice from the Australian Antarctic Division (AAD) in relation to the management of impacts from noise. The consultation outcomes are presented within the BMG Closure Project Phase 1 EP (NOPSEMA ID: 6825) and are not repeated here. The AAD advice has informed the assessment and definition of management measures for the ECP such as adjusting processes within MS09 to consider vessel noise during tendering, development of a Whale Disturbance Risk Management Process and within that, the allocation of dedicated marine mammal observers and shut-down criteria for particular activities. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to continuous sound emissions is AL11 identified in Table 8-35. These acceptable levels defined for a change in ambient underwater sound, a change in fauna behaviour and auditory injury are defined in Table 7.6.<br>The worst-case predicted impacts assessed in Section 8.2.5 are:<br>• Change in ambient sound from continuous underwater sound emissions will be managed to reduce underwater radiated noise with consideration to *MEPC.1/Circ.906* guidance approaches on maintenance of moving parts and machinery on-board vessels and lowering of vessel speeds. These specific items will be considered through the implementation of CM1: Marine Assurance Process (maintenance of power generation and propulsion systems on vessels in accordance with vessel planned maintenance system, to ensure efficient operation) and CM2: Offshore Operational Procedures (application of vessel management practices of EPBC Regulations (Part 8 Division 8.1 interacting with cetaceans)).<br>• Highest consequence for behavioural changes from continuous underwater sound emissions is for marine mammals. Despite having the highest consequence, the risk of behavioural changes to marine mammals are localized and short-term impacts to species of recognized conservation value not affecting local ecosystem function, with no population level effects.<br>• The behavioural EMBA overlaps the reproduction and migration BIAs for the southern right whale. Noise modelling of various activity scenarios indicates behavioural change thresholds will exceed the reproduction BIA for southern right whales only when certain activities are being undertaken at the well closest to the coastline (Annie-2); however, given the furthest extent modelling, it is highly unlikely that the southern right whale preferred reproduction habitat (<10 m water depth and <1 km from the coastline) would be overlapped. Potential impacts are slight (if any) changes to migratory course around temporary project vessels.<br>• The behavioural EMBA overlaps a foraging BIA for blue whales. Overall opportunities for foraging are not expected to be discernible from inherent variability.<br>• For marine mammals, turtles or fish it is unlikely they would remain within the distances of continuous sound sources for 24-hours for the onset of TTS and AUD INJ (including PTS) to occur. As such, auditory injury to marine fauna from East Coast Project continuous sound emissions are not credible and not evaluated further.<br>• The highest consequence ranking for behavioural changes from continuous underwater sound emissions was evaluated as Level 2, specifically for marine mammals, and the highest inherent risks for continuous underwater sound emissions was evaluated as Moderate (blue whale and southern right whale). The highest inherent risks for marine turtles and fish were evaluated as Low. | | |

| | |
|---|---|
| | Therefore, at its worst-case, the predicted impact from continuous sound emissions would not:<br>• Modify an important or substantial area of habitat which may adversely impact on biodiversity and ecological integrity<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species<br>• Lead to loss of habitat critical to the survival of species.<br>Therefore, the predicted levels of impact and risk due to continuous sound emissions from the East Coast Project are equal to or better than the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to continuous sound emissions are acceptable, based on:<br>• Predicted levels of impact (evaluated in Section 8.2.5) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES<br>• Relevant historical feedback from stakeholders (AAD) for activities of similar nature and scale to the East Coast Project has been used to inform mitigation measures.<br>To manage impacts to receptors to at or below the defined acceptable levels the following EPOs have been applied:<br>**EPO16:** Impacts to marine fauna from underwater anthropogenic noise emissions will be limited to temporary* behavioural change localised** to the noise source.<br>*Not exceeding the duration of the activity component (i.e. vessel campaign) (described in Section 8.1.2 and 8.2.2)<br>**Not exceeding the noise EMBA defined for the activity (described in Section 8.1.5 and 8.2.5)<br>**EPO17:** No death or injury[14] to EPBC Act listed threatened, migratory or cetacean species.<br>**EPO18:** Project related underwater noise within biologically important areas[14] and habitat critical to the survival of relevant species will be managed through the implementation of Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process, such that:<br>• Any blue whale continues to utilise biologically important areas without injury and is not displaced from a foraging area.<br>• Southern right whales are not prevented from utilising biologically important areas[15] or habitat critical to the survival of a species or cause auditory impairment.<br>• The risk of behavioural disturbance to southern right whales will be limited to temporary behavioural disturbance of individuals.<br>**EPO20:** For activity specific environment plans undertake review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. |

### 8.2.7 Environmental Performance

Table 8-35 lists the acceptable level and EPO defined for continuous sound emissions and the adopted control measures to achieve the outcome.

*Table 8-35: Environmental Performance Summary – Continuous sound emissions*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| AL11: Changes to ambient underwater sound from project | **EPO16:** Impacts to marine fauna from underwater anthropogenic noise emissions | CM1: Marine Assurance Process |

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| activities will be characterised through modelling and/or monitoring, and impacts and risks will not be inconsistent with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. | will be limited to temporary* behavioural change localised** to the noise source.<br>*Not exceeding the duration of the activity component (i.e. vessel campaign) (described in Section 8.1.2 and 8.2.2)<br>**Not exceeding the noise EMBA defined for the activity (described in Section 8.1.5 and 8.2.5)<br>**EPO17:** No death or injury[14] to EPBC Act listed threatened, migratory or cetacean species.<br>**EPO18:** Project related underwater noise within biologically important areas[14] and habitat critical to the survival of relevant species will be managed through the implementation of Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process, such that:<br>• Any blue whale continues to utilise biologically important areas without injury and is not displaced from a foraging area.<br>• Southern right whales are not prevented from utilising biologically important areas[15] or habitat critical to the survival of a species or cause auditory impairment.<br>• The risk of behavioural disturbance to southern right whales will be limited to temporary behavioural disturbance of individuals.<br>**EPO20:** For activity specific environment plans undertake review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. | CM2: Offshore Operational Procedures<br>CM3: Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process<br>CM20: Campaign Risk Review<br>CM22: Modelling Review |

## 8.3 Light Emissions

### 8.3.1 Cause of Aspect

The East Coast Project's well construction, operations, decommissioning and support activities phases will generate localised and temporary light emissions that will change ambient light levels in the marine environment at night. No permanent source of light will be introduced as part of the East Coast Project.

Relevant light emitting activities for each phase are identified in Table 8-36, which are described in further detail in subsections below.

*Table 8-36: Activities undertaken during the East Coast Project that may generate light emissions*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Well Construction** | Well clean-up and flowback |
| **Operations** | Well intervention |
| **Decommissioning** | Well abandonment |

| | |
|---|---|
| **Support activities** | Vessel operations<br>MODU operations |

### 8.3.2 Aspect Characterisation

#### *8.3.2.1 Well Construction*

Well clean up and flowback activities may introduce localised and temporary light emissions into the marine environment if flaring is required to safely manage contents circulated out of the well; this may include gas, condensate, base oil and completion fluids (e.g., brine). Burning of these fluids creates a yellow/orange flame.

Flaring will have a duration of 60 hours with a maximum volume of 150 MMscf flared per well (i.e. maximum flare rate of 60 MMscf/day). Flaring would only occur from one well at a time.

#### *8.3.2.2 Operations*

Well intervention activities, specifically well testing and flowback, may introduce localised and temporary light emissions into the marine environment if flaring is required.

Depending on well performance, well intervention activities may involve flaring of reservoir fluids, base oil and completion fluids.

If well intervention is required, it will be infrequent, and if flaring is required, the duration is estimated at ~1 day per well. Flaring will only occur from one well at a time.

#### *8.3.2.3 Decommissioning*

Well abandonment activities may introduce localised and temporary light emissions into the marine environment if flaring is required.

During well abandonment remaining gas in the well fluids may be directed to a burner boom and flared if required.

Flaring will have a maximum duration of 1 day at a rate of ~18 MMscf/ well/ day. Flaring will only occur from one well at a time. A maximum of 15 wells will be abandoned under this OPP.

#### *8.3.2.4 Support Activities*

Vessel and MODU operations will introduce localised and intermittent light emissions from navigation and safety lighting into the marine environment. Navigation and safety light emissions will be continuous while vessels / MODU are in use in the operational area.

An individual MODU will be in the operational area throughout the well construction phase, during well abandonment, and will be used as needed during operations (e.g., for well intervention). The longest duration the MODU may be present at each well location is ~60 days, during well construction.

Depending on the phase, the number of vessels in the operational area will range from a single IMR vessel during the operations phase (2 to 4 weeks duration), two vessels during both the development construction and decommissioning phases (approximately 50 days duration) , and up to 4 vessels during the well construction phase or concurrent activities (refer to Section 4.1.2 and Section 4.3.6 for further information with regards to concurrent activities).

Duration of vessel operations in the operational area also depends on the phase. A single IMR vessel undertaking inspection activities during the operations phase can be on site for ~2-4 weeks per year depending on the type of inspection and complexity. Whereas, up to 4 vessels may be undertaking drilling activities or concurrent activities (as a worst case) across the operational area for sequential duration up to 300 days; Figure 4-3 provides indicative vessel numbers and associated campaign durations.

#### 8.3.2.5 *Concurrent activities*

As described in Section 4.1.2, concurrent activities could occur. Cooper Energy assessed reasonably foreseeable concurrent activity scenarios and identified that the potential concurrent activities of drilling operations at Elanora-1 and flowline installation between Annie-2 and Casino-5 represents the activity scenario that contains the greatest number of vessels within the operational area, operating concurrently. This is called the "concurrent activity" and would involve 3 vessels and a MODU operating at once (further details in Section 8.2.2.5).

The concurrent activity includes 4 light emission sources, defined as follows:

- Elanora-1 well construction operations:
  - 1x MODU – flaring
  - 2x AHTS – navigation and safety lighting
- Flowline installation between Annie-2 and Casino-5:
  - 1x ISV – navigation and safety lighting.

Concurrent activities could occur for approximately 50 days; if flowline installation and commissioning are undertaken at the same time, the example given is flowline installation at Annie (50 days) whilst drilling is underway in the Elanora field. There are variations to these whereby concurrent activities could extend if drilling or installation activities to integrate additional fields overlap with decommissioning activities of fields that have ceased production (Figure 4-3), though in any case, flaring, which creates the largest light EMBA of the project sources, is limited to short periods during well construction, well intervention or P&A.

Flaring from the MODU will be used as the basis for the area of illuminance above ambient light intensity levels (spatial extent of light emissions) for the concurrent activity. The 3 sources of vessel navigation and safety lighting in the concurrent activity are not expected to increase the spatial extent of light emissions due to their much smaller scale and/or temporary and transient nature (Xodus, 2023).

As a result, the flaring light EMBA based on flaring light emissions spatial extent of 49 km (Section 8.3.4) also considers the spatial extent of light emissions from the concurrent activity.

### 8.3.3 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impact from light emissions is:

- Change in ambient light.

Potential risks:

- Change in fauna behaviour.
- Injury/mortality to marine fauna.

Socio-economic impacts on commercial fisheries have not been evaluated further, as there are no discernible impacts to behaviour and distribution expected at the population level given the limited nature and scale of activities.

### 8.3.4 Impact and Risk Evaluation

To determine the spatial extent for impact and risk evaluation, a review of three comparative light emissions modelling as summarised in Table 8-37 was undertaken to define the spatial extent of the potential impact area from artificial light emissions during the East Coast Project. The spatial extent is compared against the minimum light threshold of 20 km as defined in the National Light Pollution Guidelines threshold (DCCEEW, 2023k).

*Table 8-37: Comparative light emissions modelling analogues*

| Project | Infrastructure and height (m) | Flare rate (MMscf/day) | Light spatial extent (km) | |
|---|---|---|---|---|
| | | | Lighting | Lighting and Flaring |

| | | | | |
|---|---|---|---|---|
| **Otway Drilling T/49 (Xodus, 2023)** | MODU flare tip, 45 m<br>MODU navigation lights, 85 m | 40 | 9 | 49 |
| **Dorado Development (Pendoley, 2020)** | FPSO flare tip, 110 m<br>FPSO lights, 47 m | 125 | 18 | 42.2 |
| **Corowa Development (Xodus, 2020)** | MODU flare tip, 105 m<br>MODU navigation lights, 99 m | 17 | 9 | 34 |

The three light emissions modelling studies provide a suitable basis for defining the light spatial extent for the East Coast Project due to very similar operational activities.

Light emissions modelling conducted by Xodus for ConocoPhillips Australia's Otway exploration drilling campaign calculated that ambient light intensity levels are reached beyond 49 km of a flare with a flowrate of 40 MMscf/day located 45 m above sea level (Xodus, 2023). For MODU navigation lighting (on the derrick) located 84 m above sea level, ambient light intensity levels are reached beyond 9 km of the derrick (Xodus, 2023).

Light modelling by Pendoley Environmental Pty Ltd for Santos' Dorado Development used a Flare radiance interpreted from satellite radiance data of known maintenance (worst-case) flaring events of existing LNG facilities, ~500 uW/m$^2$/sr. For the Dorado development, worst case flaring events were described as occurring over <48 hours and at a rate of ~125 MMscf/d. The modelling study indicated light from the flare is no longer visible at 42.4 km, when the flare drops below the horizon. The flare height was conservatively estimated as 110 m above sea level (Pendoley, 2020). For FPSO navigation lighting located 47 m above sea level, light emissions were reduced to ambient levels at ~18 km from the navigational light source (Pendoley, 2020).

Light modelling conducted by Xodus Group for KATO Energy's Corowa Development used flaring from the MODU as the light source, with a flare flowrate 17 MMscf/day and a flare tip of 105 m above sea level. The light study estimated a spatial extent of 34 km (Xodus, 2020).

Overall, the review in Table 8-37 shows that with a flare flowrate between 17 to 125 MMscf/day, flare tip between 45 to 110 m, and navigation lights between 47 to 99 m, the light EMBA is expected to range from 34 to 49 km for the flaring scenario (inclusive of both flaring and operational lighting), and 9 to 18 km for the lighting scenario.

In general, the light emissions spatial extent is affected predominantly by the lighting power and the flaring flowrate. At this stage, the heights and lighting design of the infrastructure (i.e., MODU) are not known. ConocoPhillips Australia's Otway exploration drilling campaign is considered to be most representative, as the study parameters (flow rate, flare tip height, vessels and lighting) are likely to be most similar to the East Coast Project.

The navigational and operational light emissions spatial extent of 18 km from the source predicted by Pendoley Environmental Pty Ltd, is similar to the 20 km National Light Pollution Guidelines threshold (DCCEEW, 2023k); which has been adopted as the spatial extent for navigational/ operational lighting except for the short period when flaring would be occurring.

Given the light emissions extent for vessel/ MODU operations (excepting flaring) is not predicted to exceed the 20 km National Light Pollution Guidelines, the light emissions spatial extent (or EMBA) of 49 km for flaring has been adopted as the worst case extent, based on the flaring scenario in the ConocoPhillips Australia's Otway exploration drilling campaign (Table 8-37) for impact and risk assessment, noting that this is expected to occur for a maximum duration of 60 hours.

#### *8.3.4.1 Impact: Change in Ambient Light*

At night the moon is a source of natural light and was selected as a proxy for ambient light levels (Pendoley, 2020). Ambient light conditions are defined as the illuminance equivalent to a new moon / moonless clear night sky (Xodus, 2023; Pendoley, 2020).

Modelling predictions by Xodus (2023) and Pendoley (2020) were used to infer ambient light intensity levels are reached beyond 49 km of a flare and beyond 20 km of MODU or vessel navigational/ operational lighting which are suitable worst-case light EMBA distances for use during the East Coast Project.

Navigational/ operational lighting is a short-term source of light, given there are no permanent topsides facilities on the East Coast Project. The longest duration the MODU may be present at each well location is ~60 days, during well construction. Vessels undertaking IMR activities, installation, hook up and commissioning activities and decommissioning activities may be in the operational area for 2 to 4 weeks up to approximately 50 days.

Given that light emission sources of the East Coast Project are related to activities that are intermittent, of a short-term duration and relatively localised (change from ambient light levels within 49 km of the light EMBA), the consequence of this impact has been evaluated as **Level 1**, as light levels will return to existing ambient levels following completion of the activity with no remedial or recovery work required.

#### *8.3.4.2 Risk: Change in Fauna Behaviour – Marine Invertebrates*

**Inherent Consequence Evaluation**

Light emissions may cause behavioural changes to marine invertebrates. The operational area is in water depths ranging from 55 m to 85 m. At these water depths mobile marine invertebrates in the operational area may include cephalopods such as the arrow squid (Kailola et al., 1993) and crustaceans such as rock lobsters (Section 5.4.4).

Arrow squid is a targeted species for the Southern Squid Jig Fishery. Squid are highly attracted to artificial lights at night. This is demonstrated by the use of lights at night while jigging which is an active fishing method used by the Southern Squid Jig Fishery (AFMA, 2022). Light emissions in the operational area are expected to temporarily attract squid and other cephalopods up to the sea surface towards the light source (Imbrahim and Hajisamae, 1999).

Lobsters and other crustaceans that are generally nocturnal and highly active at night, are not expected to exhibit behavioural changes from exposure to artificial light at night based on observations of no effect on heart rate or locomotor activity (Steell et al., 2020). Laboratory studies have shown that artificial light at moderate levels at night (4–15 lux) observed suppressed activity and altered behaviour in four species of North American crayfish, and observations of Japanese spiny lobster exposed to low levels of artificial light at night also found suppressed activity (Nagata and Koike, 1997).

Light emissions in the operational area have very limited potential to suppress or change the nocturnal activities of crustacea and other organisms at the seabed given the depth of water (>50 m) between the temporary light sources at sea surface and strong light attenuation in the upper 50 m of the water column (McCafferty et al., 2004). As such, any impact from the operational and intermittent flaring light emissions to marine invertebrates will be limited to incidental behavioural changes, such as the potential for increased attraction to the light source of mobile invertebrates, such as cephalopods, within a smaller spatial extent than the light EMBAs. Light that will be used at depth for ROV operations will produce temporary sources of light with limited range inherent to subsea light sources, with potential for localise and minimal incidental behavioural reactions.

Behavioural changes to marine invertebrates from artificial light at night is expected to be localised and short term based on expectations that navigational/ operational light emissions sources are short term and highly localised.

The predicted level of impact, i.e., the consequence, to marine invertebrates from light emissions is evaluated to have a consequence of **Level 1** based on:

- invertebrate communities in the operational area are representative of what is expected throughout the Otway Basin
- localised and short-term behavioural change to marine invertebrate is expected to be limited to temporary attraction of cephalopods and incidental behavioural suppression reactions in crustaceans on the seabed.

**Inherent Likelihood**

The scattered and patchy presence of marine invertebrate communities in the operational area presents a potential overlap of marine invertebrates with the light EMBA; therefore, it is likely the risk event will occur.

The inherent likelihood of a **Level 1** consequence occurring is therefore rated as **Likely (B).**

**Inherent Risk Severity**

The inherent risk severity of behavioural changes to marine invertebrates is considered **Low**.

#### *8.3.4.3 Risk: Change in Fauna Behaviour – Fish*

**Inherent Consequence Evaluation**

Light emissions may cause behavioural changes to fish including eggs and larvae. The National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k) recognises artificial light at night can suppress the upward daily vertical migration of zooplankton (including fish eggs and larvae) which rise to the surface at night to feed. Inversely, some zooplankton at night are attracted towards illuminated parts of the ocean, where they become easy prey for predators (DCCEEW, 2023k). Suppressing or attracting zooplankton to the surface may disrupt zooplankton vertical migrations and in turn impact the movement and food availability for larger nocturnal fish predators. For example, adult benthopelagic fish have also been documented displaying large daily vertical migrations that match pelagic prey availability and movements of zooplankton (Afonso et al., 2014). Artificial light may also promote bringing diurnal fish foragers into competition with their nocturnal counterparts, thereby substantially increasing predation pressure to nocturnal prey and competition with nocturnal fish predators (DCCEEW, 2023k).

Short-finned eels also exhibit strong daily vertical migrations during the deep ocean spawning migration phase (Koster et al., 2021). A study tracked downstream spawning migration of adult short-finned eels released from south-western Victoria (Hopkins and Fitzroy River estuaries) and observed the adult eels moved east or south along the Australian continental shelf exiting the Bass Strait at the east to migrate north to spawning grounds in tropical waters of the Coral Sea (Koster et al., 2021). From the spawning site in the Coral Sea, migration of short-finned eel larvae are influenced by ocean currents that carry the larvae from the Coral Sea south along the east Australian current and transport the developing larvae through the Bass Strait to the Victorian Coast (VFA, 2017). Based on the observed migratory route of short-finned eels, transient short-finned eels may pass the operational area. During the offshore migration, eels exhibited daily vertical migrations and were presumed to stay along the seafloor during the day and ascended toward the sea surface at night. Anguillid eels such as short-finned eels do not feed during spawning migration, as a result the function of daily vertical migrations relates to predator avoidance, swimming efficiency, thermal regulation, and control of maturation (Koster et al., 2021). The change in light intensity triggers the onset of ascent and descent for short-finned eels (Koster et al., 2021). Studies have observed during the freshwater downstream migration phase for Anguillid eels, migrating eels tend to avoid artificially lit routes (by acceleration, retraction, switching and rejection) (Vowles and Kemp, 2021). Based on these studies, it is inferred that transient migrating short-finned eels in the operational area may not ascend towards the sea surface at night if artificial light is emitted during the East Coast Project reducing the change of being identified by visual predators.

The monitoring area overlaps foraging BIAs for the white shark. However, no BIAs intersect the operational area. As a result, individual white sharks are expected to be transient within the monitoring area and may be transient with the operational area. Given the ability of white sharks to detect changes in light and modify their hunting behaviour accordingly, exposure to intermittent flaring or navigational lighting during the East Coast Project could disrupt rhythmic behavioural activities of individuals (Carroll and Harvey-Carroll, 2023; Colefax et al., 2020). The increase presence of zooplankton and foraging fish at night may attract larger fish species including white sharks (Carroll and Harvey-Carroll, 2023).

Impacts, if any would be limited to temporary behavioural changes to small numbers of plankton and fish within proximity of artificial light sources in surface waters of the operational area. Zooplankton migrates upwards at dusk and downwards at dawn (Nocera et al., 2020), which for the basis of

comparison, light levels at dawn and dusk are inferred as light levels at twilight. Based on light emissions modelling, light illuminance levels that reflects twilight levels are reached within 500 m of a flare (Xodus, 2023). It is anticipated that the suppression or attraction of plankton will occur within 500 m of flaring or MODU and vessel operations, which in turn may impact the localised movement and food availability for larger nocturnal fish predators.

Behavioural changes to fish and plankton (eggs and larvae) from artificial light at night is expected to be localised and short term based on expectations that navigational/operational light emissions sources, and flaring are short-term

Given the consequence of impact by light emissions to fish including eggs and larvae will be intermittent, short-term, and highly localised (behavioural changes within 500 m of the light source), the consequence levels have been evaluated as **Level 1**, as light levels will return to existing ambient levels following completion of the activity with no remedial or recovery work required.

**Inherent Likelihood**

The risk event could happen when additional factors are present, such that zooplankton, short-finned eels, nocturnal fish and diurnal fish are present within the light EMBA during well construction, operations, decommissioning and support operations where light is generated. Fish are known to occur within the light EMBA (Section 6.5.5) however plankton populations are expected to be highly variable both spatially and temporally (Section 6.5.3).

The highly variable presence of plankton and fish populations in the operational area presents a potential overlap of marine invertebrates with the light EMBA; therefore, it is likely the risk event will occur.

The inherent likelihood of a **Level 1** consequence occurring is therefore rated as **Likely (B).**

**Inherent Risk Severity**

The predicted level of risk, i.e., inherent risk severity, of behavioural changes to fish including eggs and larvae is considered **Low**.

#### *8.3.4.4 Risk: Change in Fauna Behaviour – Marine Turtles*

**Inherent Consequence Evaluation**

Light emissions may cause behavioural changes to marine turtles. Light emissions in offshore waters at night can disrupt in-water dispersal behaviours of marine turtles by interfering with natural lighting and silhouettes (DCCEEW, 2023k; CoA, 2017). Marine turtle hatchlings are attracted to lights at sea, based on observations of hatchlings swimming around lights on boats (DCCEEW, 2023k). The potential to disrupt critical dispersal behaviours of marine turtles is considered a threat to the recovery of marine turtles (CoA, 2017).

Critical behaviours for marine turtles are generally carried out within spatial extents defined by marine turtle BIAs and habitat critical to the survival of marine turtle species. The operational area does not overlap BIAs or habitat critical to the survival of marine turtle species. There are no marine turtle BIAs adjacent to the operational area and no nesting activities along Victorian coastlines. As a result, individual marine turtles are expected to be transient within the operational area.

Impacts, if any, would be limited to temporary behavioural changes to individual marine turtles which may travel through the light EMBA. The exposure of individual marine turtles to intermittent flaring or navigational lighting during the East Coast Project could temporarily attract individual marine turtles within 49 km of flaring sources and 20 km of MODU and vessel operations undertaken at night.

Behavioural changes to marine turtles from artificial light at night is expected to be localised and short term based on expectations that navigational/operational light emissions sources, and flaring are short-term Given the consequence of impact of light emissions to marine turtles will be intermittent, short-term, and relatively localised (within 49 km of the light source), the consequence levels have been evaluated as **Level 1**, as light levels will return to existing ambient levels following completion of the activity with no remedial or recovery work required.

**Inherent Likelihood**

The risk event could happen when additional factors are present, such that individual marine turtles are present within 49 km of night-time flowback and well intervention activities and 20 km of MODU and vessel operations. No BIAs or habitat critical to the survival of marine turtles overlaps the light EMBA, however loggerhead and leatherback turtles are known to occur in this area. Based on the absence of BIAs or habitat critical to the survival of marine turtles in the light EMBA, a rare combination of factors would be required for marine turtles to be present during night-time flowback and well intervention activities, MODU and vessel operations and decommissioning. The risk event is considered conceivable and could occur at some time during the East Coast Project.

Given the nature of this risk event, the inherent likelihood of a **Level 1** consequence occurring is rated **Unlikely (D).**

**Inherent Risk Severity**

The predicted level of risk, i.e., inherent risk severity, of behavioural changes to marine turtles is considered **Low**.

#### *8.3.4.5 Risk: Change in Fauna Behaviour – Seabirds and Shorebirds*

**Inherent Consequence Evaluation**

Light emissions may cause behavioural change to nocturnal seabirds by disrupting vision at night. Nocturnal seabirds include petrels, shearwaters, albatross, noddies, terns, prions, and some penguin species (DCCEEW, 2023k). Light emissions at night can disrupt critical behaviours for nocturnal seabirds by disrupting sea-finding cues provided by moonlight and starlight. This can disorient migrating and foraging nocturnal seabirds and cause them to divert from efficient migratory routes. Light emissions can disrupt other critical behaviours such as preventing fledglings from taking their first flight if their nesting habitat does not become dark (DCCEEW, 2023k). Disorientation of seabirds from night-time light emissions may cause interference with navigation and grounding of individuals on offshore vessels (Heswall et al., 2022). The potential of disorientation from light emissions is exacerbated with an increase in proximity of nesting sites or migrating sites to artificial light sources (DCCEEW, 2023k). Light emissions can also attract seabird prey including fish and squid, resulting in increased foraging opportunities for nocturnal seabirds at lit offshore areas (Marangoni et al., 2022).

The light EMBA overlaps 7 foraging BIAs for albatross species, one breeding BIA and 2 foraging BIAs for the short-tailed shearwater, and a foraging BIA for the Australasian gannet.

<u>Albatross, Petrels and Shearwaters</u>

No habitats critical to the survival of threatened albatross and petrel species occur within the light EMBA, this includes known nesting sites or migrating sites. Suitable albatross and petrel breeding islands in Australia are limited to remote offshore islands, of which the closest is Albatross Island located 250 km southeast of the operational area (DCCEEW, 2023e).

Albatrosses and petrels are capable of foraging at both day and night. During bright moonlit nights the number of foraging flights for albatrosses and petrels significantly increase compared to moonless nights (Phalan et al., 2007; Frankish et al., 2021). As a result, it is inferred that albatrosses and petrels may forage in the light EMBA on bright moonlit nights, however not in high numbers. Light emissions in the operational area at night may further increase foraging opportunities for albatrosses and petrels outside of bright moonlit nights.

No habitats critical to the survival of threatened shearwater species occur within either light spatial extent. However, the short-tailed shearwater breeding site, Muttonbird Island, is located within the monitoring area. The light spatial extent overlaps the short-tailed shearwater breeding and foraging BIAs at Muttonbird Island (see Figure 8-3) (CoA, 2022b). It is noted that the light EMBA does not overlap foraging (in high numbers) BIAs for the short-tailed shearwater.

Shearwaters are nocturnally active at breeding colonies and nest in burrows underground during daylight hours and forage by diving in the water column at night. The short-tailed shearwater has been observed foraging at Griffith Island in inshore habitat and over the continental shelf edge (20-240 km from the colony) (Berlincourt and Arnould, 2015). Diving seabirds, particularly petrels, are sensitive to artificial light emissions, which can disorient birds during flying and foraging (Marangoni

et al., 2022). Artificial lights can also concentrate prey in marine environments which seabirds can take advantage of. Several gull species have been recorded to increase their foraging opportunities by increasing concentrations of fish, squid, and plankton in artificially lit areas in marine and coastal environments (Marangoni et al., 2022).

A study by Ravache et al. (2020) observed a positive relationship between greater seabird at sea foraging and full moon nights. As a result, shearwaters are expected within the operational area for nocturnal offshore foraging during the breeding season between September and April, however not in high numbers (CoA, 2022b). Light emissions in the operational area at night may further increase foraging opportunities for shearwaters outside of bright moonlit nights.

A critical phase of life for petrels and shearwaters is at fledgling when young birds move from parent-dependant life on land to become independent at sea. Fledglings are vulnerable to becoming disorientated during their first flight when exposed to artificial light, with some fledglings leaving the nest but becoming attracted towards artificial lighting. This disorientation can lead to injury or fatality from fallouts over the ocean, groundings or collisions with infrastructure (Rodríguez et al., 2017; Marangoni et al., 2022). Studies have shown that some fledglings will not make their first flight due to light emissions if the nesting habitat does not become dark (DCCEEW, 2023k). Fledging typically occurs towards the end of the breeding season and within the first two hours after sunset during the fledging period (Gineste, 2016 cited in Chevillion et al., 2022) which is often associated with the lunar cycle (Chevillion et al., 2022). It is widely accepted that the fledging period of the short-tailed shearwater occurs between the third week of April and the first week of May each year (Skira, 1991; Rodríguez et al., 2014; Price, 2022).

This species is nocturnally active at their breeding colonies with fledglings leaving their nests at nights (DCCEEW, 2023k). Breeding birds can be deterred from visiting breeding colonies when light emissions are close to breeding colonies. Studies have shown that the number of birds flying over a colony decreased with duration and intensity of light emissions. Increasing light emissions around breeding colonies could impact breeding behaviour and chick provisioning, which has been indicated by studies showing that shearwater chicks situated closer to high-intensity light emissions gained less weight than chicks in nests further away from the light source (Marangoni et al., 2022). Known shearwater breeding locations within the vicinity of the operational area include Muttonbird Island, Griffiths Island and Deen Maar, which are approximately 18 km, 41.5 km and 58.8 km from the operational area, respectively, from their closest points (Section 6.5.7.1). Muttonbird Island is within both the navigational/operational lighting spatial extent and the flaring light spatial extent. Griffiths Island is located within the flaring light spatial extent; but not within the navigational/operational lighting spatial extent. Deen Maar is not within either light spatial extent (refer Figure 8-3).

Based on the conservative spatial extent of light emissions described in Section 8.3.4, light emissions from intermittent flaring and navigational/operational lighting may result in light that is visible from coastal nesting locations. Nocturnal seabird species with breeding sites within the light spatial extents have been identified as shearwaters. As described above, the fledging is the period where shearwaters are the most susceptible to impacts from light emissions. Considering the fledging period of the short-tailed shearwater occurs over a 3-week period (between the end of April and beginning of May) each year, there is potential that fledging coincides with flaring activities in the operational area, ~18 km from Muttonbird Island and ~41.5 km from Griffiths Island within the 49 km flaring spatial extent (Figure 8-3). Considering drilling activities are proposed to occur over a ~60-day period there is potential for only one flaring event (maximum 60 hours) to occur during the shearwater fledging period as light levels will return to ambient conditions following completion of the activity.

Rodríguez et al. (2014) found that the irradiance value of 27 nW/sr*cm$^2$ acted as a threshold for the response of fledgling shearwaters and other seabirds at Phillip Island, which is used to define the 20 km impact assessment boundary within The National Light Pollution Guidelines for Wildlife (CoA, 2023). This value equates to approximately 0.18 lux. An illuminance value of 0.18 lux modelled from the 40 MMscf/d flare (Appendix F) is reached at a distance of 3.7 km from the flare source. Consequently, these emissions are not expected to cause behavioural impacts or injury/mortality to the species as this distance is a fraction of the distance to the nearest breeding locations (Muttonbird Island at 18 km and Griffiths Island at 49 km).

Additionally, based on the light modelling (Appendix F), the modelled illuminance during flaring at Muttonbird Island, the nearest documented breeding location and breeding BIA (18 km distance), is predicted to be 0.0077 lux, equivalent to less than that of a quarter moon. Further, when not flaring, modelled illuminance from routine facility lighting is predicted to be 0.0003 lux at a distance of 18 km, which is equivalent to less than that of a new moon or moonless clear night sky. As a result, impacts to fledglings at these locations are not predicted.

This follows similar conclusions within studies that have specifically evaluated the effect of artificial light on fledgling shearwaters at sites close to urbanised areas on Phillip Island. These birds were close to urbanised areas (within 10 km) and associated light sources. The study found that fledglings were particularly affected by light from traffic, and then susceptible to collision with vehicles, which was also the primary cause of mortality, though noted that even in this situation, there was a low proportion of fledglings affected relative to the overall production of the population (Rodríguez et al., 2014). The short-tailed shearwater is the most abundant seabird in Australia inhabiting 285 colonies in south-eastern Australia each breeding season (NRE Tas, 2024a).

Other impacts, if any, would be limited to temporary behavioural changes to foraging albatrosses, petrels and shearwaters within either light spatial extent. The exposure of foraging albatrosses, petrels and shearwaters to intermittent flaring or navigational lighting during the East Coast Project is likely to temporarily attract albatrosses, petrels and shearwaters to nocturnally feed within the offshore waters of flaring sources and MODU and vessel operations.

Orange-Bellied Parrot

The orange-bellied parrot is an EPBC-listed critically endangered ground parrot, with breeding ranges restricted to the south-west coast of Tasmania. Although the orange-bellied parrot does not have a defined BIA or habitat critical within the navigational/ operational or flaring light spatial extent, these areas do overlap a probable migration route and the species is identified as likely to occur (Section 6.5.7.3; Figure 8-4Figure 6-41).

The orange-bellied parrot is endemic to south-eastern Australia (DELWP, 2016) and participates in yearly migrations over the Bass Strait from breeding grounds in Tasmania to the mainland Australia, each winter between late February to early April (Australian Museum, 2022). This migration route follows the west coast of Tasmania, with some individuals known to stop on King Island during the migration. Non-breeding individuals can be found along South Australia and Victoria within 3 km of the coastline in habitats such as saltmarsh, coastal dunes, and estuaries throughout the winter months. The possible migration route that has been identified for the species has the potential to overlap both light spatial extents, and timing of the East Coast Project activities (DELWP, 2016).

Migrating orange-bellied parrot individuals have been assumed to mostly travel at night (Australian Museum, 2022), however there is limited evidence of nocturnal migratory behaviour for this species. Because the wild population of this species is small and difficult to detect, published data on the distribution of the orange-bellied parrot is limited to known breeding and non-breeding locations. However, it is likely that other breeding locations and migratory routes may become important as the population increases (DELWP, 2016).

The 2023-24 breeding season showed a record number of 81 orange bellied parrots return to breeding grounds and production of 59 fledglings, the third highest fledgling production since 2004 (NRE Tas, 2024b). It is estimated that a total of 139 individuals would have migrated north from the breeding grounds at the end of the 2022/23 breeding season of which 81 returned for the 2023/24 breeding season resulting in a 58% return rate (DPC, 2023).

The National Recovery Plan for the Orange-bellied Parrot (DELWP, 2016) does not identify ambient light as a threat. Barriers to migration and movement are listed as a threat which includes wind energy turbines, powerlines and associated infrastructure, aircraft, illuminated structures and illuminated boats (DELWP, 2016). Illuminated vessels could act as a potential ‘barrier’ that could modify the behaviour of individuals if encountered on migrations routes. However, this is based predominantly on anecdotal evidence, with limited research to support this (Holdsworth, 2006). Intermittent light sources from the Project such as survey or anchor handling vessels do not present the same magnitude of risk as that associated with long term or permanent illuminated structures or illuminated commercial vessels which are positioned within the probable migration route year-round. Survey or anchor handling vessels would rarely be within the probable migration route and thus are

unlikely to act as a barrier to migration or movement according to the species recovery plan (DELWP, 2016).

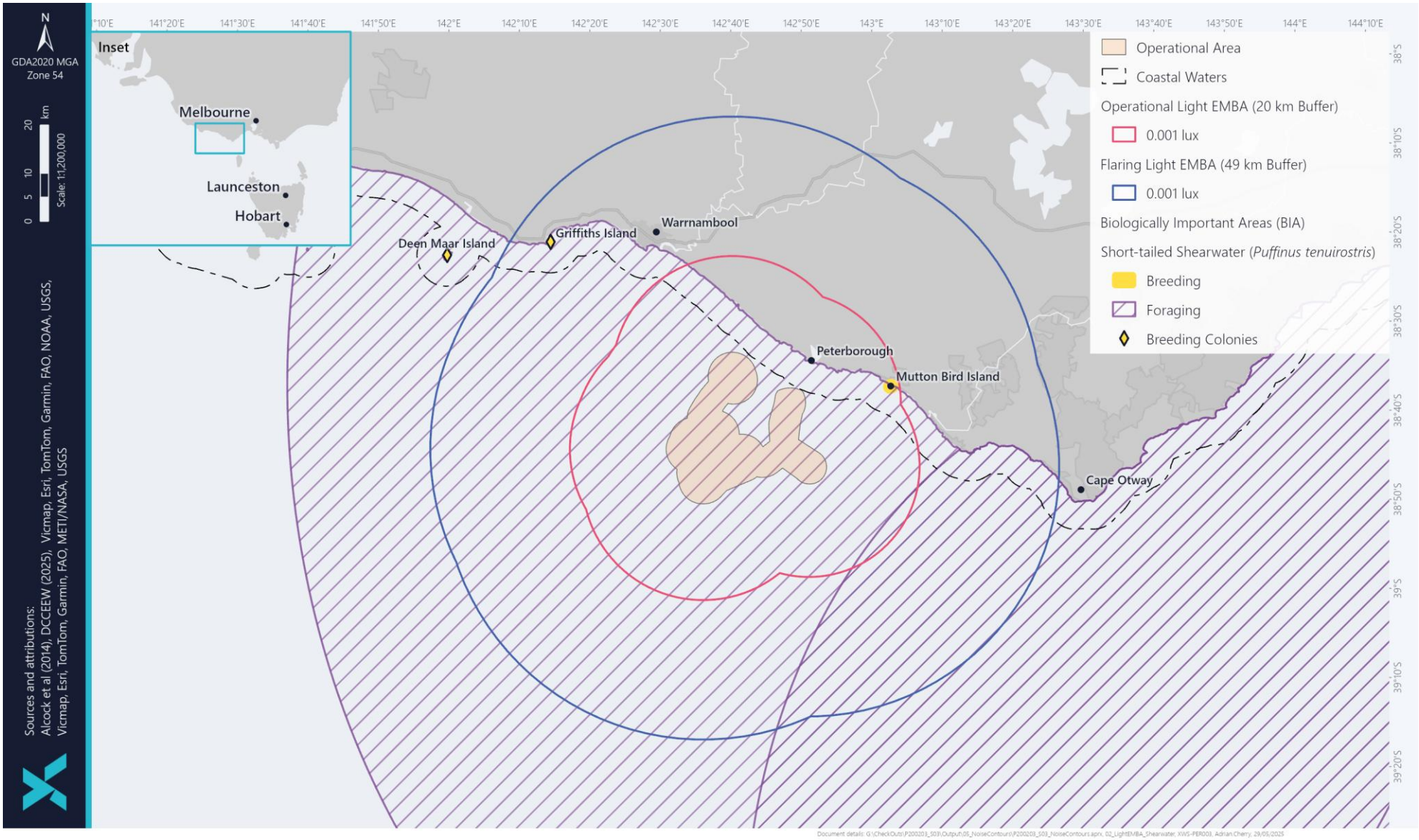



*Figure 8-3: Light EMBAs and shearwater BIAs relevant to the East Coast Project*

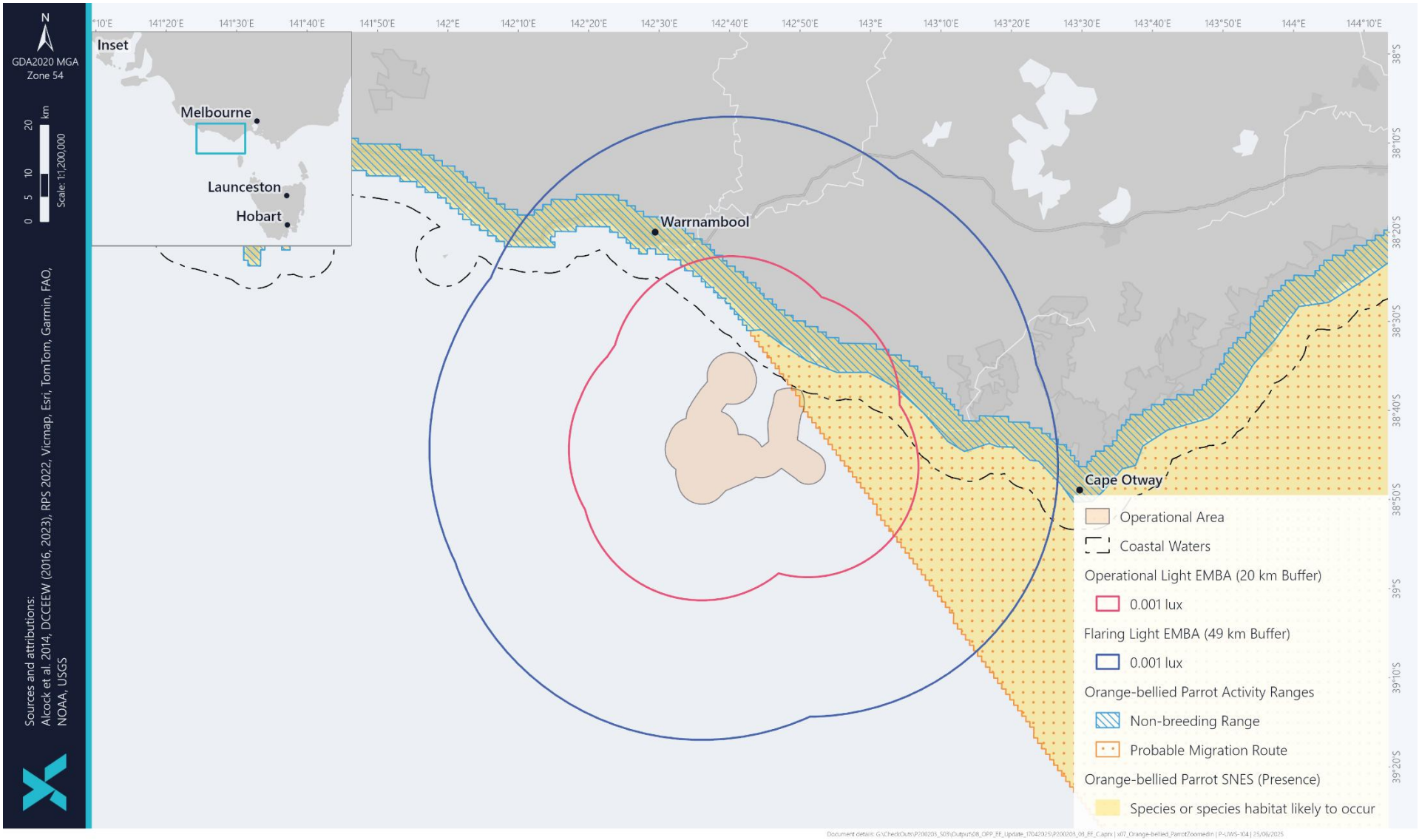



*Figure 8-4: Light EMBAs and Orange Bellied Parrot Activity Ranges/ Presence relevant to the East Coast Project*

The known migration route of the orange-bellied parrot is ~120 km from the operational area, between King Island and the west coast of Tasmania. The 20 km navigational/ operational lighting spatial extent and 49 km flaring spatial extent both overlap the western most portion of the probable migration route near the Victorian coastline (approximately 1.3% and 3.5%, respectively); and the area identified as the species likely to occur (Figure 6-41), though not the known migration route. Flaring activities would be intermittent and short-term (60 hours from one well at a time) with light levels returning to ambient following completion of vessel or flaring activity. Light emissions modelling conducted by Xodus for ConocoPhillips Australia's Otway exploration drilling campaign determined that changes to ambient light in the non-breeding range associated with short-term flaring at the closest possible distance (of the Otway exploration drilling campaign) of 20 km from the Victorian coast and 33 km from King Island were predicted to result in an increase in light intensity of <0.007 and <0.003 lux, respectively, which is less than the light from a quarter moon night sky (0.01 lux) (Xodus, 2023). In the context of the Project, it can be estimated that navigational/operational light and flaring light emissions would be less than the light from a quarter moon night sky (0.01 lux) where the spatial extent overlaps with the probable migration route.

Based on this, it is concluded that the overlap from the light spatial extents will be comparatively small and will not impact a large extent of the probable migration route and would not overlap the current known migration route. As changes in ambient light are not recognised as a threat to species recovery and are expected to be short-term and predominantly outside of the species' migratory corridor, significant behavioural changes to the species whilst migrating are not predicted. Further, as the temporary changes in ambient light inside the probable migration route from the activity are low level (lower than that from a quarter moon night sky), migratory behaviours are not expected to be impacted at either the individual or population level.

Summary

Behavioural changes to seabirds and shorebirds from artificial light at night are expected to be localised and short term based on expectations that navigational/operational light emissions sources are short-term.

The predicted level of impact, i.e., the consequence, to seabirds and shorebirds because of light emissions is evaluated to have a consequence of **Level 1** based on:

- operational lighting on vessels and the MODU will be limited to that which is required for navigational and safety requirements; and will be short-term.
- the spatial extent is relatively localised for navigational/operational lighting (at 20 km); and larger for flaring (49 km) flaring will occur from one well at a time for up to 60 hours per event.
- the flaring spatial extent overlaps 7 foraging BIAs for albatross species. Given the large areas typically covered by foraging individuals, and the transient nature of the species, light impacts are not expected to cause significant impacts to foraging behaviours.
- the flaring spatial extent overlaps with one breeding BIA and one known breeding island for the short-tailed shearwater. The impact from flaring will be intermittent and temporary and is therefore not expected to interrupt breeding behaviours or cause impacts at a population level.
- the fledging period of the short-tailed shearwater occurs over a 3 week period each year and may coincide with flaring in the operational area (~18 km from Muttonbird Island and ~41.5 km from Griffiths Island from the closest points); however there is only potential for one flaring event (maximum 60 hours) to occur during this window of sensitivity. Given the distance between these breeding locations and the operational area, light from flaring received would be expected to be of lower intensity (less than that of a quarter moon) and negligible when considered alongside the lighthouse installed on Griffiths Island, coastal sources of light and regular vessel traffic directly off the coast (Section 6.7.3.1).
- neither of the Project light spatial extents are within the known migration route for the orange-bellied parrot, and the overlap with the western portion of the probable migration route near the Victorian coastline, and the area identified as the species likely to occur, is small in the context of the overall extent of these areas.

- Light emissions will be intermittent, short-term and localised and will return to ambient levels following completion of the activity. There are no long-term topsides facilities or light sources for the East Coast Project to which animals may habituate or which impact individuals over multiple sequential biologically important periods.

**Inherent Likelihood**

The risk event could happen when additional factors are present, such that night-time flowback and well intervention activities, MODU and vessel operations and decommissioning occur during orange-bellied parrot migration between February and April, the short-tailed shearwater breeding period between September and April and fledging period between late April and early May, or when transient albatrosses and petrels opportunistically feed whilst passing through the light EMBA. Based on the overlap of seabird BIAs with the light EMBA and considering the shorter duration of the greatest source of light (i.e. flaring), the risk event of minor local behavioural changes to nocturnal seabirds is considered possible.

Given the nature of this risk event, the inherent likelihood of a **Level 1** consequence occurring is rated **Possible C.**

**Inherent Risk Severity**

The predicted level of risk, i.e. inherent risk severity, of behavioural changes to seabirds is considered **Low**.

#### *8.3.4.6 Risk: Injury/mortality to Marine Fauna – Seabirds and Shorebirds*

**Inherent Consequence Evaluation**

The behavioural responses in seabirds and shorebirds due to artificial light described in Section 8.3.4.5 above can potentially cause injury or mortality. This may occur due to disorientation causing collisions with infrastructure, entrapment, stranding, grounding, interference with navigation (being drawn off course from usual migration route). Migratory shorebirds may use less preferrable nesting sites which avoid lighting but may be exposed to increased predation (DCCEEW, 2023k).

Knowledge on light-induced mortality at sea is quite limited (Gjerdrum et al., 2021), although it is known that adults can also be involved in attraction episodes. Stranding events are more likely during nights with little or no moonlight, but systematic searches for stranded birds, with clear monitoring protocols are needed to better understand how light characteristics, weather, and the location of sites influence strandings, and to monitor the effectiveness of light mitigation (Marangoni et al., 2022).

A study was undertaken on the number of fledging short-tailed shearwaters found grounded by evening and morning rescue patrols conducted at Phillip Island during a 15-year period (1999–2013) (Rodríguez et al., 2014). The study associated light from roads and traffic with the attraction, grounding and mortality of seabird fledglings, preventing a proportion of the population from making it to sea. During a 15-year period, rescue patrols on Phillip Island found 8,871 grounded fledgelings, mostly on and around roads; ~40% of those suffered mortality mainly through collision with vehicles. Rodríguez et al suggest that light induced mortality is usually underestimated elsewhere, though also note a low proportion of affected fledglings relative to the overall production of the population.

The collision of birds with offshore oil and gas structures has been reported. A study on bird fatalities at an unmanned research platform in the North Sea found 34 species over the 4-year monitored period, and extrapolated there was an average of 150 birds killed by collision per year at the offshore structure (Huppop et al., 2016); further extrapolating the potential numbers of deaths to across the 1000+ structures offshore North Sea, Huppop et al. conclude at the current rates of mortality are not alarming given at the species level, <1% of populations would be affected. The study identified the bird species to be mainly passerines, such as thrushes and European starlings, that can undertake intensive nocturnal migration. The East Coast Project does not have any ongoing presence of a topsides structure. Whilst artificial lighting will be required offshore, the sources would be temporary.

The flare itself may also present a hazard to birds, as component of the MODU such as the flare boom can provide a perch for individual birds that may migrate through or forage within the area. These birds could then be susceptible to burning by the flare. Due to the very short duration of

flaring (60 hours) on an intermittent basis, at one well at a time, this is not expected to occur and can be managed via standard practices such as flare watch and start-up procedures to manage the flare around the possible presence of birds.

Any injury or mortality to seabirds as a result of a behavioural response to light emissions is not expected to cause any impacts at a population level.

**Inherent Likelihood**

The risk event could occur when the change in fauna behaviour as a result of light emissions described in Section 8.3.4.5 could lead to injury or mortality of seabirds. The source of this hazard is lighting, and collision or stranding on the MODU, or contact with the flare itself. Over the course of Cooper Energy's offshore activities to date, there have been no reports of collisions of birds with vessels or MODUs, or interactions between flares and birds. Birds are observed on and from vessels and MODUs on a regular basis (Section 6.5.7.1); very rarely individual birds have exhibited signs of fatigue. One such event occurred during Cooper Energy's ~6 month well decommissioning campaign in the Gippsland region in 2024; where a petrel was observed seeking refuge on the campaign MODU during a strong cold front, before moving on within 24h. Based on the overlap of seabird BIAs with the light EMBA, and considering the likelihood of a change in behaviour resulting in injury or mortality, the inherent likelihood of a **Level 1** consequence occurring is rated **Unlikely D.**

**Inherent Risk Severity**

The predicted level of risk, i.e. inherent risk severity, of injury or mortality to seabirds is considered **Low**.

### 8.3.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented inTable 8-38.

*Table 8-38: Light emissions acceptability assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: Change in ambient light | Consequence: Level 1 |
| | Risk: Change in fauna behaviour | Risk: Low – marine invertebrates<br>Risk: Low – fish<br>Risk: Low – marine turtles<br>Risk: Low – seabirds |
| | Risk: Injury/mortality to marine fauna | Risk: Low – seabirds |
| **Principles of ESD** | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (section 8.3.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the impacts and risks from light emissions are identified as:<br>• Level 1 consequence for change in ambient light<br>• Low risk for change in fauna behaviour | |

| Acceptability Criteria | Demonstration of Acceptability | | |
|---|---|---|---|
| | • Low risk for injury/mortality to marine fauna.<br>The above predicted levels of impact and risk due to light emissions from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology and the National Light Pollution Guidelines (DCCEEW, 2023k). Several proxy modelling studies were evaluated for their suitability to the East Coast Project, and from those, conservative parameters were selected.<br>• The highest consequence ranking for light emissions was evaluated as Level 1 and the highest inherent risks for light emissions was evaluated as Low; therefore, light emissions from the East Coast Project will not result in serious or irreversible environmental damage.<br>• There is little scientific uncertainty associated with predicted environmental impact and the anticipated effectiveness of management measures.<br>• The potential impacts and risks from light emissions are well-understood, and management measures are well established and regulated in Australian waters.<br>• Any residual uncertainty surrounding the suitability of analogue light modelling scenarios will be addressed by EPO20 which establishes a modelling review to ensure that scenarios and thresholds remain appropriate for activity specific environment plans. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risks for light emissions were evaluated as Low and therefore will not forego the health, diversity and productivity of the environment for future generations through protection of environmental values.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.3.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to artificial light emissions were evaluated in Section 8.3.4 and the highest inherent risk for light emissions was evaluated as Low.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.3.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained through protection of the values of the Commonwealth Marine Area as per the objectives of bioregional plans. | | |
| | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |

| Acceptability Criteria | Demonstration of Acceptability | | |
|---|---|---|---|
| **Legislative and Other Requirements** | Albatrosses and Giant Petrels as per National Recovery Plan for Albatrosses and Petrels 2022 (DCCEEW, 2022e) | N/a – Artificial light is not identified as a threat within the Conservation Management Plan for Albatrosses and Petrels. | Adoption of the following control measures:<br>CM1: Marine Assurance Process<br>This process ensures that the MODU and vessels meet relevant maritime laws. The MODU and vessels operating in the operational area will be required to adhere to navigations safety requirements. AMSA Marine Orders 21 and 30 for the safety of navigation and prevention of collisions require that onboard navigation, watchkeeping, radar equipment, and lighting meets the International Rules for Preventing Collisions at Sea (COLREGs) and industry standards.<br>CM4: Light Management Measures<br>The Cooper Energy Light Management Measures acknowledges legislative requirements and identifies management measures for different types of offshore activities, accounting for nature and scale of the potential impacts and risks, to ensure they remain within acceptable levels, and are managed to ALARP. MODU and vessel lighting will be limited to the minimum required for navigational and safety requirements, with the exception of emergency events. Provisions within the Light Management Measures include consideration for vulnerable species during sensitive life stages most susceptible to artificial light via a planning-phase risk review, integrating latest published Government Plans and scientific literature. This will consider scheduling of activities outside of higher sensitivity period where practicable, and review of control measures to ensure levels of impact and risk remain ALARP.<br>MODU and the vessels will implement light management measures developed with consideration to the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k), these include, but are not limited to:<br>• Outward facing lights will be reduced to minimum levels required for a safe work environment.<br>• Requirement to minimise the use of non-essential lights (e.g. close blinds, turn off lights when leaving a room) will be included in MODU and vessel inductions. |
| | Wildlife Conservation Plan for Seabirds (CoA, 2020) | Objective: Seabirds and their habitats are identified, protected and managed in Australia.<br>Management action:<br>Action 2e: Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas. | |
| | National Recovery Plan for the Orange-bellied Parrot (*Neophema chrysogaster*) | Objective:<br>To achieve a stable or increasing population in the wild within five years.<br>Management action<br>Assess and manage the risks from development proposals that may represent a barrier to migration or movement. | |
| | Recovery plan for marine turtles in Australia 2017–2027 | 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.<br>Interim objective 3: Anthropogenic threats are demonstrably minimised.<br>No relevant management actions. | |
| | Recovery Plan for the White Shark (*Carcharodon carcharias*) 2013 | N/a – Artificial light is not identified as a threat within the Species Conservation Management Plan. | |

| Acceptability Criteria | Demonstration of Acceptability | | |
|---|---|---|---|
| | | | • Recording and reporting of any seabirds found on the MODU or vessels in need of care.<br>• Procedures to manage and care for any seabirds found on board requiring care, including remote advice from Zoos Victoria Marine Response Unit (MRU) or equivalent.<br>• Adaptive management will be detailed in the light management measures to be included in future EPs under this OPP when scheduling of the activity is known in greater detail, including the potential for concurrent vessel/ MODU activities and overlap with biologically important periods.<br>CM22: Modelling Review<br>Modelling studies used to inform the Activity Environment Plan will use scenarios that are representative of the activity, and current, published thresholds that are suitable for sensitive receptors. |
| **N/a** | **Guideline** | **Relevant considerations** | **Where Guideline is Considered** |
| | National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k) | Objective: Artificial light will be managed so wildlife is:<br>1. Not disrupted within, or displaced from, important habitat<br>2. Able to undertake critical behaviours such as foraging, reproduction and dispersal.<br>Management actions which will be considered where practicable:<br>• Start with natural darkness and only add light for specific purposes.<br>• Use adaptive light controls to manage light timing, intensity and colour.<br>• Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill.<br>• Use the lowest intensity lighting | CM1: Marine Assurance Process<br>CM4: Light Management Measures |

| Acceptability Criteria | Demonstration of Acceptability | | |
|---|---|---|---|
| | | appropriate for the task.<br>• undertaking an environmental impact assessment of effects of artificial light on listed species for which artificial light has been demonstrated to affect behaviour, survivorship or reproduction.<br>Section 8.3.4 details the environmental impact and risk evaluation for listed species within the light EMBA. | |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11)<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | No feedback from stakeholders has been received that would inform the values and sensitivities / existing environment, impacts and risks, performance outcomes or mitigation measures of light emissions. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable levels of impact relevant to light emissions is AL5 identified inTable 8-39. This acceptable level defined for a change in ambient light, and potential changes in fauna behaviour is defined in Table 7.6.<br>The worst-case predicted impacts assessed in Section 8.3.4 are:<br>• Localised and short-term change in ambient light is limited to the intermittent presence of vessels and MODU activities and drilling operations at night. Ambient light levels are expected to immediately return following completion of support operation activities and drilling operations.<br>• The short-term temporal extent of change in ambient light is based on the intermittent presence of operational/navigational lighting on vessels and the MODU required for navigational and safety requirements (i.e. ~60 days per well for the MODU, and ~45 days per installation). Flaring will occur from one well at a time for a maximum of 60 hours per event.<br>• The localised spatial extent of change in ambient light is 20 km for navigational/operational lighting; and 49 km for flaring.<br>• The flaring spatial extent overlaps with one breeding BIA and one known breeding island of the short-tailed shearwater. The impact from flaring will be intermittent and temporary and is therefore not expected to interrupt breeding behaviours or cause impacts at a population level. Although neither spatial extents are within the known migration route for the orange-bellied parrot, both have a relatively small overlap with the western portion of the probable migration route and the area identified as the species likely to occur.<br>• Any injury or mortality to seabirds as a result of a behavioural response to light emissions is not expected to cause any impacts at a population level.<br>• The highest consequence ranking for light emissions was evaluated as Level 1 and the highest inherent risks for light emissions was evaluated as Low.<br>Therefore, at its worst-case, the predicted impact from light emissions would not: | | |

| Acceptability Criteria | Demonstration of Acceptability |
|---|---|
| | • Modify an important or substantial area of habitat which may lead to substantial adversely impact on biodiversity and ecological integrity.<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species<br>• Lead to loss of habitat critical to the survival of species.<br>Therefore, the predicted level of impact due to light emissions from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to light emissions are acceptable, based on:<br>• Predicted levels of impact (evaluated in Section 8.3.4) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors;<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes.<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD.<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES.<br>• No feedback from stakeholders has been received that would inform the values and sensitivities / existing environment, impacts and risks, performance outcomes or mitigation measures.<br>To manage impacts to receptors to at or below the defined acceptable levels the following EPOs have been applied:<br>**EPO9:** Artificial light generated by the Activity will be managed to ensure biologically important behaviours of species that occur within the Activity light EMBA can continue while activities are being undertaken.<br>**EPO20:** For activity specific environment plans, undertake a review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. |

### 8.3.6 Environmental Performance

Table 8-39 lists the acceptable level and EPOs defined for light emissions and the adopted control measures to achieve the outcome.

*Table 8-39: Environmental performance summary – Light emissions*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL5:** Artificial light from project activities defined in this OPP will not exceed lighting levels required for navigation and safe operation, with any change in ambient light levels being temporary[12]. Lighting management measures will be applied during offshore campaigns, and will be informed by the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k), to ensure biologically important behaviours of light sensitive species can continue. | **EPO9:** Artificial light generated by the Activity will be managed to ensure biologically important behaviours of species that occur within the Activity light EMBA can continue while activities are being undertaken.<br>**EPO20:** For activity specific environment plans, undertake a review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. | CM1: Marine Assurance Process<br>CM4: Light Management Measures<br>CM22: Modelling Review |

## 8.4 Atmospheric Emissions

### 8.4.1 Cause of Aspect

Atmospheric emissions can be divided into greenhouse gas (GHG), and non-GHG emissions – also known as atmospheric pollutants. This section will only evaluate non-GHG emissions (atmospheric pollutants). GHG emissions are assessed in Section 8.5.

The atmospheric emissions produced by the MODU, vessels and machinery contain atmospheric pollutants. Atmospheric pollutants considered in this section include: Carbon monoxide (CO), Particulate Matter (PM) (i.e. dust in the air), typical pollutants for nitrogen oxides ($NO_x$), Ozone-depleting substances (ODS), Mercury (Hg), typical pollutant as sulphur oxides ($SO_x$), and Non-methane volatile organic compounds (NMVOCs), which includes aromatic (BTEX – benzene, toluene, ethylbenzene and xylene) and aliphatic (propane and long organic compound containing carbon and hydrogen joined together in straight chain).

Atmospheric emissions will be generated as a result of the East Coast Project activities, identified in Table 8-40.

*Table 8-40: Activities undertaken in the East Coast Project that may generate atmospheric emissions*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Well Construction** | Well clean-up and flowback |
| **Installation and Commissioning** | Testing, preservation and start-up |
| **Operations** | Well intervention |
| **Support Operations** | MODU operations<br>Vessel operations<br>Helicopter operations |
| **Decommissioning** | Well abandonment |

### 8.4.2 Aspect Characterisation

#### *8.4.2.1 Well Construction*

Well construction will be carried out using a MODU and flaring may occur during flowback activities and well clean-up. Flaring is required to safely manage fluids circulated out of the well; this may include hydrocarbon gas, condensate, base oil and completion fluids (e.g. brine).

Throughout well clean-up and flowback activities, the well is flowed to remove contaminants including drilling or completions fluids, debris and solids that come from the formation. These contaminants are circulated back to the MODU and during this process, hydrocarbon gas may be removed from the well. For safety purposes, this gas will be flared and $SO_2$, NOx, CO, Hg and NMVOCs may be present in air emissions from gas flaring.

If required, flaring will occur from one well at a time and is estimated to take 60 hours to complete per well.

#### *8.4.2.2 Installation and Commissioning*

Once flowline testing is complete, they will be flooded with preservation fluids (inhibited water). Before the production start-up from the wells, the subsea system is dewatered by displacing the lines with nitrogen gas. Nitrogen is used because it is an inert gas with no risk of ignition and is non-corrosive.

The predicted maximum volume of nitrogen gas across all flowlines (subject to detailed design) that will be pumped from a surface vessel via a downline into the subsea system is 3,232 $m^3$. The

inhibited water is displaced to sea (at manifold or tie-in locations), until the system is filled with nitrogen gas. It is expected to be a once-off release, per flowline.

#### *8.4.2.3 Operations*

Flaring may be required as part of well intervention, similar to drilling. If well intervention is required, it will be infrequent, and if flaring is required, the duration is estimated at ~1 day per well.

During well intervention, small volumes of gas may need to be handled back to the MODU. Where the volume is too small to flare, it will be cold vented to atmosphere.

#### *8.4.2.4 Decommissioning*

During abandonment of the wells, any remaining gas in the well fluids may be bled off or flared. If required, it will occur from one well at a time and is estimated to take a maximum of one day per well to complete at a rate of ~18 MMscf/well/day. A maximum of 15 wells will be abandoned under this OPP.

#### *8.4.2.5 Support Activities (all phases)*

Vessels and the MODU use diesel or gas to generate power for operation. Vessels will use marine diesel oil (MDO) or marine gas oil (MGO) instead of heavy fuel oil (HFO). Pollutants such as PM, CO, NOx, $SO_2$ and NMVOCs are released to the atmosphere during the combustion of these fuels.

The MODU will be present in the operational area during well construction, well intervention and for well abandonment activities. Up to 15 production wells may be drilled for the East Coast Project within the scope of this OPP, with each well expecting to take up to 60 days.

Vessels are expected to be present in the operational area during all phases of the East Coast Project. The maximum number of vessels in the operational area at a time is expected during well construction activities and is expected to be 3 anchor handler vessels or PSVs plus the MODU.

Installation and commissioning activities are included in the pre-operation phase, which could comprise of intermittent offshore activities for a duration of up to 6 years for all gas development opportunities and fields identified within this OPP. The post-operations phase could involve between 3 and 5 years of intermittent offshore activities. The largest vessel which could be used on the project is likely to be an Installation Support Vessel (ISV) or Reel-Lay vessel and could be in field for ~45 days per campaign.

Helicopters will be used during well construction and installation activities, primarily for crew change and medevac, and occasionally equipment and material transfers. Helicopter flights are expected to occur of 5-8 times a week during well construction, installation and commissioning and decommissioning phases, dependent on the progress of the drilling program, subsea installation, and logistical constraints. Helicopters use aviation fuel.

Vessels and the MODU may also be a source of fugitive emissions with the presence of diesel storage tanks on-board.

There may be ODSs present on board the vessels and MODU; however, these are typically found within old refrigeration and air conditioning units and their gradual phase out within the marine industry is managed at an international level under MARPOL Annex VI.

#### *8.4.2.6 Concurrent activities*

As described in Section 4.1.2, concurrent activities could occur. Cooper Energy assessed reasonably foreseeable concurrent activity scenarios and identified that the potential concurrent activities of drilling operations at Elanora-1 and flowline installation between Annie-2 and Casino-5 represents the activity scenario with the greatest number of vessels within the operational area, operating concurrently. This could involve 3 vessels and a MODU operating at once (further details in Section 8.2.2.5). These kinds of concurrent activities could occur over periods of ~50 days depending on the exact scope of works to be completed and availability of vessels and equipment. Drilling and related activities such as flaring would occur only from 1 well at a time.

### 8.4.3 Predicted Environmental Impacts and/or Risks (Consequence)

The predicted environmental impacts from atmospheric emissions are:

- Change in air quality.

Impacts to marine fauna within the operational area are not predicted, as a reduction in air quality is restricted to within the immediate proximity of the release source and is temporary as pollutants would be rapidly dispersed by the open ocean environment and prevailing winds of the Otway Basin. Therefore, impacts to marine fauna and social receptors from a change in air quality are not expected and have not been evaluated further.

### 8.4.4 Impact and Risk Evaluation

#### *8.4.4.1 Impact: Change in Air Quality*

A change in ambient air quality from atmospheric emissions as a direct result of the East Coast Project are most likely to result from combustion of fuels, such as diesel used to generate energy for equipment operation and flaring of hydrocarbon gas, condensate, base oil and completion fluids. The combustion of fuels and flaring will result in emission of GHGs such as carbon dioxide ($CO_2$), methane ($CH_4$) and $N_2O$, along with non-GHG such as sulphur oxides (SOX), nitrous oxides (NOX) and particulates.

Routine atmospheric emissions will be generated by the combustion of fuel for power generation by the vessel and helicopters. These emissions will be continuous whilst the vessels are in use, however intermittent and short term over the duration of the activity. Flaring during drilling, and well abandonment is a once-off and infrequent activity respectively. It is short-term (60 hours per well).

Particulate matter from the combustion of fuel can be used as an indicator of potential exposure risk from combustion products. Exposure standards for airborne contaminants have been established for human work environments, including those working offshore. In 2024 Cooper Energy and their Service Partners commissioned a study to monitor diesel particulate matter from the engine exhaust of a semisubmersible MODU within the Bass Strait in 2024. The study was completed over a range of meteorological conditions and confirmed that exposure limits were not exceeded on the working decks of the MODU (Tetra Tech Coffey, 2024). With distance from the MODU, dispersion of exhaust products increases, and exposure levels would decrease further still. This indicates that there would be minimal exposure risk from exhaust emissions around the MODU or further afield. No local settlements or critical habitats are expected to be impacted by air quality changes arising from the East Coast Project. Due to the meteorological conditions, it is anticipated that any potential impacts on air quality will be localised and temporary. No adverse impact to local or regional biodiversity is expected.

Nitrogen gas is very stable in the atmosphere and is not significantly involved in chemical reactions. The release volume across all flowlines is relatively small of 3,232 $m^3$. Additionally, nitrogen gas is a natural constituent of the Earth's atmosphere, accounting for 78% of its total composition, thus not being considered a pollutant gas.

The predicted level of impact, i.e., the consequence, of change in air quality as a result of the East Coast Project is evaluated to have a consequence of **Level 1**, based on:

- localised and temporary nature of a direct reduction in air quality due to low level of emissions from support activities, and short-term infrequent emissions from commissioning and flaring activities
- the open ocean environment and prevailing winds of the Otway Basin atmospheric emissions will rapidly disperse to background levels close to the emissions source.

### 8.4.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table

7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 8-41.

*Table 8-41: Atmospheric Emissions Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: Change in air quality | Consequence: Level 1 |
| **Principles of ESD** | ‘A) ‘Integration principle’<br>Consistent with Cooper Energy’s risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 8.4.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the impacts from atmospheric emissions are identified as:<br>• Level 1 consequence for change in air quality.<br>The above predicted level of impact due to atmospheric emissions from the East Coast Project is equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) ‘Precautionary principle’<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy’s risk assessment methodology.<br>• The highest consequence ranking for atmospheric emissions was evaluated as Level 1; therefore, atmospheric emissions from the East Coast Project will not result in serious or irreversible environmental damage.<br>• The potential impacts of atmospheric emissions are well-understood, and measures are well established and regulated in Australian waters. | |
| | C) ‘Intergenerational principle’<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest consequence ranking for atmospheric emissions was evaluated as Level 1 and therefore will not forego the health, diversity and productivity of the environment for future generations through protection of environmental values.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.4.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | |
| | D) ‘Biodiversity principle’<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as: | |

<table>
<tr><td></td><td colspan="3">• The relevant environmental values and sensitivities to atmospheric emissions were evaluated in Section 8.4.4 and the highest consequence ranking for atmospheric emissions was evaluated as Level 1.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.4.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained through protection of the values of the Commonwealth Marine Area as per the objectives of bioregional plans.</td></tr>
<tr><td rowspan="3">Legislative and Other Requirements</td><td>Requirement</td><td>Relevant Objective / Action</td><td>Demonstration of Requirement</td></tr>
<tr><td>Marine Order 97: Marine Pollution Prevention – Air Pollution</td><td>Vessels will comply with Marine Orders – Part 97: Marine Pollution Prevention – Air Pollution (appropriate to vessel class) for emissions from combustion of fuel including:<br>Hold a valid International Air Pollution Prevention (IAPP) certificate.<br>Engine NOx emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.<br>Sulphur content of diesel/fuel oil complies with Marine Order Part 97 and Regulation 14 of MARPOL 73/78 Annex VI.</td><td rowspan="2">Adoption of the following control measures:<br>CM1: Marine Assurance Process<br>Vessels and MODU operating in the operational area will comply with AMSA Marine Order 97 Marine Pollution Prevention – Air Pollution (appropriate to vessel class) for emissions from combustion of fuel including:<br>• Hold a valid International Air Pollution Prevention (IAPP) certificate.<br>• Engine NOx emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.<br>Sulphur content of diesel/fuel oil complies with Marine Order Part 97 and Regulation 14 of MARPOL 73/78 Annex VI.</td></tr>
<tr><td>Ozone Protection and Synthetic Greenhouse Gas Management Act 1989</td><td>Key objectives are to:<br>• control the manufacture, import, export, use and disposal of substances that deplete ozone in the stratosphere and contribute to climate change<br>• achieve a faster and greater reduction in the levels of production and use of ozone depleting substances than are required under the Montreal Protocol<br>• promote responsible management and handling of ozone depleting substances and synthetic greenhouse gases to minimise their impact on the atmosphere.</td></tr>
<tr><td>Internal Context</td><td colspan="3">Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Operations Management (MS07)<br>• External Affairs & Stakeholder Management (MS05)<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12).</td></tr>
<tr><td>External Context</td><td colspan="3">No feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.</td></tr>
</table>

| | |
|---|---|
| **Comparison of Predicted Impact with Defined Acceptable Level** | The defined acceptable level of impact relevant to impacts from atmospheric emissions is AL1, identified inTable 8-41. This acceptable level defined for a change in air quality is defined in Table 7-6.<br>The predicted impacts assessed in Section 8.4.4 as worst-case include:<br>• Localised and temporary change in air quality due to the low level of emissions from:<br>o fuel combustion for intermittent support activities (i.e. ~60 days per well for the MODU, and ~45 days per installation)<br>o short-term infrequent flaring activities (maximum of 60 hours per flaring event)<br>o once-off release, per flowline of nitrogen gas (predicted maximum volume of nitrogen gas across all flowlines of 3,232 $m^3$).<br>Ambient air quality levels are expected to immediately return to existing levels following completion of support activities and commissioning and flaring activities.<br>• Localised change in air quality is expected close to the emissions source based on study by Tetra Tech Coffey (2024) confirmed exposure standards for airborne contaminants for human work environments were not exceeded on the working decks of the MODU from engine exhaust.<br>• The open ocean environment and prevailing winds of the Otway Basin will rapidly disperse to background levels close to the emissions source.<br>• The highest consequence ranking for atmospheric emissions was evaluated as Level 1.<br>Therefore, at its worst-case, the predicted impact from atmospheric emissions would not lead to a substantial change in air quality which may adversely impact biodiversity, ecological integrity, or human health and well-being.<br>Therefore, the predicted level of impact resulting from atmospheric emissions from the East Coast Project is at or below the defined acceptable level. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to atmospheric emissions are acceptable, based on:<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES<br>• No feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.<br>To manage impacts to receptors to, at or below the defined acceptable levels, the following EPO has been applied:<br>**EPO1:** Manage atmospheric emissions generated by activities defined in this OPP in accordance with MARPOL Annex VI (Prevention of Air Pollution from Ships) enacted in the *Navigation Act 2012*, with no impacts to amenity outside of the operational area. |

### 8.4.6 Environmental Performance

Table 8-42 lists the acceptable level and EPO defined for atmospheric emissions and the adopted control measures to achieve the outcome.

*Table 8-42: Environmental Performance Summary – Atmospheric emissions*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL1:** Activities defined in this OPP that generate atmospheric emissions | **EPO1:** Manage atmospheric emissions generated by activities defined in this OPP | CM1: Marine Assurance Process |

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| resulting in localised change in air quality will comply with MARPOL Annex VI (Prevention of Air Pollution from Ships) enacted in the Navigation Act 2012, with any difference from regional baseline being temporary[10]. . | in accordance with MARPOL Annex VI (Prevention of Air Pollution from Ships) enacted in the *Navigation Act 2012*, with no impacts to amenity outside of the operational area. | |

## 8.5 GHG Emissions

### 8.5.1 Cause of Aspect

Greenhouse gas (GHG) emissions will be caused by the activity through the drilling, operations, support operations, decommissioning, processing, transmission and use of hydrocarbons. GHG are emitted to the atmosphere when hydrocarbons are burned, flared, released as fugitive emissions either at the plant or through transmission. GHG emissions include carbon dioxide ($CO_2$), nitrous oxide ($N_2O$), methane ($CH_4$), sulphur hexafluoride ($SF_6$) and specified kinds of hydrofluorocarbons and perfluorocarbons.

Direct GHG emissions will be generated because of East Coast Project activities, identified in Table 8-43.

*Table 8-43: Activities undertaken in the East Coast Project that may generate GHG emissions*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Well Construction** | Well clean-up and flowback |
| **Operations** | Hydrocarbon extraction and transport<br>Well intervention |
| **Support Activities** | MODU operations<br>Vessel operations<br>Helicopter operations |
| **Decommissioning** | Well abandonment |

### 8.5.2 Aspect Characterisation

#### *8.5.2.1 Well Construction*

Well construction will be carried out using a MODU and flaring may occur during flowback activities and well clean-up.

As outlined in Section 1.3.1, the East Coast Project will be staged and developed incrementally, consistent with the existing fields. Therefore, not all gas-development opportunities will be developed in a single campaign, which may result in different phases occurring concurrently. This enables the drilling campaigns to be conducted in response to gas demand and reduce GHG emissions should later drilling campaigns not be required.

Throughout well clean-up and flowback activities, the well is flushed to remove contaminants including drilling or completions fluids, debris and solids that come from the formation. These contaminants are circulated back to the MODU, and hydrocarbon gas may also be returned to the MODU. For safety purposes, this gas is flared.

If required, flaring will occur from one well at a time and is estimated to take up to 60 hours to complete per well, though generally <36 hours per well. The well flowback and associated flaring durations depend on the complexity of the reservoirs and data required to characterise them.

#### 8.5.2.2 Operations

The principal activity during the scope of the East Coast Project will be the flow and transportation of hydrocarbons from the wells to the existing CHN pipelines and then to the shore-based Athena Gas Plant.

Flaring may be required as part of well intervention, similar to drilling. If well intervention is required, it will be infrequent, and if flaring is required, the duration is estimated at ~1 day per well. Flaring will only occur from one well at a time.

During well suspension and intervention, small volumes of gas may need to be handled back to the MODU. Where the volume is too small to flare, it will be cold vented to the atmosphere.

#### 8.5.2.3 Support Activities (all phases)

Vessels and the MODU use diesel or gas to generate power for operation. Vessels will use marine diesel oil (MDO) or marine gas oil (MGO) instead of heavy fuel oil (HFO).

The MODU will be present in the operational area during drilling, well intervention and for P&A activities. Up to 15 production wells may be drilled for the East Coast Project within the scope of this OPP, with each well expecting to take up to 60 days.

Vessels will be used for several activities such as bunkering and bulk transfer, collection and potentially treatment of waste from the MODU, vessel positioning, towing the MODU and mooring installation. Vessels are expected to be present in the operational area during all phases of the East Coast Project. The maximum number of vessels in the operational area at a time is expected during drilling activities and is expected to be 3 anchor handler vessels or PSVs plus the MODU.

Installation and commissioning activities are included in the pre-operation phase, which is expected to last up to 6 years for all gas development opportunities and confirmed fields. Decommissioning activities are predicted to last between 3 to 5 years. The largest vessel is likely to be an Installation Support Vessel (ISV) or Reel-Lay vessel and would be expected to be in field for ~45 days per campaign.

Helicopters will be used during the drilling and installation activities, primarily for crew change and medevac, and occasionally equipment and material transfers. Helicopter flights are expected to occur of 5-8 times a week, dependent on the progress of the drilling program, subsea installation, and logistical constraints. Helicopters use aviation fuel.

Vessels and the MODU may also be a source of fugitive emissions with the presence of fuel storage tanks on board. That is considered immaterial, and it is not included in the GHG inventory.

#### 8.5.2.4 Decommissioning

During well abandonment, any remaining gas in the well fluids may be bled off or flared. If required, it will occur over a maximum of one day per well at a rate of ~18 MMscf/well/day and only occur from one well at a time. A maximum of 15 wells will be abandoned under this OPP.

#### 8.5.2.5 Concurrent activities

The GHG modelling (Section 8.5.2.6) has been undertaken for all activities for all phases of the East Coast Project and includes concurrent activities.

#### 8.5.2.6 GHG Modelling

*Scoping*

GHG are described as direct or indirect emissions, where direct emissions occur as a direct result of the East Coast Project. describes the emissions estimation, monitoring and reporting work flow applied to the activities.

To reflect East Coast Project activities accurately, the terminology approach used in this section is elaborated below and illustrated in Table 8-44 as they relate to the East Coast Project.

Cooper Energy has commissioned an Otway Offshore Project Proposal - GHG Inventory Technical Note, included in Appendix 5, which describes assessment boundaries and methodologies. The emissions have been estimated based on a scenario where all fields within the scope of the OPP are developed, and multiple fields are brought online simultaneously. It should be noted that this is considered highly conservative, as it represents the maximum possible development scope envisaged. The emissions estimated within this section should be viewed as a maximum, the production and emissions profiles will be refined as field development plans are matured, and this will be reflected in the relevant Environment Plans.

**Direct GHG Emissions**

Direct GHG emissions are created as a direct result of the East Coast Project activities within Commonwealth jurisdiction, for all phases (surveys, drilling, installation and commissioning, operations and decommissioning) and support activities. These emissions originate from the use of support activities – MODU and vessels within Commonwealth waters, including flaring and fuel vessel use.

The direct emissions do not equate to scope 1 emissions (i.e., emissions under operational control of the organisation) under the *National Greenhouse and Energy Reporting Act 2007* (Cwth), as the:

- direct emissions in this inventory includes relevant Support Operations both within and outside of Copper Energy's operational control.
- scope 1 emissions associated with the transport and processing of hydrocarbons outside of Commonwealth Waters are considered indirect emissions in this inventory.

**Indirect GHG Emissions**

Indirect emissions 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. Indirect emissions also include electricity used at the Athena Gas Plant, when purchased from the grid, is generated from a mix of renewable and non-renewable sources. GHG emissions are generated in the process of making the energy that supplies the grid.

Other key sources of indirect emissions include upstream purchased products and services, such as cement, corrosion-resistant alloy (CRA), carbon steel, flowlines, umbilicals, manifolds and waste generated (solid steel waste, flowline disposal, umbilicals disposal, mattresses disposal, and hazardous liquids disposal).

**Downstream Indirect GHG Emissions**

Once processed, the refined products are sold to domestic customers for various uses. The refined products that leave the Athena Gas Plant, and the emissions associated with the transmission, distribution and use of those products are known as downstream indirect emissions. Sales gas would be piped to end users from Athena Gas Plant to Cooper Energy's customers in Victoria and South Australia. Condensate product would be trucked to the Viva refinery in Geelong.

Cooper Energy does not have control of, or legislated responsibility for, emissions downstream of the process facility.

According to the 2024 Gas Statement of Opportunities (GSSO), gas will continue to be used by Australian households, business and industry during Australia's transition to a net zero emissions future (AEMO, 2024).

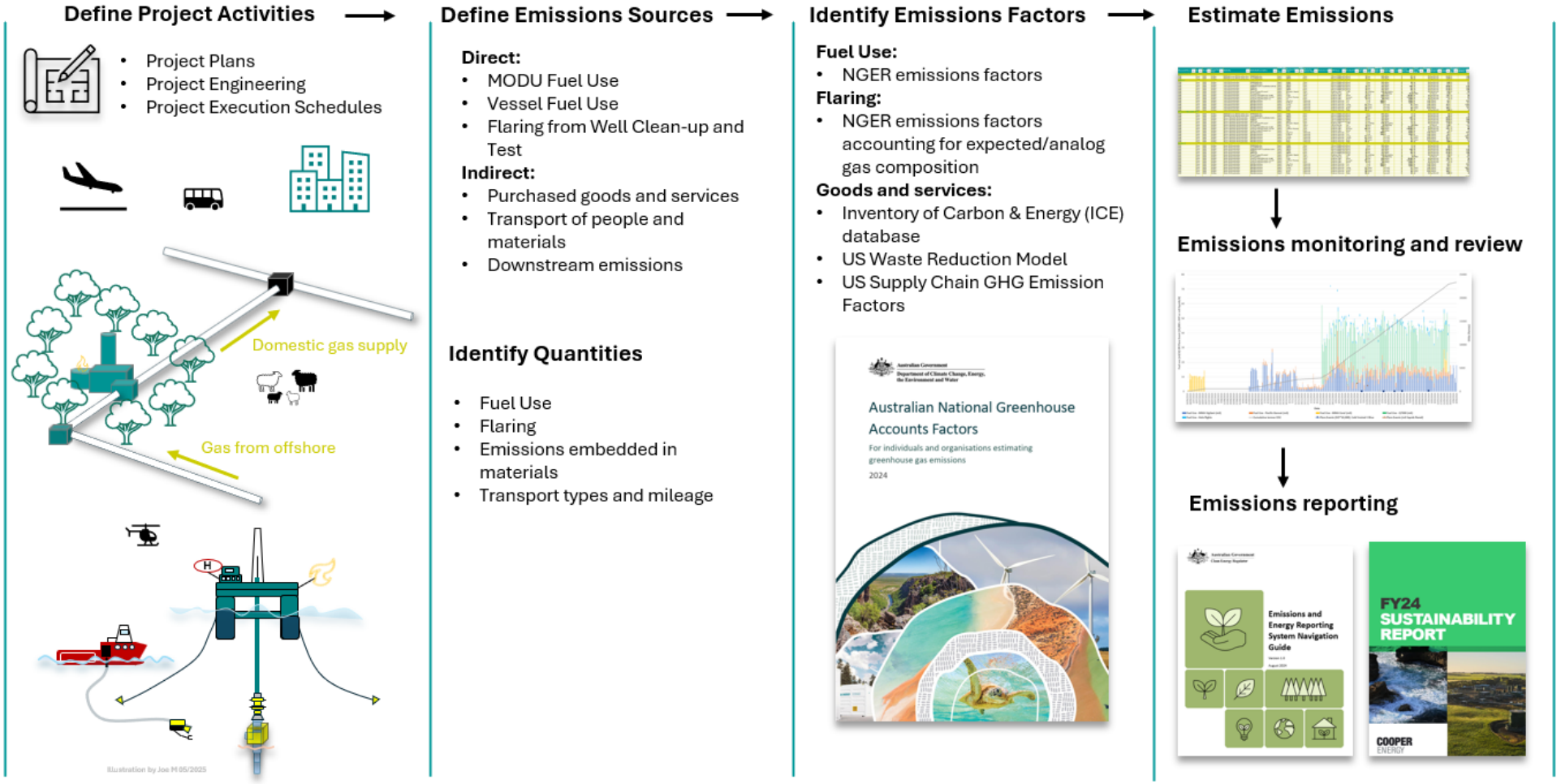



*Figure 8-5: Emissions Estimation, Monitoring and Reporting Workflow*

*Table 8-44:Boundary of assessment and emissions sources (with baseline being the emissions form the existing CHN facilities)*

| Direct GHG Emissions Sources | | | | | Indirect GHG Emissions Sources | Downstream Indirect GHG Emissions Sources |
|---|---|---|---|---|---|---|
| **East Coast Project** | | | | | | |
| Survey | Drilling | Installation and Commissioning | Operations | Decommissioning | • Fuel gas usage<br>• Flaring and venting<br>• Diesel usage<br>• Fugitives<br>• Purchased goods and transportation<br>• Purchased electricity<br>• Other (vessels including ROV/AUV‡*, liquid fuel, waste generated and employee commuting) | • Combustion of products<br>• Fugitive emissions from natural gas transmission and distribution<br>• Condensate transportation |
| **Vessels†** | • MODU<br>• Flaring<br>• Vessels†<br>• ROV/AUV†* | • Vessels†<br>• ROV/AUV†* | • Vessels (IMR)†<br>• ROV/AUV (IMR)†*<br>• Flaring (well intervention) | • MODU<br>• Flaring<br>• Vessels†<br>• ROV/AUV† | | |
| **Baseline: the existing CHN Facilities** | | | | | | |
| - | - | - | - | - | • Fuel gas usage<br>• Flaring and venting<br>• Diesel usage<br>• Fugitives<br>• Purchased goods and transportation<br>• Purchased electricity<br>• Other (vessels including ROV/AUV‡*, liquid fuel, waste generated, leased assets, employee commuting, business travel, CHN and AGP decommissioning) | • Combustion of products<br>• Fugitive emissions from natural gas transmission and distribution<br>• Condensate transportation |

*† Within Commonwealth jurisdiction*

*‡ Within State jurisdiction*

**No additional emissions from the ROV/AUV as they are powered by the vessel*

*GHG Modelling Results*

Results of the GHG modelling are detailed in Appendix 5 and are summarised below.

**Direct GHG Emissions**

The direct GHG emissions for the East Coast Project are estimated to be 1,099 kt $CO_2$-e over the project life. Figure 8-6A shows the emissions generated during each project lifecycle stage and embeds the support operations associated with each stage. Figure 8-6B extracts the associated support operations from each life cycle stage and presents these emissions as its own stage alongside the non-vessel related activities. Surveying is not presented in Figure 8-6B as all emissions relate to vessel operation.

As presented in (Figure 8-6B), approximately 895 kt $CO_2$-e or around 81% of the direct GHG emissions are attributed to support operations (i.e., use of vessels and MODU), ~204 kt $CO_2$-e or around 19% attributable during Well Construction, Operations and Decommissioning.

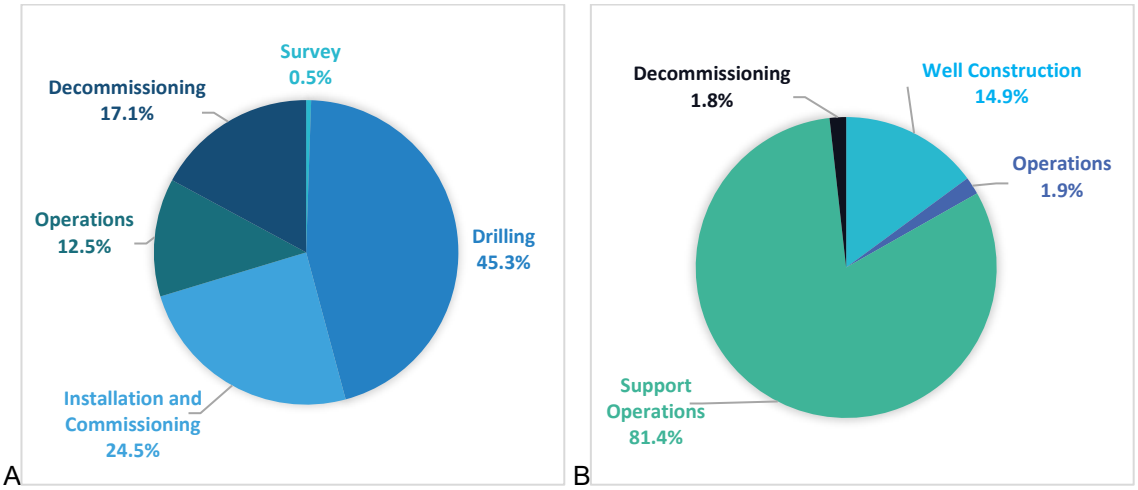



*Figure 8-6: (a) Direct GHG emissions generated during each project lifecycle stage (with support operations embedded in each stage), (b) Direct GHG emissions breakdown into Well Construction, Operations, Decommissioning and Support Operations.*

The maximum (peak) and average annual emissions for the East Coast Project are estimated to be less than 236 kt $CO_2$-e/year and 44 kt $CO_2$-e/year, respectively.

**Indirect GHG Emissions**

The indirect GHG emissions, excluding downstream indirect GHG emissions are estimated to be 1,571 kt $CO_2$-e over the project life. As summarised in Figure 8-7, the key emissions sources are fuel gas (40.3%), flaring and venting (24.1%), purchased electricity (14.2%), purchase goods and transportation (10.7%), fugitive emissions (9.4%), and others (1.3%).

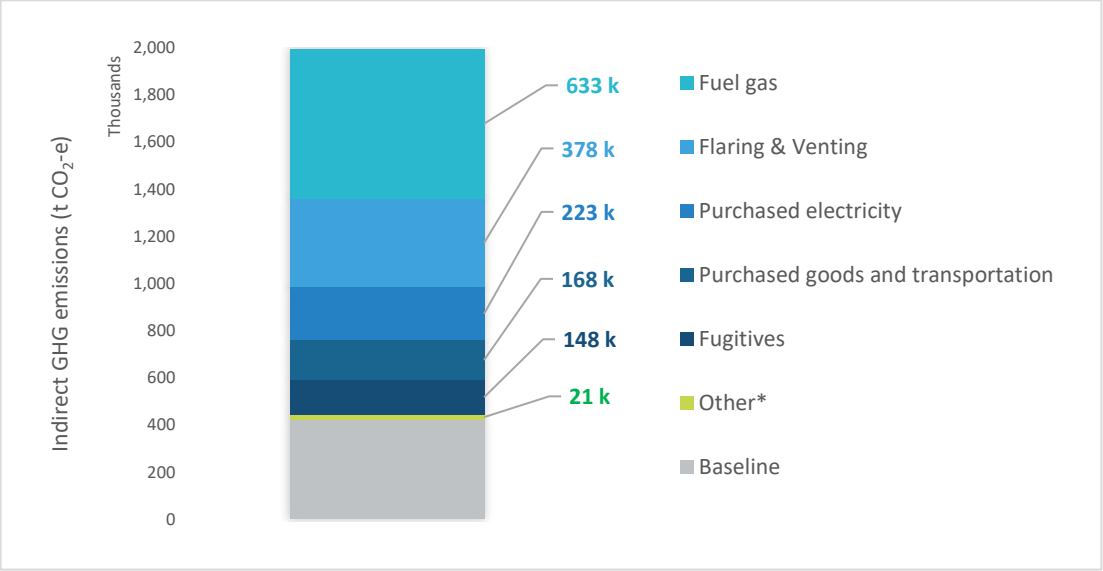



*Figure 8-7: Indirect GHG emissions breakdown by emissions source*

Downstream indirect emissions are estimated to be 38,561 kt $CO_2$-e, consisting of 6.5% of emissions from the downstream transportation and distribution and 93.5% of emissions from the combustion of products.

**Total GHG Emissions**

Table 8-45 summarises the total direct and indirect GHG emissions for the East Coast Project. The direct emissions for the East Coast Project are estimated to be 1,099 kt $CO_2$-e over the project life, and the indirect emissions and downstream indirect emissions are estimated to be 1,571 and 38,561 kt $CO_2$-e, respectively.

*Table 8-45: Total GHG emissions for the East Coast Project*

| Category | East Coast Project t $CO_{2-e}$ | % | Baseline t $CO_{2-e}$ | Total t $CO_{2-e}$ |
|---|---|---|---|---|
| **Direct GHG emissions** | 1,099,000 | 2.7 | 0 | 1,099,000 |
| **Indirect GHG emissions** | 1,571,000 | 3.8 | 422,000 | 1,993,000 |
| **Downstream indirect GHG emissions** | 38,561,000 | 93.5 | 2,065,000 | 40,626,000 |
| **Total GHG Emissions (t $CO_2$-e)** | 41,231,000 | - | 2,487,000 | 43,718,000 |

Figure 8-8 shows the indicative annual total GHG emissions for the East Coast Project over the project life, broken down to the emissions category. The maximum and average annual emissions (inclusive of the baseline) are estimated to be approximately 2,872 kt $CO_2$-e/year and 1,749 kt $CO_2$-e/year, respectively. The associated emissions intensity based on a representative production year (2035) is estimated to be 58 t $CO_2$-e/TJ.

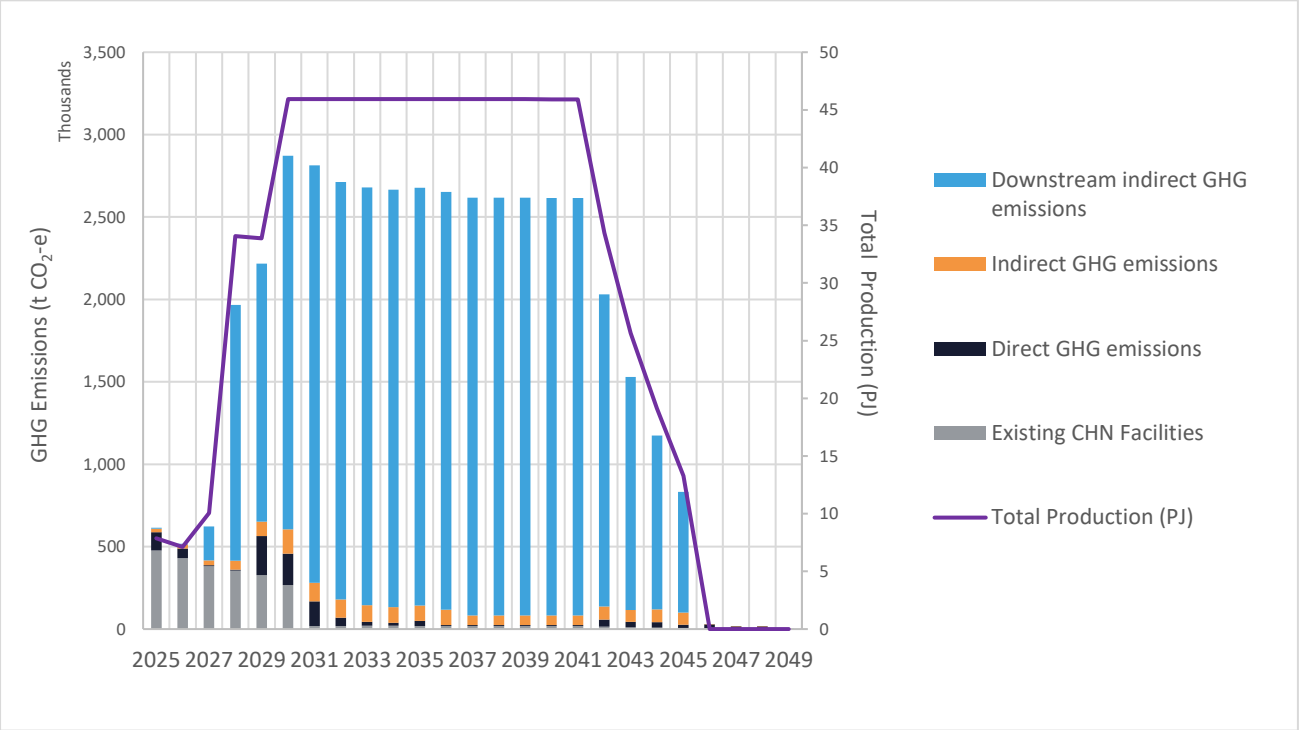



*Figure 8-8: Annual total GHG emissions breakdown by category and production profile forecast*

### 8.5.3 Predicted Environmental Impacts and/or Risks (Consequence)

The predicted environmental impacts from GHG emissions are:

- Increase in GHG emissions.

Potential risk:

- Change in climate systems
- Change in ecosystem
- Change in socio-economic factors.

### 8.5.4 Impact and Risk Evaluation

#### *8.5.4.1 Impact: Increase in GHG Emissions*

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 emissions from the East Coast Project add to the GHG load in the atmosphere resulting in global warming potential, they are small on a national scale.

Following the updated Nationally Determined Contribution (NDC) in June 2022, Australia committed to reduce GHG emissions to 43% below 2005 levels by 2030 and reaffirmed its target to achieve net zero emissions by 2050. These targets are legislated under the *Climate Change Act 2022* (Cwth).

Based on forecasting conducted by the DCCEEW in 2024 the Commonwealth Government has forecasted the annual carbon budget including a scenario called 'with additional measures' that includes policies and measures in place at the time of publication. The 'baseline' and 'with additional measures' scenario include the Safeguard Mechanism reforms and the 82% renewable energy target in Australia's electricity grid by 2030 (DCCEEW, 2024q).

Carbon budgets under current policy settings can be developed for Australia with the following approach:

- By summing the annual projected emissions of the 'with additional measures' scenario up to 2040, and assuming a linear decline to net zero emissions between 2041 to 2050 (DCCEEW, 2024q).

For the duration of the Project, the total direct GHG emissions from the East Coast Project are estimated to be approximately 0.016% of the Australian carbon budget, respectively. The total indirect GHG emissions from the East Coast Project are estimated to be approximately 0.596% of the Australian carbon budgets, respectively, the vast majority of which is attributable to the end use of gas for domestic electricity generation, industrial and residential use.

Within the OPP conservative emissions profiles have been estimated based on a scenario where all fields within scope are developed, and multiple fields are brought online simultaneously. As shown in the OPP, in this development scenario, and based on the gas reserves and rates anticipated from each field, greenhouse gas emissions from the East Coast Project have the potential to exceed the Safeguard Mechanism coverage threshold.

Exceedance of the coverage threshold is not definitive at this stage of planning of the East Coast Project and is highly dependent on future detailed engineering and field sequencing which will determine when different fields within the East Coast Project will be brought online, as well as the volume and rate of gas that will be produced through the Athena Gas Plant. At this stage of project planning, it is likely that emissions from the East Coast Project will not exceed the current Safeguard Mechanism coverage threshold (the OPP does present a conservative emissions profile), however it is possible that the Safeguard Mechanism coverage threshold could be lowered within the lifespan of the East Coast Project, over the next ~25 years.

Cooper Energy has engaged with the Clean Energy Regulator to ensure that the facility boundaries for the possible field development scenarios for the East Coast Project are appropriately considered under the NGER Act. The Clean Energy Regulator and Cooper Energy confirmed to continue discussions on application of the Safeguard Mechanism where there is a risk that the coverage threshold could be exceeded as field development plans are matured and production and emissions profiles are refined.

The predicted level of impact, i.e., the consequence of GHG emissions as a result of the East Coast Project is evaluated to be **Level 1**, based on:

- The minor contribution to Australian carbon budget to continue to meet demand to the south east domestic market, in alignment with the Governments' Future Gas Strategy.
- Cooper Energy having a robust emissions reduction process to monitor and address legislative requirements, and enable a systematic process to identify, assess and implement GHG emissions reduction opportunities, meaning the projects direct emissions will continue to be aligned with Australia's GHG emissions commitments.

  Since FY20 Cooper Energy has been certified carbon neutral by Climate Active in respect of its' scope 1, scope 2 and relevant scope 3 emissions[18]. This voluntary process includes calculating emissions, developing and implementing and emissions reduction strategy and using carbon offsets to compensate for the remaining emissions. The certification requires independent technical assessment and verification. It ultimately gives Cooper Energy a detailed understanding of its emissions profile and provides a real cost of carbon for its business activities.
- Gas from the East Coast Project will be used exclusively within the domestic market, meaning the emissions associated with the end use of the product will fall exclusively within Commonwealth jurisdiction and be managed in line with Australia's emissions reduction targets, NDC under the Paris Agreement and in accordance with relevant GHG and emissions reduction legislation including the Safeguard Mechanism and *Climate Change Act 2022* (Cwth).

[18] *See Cooper Energy's 2023 Sustainability Report for detail.*

#### *8.5.4.2 Risk: Change in Climate and Marine Systems*

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) Working Group I was released in August 2021. The IPCC states with high confidence that many extreme heat events and global surface temperature rise would not have occurred without human influence and could be irreversible for several decades to millennia (IPCC, 2021).

This is reiterated in the AR6 Synthesis Report released in March 2023, "[H]uman activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Global greenhouse gas emissions have continued to increase over 2010-2019, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and between individuals (high confidence). Human-caused climate change is already affecting many weather and climate extremes in every region across the globe" (IPCC, 2023).

According the AR6 Synthesis Report, heat extremes (including heatwaves) have become more frequent and more intense across most land regions since the 1950s while cold extremes have become less frequent and less severe. Marine heatwaves have approximately doubled in frequency since the 1980s. The frequency and intensity of heavy precipitation events have increased since the 1950s over most land areas for which observational data are sufficient for trend analysis. It is likely that the global proportion of major (Category 3–5) tropical cyclone occurrence has increased over the last four decades (IPCC, 2023).

The State of the Climate 2024 (BoM and CSIRO, 2024) reported that Australia's climate warmed by an average of 1.51 ± 0.23°C between 1910 and 2023[19], reflecting global warming trends. This warming trend has been accompanied by a shift towards drier conditions in southern Australia and wetter conditions in northern Australia. Additionally, the frequency and/or intensity of some extreme weather events, including heat waves and short-term heavy rainfall events are also anticipated to increase with potential consequences to human health and impacts on biodiversity and ecosystems. Conversely, a downward trend in the number of tropical cyclones has been observed since 1982 (BoM and CSIRO, 2024). Average sea surface temperature in the Australian region has warmed by 1.08°C since 1900, with nine of the 10 warmest years on record occurring since 2010, associated with longer and more frequent marine heatwaves (BoM and CSIRO, 2024). A warming ocean affects the global ocean and atmospheric circulation, the cryosphere, global and regional sea levels, and causes losses in dissolved oxygen, impacts on marine ecosystems (BoM and CSIRO, 2024), including changes to species abundance, community structure and increased frequency and intensity of thermally induced coral bleaching events (CSIRO, 2017).

Oceanic warming has also served to alter ocean currents around Australia. In response to both ocean warming and stratospheric ozone depletion, the East Australian Current has increased in strength by about 20% between 1978 and 2005 (Cai and Cowan, 2006). The East Australian Current now also extends further south, creating areas of more rapid warming within the Tasman Sea (BoM and CSIRO, 2024). Sea surface temperatures are projected to continue to increase, with estimates of warming in the Southern Tasman Sea of between 0.6°C to 0.9°C and between 0.3°C to 0.6°C elsewhere along the Australian coast by 2030 (Church et al., 2006).

Global mean sea level increased by 22 cm between 1910 and 2023. The average rate of sea level rise was 1.5 cm per decade between 1901 and 2000, increasing to 4 cm per decade between 1993 and 2023. Human influence was very likely the main driver of these increases since at least 1970. The rate of sea level rise varies considerably across Australia. The north and south-east of experiencing sea level rise at rates higher than the global average, possibly related to a poleward

*[19] It is important to note that this 1.5°C warming above 1910 temperatures does not necessarily reflect that the 1.5°C threshold of the Paris Agreement has been exceeded. The IPCC AR6 Report defines that an exceedance of this threshold should be in relation to a 20 year temperature average.*

shift and strengthening of the subtropical ocean gyre circulation. Conversely, sea level rise on other coastlines is closer or lower than the global average (BoM and CSIRO, 2024).

Global mean sea level is predicted to rise between 0.308 m and 0.44 m by 2050, and between 0.438 m and 1.168 m by 2100, relative to 1900 levels (IPCC, 2023). This global mean sea level rise is primarily caused by thermal expansion and mass loss from glaciers and ice sheets, with minor contributions from changes in land-water storage. Global mean sea level will continue to increase for centuries to millennia due to continuing deep ocean warming and ice sheet melt, and sea levels will remain elevated for thousands of years, at rates dependent on future emissions (IPCC, 2023). This will lead to some coastal inundation affecting mangroves, salt marshes and coastal freshwater wetlands. Furthermore, as $CO_2$ is gradually absorbed by oceans and fresh water, the water becomes more acidic, which increases the solubility of calcium carbonate, the principal component of the skeletal material in aquatic organisms (Steffen et al., 2009). It is estimated that a global decline in the pH of surface waters of 0.12 (30% increase in acidity) has occurred since 1880-1889 and the rate of acidification has increased in recent decades. In Australia, the Southern Ocean experienced the greatest acidity increase between 1982 to 2022 (21%) (BoM and CSIRO, 2024).

The predicted level of impact, i.e., the consequence, of an impact on climate systems from an increase in GHG emissions as a result of the East Coast Project is evaluated to have a consequence of **Level 1**, based on:

- The minor contribution to Australian and Victorian carbon budgets to continue to meet demand to the south east domestic market, in alignment with the Governments' Future Gas Strategy.
- Gas from the East Coast Project will be used exclusively within the domestic market, meaning the emissions associated with the end use of the product will fall exclusively within Commonwealth jurisdiction and be managed in line with Australia's emissions reduction targets, NDC under the Paris Agreement and in accordance with relevant GHG and emissions reduction legislation including the Safeguard Mechanism and *Climate Change Act 2022* (Cwth).
- Cooper Energy having a robust emissions reduction process to monitor and acknowledge legislative requirements and enable a systematic process to identify, assess and implement GHG emissions reduction opportunities, meaning the East Coast Project's direct emissions will continue to be aligned with Australia's GHG emissions commitments. Since FY20 Cooper Energy has been certified carbon neutral by Climate Active in respect of its' scope 1, scope 2 and relevant scope 3 emissions[20]. This voluntary process includes calculating emissions, developing and implementing and emissions reduction strategy and using carbon offsets to compensate for the remaining emissions. The certification requires independent technical assessment and verification. It ultimately gives Cooper Energy a detailed understanding of its emissions profile and provides a real cost of carbon for its business activities.

#### *8.5.4.3 Risk: Change in Ecosystems*

As potential impacts to ecosystems due to GHG are driven by changes in climatic conditions they occur on a global scale and are not restricted to the vicinity of the emissions sources. Therefore this impact assessment considers ecosystems across Australia. Ecosystems that are particularly susceptible to adverse effects of climate change include alpine habitats, coral reefs, wetlands and coastal ecosystems, polar communities, tropical forests, temperate forests and arid and semi-arid environments (DoEE, 2019). In Australia, this includes coral reefs, alpine regions, rainforests, arid and semi-arid environments, mangroves, grasslands, temperate forests and sclerophyll forests. Future climate change (increased temperature and decreased, but more variable rainfall) has the

[20] *See Cooper Energy's 2023 Sustainability Report for detail.*

potential to have a range of impacts on ecological factors and threaten biodiversity in the Australian Mediterranean ecosystem (CSIRO, 2017).

Redistribution and reorganisation of natural systems, driven by climate change is a major threat to biodiversity (Chapman et al., 2020). A report by Australia's Biodiversity and Climate Change Advisory Group summarises the potential impacts of climate change to marine and terrestrial species, habitats, and ecosystems across Australia (Steffen et al., 2009). The impacts to taxa are outlined in Table 8-46 and the impacts to ecosystems in Table 8-47.

*Table 8-46: Overview of Impacts of Climate change to the Future Vulnerability of Particular Taxa (modified after Steffen et al., 2009)*

| Taxa | Potential Vulnerability |
|---|---|
| **Mammals** | Narrow-ranged endemics susceptible to rapid climate change in-situ; changes in competition between grazing macropods in tropical savannas mediated by changes in fire regimes and water availability; herbivores affected by decreasing nutritional quality of foliage because of $CO_2$ fertilisation. |
| **Birds** | Changes in phenology of migration and egg-laying; increased competition of resident species; breeding of waterbirds susceptible to reduction; top predators vulnerable to changes in food supply; rising sea levels affecting birds that nest on sandy and muddy shores, saltmarshes, intertidal zones, coastal wetlands, and low-lying islands; saltwater intrusion into freshwater wetlands affecting breeding habitat. |
| **Reptiles** | Warming temperatures may alter sex ratios of species with environmental sex determination to cope with warming in-situ. |
| **Amphibians** | Frogs may be the most at-risk terrestrial taxa. Amphibians may experience altered interactions between; pathogens, predators, and fires. |
| **Fish** | Freshwater species vulnerable to reduction in water flows and water quality; limited capacity for freshwater species to migrate to new waterways; all species susceptible to flow-on effects of warming on the phytoplankton base of food webs. Significant decreases in streamflow are concentrated in southern Australia, while increases are in the north but are less widespread (BoM and CSIRO 2024). |
| **Invertebrates** | Expected to be more responsive than vertebrates due to short generation times, high reproduction rates and sensitivity to climatic variables. |
| **Plants** | Climate change may impact various functional dynamics of plants due to changes in; increasing $CO_2$, fires, plant phenology and specific environmental characteristics. |

*Table 8-47: Projected Impacts of $CO_2$ Rise and Climate Change on Australian Ecosystems (modified after Steffen et al., 2009)*

| Key Component of Environmental Change | Projected Impacts of Ecosystems |
|---|---|
| **Coral Reefs** | |
| **$CO_2$ increases leading to increased ocean acidity** | Reduction in ability of calcifying organisms, such as corals, to build and maintain skeletons. |
| **Sea surface temperature increases, leading to coral bleaching** | If frequency of bleaching events exceeds recovery time, reefs will be maintained in an early successional state or be replaced by communities dominated by macroalgae.<br>Five mass bleaching events have been recorded at the Great Barrier Reef in the past decade, associated with marine heatwaves. More frequent, longer and intense marine heatwaves are predicted in the future (BoM and CSIRO, 2024).<br>Temperature increases of 1°C above the long-term summer maximum for an area over 4-6 weeks is enough to cause mass coral bleaching and mortality (Baker et al., 2008; Hoegh-Guldberg, 1999; Hughes et al., 2017; Spalding and Brown, 2015). Coral mortality or die off following coral bleaching events can stretch across thousands of |

| Key Component of Environmental Change | Projected Impacts of Ecosystems |
|---|---|
| | square kilometres of ocean (Gilmour et al., 2016; Hoegh-Guldberg, 1999; Hughes et al., 2017). |
| **Ecosystems services** | The impacts associated with a warming ocean, coupled with increasing acidification, are expected to undermine the ability of tropical coral reefs to provide habitat for fish and invertebrates, which together provide a range of ecosystem services such as food, livelihoods and coastal protection (Hoegh-Guldberg et al., 2018). Coral reefs are projected to decline by 70–90% as a result of 1.5°C of global warming (IPCC, 2023). |
| **Oceanic Systems (including planktonic systems, fisheries, sea mounts and offshore islands)** | |
| **Ocean warming** | Many marine organisms are highly sensitive to small changes in average temperature (1-2ºC), leading to effects on growth rates, survival, dispersal, reproduction and susceptibility to disease. |
| **Changed circulation patterns, including increase in temperature stratification and decrease in mixing depth, and strengthening of the East Australia Current (EAC)** | Distribution and productivity of marine ecosystems is heavily influenced by the timing and location of oceanic currents; currents transfer the reproductive phase of many organisms. Climate change may suppress upwelling in some areas and increase it in others, leading to shifts in location and extent of productivity zones. |
| **Changes in ocean chemistry** | Increasing $CO_2$ in the atmosphere is leading to increased ocean acidity and a concomitant decrease in the availability of carbonate ions. |
| **Estuaries and Coastal Fringe (including benthic, mangrove, saltmarsh, rocky shore, and seagrass communities)** | |
| **Sea level rise** | Landward movement of some species as inundation provides suitable habitat, changes to upstream freshwater habitats will have flow-on effects to species. |
| **Increase in water temperature** | Impacts on phytoplankton production will affect secondary production in benthic communities.<br>Mangrove ecosystems in Australia will face higher temperatures, increased evaporation rates and warmer oceans (McInnes, 2015) as well as an associated sea level rise (Hoegh-Guldberg et al., 2018).<br>Increased frequency of marine heatwaves may result in depletion of kelp forests and seagrasses and a poleward shift in marine species and increase incidence of disease (BoM and CSIRO, 2024). |
| **Drought** | A shift towards drier conditions has been observed in southern Australia with a corresponding shift to wetter conditions in the North. Australian rainfall is influenced to seasonal climate influences and is therefore highly variable (BoM and CSIRO, 2024). Modelling indicates an increased likelihood of future severe and extended droughts across parts of Northern Australia (Dai, 2013). Consequently, mangrove ecosystems may increase their southern range because of warmer temperatures. However, higher temperatures and evaporation rates, and extended droughts could lead to die-offs in Northern Australia and a change in mangrove distribution and abundance (Duke et al., 2017). Mangrove systems should cope with rising sea levels by accumulating more peat or mud which will give them the opportunity to adjust to a rising sea level (Field, 1995). |
| **Savannas and Grasslands** | |
| **Elevated $CO_2$** | Shifts in competitive relationships between woody and grass species due to differential responses. |
| **Increased rainfall in north and northwest regions** | Increased plant growth will lead to higher fuel loads, in turn leading to fires that are more intense, frequent and occur over larger areas. |
| **Tropical Rainforests** | |

| Key Component of Environmental Change | Projected Impacts of Ecosystems |
|---|---|
| **Potential increases in frequency and intensity of fires** | Increased probability of fires penetrating rainforest vegetation resulting in shift from fire-sensitive vegetation to communities dominated by fire-tolerant species. |
| **Warming and changes in rainfall patterns** | Potential increases in productivity in areas where rainfall is not limiting; reduced forest cover associated with soil drying projected for some Australian forests. |
| **Seasonal variation** | Changes in the timing of seasons (i.e., extended summers) could cause change in the seasonal response of plants, and alterations to species ranges and abundances (Hoegh-Guldberg et al., 2018). |
| **Inland Waterways and Wetlands** | |
| **Reduction in precipitation, increased frequency and intensity of drought** | Reduced river flows and changes in seasonality of flows. Significant decreases in streamflow are concentrated in southern Australia, while increases have occurred in the north but are less widespread (BoM and CSIRO, 2024). |
| **Changes in water quality, including changes in nutrient flows, sediment, oxygen and $CO_2$ concentration** | May affect eutrophication levels, incidence of blue-green algal outbreaks. |
| **Sea level rise** | Saltwater intrusion into low-lying floodplains, freshwater swamps and groundwater; replacement of existing riparian vegetation by mangroves. |
| **Arid and Semi-arid Regions** | |
| **Increasing $CO_2$ coupled with drying in some regions** | Interaction between $CO_2$ and water supply critical, as 90% of the variance in primary production can be accounted for by annual precipitation. |
| **Shifts in seasonality of intensity of rainfall events** | Any enhanced runoff redistribution will intensify vegetation patterning and erosion cell mosaic structure in degraded areas. Changes in rainfall variability and amount will also impact on fire frequency. Dryland salinity could be affected by changes in the timing and intensity of rainfall. |
| **Warming and drying, leading to increased frequency and intensity of fires** | Reduction in patches of fire-sensitive mulga in spinifex grasslands potentially leading to landscape-wide dominance of spinifex. |
| **Alpine and Montane Areas** | |
| **Reduction in snow cover depth and duration** | Alpine systems are generally considered to be among the most vulnerable to future climate change (Hughes, 2003). The extent of true alpine habitat in Australia is very small (0.15% of Australian land surface) with limited high-altitude refuge (Hughes, 2003). Australian alpine regions are home to a variety of alpine vertebrates who rely on snow cover for their survival. A downward trend in snow depth, cover and number of snow days has occurred across Australian alpine regions since the late 1950's (BoM and CSIRO, 2024).<br>Potential loss of species dependent on adequate snow cover for hibernation and protection from predators; increased establishment of plant species at higher elevations as snowpack is reduced. There is evidence of a reduction in populations of dusky antechinus, broad-toothed rats, and the mountain pygmy possum. The first two species are active under the snow throughout the winter season and are therefore subject to increased predation by foxes when snow is reduced (Hughes, 2003). |

Extensive modelling and monitoring studies over the last twenty years provide considerable evidence that climate change is already affecting and will continue to affect species globally (Hoegh-Guldberg et al., 2018) however, these impacts are likely to be highly species-dependent and spatially variable. The most frequently observed and cited ecological responses to climate change include species distributions shifting towards the poles, upwards in elevation and shifts in phenology

(Dunlop et al., 2012). Climate change may not only change species distributions but also life-history traits such as migration patterns, reproductive seasonality and sex-ratios (Table 8-46).

All terrestrial ecosystems are likely to be impacted by a changing climate (Table 8-47; Steffen et al., 2009; Hughes, 2011; Dunlop et al., 2012; Hoegh-Guldberg et al., 2018). The predicted impact of climate change on these ecosystems is highly variable, both between ecosystems and within individual ecosystems (Dunlop et al., 2012). Impacts of climate change such as altering temperature, rainfall patterns and fire regimes are likely to lead to changes in vegetation structures across terrestrial ecosystems within Australia (Table 8-47, Dunlop et al., 2012). Increases in fire regimes will impact Australian ecosystems altering composition structure, habitat heterogeneity and ecosystem processes. Australia is already experiencing an increase in extreme fire weather, with a longer fire season, across large parts of the country since the 1950s (BoM and CSIRO 2024). Changes in climate variability, as well as averages, could also be important drivers of altered species interactions, both native and invasive species (Dunlop et al., 2012). Climate change could result in significant ecosystem shifts, as well as alterations to species ranges and abundances within those ecosystems (Hoegh-Guldberg et al., 2018).

The IPCC Special Report describes impacts of warming above pre-industrial levels to key receptor groups including terrestrial ecosystems, mangroves, warm-water corals, unique and threatened systems, and arctic regions (Hoegh-Guldberg et al., 2018). These receptor groups show varying sensitivity to warming conditions, with a range of responses shown at 1°C warming; from corals suffering moderate impacts, to mangroves not showing any detectable impacts that can be attributed to climate change (Hoegh-Guldberg et al., 2018). As warming reaches 1.5°C above pre-industrial levels, all receptor groups show impacts attributable to climate change with severity ranging from moderate impacts that are detectable and attributable to climate change (mangroves), to impacts that are severe and widespread (warm-water corals) (Hoegh-Guldberg et al., 2018). At the point where global temperature rise, due to climate change, reaches 2°C, increasing numbers of receptor groups suffer impacts which are high to very high, and likely to be irreversible (terrestrial ecosystems, warm-water corals, unique and threatened systems, and arctic regions) (Hoegh-Guldberg et al., 2018).

The State of the Environment (SoE) report is produced every five years by the Australian Government as a comprehensive review on the state of the Australian environment. The most recent report was released in July 2022. The SoE concluded that climate change and extreme weather events were impacting the Australian environment and especially impacting various taxa (DCCEEW, 2021). In many cases, the impacts of climate change on biodiversity are exacerbated by other pressures such as land clearing and invasive species, but in some cases, impacts can be unequivocally attributed to climate change. A summary of the SoE impacts from climate change is provided in Table 8-48.

*Table 8-48: Summary of SoE Report Conclusions on Climate Change Impacts*

| Taxa | Potential Vulnerability |
|---|---|
| **Mammals** | Terrestrial mammals are subject to ongoing population declines due to climate change and changes within habitats |
| **Birds** | There is strong evidence of population declines in threatened bird species, waterbirds and migratory birds. Various extensive and persistent impacts contribute to declines, including climate change (particularly drought) and extreme events, habitat degradation, and invasive predators. |
| **Reptiles** | Reptile species in all areas of Australia have an increasing risk of extinction. Risk of extinction was recognised as primarily related to ongoing pressure from invasive predators, but compounded by pressure from habitat modification, climate change (particularly drought) and disease.<br>Half of Australian freshwater turtle species are in drastic population decline due to climate change. |
| **Amphibians** | Droughts and fires are increasing pressures within habitats that impact amphibian species. |

| Taxa | Potential Vulnerability |
|---|---|
| | The number of known threatened amphibian species, including those that are Critically Endangered in Australia, is increasing. Drought and fire are recognised as increasing pressures contributing to this decline. |
| **Fish** | Freshwater fish throughout Australia have more than a 50% risk of extinction in the next 20 years due to climate change and changes within freshwater habitats. |
| **Invertebrates** | Most threatened invertebrates are suffering from largescale habitat degradation and loss of biodiversity<br>Changes in regional temperature, humidity and rainfall impact their distribution, development and reproduction. |
| **Plants** | Habitat destruction is the leading cause of vulnerability within plant species. However, changes in temperature, rainfall and fire regimes are contributing threats to plant species.<br>Alpine ecosystems and biodiversity in Australia are particularly vulnerable to climate change that affects snow depth and the spatial and temporal extent of snow, which have all declined since the late 1950s. |

Many EPBC protected species, including marine migratory seabirds, seabirds, turtles and whales have been identified as susceptible to climate change and climate variability in EPBC management plans, see Table 2-3. EPBC management plans identify ways that climate change and variability can impact species such as, reducing the extent of coastal nesting and foraging habitat, reducing prey abundance and distribution and influencing the timing of important behaviours such as breeding and migration.

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The predicted level of impact, i.e., the consequence, of an impact on ecosystems from an increase in GHG emissions as a result of the East Coast Project is evaluated to have a consequence of **Level 1**, based on:

- The minor contribution to Australian and Victorian carbon budgets to continue to meet demand to the south east domestic market, in alignment with the Governments' Future Gas Strategy.
- Gas from the East Coast Project will be used exclusively within the domestic market, meaning the emissions associated with the end use of the product will fall exclusively within Commonwealth jurisdiction and be managed in line with Australia's emissions reduction targets, NDC under the Paris Agreement and in accordance with relevant GHG and emissions reduction legislation including the Safeguard Mechanism and *Climate Change Act 2022* (Cwth).
- Given the minor contribution to carbon budgets, the indirect emissions are not a substantial cause of the physical effects of climate change on MNES. Therefore these physical effects are not considered impacts, as per s527E of the EPBC Act.
- Cooper Energy having a robust emissions reduction process to monitor and acknowledge legislative requirements and enable a systematic process to identify, assess and implement GHG emissions reduction opportunities, meaning the East Coast Project's direct emissions will continue to be aligned with Australia's GHG emissions commitments.

- Since FY20 Cooper Energy has been certified carbon neutral by Climate Active in respect of its' scope 1, scope 2 and relevant scope 3 emissions[21]. This voluntary process includes calculating emissions, developing and implementing and emissions reduction strategy and using carbon offsets to compensate for the remaining emissions. The certification requires independent technical assessment and verification. It ultimately gives Cooper Energy a detailed understanding of its emissions profile and provides a real cost of carbon for its business activities.

#### *8.5.4.4 Risk: Change in Socio-economic Factors*

Changes to climate can result in an impact to social receptors that have values which include the ecological receptors previously discussed. This includes KEFs and AMPs. Climate change also impacts on the functions, interests or activities of other users which rely on ecological values, including commercial and recreational fisheries and tourism. For instance, coral bleaching events could impact on reef fisheries and rising sea levels pose a significant threat to coastal communities by amplifying the risks of coastal inundation, storm surge, erosion and saltwater intrusion into groundwater systems. Coastal communities in Australia are already experiencing some of these changes (BoM and CSIRO 2024).

The social receptors that may be impacted in the region of this activity are discussed in Section 6.7.

The predicted level of impact, i.e. the consequence, of an impact on socio-economic factors from an increase in GHG emissions as a result of the East Coast Project is evaluated to have a consequence of Level 1, based on:

- The minor contribution to Australian and Victorian carbon budgets to continue to meet demand to the south east domestic market, in alignment with the Governments' Future Gas Strategy.
- Gas from the East Coast Project will be used exclusively within the domestic market, meaning the emissions associated with the end use of the product will fall exclusively within Commonwealth jurisdiction and be managed in line with Australia's emissions reduction targets, NDC under the Paris Agreement and in accordance with relevant GHG and emissions reduction legislation including the Safeguard Mechanism and *Climate Change Act 2022* (Cwth).
- Given the minor contribution to carbon budgets, the indirect emissions are not a substantial cause of the physical effects of climate change on MNES. Therefore these physical effects are not considered impacts, as per s527E of the EPBC Act.
- Cooper Energy having a robust emissions reduction process to monitor and acknowledge legislative requirements and enable a systematic process to identify, assess and implement GHG emissions reduction opportunities, meaning the East Coast Project's direct emissions will continue to be aligned with Australia's GHG emissions commitments.
- Since FY20 Cooper Energy has been certified carbon neutral by Climate Active in respect of its' scope 1, scope 2 and relevant scope 3 emissions[22]. This voluntary process includes calculating emissions, developing and implementing and emissions reduction strategy and using carbon offsets to compensate for the remaining emissions. The certification requires independent technical assessment and verification. It ultimately gives Cooper Energy a detailed understanding of its emissions profile and provides a real cost of carbon for its business activities.

[21] *See Cooper Energy's 2023 Sustainability Report for detail.*
[22] *See Cooper Energy's 2023 Sustainability Report for detail.*

### 8.5.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 8-49.

*Table 8-49: GHG emissions acceptability assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: Increase in GHG emissions | Consequence: Low |
| | Risk: Change in climate and marine systems | Level 1 |
| | Risk: Change in ecosystem | Level 1 |
| | Risk: Change in socio-economic factors | Level 1 |
| **Principles of ESD** | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 8.5.48.4.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>Cooper Energy integrates long and short-term economic, environmental, social and equity considerations, providing the framework, policies and processes to guide responsible decision making and subsequent implementation.<br>East Coast Project will contribute to alleviating the gas supply shortfall identified in the GSOO (AEMO, 2024) and the Australian Governments Future Gas Strategy (DISR, 2024) which confirms gas as a key transition and firming fuel. The implementation is consistent with Australian and Victorian legislative requirements which transition electricity producers and large emitters to reduce emissions to meet Australia's NDC.<br>As well as delivering energy to the Australian market, Cooper Energy's strategy is aimed at aligning with the energy and decarbonisation needs of Australia. For this reason, Cooper Energy implements its' Emissions Management Process, which provides a framework for identifying, assessing and implementing emissions reduction opportunities and aligning these activities with other business processes. | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• The environmental impact of climate change is well understood and there are acceptable levels of impact established by the Paris Agreement and the EPBC Act.<br>• The proposed control measures outlined below manage the threat of serious or irreversible environmental damage. Therefore, the East Coast Project is consistent with Australia's NDC, and the project is aligned with Paris Agreement and consistent with the EPBC Act.<br>• The greatest consequence ranking for the risks associated with increasing GHG emissions was Level 1 and the highest inherent risks for GHG emissions | |

| Acceptability Criteria | Demonstration of Acceptability |
|---|---|
| | was evaluated as low, therefore, GHG emissions from the East Coast Project will not result in serious or irreversible environmental damage. |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• East Coast Project will contribute to alleviating the gas supply shortfall identified in the GSOO (AEMO, 2024) and is aligned with the Australian Government's Future Gas Strategy (DISR, 2024) which confirms gas as a key transition and firming fuel.<br>• Cooper Energy's processes, particularly it's emissions reduction process, ensures that the East Coast Project's direct emissions will continue to be aligned with Australia's GHG emissions commitments, which may evolve over the lifecycle of the project.<br>• Gas from the East Coast Project will be used exclusively within the domestic market, meaning the emissions associated with the end use of the product will fall exclusively within Commonwealth jurisdiction and be managed in line with Australia's emissions reduction targets, NDC under the Paris Agreement and in accordance with relevant GHG and emissions reduction legislation including the Safeguard Mechanism and *Climate Change Act 2022* (Cwth). The domestic only use of the gas product within the context of such emissions reduction frameworks reduces the risks and impacts associated with climate change.<br>• The highest inherent risks for GHG emissions was evaluated as low and therefore will not forego the health, diversity and productivity of the environment for future generations. |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect by:<br>• adopting the United Nations' definition on Sustainable Development<br>• the implementation of CEMS which drives the company to reduce impacts to ALARP and acceptable levels<br>• specialist environment input and support<br>• recording, reporting, investigation and management of incidents in accordance with Cooper Energy requirements<br>• maintaining a working knowledge of legal and statutory Environmental obligations<br>• monitoring, evaluating and reporting environmental performance.<br>• The relevant environmental values and sensitivities to GHG emissions were evaluated in Section 8.5.4 and the highest inherent risk for GHG emissions was evaluated as Low. |
| | E) 'Valuation principle'<br>Improved valuation, pricing and incentive mechanisms should be promoted.<br>The East Coast Project is consistent with the principle of ESD (e) for this aspect by:<br>The East Coast Project, including downstream indirect emissions, are governed by Australia's emissions management regulatory framework, including the Safeguard Mechanism. This incentivizes and necessitates business to transition to net zero. |

| Acceptability Criteria | Demonstration of Acceptability | | |
|---|---|---|---|
| | Since FY20 Cooper Energy has been certified carbon neutral by Climate Active in respect of its' scope 1, scope 2 and relevant scope 3 emissions[23]. This voluntary process includes calculating emissions, developing and implementing and emissions reduction strategy and using carbon offsets to compensate for the remaining emissions. The certification requires independent technical assessment and verification. It ultimately gives Cooper Energy a detailed understanding of its emissions profile and provides a real cost of carbon for its business activities. | | |
| **Legislative and Other Requirements** | Requirement | Relevant Objective / Action | Demonstration of Requirement |
| | *Climate Change Act 2022* (Cwth) | Objective: Sets out Australia's GHG emissions reduction targets in a manner consistent with the Paris Agreement and Australia's NDCs.<br>Management action: The Cooper Energy Emissions Management Process acknowledges legislative requirements and establishes a systematic process to identify, assess and implement GHG emissions reduction opportunities through a project's life cycle. The process sets a continual improvement cycle such that new technologies and approaches can be incorporated as they are developed. It ensures the East Coast Project's direct emissions will continue to be aligned with the Commonwealth's GHG legislative requirements, however these may evolve over the lifecycle of the Project. | Adoption of the following control measures:<br>CM1: Marine Assurance Process<br>Vessels and MODU operating in the operational area will comply with AMSA Marine Order 97 Marine Pollution Prevention – Air Pollution (appropriate to vessel class) for emissions from combustion of fuel including:<br>• Hold a current international energy efficiency certificate.<br>• Have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI.<br>CM5: Cooper Energy Emissions Management Process<br>The Cooper Energy Emissions Management Process acknowledges legislative requirements and establishes a systematic process to identify, assess and implement GHG emissions reduction opportunities throughout a project's life cycle. The process sets a continual improvement cycle such that new technologies and approaches can be incorporated as they are developed.<br>The objectives of the Emissions Management Process are to:<br>• Identify requirements relating to GHG emissions reduction.<br>• Provide a framework for identifying, assessing and implementing emissions reduction opportunities. Align emissions reduction activities with other business processes.<br>CM21: Well Flowback Program |
| | NGER Act and NGER Regulations 2008 | Objective: single national framework for reporting company information about GHG emissions, energy production and energy consumption.<br>Management action: Cooper Energy reports GHG emissions, energy consumption and energy production as per the NGER Act. | |
| | Safeguard Mechanism rule 2015 (Cwth) | Objective: Key statutory instruments for regulating Australia's GHG emissions in line with Australia's NDCs under the Paris Agreement. Currently applies to facilities that emit more than 100,000 $tCO_2$-e of scope 1 emissions per annum, which may be the case during some years of the East Coast Project.<br>Management action: Cooper Energy monitors the status of its | |

[23] *See Cooper Energy's 2023 Sustainability Report for detail.*

| Acceptability Criteria | Demonstration of Acceptability | | |
|---|---|---|---|
| | | NGER facilities and legislative changes that may affect Safeguard eligibility. | Clean-up and flowback criteria will be defined within the flowback program. The flowback criteria will establish the rates and volumes to be produced from the well to gather sufficient information to characterise the reservoir and fluid, and clean-up the well.<br>Flow from the well will cease once sufficient information has been gathered. Flared volumes of gas will not exceed a rate of 60 MMscf/day, or duration of 60 hours per well.<br>CM23: Safeguard Mechanism Monitoring<br>Direct and indirect GHG emissions will be monitored throughout the project lifecycle against the threshold established by the Safeguard Mechanism. Liaison with the Clean Energy Regulator will be undertaken if the likelihood of triggering the Safeguard Mechanism becomes apparent.<br>CM26: NGER Scheme Reporting<br>Operational control-based reporting as part of the national reporting framework for greenhouse gas emissions, energy consumption and energy production to meet the objectives of the NGER Act. |
| | Marine Order 97: Marine Pollution Prevention – Air Pollution | Objective: prevention of air pollution from vessels<br>Management action: Vessels will comply with Marine Orders – Part 97: Marine Pollution Prevention – Air Pollution (as appropriate to vessel class) for emissions from combustion of fuel including:<br>• Hold a current international energy efficiency certificate.<br>• Have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI. | |
| **Internal Context** | Since FY20 Cooper Energy has been certified carbon neutral by Climate Active in respect of its' scope 1, scope 2 and relevant scope 3 emissions[24]. This voluntary process includes calculating emissions, developing and implementing and emissions reduction strategy and using carbon offsets to compensate for the remaining emissions. The certification requires independent technical assessment and verification. It ultimately gives Cooper Energy a detailed understanding of its emissions profile and provides a real cost of carbon for its business activities. 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:<br>• To provide clean, reliable, and affordable energy, focused on south-eastern Australia, with active participation in society's decarbonisation journey.<br>• To inspire our people to contribute to future energy solutions for our customers and our communities.<br>• To operate in innovative and responsible ways, with an emphasis on care, shareholder value and sustainability.<br>The Policy also commits the company to the following:<br>• Recognise the important role of renewables and the key role gas plays in complementing and supporting the deployment of renewable technologies. | | |

[24] *See Cooper Energy's 2023 Sustainability Report for detail.*

| Acceptability Criteria | Demonstration of Acceptability |
|---|---|
| | • 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.<br>• Identify and, where practicable, implement opportunities for GHG emission reduction within our operations and through our supply chain.<br>• Factor carbon pricing into business decisions and commercial models.<br>• Identify, manage and mitigate material climate change risks to our activities.<br>• Voluntarily align our climate change related disclosures, including our emissions, with the principles of ESD.<br>• Disclose Cooper Energy's governance around climate change, including:<br>  ○ material short, medium and long-term climate-related risks and opportunities on our business, strategy and financial planning and<br>  ○ the resilience of our strategy, taking into account different climate scenarios, including Paris-aligned scenarios.<br>• Align with our customers' sustainability and emissions reduction initiatives which will enable collaboration to address the broader challenge of reducing downstream indirect emissions.<br>• Work with governments and stakeholders in the design of climate change regulation and policies and<br>• Cooper Energy's Risk and Sustainability Committee oversights the Company's sustainability policies and practices.<br>Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). |
| **External Context** | Stakeholder feedback received.<br>DEECA Earth Resources Regulator has advised that the OPP should consider the Victorian Gas Substitution Roadmap. As outlined in Section 8.5.2.1, the development of progressive drilling and production campaigns for the East Coast Project is conducted in response to supply demands and therefore consistent with the Gas Substitution Roadmap.<br>AEMO in the GSOO 2024 identified that the gas supply in southern Australia is declining faster than projected demand (AEMO, 2024). As Australia transforms to meet a net zero emissions future, gas will continue to complement zero emissions and renewable forms of energy, and to provide a reliable and dispatchable form of electricity generation for domestic and industrial users and may provide potential pathways to incorporate hydrogen and other 'green' gases within Australia's energy landscape. Furthermore, the gas supplied by the Project is also consistent with Victorian State Government Climate Change Strategy to support renewables and replace coal-fired power generation (DELWP, 2021).<br>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 to enable this, via detailed calculation and public reporting of its downstream scope 3 emissions intensity.<br>In the 2024 report, AEMO states that despite falling gas consumption, investments are needed in the near term to ensure operational solutions to improve supply from 2026. This is also recognized within the Victorian State Government Climate Change Strategy in the commitment to ensure gas reliability and security for all Victorians in the short-term (DEWLP, 2021). |

| Acceptability Criteria | Demonstration of Acceptability |
|---|---|
| | 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 East Coast Project 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.<br>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.<br>The activity will be undertaken in a manner consistent with relevant legislation, industry standards and guidelines, offshore practices and benchmarking.<br>GHG emissions, energy consumption, and energy production data will be reported annually to the Clean Energy Regulator in accordance with the NGER requirements. The Clean Energy Regulator and Cooper Energy confirmed to continue discussions on application of the Safeguard Mechanism where there is a risk that a safeguard threshold could be exceeded as field development plans are matured and production and emissions profiles are refined.<br>Many of Cooper Energy's customers (who generate indirect emissions by using products produced by this activity) are governed by the Safeguard Mechanism. The Safeguard Mechanism establishes a GHG baseline. Baseline exceedance is required to be offset through the purchase of carbon credits; the cost of the carbon credits provides a cost stimulus to abate emissions consistent with the baseline. The current Safeguard Mechanism reform is "to deliver emissions reductions consistent with Australia's Nationally Determined Contribution under the Paris Agreement" (DCCEEW, 2023p), 43% below 2005 levels by 2030 and the long-term goal of net zero emissions by 2050. |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to GHG emissions is AL10 identified in Table 8-50. This acceptable level defined for an increase in GHG emissions, a change in climate systems, ecosystems and socio-economic factors are defined in Table 7-6.<br>The worst-case predicted impacts assessed in Section 8.5.4 are:<br>• Given the minor contribution to carbon budgets, the indirect emissions are not a substantial cause of the physical effects of climate change on MNES. Therefore these physical effects are not considered impacts, as per s527E of the EPBC Act.<br>• The minor contribution to Australian and Victorian carbon budgets to continue to meet demand to the south east domestic market, is in alignment with the Governments' Future Gas Strategy.<br>• Cooper Energy only supplies the domestic Australian market, has a robust emissions reduction program, and since FY20 Cooper Energy has been certified carbon neutral by Climate Active in respect of its' scope 1, scope 2 and relevant scope 3 emissions.<br>• The highest consequence ranking for GHG emissions was evaluated as Level 1 and the highest inherent risks for GHG emissions was evaluated as Low.<br>Therefore, at its worst-case, the predicted impact from GHG emissions would not:<br>• Contribute to Australia's GHG emissions such that it prevents Australia from meeting greenhouse gas commitments as per the Paris Agreement and *Climate Change Act 2022*.<br>• Have a significant contribution to GHG emissions such that it prevents the conservation of biodiversity, maintenance of ecosystem health or protection of threatened species.<br>• Have a significant contribution to GHG emissions such that the rights of other marine users are compromised or there are substantial adverse effects on the sustainability of commercial fisheries.<br>Therefore, the predicted level of impact due to GHG emissions from the East Coast Project is at or below the defined acceptable levels.<br>Application of the Safeguard Mechanism to East Coast Project emissions |

| Acceptability Criteria | Demonstration of Acceptability |
|---|---|
| | Within the OPP conservative emissions profiles have been estimated based on a scenario where all fields within scope are developed, and multiple fields are brought online simultaneously. As shown in the OPP, in this development scenario, and based on the gas reserves and rates Cooper Energy anticipate from each field, greenhouse gas emissions from the East Coast Project have the potential to exceed the safeguard threshold.<br>Exceedance of the safeguard threshold is not definitive at this stage of planning of the East Coast Project and is highly dependent on future detailed engineering and field sequencing which will determine when different fields within the East Coast Project will be brought online, as well as the volume and rate of gas that will be produced through the Athena Gas Plant. Though at this stage of planning, we consider it just as likely that emissions from the East Coast Project will not exceed the current safeguard threshold (because in the OPP we present a conservative emissions profile), it is also possible that the safeguard threshold could be lowered within the lifespan of the East Coast Project, over the next ~25 years.<br>Cooper Energy has engaged with the Clean Energy regulator regarding facility boundaries for possible field development scenarios for the East Coast Project, to ensure the facility boundaries are appropriate under the NGER Act. Cooper Energy will continue to refine production and emissions profiles as field development plans are matured and re-engage the Clean Energy Regulator where there is a risk that a safeguard threshold could be exceeded. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to GHG emissions are acceptable, based on:<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes.<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD.<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advice, and significant impact guidelines for MNES.<br>• Feedback received from stakeholders has been considered within the assessment of impacts, risks and project need and acceptability described above.<br>To manage impacts to receptors to or below the defined acceptable levels the following EPO have been applied:<br>**EPO15:** GHG emissions related to the Project, including (scope 1 [Inside Project Boundary], scope 1* [Outside Project Boundary] and scope 3) emissions are consistent with Australia's international GHG emissions commitments, as outlined in the *Climate Change Act 2022.* Emissions are to be determined based on the NGER scheme and managed by the Safeguard Mechanism. |

### 8.5.6 Environmental Performance

Table 8-50 lists the acceptable level and EPO defined for GHG emissions and the adopted control measures to achieve the outcome.

*Table 8-50: Environmental Performance Summary – GHG emissions*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL10:** GHG Emissions from activities defined in this OPP will not interfere with Australia's greenhouse gas commitments under the Paris Agreement, enacted in the *Climate Change Act* | **EPO15:** GHG emissions related to the Project, including (scope 1 [Inside Project Boundary], scope 1* [Outside Project Boundary] and scope 3) emissions are consistent with Australia's international GHG emissions commitments, as outlined in the *Climate Change Act 2022.* Emissions are to be determined based on the | CM1: Marine Assurance Process |
| | | CM5: Cooper Energy Emissions Management Process |
| | | CM21: Well Flowback Program |

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| *2022* and managed by the safeguard mechanism. | NGER scheme and managed by the Safeguard Mechanism. | CM23: Safeguard Mechanism Monitoring |
| | | CM26: NGER Scheme Reporting |

## 8.6 Planned Discharges – Drilling

### 8.6.1 Cause of Aspect

Drilling activities will generate drill cuttings, drilling fluids, cement, control fluids and completion fluids. When working in offshore regions, these materials and fluids are typically discharged into the marine environment, ensuring any limitations defined during the EP process are not exceeded.

Phases and associated activities that will generate drilling discharges are identified in Table 8-51, and described in further detail in subsections below.

*Table 8-51: Activities undertaken in the East Coast Project that may result in drilling discharges*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Well Construction** | Drilling operations |
| | BOP installation and testing |
| | Drilling cuttings and fluids* |
| | Cementing operations* |
| | Well completions |
| | Well suspension |
| **Operations** | Well intervention |
| **Decommissioning** | Well abandonment |

**Note: Physical disturbance to the seabed from discharges will occur within the planned disturbance footprint defined and assessed in Section 8.8.*

### 8.6.2 Aspect Characterisation

#### *8.6.2.1 Well Construction*

The proposed East Coast Project plans to drill up to 15 production wells within the scope of this OPP. As described in Section 1.2.2, 3 of the wells may be drilled as exploration wells, with their construction provided for an Exploration EP, or, subject to further field development planning, as development wells. The latter scenario is included within the scope of the OPP. Activities subsequent to well construction, associated with the tie-in, operation and decommissioning of these wells are also in scope of the OPP.

Drilling activities are conducted from a MODU which may be at the well location for ~60 days. Drill cuttings, drilling fluids, cement, control fluids and completion fluids will be discharged to surface waters or at the seabed depending on the stage of the drilling operations. These discharges will occur intermittently throughout the drilling activities, generally released in batches, lasting <24 hours. Collectively, these discharges are herein termed drilling discharges. Details of each drilling discharge is described below:

- **Drill cuttings:** these comprise sediment and small rock chips generated by drilling into the seabed. Discharges of drill cuttings occurs whilst drilling into the seabed. Depending on the rate of drilling, these discharges may continue for <1 to ~10 days per well section.

- **Drilling fluids**: often referred to as 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 a variety of functions such as cooling and lubricating the drill bit, transporting drill cuttings to the surface, and maintaining hydrostatic pressure higher than formation pressure which manages the risk of the uncontrolled influx of hydrocarbons into the wellbore.
- **Cement:** used during drilling to seal the casing of each section is a mixture of dry cement, additives, and water. The dry cement is generally Portland Cement and contains other minor components including crystalline silica.
- **Control fluids**: BOPs are typically controlled and operated using glycol-based control fluids; these are generally soluble/miscible in/with water and may contain additives such as corrosion inhibitors and dye.
- **Completion fluids:** completion fluids may be sodium chloride (NaCl) or potassium chloride (KCl) based with biocide and oxygen scavenger components. Completion fluids are used manage integrity of the wellbore and associated steel casing/tubing.
- **Contingent use of Synthetic Based Drilling Fluids** – drilling fluids in which synthetic oil is the base fluid with bentonite clay, barite, fluid-loss control agents, lime, aqueous chloride, bridging agents and emulsifiers added. If required, SBDF will be used once the riser is installed and returned to the topsides of the MODU, treated through the mud systems and reused. SBDF has increased lubricity, greater cleaning abilities with less viscosity than water-based fluids plus can withstand greater heat without breaking down. Base fluid is typically a hydrocarbon, ether, ester, or acetal as a base. Bulk SBDF will not be discharged the sea, only residual traces that cannot be recovered from the drill cuttings will be released back to the seabed.

Table 8-52 details and lists drilling activities with discharges to surface waters and at the seabed.

*Table 8-52: Volumes and location of drilling discharges*

| Activity Component | Discharge Type | Description of Discharge | Volume (approx. per well) |
|---|---|---|---|
| **Surface water drilling discharges** | | | |
| **Bottom-hole drilling** | Drill cuttings | Drill cuttings returned to the MODU will be processed through solids control equipment. Processed drill cuttings will be discharged below the water line. | ~180 $m^3$ |
| | Drill fluids | Drill fluids are separated from drill cuttings when processed through the solids control equipment. Drill fluids that have reach the end of their usable life are discharged to surface waters. | ~2,000 $m^3$, at 10-100 $m^3$ batched intervals |
| **Cementing operations** | Dry cement | Small amounts of dry cement will be released from dry bulk storage tank venting pipes. | Negligible |
| | Cement slurry | Cement slurry flushed overboard from the cement unit during testing. | ~8 $m^3$ |
| | Cement slurry | Cement slurry flushed overboard from the cement unit during cleaning. | <3$m^3$ |
| **Well completions** | Completion fluids | Fluids not suitable for reuse are discharged overboard. | ~500 $m^3$ |
| **Well suspension** | Completion fluids | Prior to well shut-in, the well and SST barriers will be tested, and completion fluids may be flushed to sea. | ~220 $m^3$ |
| **Seabed drilling discharges** | | | |
| **Top-hole drilling** | Drill cuttings | Top-hole drilling will discharge cuttings from the wellbore and drilling fluids to the seabed. | ~150 $m^3$ |

| Activity Component | Discharge Type | Description of Discharge | Volume (approx. per well) |
|---|---|---|---|
| | Drill fluids | | ~1,500 $m^3$, at 10-100 $m^3$ batched intervals |
| **BOP installation, testing** | Control fluid | Control fluid will be discharged at the BOP located near the seabed during BOP testing and operation. 2-3 tests may be completed per well depending on construction duration. | ~2.5 $m^3$/test |
| **Cementing operations** | Cement | Displacement fluid is pumped into the casing to displace cement out of the bottom of the casing. The direct footprint of the 'overflow' cement on the seabed is a 10 to 50 m radius from the well. | up to 40 $m^3$ |
| **Contingency SBDF discharges** | | | |
| **Bottom-hole Drilling** | Drill cuttings | Drill cuttings returned to the MODU will be processed through solids control equipment. Processed drill cuttings with rresidual traces of SBDF that cannot be recovered will be discharged below the water line. SBDF that is recovered from drill cuttings for re-use will be recycled or disposed of at a land-based facility or used in future drilling activities. | Drill cuttings with residual SBDF - 180$m^3$ |
| | Drill Fluids | If required, SBDF will be used once the riser is installed and returned to the topsides of the MODU, treated through the mud systems and reused.<br>There will be no planned discharge of bulk SBDF into the marine environment, noting that potential residual discharges are discussed above. | |

**Residual Bulk Material Disposal**

Following the completion of well construction activities residual barite and bentonite will be managed in accordance with Figure 12-7. Cooper Energy's preference will be to transfer unused bulk products to the next client with the MODU, however, if this is not possible, a residual bulks management process (Figure 12-7) has been developed to allow for consideration of disposal options other than overboard discharge which has been standard practice in industry. Cooper Energy will continue investigating options to manage bulk materials to avoid overboard discharge of residual bulks; this will be done via industry collaboration and with relevant service partners (cementing / fluid services). If bulks are discharged, they would be mixed with seawater and discharged to sea as a slurry. It is anticipated that batch volumes of ~50 $m^3$ of barite and ~50 $m^3$ bentonite (accounting for possible leftover contingency) may be discharged at the end of a well construction campaign.

### *8.6.2.2 Operations*

During the operations phase, well intervention activities may be required for wellbore maintenance and repair. The frequency of well intervention activities will depend on well performance. Well intervention activities may result in discharge of completion and control fluids (Table 8-52). Completion fluids not suitable for reuse are discharged overboard with indicative volumes being ~500 $m^3$. Control fluids discharged near the seabed may occur during well testing activities i.e., BOP test resulting in control fluid discharge of ~2.5 $m^3$/test. These discharges will occur intermittently throughout the operations phase, generally released in batches, typically lasting <24 hours.

### *8.6.2.3 Decommissioning*

Abandonment activities will be assisted by a MODU, and operations are expected to occur for ~25 days per well. Well abandonment operations involve setting a series of cement and mechanical plugs within the wellbore, to ensure isolation of the reservoir and mitigate the risk of reservoir fluid release into the marine environment. Plugs are then tested to confirm integrity. Well abandonment

operations may result in the discharge of fluids (treated sea water, completions fluids, drilling fluids) as well as cement discharges (Table 8-52). These discharges will occur intermittently throughout the well abandonment activities, generally released in batches, typically lasting <24 hours. A maximum of 15 wells will be abandoned under this OPP.

#### *8.6.2.4 Concurrent activities*

There will not be any concurrent drilling activities for the East Coast Project; as there would only ever be one MODU in the operational area at a time.

### 8.6.3 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impacts from drilling discharges are:

- Change in water quality
- Change in sediment quality
- Change in benthic habitat.

Potential risks:

- Injury/mortality to marine fauna.

Socio-economic impacts on commercial fisheries have not been evaluated further, as there are no discernible impacts to behaviour or distribution expected at the population level given the limited nature and scale of activities associated with drilling discharges.

### 8.6.4 Impact and Risk Evaluation

#### *8.6.4.1 Impact: Change in Water Quality*

**Inherent Consequence Evaluation**

Intermittent drilling discharges will result in localised and temporary change in water quality from the discharge of cuttings, fluids and cement into the water column. The fate of drilling discharges to the sea has been studied extensively and indicate changes in water quality are temporary, associated with the increase in turbidity in the water column whilst the discharges disperse (Sanzone et al., 2016).

Drilling cuttings and fluids

Surface water and seabed drilling discharges released into the marine environment during the project may result in temporarily elevated turbidity levels within surrounding waters. These discharges will form a plume in the water column contain cuttings, fluids and/or cement particles. Typically, coarse materials (>37.5 mm) will settle rapidly and have little potential impact to water quality. As particle size decrease, the settling velocity typically decreases resulting in a turbid plume that will decrease as the plume is diluted and the suspended particles are deposited. Elevated turbidity/total suspended solids (TTS) have the potential to temporarily elevate the turbidity of surrounding waters.

Drilling fluids will be discharged intermittently in batched intervals ranging from around 10 $m^3$ to 100 $m^3$ and, depending on the volume, may be discharged over a period less than 24 hours. The drilling discharge plumes will be heavily influenced by the prevailing currents which will disperse and dilute the plume in receiving waters (Sanzone et al., 2016). As such, the drilling discharge turbidity plume is expected to be intermittent (from batched releases), and brief (such that the plume is dispersed within minutes post-discharge) based on discharge durations and dispersion fates (Jones et al., 2021).

A study conducted in the Northwest Shelf modelled and surveyed the fate of drill cuttings and fluids for three wells with a total discharge volume of 1,543 $m^3$ in water depths ranging from 20 to 120 m, and current speeds at ~0.11-0.38 m/s (Jones et al., 2021). With the cutting discharge rates ranging from ~0.8 kg/s to 9.3 kg/s, the study found sporadic and intermittent Total Suspended Solid (TSS)

concentrations exceeded 600 mg/L close to the discharge outlet and dropped to 15 mg/L approximately 1000 m from the discharge point lasting over a period of minutes for each discharge event (Jones et al., 2021).

In context, water column turbidity on the Victorian coastline is subject to high natural variability. Wave-driven sediment resuspension generates high turbidity levels within coastal zones, commonly exceeding 50 mg/L (Section 6.4.6). The Bass Strait is a high-energy environment with average current speeds in the area range between 0.15 m/s to 0.24 m/s (Section 6.4.5.1).

As the water depths (~55-85 m) and current spends (0.15-0.24 m/s) of the East Coast Project are within the range of the study (Jones et al., 2021), assuming similar cutting discharge rates of 0.8-9.3 kg/s, the dispersion extents in Jones et al., 2021 are considered representative. It is expected that drilling discharges during the East Coast Project could increase turbidity levels in surrounding waters to up approximately 1000 m from the discharge point over a period of minutes, though would more likely reduce quickly to the point where changes would not be discernible from the background turbidity levels and high natural variability offshore Victoria.

Discharges of the nature described for this project have been undertaken historically in the region, and have been shown to result in little to no impact on water or sediment quality and associated amenity (Section 6.4.6 and Section 6.4.7). Residual barite, bentonite and brine may also be discharged at the end of drilling as a slurry. Barite will have very low concentrations of mercury (Hg) and cadmium (Cd) (less than 1 mg/kg and 3 mg/kg, respectively). Crecelius et al. (2007) recorded the solubility of barite and trace metal compounds and observed that 1% of mercury and 15% of the cadmium dissolved from the barite after one week of exposure to the marine environment, indicating their low bioavailability (Schanning et al., 2002). Furthermore, the concentrations of these components within barite are so low (Sadiq et al., 2003) that barite is referred to as inert from a toxicological perspective (Crecelius et al., 2007). As such these will not contribute to toxicity due to their low concentrations and limited bioavailability. As such, change to the water quality is anticipated to be negligible.

Synthetic Based Drilling Fluids (SBDF)

The potential use of Synthetic Based Drilling Fluids (SBDF) is considered as a contingency activity for the Project. Discharges of SBDF into the marine environment during contingent use will be confined to the residual fluids that adhering to the surfaces of the drill cuttings. The discharge of SBDF is minimised through recycling the drilling fluid during operations through solids control and secondary processing equipment installed on the MODU. This treatment of cuttings will ensure that the amount of residual fluid released into the marine environment will be minimised.

SBDFs, though generally less toxic than traditional oil-based muds, can introduce low concentrations of hydrocarbons to the marine environment. Current SBDF systems typically have low toxicity to the water column and benthic organisms (IOGP, 2016). Dispersion into the water column is dependent on the SBDF type and concentration of the base fluid found on cuttings (i.e., the cuttings will disperse more effectively if the base oil is less than ~5 %) (Neff et al., 2000). In general, discharged SBDF cuttings, which are “oil-wet”, have a tendency to clump together in large particles and rapidly settle to the seafloor (Neff et al., 2000). Deposition of the cuttings on the seafloor depends on the current direction, speed, and depth of release. Cuttings piles have occasionally been observed in shallow water, however, rarely occur when discharged in deep water or in high energy marine environments (Neff et al., 2000).

The use of the SBDF will also be assessed in accordance with the Cooper Energy Offshore Chemical Assessment Procedure to ensure chemicals used are environmentally acceptable. Given the residual volumes expected, and the anticipated rapid settling, increases in the water quality turbidity and/or toxicity are not anticipated. As such, SBDF on cuttings will not result in a widespread reduction in water quality, and any impact, albeit unlikely, will be localised and recoverable.

Cement

Drilling activities generate excess cement slurry and washings which are typically released to the marine environment which will change water quality for brief periods whilst cement particles are suspended in higher concentrations. The discharge of cement particles at the surface will disperse

under the 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. Cement is listed as a substance that is considered to pose little or no risk to the environment (OSPAR, 2021), therefore, toxicity impacts are not anticipated.

Previous modelling of surface cement discharges of was conducted by BP (2013) 78 $m^3$ discharged over one hour. The study found the discharge resulted in a suspended solid concentration between 0.005-0.05 $mg/m^3$ within the extent of the plume (~150 m horizontal and 10 m vertical) over 2 hours. Four hours post-discharge concentrations were <0.005 $mg/m^3$. The volume modelled is significantly greater than the maximum surface discharge volume predicted for the Project (Table 8-52), therefore it is conservatively predicted that both the concentration of suspended sediments and time to return to pre-discharge conditions would be within four hours post-discharge.

With consideration of the high energy marine environment, and given the low persistence expected of the cement discharges, any impacts water quality are expected to be localised and temporary.

Completions fluids and control fluid

Well completion and well suspension activities will up to a total of 720 $m^3$ completions fluids (Table 8-52) which may be released to sea if deemed not suitable for reuse. Biocides and chemical additives in completions fluids are selected in accordance with the Cooper Energy Offshore Chemical Procedure to ensure ecotoxicity profiles are of an acceptable level, and that products with lower ecotoxicity profiles are selected. 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.

Minor volumes of control fluids will be discharged during well integrity testing activities (~2.5 $m^3$/test). As above, chemicals that are highly toxic, highly bio-accumulative, and highly persistent in the project and environment setting, would not be selected if they were to be discharged, and those with the lowest ecotoxicity profiles preferentially selected, where they also meet technical requirements as per the Cooper Energy Offshore Chemical Assessment Procedure. Control fluids are glycol and water-based, low toxicity and readily biodegradable in water. On discharge they dilute rapidly in the open water environment to concentrations below which could possibly cause environmental harm. Furthermore, given the high energy marine environment found in the operational area and the volumes released, discharges during BOP installation and testing, will dissipate rapidly and any change in water quality will be localised and temporary.

Summary

Given that drilling discharges during the East Coast Project are related to activities that are intermittent, brief and result in localised changes to water quality (increase in turbidity within ~1000 m from the discharge point), the consequence of this impact has been evaluated as **Level 1**, as water quality levels will return to existing ambient levels following completion of the activity with no remedial or recovery work required.

#### *8.6.4.2 Impact: Change in Sediment Quality*

**Inherent Consequence Evaluation**

Surface water and seabed drilling discharges will create an in-water plume that is then expected to settle on the seabed. Deposition of drilling discharges on the seafloor has the potential to change seafloor sediment quality (IOGP, 2016). The deposition of drilling discharges on the seafloor also introduces new materials to seabed, including metals (usually barium weighting agent often the most abundant solid ingredient in drilling fluids), suspended solids from drilling fluids, cement solids and additives.

The area and thickness of seafloor deposition from the release drill cuttings will depend on the cuttings type, the amount of fluid retained on the cuttings, particle size distribution, water depth, and

current speed and direction found in the water column at the discharge site (Sanzone et al., 2016). A summary of significant published field, laboratory and modelling studies on drill fluid and cuttings conducted since 2003 was included within the 2016 International Association of Oil and Gas Producers (IOGP) report (IOGP, 2016). The field studies within the report included:

- Seven field studies on Group III base fluid Non-Aqueous Drilling Fluid (NADF) also known as SBDF, cuttings at water depths 38 m to 1125 m on the continental shelf and slope of the Gulf of Mexico and the southwest Atlantic off Brazil, on the Grand Banks of Canada, off Sabah and Sarawak, Malaysia, and in the tropical eastern Atlantic off Ghana.
- Nine field studies on WBDF and NADF cuttings within water depths 32 m to 600 m on the continental shelf off south Australia, southern California, Norway, and on the continental slope in the Faroe-Shetland Channel in the northeast Atlantic and in the Norwegian Sea; and
- Four field studies of Group I and II base fluid NADF cuttings within water depths 30 m to 670 m off West Africa and Malaysia.

The IOGP report found that in all cases the seafloor discharge of cuttings and adhered WBDF were detected within 10–150 m of the discharge source; whereas cuttings discharged near the surface were shown to accumulate on the seafloor at distances of ~0.1–1 km (IOGP, 2016). Surface discharges undergo higher levels of dispersion of smaller cuttings within the water column resulting in a thinner layer near the well site.

The IOGP studies (IOGP 2016) also found surface discharges of SBDF are generally deposited within approximately 100–200 m downstream of the discharge source for shallower water (<400 m) and up to a maximum of 1 km downstream for deeper waters with concentrations decreasing with distance from the discharge site and that for both SBDF and WBDF discharges at the seafloor; cuttings could be detected visually, or as elevated barium concentrations in benthic sediments within 10 – 150 m of the discharge, with a greater spread down-current.

The physical persistence of drilling discharges on the seafloor depends on the energy of bottom waters and degradability of the discharged material. The greater Bass Strait is known for its complex, high energy wave climate and strong ocean currents (Currie and Isaacs, 2005). Scouring is a natural feature on the Otway shelf whereby currents may erode sediments around hard calcareous sediments (Ramboll, 2020b). Strong bottom currents in the operational area are expected to resuspend and transport drilling discharges deposited on the seafloor. Deposited drilling discharges may also be exposed to bioturbation and sedimentation of natural particulate matter which may further dilute the deposited drilling discharges.

WBDFs are comprised primarily of common, inorganic components such as Potassium Chloride with weighting agents such as barite. Most of these components are classified internationally as Posing Little or No risk to the Environment (PLONOR). Organic additives to drilling fluids are mostly biodegradable and are degraded by microbes on the seafloor (Folayan et al., 2023). These dispersive and degradative processes reduce the concentration of the materials over time (IOGP, 2016).

A study was conducted on the WBDF and associated cuttings produced from the exploratory drilling of the Minerva A-2 well drilled in 2002 in Bass Strait, 12 km south of Port Campbell, Victoria, Australia within comparable water depths of 67 m (Currie and Isaacs, 2005). The study detected drill cuttings in sediment grab samples and in video surveys by ROVs within 100 m of the drilling rig. Samples taken two weeks after drilling concluded that the abundance of benthic fauna and faunal diversity was 45-75% lower than in the pre-drilling surveys within 100 m of the discharge (Currie and Isaacs, 2005). Subsequent surveys conducted that most benthic faunal changes were no longer detectable after 4 months. However, modified benthic communities persisted for at least 11 months after completion of drilling within 100 m of the rig. Drilling discharges were no longer detected within the surveys conducted 11 months after drilling (Currie and Isaacs, 2005).

A number of field monitoring studies to assess the impacts of drilling discharges have been completed in the Bass Strait and around the world. In a stable cuttings pile with little physical disturbance or bioturbation, it is probable that the fraction of the total cuttings pile metals that is in

the dissolved, bioavailable fraction remains low. The low solubility of SBDF materials does not make it available for uptake and bioaccumulation, this has been confirmed by the fact that these base fluids have not been detected in tissues of marine organisms near SBDF cuttings discharges (IOGP, 2016). A study conducted at three continental shelf drilling discharge locations within the Gulf of Mexico (37 to 119 m water depths) supported the above findings. Surveys undertaken within the 100 m distance from the platform found that the seabed barium concentration decreased from 2.4% by 80% in one year between the first and second post-discharge surveys (IOGP, 2016).

Based on the above comparable studies, it is expected that deposited drilling discharges on the seabed will change sediment quality within a conservative 200 m from the drilling location due to the introduction of new material to seabed sediments. However, due the high energy environment found within the operational area and the water depths from comparable studies, the concentration of the drilling components within the seabed are expected to decrease from natural dispersive and degradative processes within the first year post drilling.

As discussed in Section 8.6.4.2, low concentrations of mercury (Hg) and cadmium (Cd) (less than 1 mg/kg and 3 mg/kg, respectively) found in the residual barite may be discharged at the end of drilling. Discharges are not expected to contribute to sediment toxicity due to the low bioavailability of mercury and cadmium (Schanning et al., 2002). ANZG (2018) sediment quality default guideline values for Hg and Cd are 0.15 mg/kg and 1.5 mg/kg, respectively. Based on an estimate of 100 $m^3$ of bulk materials (barite, bentonite and cement) discharged to sea and assuming the bulk materials settle to the sea floor within 200 m of the release point as defined above a dispersed concentration of 0.04 mg/kg Hg and 0.12 mg/kg Cd is estimated (Figure 8-9). These concentrations are well below the applicable ANZG values for sediment, and therefore no discernible ongoing impacts are predicted.

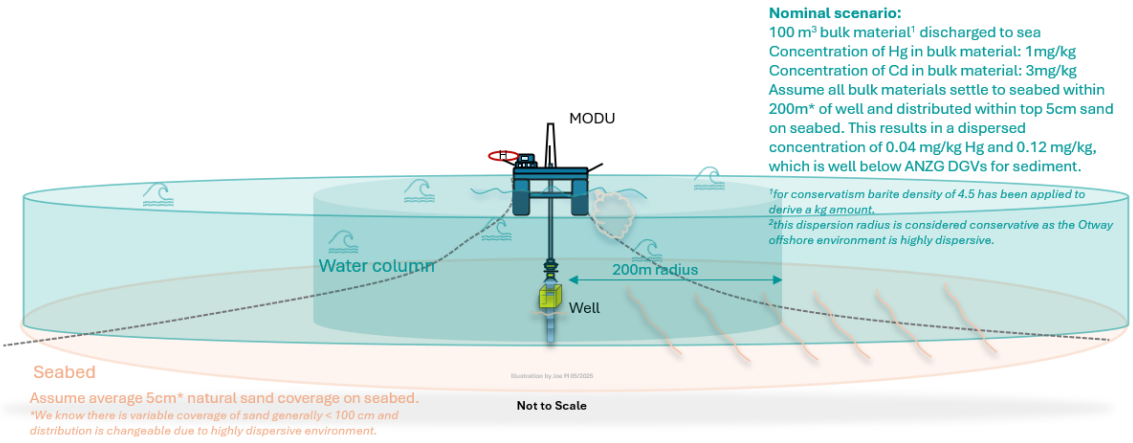



*Figure 8-9: Illustration – dispersion of bulk materials*

Discharges of the nature described for this project have been undertaken historically in the region, and have been shown to result in little to no impact on water or sediment quality and associated amenity (Section 6.4.6 and Section 6.4.7).

Biocides and chemical additives in drilling fluids are selected in accordance with the Cooper Energy Offshore Chemical Procedure to ensure ecotoxicity profiles are of an acceptable level, and that products with lower ecotoxicity profiles are selected. For context, chemicals that are highly toxic, highly bioaccumulative and highly persistent in the project and environment setting, would not be selected if they were to be discharged, and those with the lowest profiles preferentially selected, where they also meet technical requirements.

Given that drilling discharges during the East Coast Project are related to activities that are intermittent, brief and result in localised changes to sediment quality, the consequence of this impact has been evaluated as **Level 1**, as sediment quality levels will return to existing ambient levels following completion of the activity with no remedial or recovery work required.

#### *8.6.4.3 Impact: Change in Habitat*

**Inherent Consequence Evaluation**

Deposition of drilling discharges onto the seabed is expected to result in localised change to the benthic habitat and associated benthic assemblages. The effects of WBDF and SBDF cuttings deposits on benthic communities are caused mainly by burial, changes in sediment texture, and low sediment oxygen concentrations that result from microbial degradation of organic matter (organic enrichment) (IOGP, 2016).

Studies have shown that impacts to benthic assemblages from drilling discharges are highly localised (Balcom et al., 2012; Sanzone et al., 2016). Surveys surrounding the drill centres of three wells in the Northwest Shelf found a high impact zone within a 75 m radius of the well contributed by seabed discharges from tophole drilling (Jones et al., 2021). The high impact zone was largely devoid of all epibenthic fauna and showed a clear loss of soft corals, sponges, and hydroids (Jones et al., 2021). The impact zones observed by the Northwest Shelf surveys coincide with observations of several monitoring studies reviewed by Sanzone et al. (2016) where the abundance and diversity of sessile and slow-moving benthic fauna were reduced within 50 to 100 m of the discharge site. This change in habitat is most likely the direct result of burial from drilling discharge deposition (Sanzone et al., 2016).

Beyond 100 m of the well, the deposition of drilling discharges may change the grain size and chemical properties of seabed sediments and may cover epibiota with sediment. These changes may influence the abundance of fauna, composition, and diversity of benthic habitats. The survey by Jones et al. (2021) defined a medium impact zone, within 200 m of the well, where sponges and soft corals were found to be covered by sediment (Jones et al., 2021). For the East Coast Project, it is expected that within 200 m of the well, solids from drilling discharges may settle onto benthic assemblages.

Observations of several monitoring studies reviewed by Sanzone et al. (2016) found that impacted benthic habitats and assemblages can rapidly recover post drilling. These studies demonstrated substantial recovery in benthic communities within one to a few years after impacts to drilling discharges.

In a contingency event where SBDF is used for lower well sections, the discharge of residual SBDF adhered to cuttings will deposit of the seabed resulting in an increase in SBDF in benthic sediments that may lead to depletion of oxygen in surface layers and cause a change in or decrease in diversity of the benthic community (IOGP, 2016). The biological effects of SBDF cuttings discharges are mainly restricted to the benthic environment. Effects of treated Group III (negligible aromatic content) SBDF cuttings accumulations in sediments are usually minor and biological recovery is often underway within a year of completion of discharge (IOGP, 2016).

Neff (2010) suggests that synthetic-based mud-coated cuttings tend to clump and settle rapidly as large particles over a small area near the discharge point and tend not to disperse rapidly, indicating that when drilling with synthetic-based muds, extent of dispersion is expected to decrease, but thickness of cuttings piles is expected to increase. SBDF also contains hydrocarbons that may bioaccumulate. However, Melton et al. (2000) suggests that given the ability for organisms to oxidise and expel aromatics, hydrocarbons are not expected to bioconcentrate given the reactivity and biodegradation rate of drilling materials in high energy environments, such as those offshore in the Otway.

Neff (2010) found that recolonisation of synthetic-based, mud-cuttings piles in cold-water marine environments began within one to two years of ceasing discharges once the hydrocarbon component of the cutting piles biodegraded. The recovery of the benthic community is depended upon several factors: type of affected community, thickness of impacted area, persistence of the cuttings (dependent upon both biodegradation and seafloor distribution), availability of colonising organisms. Ecological recovery of benthic communities usually begins shortly after drilling activities are complete and is often well advanced within a year (IOGP,2016). Additional studies indicate that benthic infauna and epifauna recover relatively quickly, with substantial recovery in deepwater benthic communities within three to ten years (Jones et al., 2012). Shell Malaysia compared seabed

conditions one month and one year after discharge of drill cuttings from shallow and deep water wells drilled using synthetic-based muds (Dorn et al., 2007). The synthetic based muds were either paraffin (e.g. Saraline 185V) or olefin based. Samples collected post drilling using paraffins as the synthetic base fluid showed limited areal coverage, predominately within 150 m of discharge and at depths <6cm.

As described in Section 6.4.7 and 6.5.1 Ramboll (2020a) and Ramboll (2020b) both found that benthic habitats within, and in close vicinity of the East Coast Project operational area to be composed of seabed sediments characterised by sand or gravelly / rubble and hard platform substrates. These findings are highly representative of the wider Otway region and consistent with other reports for the wider Bass Strait region (Ramboll, 2020b; Barton et al., 2012; Murray-Wallace and Woodroffe, 2014; Jones and Davies, 1983). Benthic assemblages proximal and within the operational area were surveyed (see Figure 6-17), and results observed an unmodified marine environment with scattered areas of hard ground supporting patchy areas of abundant epibiota, typically bryozoans, gorgonian, cnidarians and sponges (Ramboll, 2020b). While there is some residual uncertainty on exact benthic assemblage composition in the south-western portion of the operational area, as there is no historical survey data in that area; Ramboll (2020a) surveyed a similar water depth and distance offshore in a neighbouring title area (Figure 6-17; Section 6.5.1), ) and which provide a reasonable proxy for the purpose of impact and risk assessment. No ecological communities listed as threatened under the EPBC Act were observed and the operational area does not overlap AMPs.

The operational area contains seabed representative of some values associated with the Shelf rocky reefs and hard substrates KEF (see Section 6.6.6). This KEF has not been spatially delineated other than it being described as occurring throughout the south-east marine region (CoA, 2015a). Surveys of parts of the operational area and surrounds observed areas of hard ground and patchy epifauna with the presence of several or occasional fish (Santos, 2004; Ramboll, 2020b).These areas are consistent with some values of the Shelf rocky reefs and hard substrates KEF(see Section 6.6.6). These widely represented habitats of hard ground and patchy epifauna will be impacted by the settling out of solids from drilling discharges on the seabed. Seabed surveys and facility inspections proximal to the East Coast Project, including over the existing network of wells and pipelines commonly show high colonisation of infrastructure consistent in appearance with the surrounding seabed communities (Figure 6-16). These observations indicate that the localised disturbance from installation of seabed infrastructure is recoverable and would not be expected to alter the habitat value associated with the commonly represented areas of rocky reef and hard substrate within the Otway region.

For the East Coast Project, any impacts to benthic assemblages including to epibiota from smothering or burial is therefore expected to predominantly occur within ~200 m of the drill centre and anticipated to recover rapidly following the activity given the dispersive nature of the subsea environment and natural high movement and redistribution of sandy sediments by prevailing weather as indicated by the juxtaposition of rock substrate interspersed by thin layers of sand. Epibiota of the Otway region may experience localised and short-term impacts; however, due to their scattered distribution and ability to recovery rapidly this is not predicted to impact the ecosystem integrity or functioning of the commonly represented areas of rocky reef and hard substrate habitats.

Drilling discharges during the East Coast Project are related to activities that are intermittent, brief and result in localised changes to habitat assemblages (deposition of drilling discharges resulting in changes to benthic assemblages within ~200 m from the discharge location). The consequence of this impact has been evaluated as **Level 1**, noting areas of rocky reef and hard substrate are well represented in the region, the scattered distribution of benthic assemblages in the operational area, and their ability to naturally recover with no remedial or recovery work required.

#### *8.6.4.4 Risk: Injury / Mortality to Marine Fauna*

**Inherent Consequence Evaluation**

Marine fauna at risk of injury / mortality from drilling discharges include species that may pass through in-water drilling discharge plumes or are exposed to drilling discharge deposition on the seabed, including:

- Plankton
- Fish
- Marine reptiles
- Marine mammals.

Plankton, including fish eggs and larvae

Fish eggs and larvae are more susceptible to injury and mortality when exposed to in-water elevated turbidity levels. Eggs and larvae lack the ability to move and avoid potential drilling discharge plumes in the operational area and are also more sensitive to low turbidity levels i.e. TSS levels greater than 500 mg/L for one hour has the potential to trigger the onset of physiological stress (Johnson, 2018). Jenkins and McKinnon (2006) reported that levels of 100 mg/L may injure larvae of some species if exposed for periods greater than 96 hours.

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, fish larvae within this localised area may be vulnerable to impacts from an increase in total suspended sediments if exposed over 96 hours. The Bass Strait is known for a complex, high energy wave climate and strong ocean currents. High energy oceanographic processes in the operational area will result in rapid dispersion of the drilling discharges plume. Rapid dispersion of the plume prevents 96-hour exposure necessary for the onset of injury to occur fish eggs and larvae.

For plankton, including fish eggs and larvae, the intermittent and brief exposure of to in-water drilling discharge plume is unlikely to result in injury or mortality. Impacts to plankton, including fish eggs and larvae, will be limited to minor physiological stress, with populations expected to rapidly recover noting high levels of natural mortality and a rapid replacement rate (United Nations Environment Program (UNEP), 1985).

Fish

The intermittent and brief exposure nature of in-water drilling discharge plumes will preclude chronic exposure of marine organisms. As a result, mortality to adult and juvenile pelagic fish from drilling discharges is not a credible event.

Highly mobile adult and juvenile pelagic fish that swim through drilling discharge plumes will be exposed to temporary elevated levels of turbidity. Mobile fish passing through the plume may experience behavioural or sub-lethal effects (Johnson, 2018). Observations from numerous studies have identified that adult and larger fish can tolerate relatively high levels of turbidity and TSS for short periods (Johnson, 2018). Fish respond to elevated turbidity levels by actively avoiding the plume. This response prevents chronic exposure that may lead to sub-lethal impacts relating to minor physiological stress (increased coughing, increased respiration rate) which requires at least 6-day continuous exposure to elevated turbidity levels; drilling discharges are intermittent, and high turbidity localised and temporary. Pelagic fish in the operational area would not be exposed to high levels of turbidity (above background) for long periods (Section 8.6.4.1).

Thirty-three fish species are listed as having the potential to occur within the operational area in the EPBC Act PMST (26 of which are pipefish, pipehorses, seadragons and seahorses). There are 5 threatened species within this list that may be present in the operational area including blue warehou, southern bluefin tuna, Australian grayling, white shark and eastern school shark. Migratory species include species that may be present within the operational area include white shark, shortfin mako and mackerel porbeagle. The operational area does not contain habitats to support aggregations or site fidelity for these listed fish species. Except for pipefish, pipehorses, seadragons

and seahorses, all species are mobile and are expected to move away from the drilling discharge plume if it exceeds their levels of tolerance.

Sessile and slow-moving fish species including pipefish, pipehorses, seadragons and seahorses are susceptible to smothering and burial from drilling discharge deposition on the seabed. Smothering and burial of sessile benthic fish has the potential to result in injury and mortality. Pipefish, pipehorses, seadragons and seahorses found in a variety of habitats ranging from deep reefs to coastal algae, or weed or seagrass habitats (Kuiter, 2000). Certain seahorse species, such as the big-belly seahorse (*Hippocampus abdominalis*) have been identified in water depths up to 104 m; attached to sponges and colonial hydroids (DoE, 2024). The seabed proximal to the operational area does not include weed or seagrass habitats (Ramboll, 2020b). The majority of the area within and proximal to the operational area is reef and patches of sand substrate. This seabed type does support benthic fauna including sessile marine invertebrates such as sponges (Ramboll, 2020b). Within the Otway the seabed is heavily influence by strong currents and storm events and which episodically elevate turbidity. The sessile communities are common within the region and have been frequently observed during surveys within and proximal to the existing and planned facilities. Existing equipment on the seabed has been substantially colonised by the sessile communities of similar appearance to the surrounding undisturbed seabed (Figure 6-16). Impacts to seabed are anticipated from the East Coast project; these impacts will be limited to the near vicinity of the activities at seabed, and are expected to recover, as demonstrated by surveys of existing infrastructure and adjacent seabed.

Commercial fish species that may occur within the operational area include elephantfish, gummy shark, sawshark and lobster. Lobster are mobile species and are generally considered less vulnerable to seabed disturbance compared to sessile taxa as they are able to move (Fraser et al., 2017). These commercial fish and shark species are not known to exhibit site fidelity and are anticipated to be transient through the operational area. Therefore, impacts are predicted to be limited to temporary and localised avoidance behaviours during drilling activities. Overall, the potential for injury / mortality to fish is limited to sessile and slow-moving fish species with low mobility. However, any impacts from drilling discharges within 100 m of the well are not anticipated to change the viability of the population of these species. For pelagic fish, the intermittent and brief exposure to in-water drilling discharge plume is unlikely to result in injury or mortality. Impacts to adult and juvenile pelagic fish are limited to behavioural effects.

Marine Reptiles

The intermittent and brief exposure nature of in-water drilling discharge plumes will preclude chronic exposure of marine organisms. As a result, mortality to marine reptiles from drilling discharges is not a credible event.

Marine reptiles, specifically turtles, can experience behavioural and physiological effects that may lead from exposure to temporary increases in water turbidity (Johnson, 2018). Marine turtles are dependent on vision to forage, communicate and move through the water. Increase in turbidity from drilling discharges may result in plume avoidance by marine turtles when exposed to drilling discharge plumes in the operational area (Johnson, 2018).

The operational area does not overlap recognised BIAs for marine turtles and therefore only low numbers (if any) may move through the area. Marine turtles with the potential to be exposed to drilling discharge plumes in the operational area are therefore limited to transient individuals. Brief exposure to the plumes may result in minor behavioural changes that are unlikely to lead to sub-lethal injury given the absence of habitats that encourage long-term presence of marine turtles in the operational area.

As a result, impacts to marine reptiles from drilling discharges is limited to behavioural effects to individual foraging turtles, therefore no population impacts are expected.

Marine Mammals

The intermittent and brief exposure nature of in-water drilling discharge plumes will preclude chronic exposure of marine organisms. As a result, mortality to marine mammals from drilling discharges is not a credible event.

Marine mammals exposed to temporary elevated levels of turbidity may experience minor behavioural effects (Johnson, 2018). Increase in turbidity from drilling discharges may result in plume avoidance by marine mammals when exposed to drilling discharge plumes in the operational area (Johnson, 2018).

The operational area overlaps BIAs for the pygmy blue whale and southern right whale. The operational area is also within a region of the Bass Strait which is strongly influenced by the seasonal Bonney Upwelling system and is a known seasonal feeding aggregation area for pygmy blue whales. Pygmy blue whale aggregations may overlap the operational area and surrounds to feed from November and May (DoE, 2015a).

The Bonney Upwelling is a seasonal system that causes high natural variability of water column turbidity on the Victorian coastline. Marine mammals that regularly feed along the Victorian coastline are adapted to high natural variability of in-water turbidity. Given marine mammals in the region are adapted to temporary increases in turbidity, plumes generated by drilling discharges are not expected to have a discernible effect on foraging behaviours or movement patterns of individuals, nor therefore at a population level.

Summary

The predicted level of impact, i.e., the consequence, to marine fauna as a result of drilling discharges is evaluated to have a consequence of **Level 1** based on:

- Temporary and localised impacts to rocky reef / hard substrate and associated assemblages which is identified as a Key Ecological Feature, characteristic and widespread within the South East Marine Region. The feature has identified values: *'…provide attachment sites for macroalgae and sessile invertebrates, increasing the structural diversity of shelf ecosystems. The reefs provide habitat and shelter for fish and are important for aggregations of biodiversity and enhanced productivity'*. The seabed characteristics are not expected to be modified to the extent that the identified values would be impacted beyond the very near vicinity of the wells sites, and temporarily. Drilling discharges and installed infrastructure have structural diversity and, as observed during inspections of existing facilities, colonisation of installed materials by invertebrates has occurred, often in a similar pattern to natural (exposed and sand covered) reef (Figure 6-16).
- The high energy oceanographic processes typical of the Otway Basin will result in rapid dilution and dispersion of operational discharges; exposure times to elevated turbidity within the water column will be short.
- The operational area is subject to high natural variation in turbidity levels, therefore, marine fauna present within the operational area will be adapted to brief and high levels of turbidity.
- Due to the intermittent and brief presence of drilling discharges plume in the operational area; discharges within the water column would be expected to disperse to below no-observed-effect-concentrations (NOEC) before marine fauna could be exposed for long enough to experience toxicity impacts.
- Potential impacts to the diversity and productivity of seabed assemblages will be localised and recoverable.

**Inherent Likelihood**

The operational area is known habitat for marine invertebrates, fish and foraging marine mammals. Drilling discharge plumes and seabed deposition in the operational area is likely to interact with sessile marine invertebrates resulting in minor impacts to distribution, which are observed as being recoverable; therefore, it is likely the risk event will occur.

The inherent likelihood of a Level 1 consequence occurring is rated **Likely (B).**

**Inherent Risk Severity**

The predicted level of risk, i.e., inherent risk severity, to marine fauna as a result of injury/mortality is considered **Low**

### 8.6.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 8-53.

*Table 8-53: Drilling discharges acceptability assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: Change in water quality | Consequence: Level 1 |
| | Impact: Change in sediment quality | Consequence: Level 1 |
| | Impact: Change in habitat | Consequence: Level 1 |
| | Risk: Change in behaviour and injury/mortality to marine fauna | Risk: Low |
| **Principles of ESD** | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 8.6.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the impacts and risks from planned discharges – drilling are identified as:<br>• Level 1 consequence for changes in water quality, sediment quality and habitat<br>• Low risk for change in behaviour and injury/mortality to marine fauna.<br>The above predicted levels of impact and risk due to planned discharges – drilling from the East Coast Project is equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology and Cooper Energy Offshore Chemical Assessment Procedure.<br>• The highest consequence ranking for drilling discharges was Level 1 and the highest inherent risk was evaluated as Moderate; therefore, drilling discharges from the East Coast Project will not result in serious or irreversible environmental damage.<br>• The potential impacts and risks from drilling discharges are well-understood, and management measures are well established and regulated in Australian waters.<br>• Uncertainty surrounding the benthic habitats and communities present within the direct disturbance spatial extent, will be managed by EPO12. Seabed surveys will be conducted prior to laying infrastructure on the seabed; the survey will collect data that will be used to identify the condition of existing sediment, the presence of | |

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| | cultural heritage and sensitive seabed features, to inform the field layout and enable the implementation of EPO7 and EPO19. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest consequence ranking for drilling discharges was Level 1 and the highest inherent risk was evaluated as Low and therefore will not forego the health, diversity and productivity of the environment for future generations through minimising disturbance to these environmental values.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.6.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to drilling discharges were evaluated in Section 8.6.4 and the highest consequence ranking for drilling discharges was Level 1 and the highest inherent risk was evaluated as Low.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.6.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained through not disrupting the protection of fauna and habitat as per the objectives of species recovery plans and conservation advice. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | Recovery Plan for Marine Turtles in Australia, 2017 – 2027 | <u>Recovery objective:</u><br>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.<br><u>Interim objective 3:</u><br>Anthropogenic threats are demonstrably minimised.<br>No relevant management actions. | Adoption of the following control measures:<br>CM2: Offshore Operational Procedures<br>Drilling Discharges Management processes minimise as far as practicable, the overall volumes of WBDF discharged to the marine environment. It does this by defining the:<br>• volumes of fluids required for safe execution of the activity, including contingency for well control.<br>• fluids storage arrangements and transfer capacities on the MODU and support vessels, and how storage capacity will be actively managed to facilitate re-use of WBDF.<br>• properties of the fluid required to be maintained throughout the different stages of well construction.<br>• fluid acceptability criteria for re-use.<br>• the solids control equipment to enable re-use of fluids.<br>These aspects of drilling fluids management are a direct result of the |
| | *Industrial Chemicals (Notification and Assessment Act) 1989* | Project Chemicals will be considered under the requirements of this Act prior to use as relevant. | |
| | Minamata Convention on Mercury | Cooper Energy will consider best available techniques and environmental practices to control releases of components containing | |

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| | | mercury in future activity specific EPs. | well design and technical requirements that are defined in the WOMP.<br>Drilling and cementing procedures will define how each step of the well construction process is to be completed in accordance with relevant standards (as defined in the WOMP) before the offshore activities take place.<br>SBDF may be used where technical requirements preclude the use of WBDF (contingent), only once the riser between the well and MODU is installed. This ensures SBDF is circulated in a closed loop and no bulk SBDF fluids are discharged overboard. Drill cuttings recovered with the SBDF will be processed on the MODU to recover and reduce residual SBDF content prior to overboard discharge. There will be no bulk discharge of SBDF.<br>CM6: Cooper Energy Offshore Chemical Assessment Procedure<br>Project chemicals will meet the requirements of the Cooper Energy Offshore Chemical Assessment Procedure. This process is used to ensure the lowest toxicity, most biodegradable and least bioaccumulative chemicals are selected which meet the technical requirements, where their function necessitates discharge to sea. The process consults public chemical assessment repositories such as PLONOR list, OCNS Definitive Ranked List, OSPAR and OCNS listings for those chemicals to be discharged. Eco-toxicity is evaluated with any required control measures defined. Chemicals that are highly toxic, have high bioaccumulation potential, and have high persistence in organisms are screened out during the assessment process. Only chemicals that meet low ecotoxicity pre-screening criteria or are further justified as ALARP can be approved for discharge. An accepted chemical list is issued to the offshore project team detailing which products may be discharged and in what circumstances.<br>CM7: Offshore Equipment<br>Additional equipment, such as solids equipment, will be available on the MODU. Equipment will assist with recovering and reducing the discharge of excess fluids and reduce the volume of SBDF on cuttings.<br>CM20: Campaign Risk Review<br>The Cooper Energy Environmental Protocol describes how environmental |

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| | | | impact and risk management, including risk assessments, is undertaken for activities including offshore campaigns.<br>As part of pre-campaign planning a risk review (refer Figure 12-5) will be undertaken to re-assess campaign environmental impacts and risks to ensure acceptability criteria are met and that impacts and risks are reduced to ALARP.<br>The risk review will consider aspects relevant to the campaign; where there is a risk that campaign discharges to sea may contain mercury, the risk review will consider the current best available techniques and environmental practices in order to control releases of mercury.<br>CM24: Seabed Survey<br>Seabed surveys (geophysical, geotechnical, visual and contaminant sampling) will be undertaken for the purposes of collecting information to manage risks to the Shelf rocky reefs and hard substrates KEF values (high relief outcrops, reefs and sponge beds), sediment quality, underwater heritage, debris and hazards on the seafloor. These surveys will be undertaken prior to finalising MODU position, location of mooring equipment and finalising wells and subsea infrastructure locations.<br>Details of relevant survey seabed findings (benthic environment, heritage, hazards) will be included in future EPs. In the event unpredicted contaminants are detected Cooper Energy will undertake a human health and environmental risk assessment to ensure ALs and EPOs are met.<br>CM25: Inventory Management<br>Aligned to Minimata Convention, quality control limits for barite will be applied:<br>• Mercury (Hg) – 1 mg/kg (1 ppm) dry weight in stock barite.<br>• Cadmium (Cd) – 3 mg/kg (3 ppm) dry weight in stock barite.<br>At the end of the Project unused bulks will be managed in accordance with Figure 12-7. Upon completion of the activity, excess dry bulks will be managed with one of the following:<br>• retained onboard for future activity where acceptable by the subsequent operator<br>• use up cement via increasing the volume used in the well, if design allows |

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| | | | • returned to shore where feasible, where considered ALARP after risk assessment during the execution phase, and where permitted by the MODU and vessel operator safe systems of work. Spare chemical additives will be retained on board where acceptable by the subsequent operator or returned to shore. |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11)<br>• Operations Management (MS07)<br>• External Affairs & Stakeholder Management (MS05).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | No feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures for drilling discharges. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant planned drilling discharges is AL2, AL4, AL6 and AL7, identified in Table 8-52. These acceptable levels defined for a change in water quality, sediment quality, habitat and injury / mortality to marine fauna are defined in Table 7-6.<br>The worst-case predicted impacts assessed in Section 8.6.4 are:<br>• Drilling discharges are intermittent, brief and result in localised changes to sediment and water quality and benthic habitat assemblages (deposition of drilling discharges resulting in changes to benthic assemblages within ~200 m from the discharge location).<br>• Temporary and localised impacts to rocky reef / hard substrate and associated assemblages which is identified as the shelf rocky reef KEF are characteristic and widespread within the South East Marine Region.<br>• The drilling discharge plumes will be heavily influenced by the prevailing currents which will disperse and dilute the plume in receiving waters. Water quality will return to existing ambient levels following completion of the activity with no remedial or recovery work required.<br>• The greatest consequence ranking for drilling discharges was Level 1, and highest level of risk is Moderate.<br>Therefore, at its worst-case, the predicted impact from planned drilling discharges would not:<br>• Lead to a substantial change in water quality which may adversely impact biodiversity and ecological integrity.<br>• Lead to changes to seabed quality that adversely affect biodiversity, and ecological integrity.<br>• Modify an important or substantial area of habitat which may adversely impact on biodiversity and ecological integrity.<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species.<br>• Lead to loss of habitat critical to the survival of species.<br>Therefore, the predicted level of impact resulting from planned drilling discharges from the East Coast Project is at or below the defined acceptable levels. | | |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to drilling discharges are acceptable, based on: | | |

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| | • Predicted levels of impact (evaluated in Section 8.6.4) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors.<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes.<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD.<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES.<br>• No feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.<br>To manage impacts to receptors to or below the defined acceptable levels the following EPO have been applied:<br>**EPO2:** Undertake drilling discharges management processes to reduce as far as practicable the overall volumes of WBDF discharged to the marine environment.<br>**EPO3:** Contingent use of SBDF only where technically required<br>**EPO4:** Only approved chemicals (which meet low ecotoxicity pre-screening criteria or are further justified as ALARP) will be discharged to sea.<br>**EPO5:** Use solids control equipment, when drilling with riser installed, to recover and limit discharge of excess drilling fluids (and SBDF on cuttings) to the environment<br>**EPO6:** Manage discharge of residual bulks materials to the marine environment in accordance with Cooper Energy's residual bulks management process.<br>No bulk discharge of SBDF..<br>**EPO7:** Planned vessel/ MODU discharges will meet AMSA Discharge Standards for operating in Australian waters.<br>**EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the Underwater Cultural Heritage Act 2018.<br>**EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts, including potential changes to seabed quality. |

### 8.6.6 Environmental Performance

Table 8-54 lists the acceptable level and EPOs defined for drilling discharges and the adopted control measures to achieve the outcome.

*Table 8-54: Environmental performance summary – Drilling discharges*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL2:** Water quality beyond 1000 m of the discharge location is within the range for water typical of the wider Otway offshore marine environment, with any difference from regional baseline being temporary[11]. Planned project discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure. | **EPO2:** Undertake drilling discharges management processes to reduce as far as practicable the overall volumes of WBDF discharged to the marine environment.<br>**EPO3:** Contingent use of SBDF only where technically required.<br>**EPO4:** Only approved chemicals (which meet low ecotoxicity pre-screening criteria or are further justified as ALARP) will be discharged to sea.<br>**EPO5:** Use solids control equipment, when drilling with riser installed, to recover and limit | CM2: Offshore Operational Procedures<br>CM6: Cooper Energy Offshore Chemical Assessment Procedure<br>CM7: Offshore Equipment<br>CM20: Campaign Risk Review<br>CM24: Seabed Survey<br>CM25: Inventory Management |

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL4:** Sediment quality beyond 1000 m of the discharge location is within the range for sediments typical of the wider Otway offshore marine environment.<br>Planned project discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure | discharge of excess drilling fluids (and SBDF on cuttings) to the environment.<br>**EPO6:** Manage discharge of residual bulks materials to the marine environment in accordance with Cooper Energy's residual bulks management process.<br>No bulk discharge of SBDF.<br>**EPO7:** Planned vessel/ MODU discharges will meet AMSA Discharge Standards for operating in Australian waters. | |
| **AL6:** No unrecoverable impacts to seabed including shelf rocky reef and hard substrate KEF values[13]. | **EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the Underwater Cultural Heritage Act 2018.<br>**EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts, including potential changes to seabed quality. | |
| **AL7:** Seabed disturbance will not occur outside the Operational Area | **EPO12:** Seabed disturbance limited to the planned disturbance areas defined in this OPP and limited to within the Operational Area. | |

## 8.7 Planned Discharges – Operational

### 8.7.1 Cause of Aspect

Operational activities during installation and commissioning, operations, decommissioning and support operations phases of the East Coast Project will result in discharges to sea.

Discharges may be routine or non-routine. Routine discharges include those from contracted vessels when they work offshore on project activities. Vessel discharges can include cooling water and RO brine, deck drainage and bilge, food waste, greywater, and sewage. All of these types of discharges are regulated under existing marine pollution prevention laws. Non-routine discharges may include inhibited seawater, MEG, nitrogen gas, pigging fluids, grout, and chemicals used to assist clean-up or removal of calcareous deposits, typically sulfamic acid (or equivalent such as citric acid). These types of discharge are expected to occur infrequently during each phase of the East Coast Project; they are regulated through the OPGGS Act, Environment Regulations and associated EP process. Collectively, all discharges are herein termed operational discharges and are assessed below.

Phases and associated activities that will generate operational discharges are identified in Table 8-55 and described in further detail in the subsections below.

*Table 8-55: Activities undertaken during the East Coast Project that may result in operational discharges*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Support Activities** | Vessel operations |
| | MODU operations |

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Installation and Commissioning** | Pre-lay works |
| | Installation of subsea structures |
| | Testing, preservation and start-up |
| **Operations** | Maintenance and repair |
| **Decommissioning** | Flowline and umbilical decommissioning |
| | Removal of remaining subsea infrastructure |

### 8.7.2 Aspect Characterisation

#### *8.7.2.1 Installation and Commissioning*

During installation and commissioning activities, operational discharges may result from pre-lay works, installation and commissioning and testing, preservation and start-up. These discharges will occur intermittently during some of the activities, generally released in batches, typically lasting <24 hours.

Pre-lay works may include installation of grout bags by pumping material (cement and water) through a hose from the vessel to fill them underwater (Section 4.3.3.1). Some displacement (~3 $m^3$ per bag) of grout may occur during filling of the bags and when the hose is flushed with seawater at the completion of operations, dispersing residual grout to sea.

During the installation and commissioning phase, internal cavities within subsea structures will be flooded for pre-commissioning tests to ensure they function correctly. Inhibited seawater, nitrogen gas and MEG may be discharged to the marine environment. Collectively, these discharges are termed non-routine commissioning discharges.

Table 8-56 details non-routine commissioning discharges to the marine environment. A contingency volume of 50% has been included in the volumes of inhibited seawater and MEG within Table 8-56.

*Table 8-56: Volumes and location of non-routine commissioning discharges*

| Discharge Type | Description of Discharge | Total Volumes |
|---|---|---|
| **Inhibited seawater** | Inhibited seawater is utilised in multiple pre-commissioning activities such as flooding, cleaning, hydrotesting and dewatering. It is a mixture of seawater and chemical additives (corrosion inhibitor, oxygen scavenger, biocide and dye) and is discharged subsea. | 3,232 $m^3$ |
| **MEG*** | MEG is used to prevent hydrate formation in pipelines and flowlines. It is typically mixed with water and will be discharged subsea. | 3,232 $m^3$ |
| **Grout** | Grout bags may be utilised for free spans or stabilization. The grout bags used for stability, will be filled with a dry mixture of cement and sand which mixes with seawater on contact. The bags used for free spans may be filled subsea by pumping cement slurry (cement sand and water mix)/ grout through a hose from the vessel, and residual grout may be dispersed into the marine environment. | 3 $m^3$ per bag |
| **Nitrogen gas** | Nitrogen gas is an inert gas that will be used to dewater the flowlines ensuring that the system is safe to receive hydrocarbons. It will be used pushed to the onshore Athena Gas Plant for discharge which is outside the scope of the East Coast Project. Nitrogen gas is used as there is no risk of ignition and it is non-corrosive. | N/A |

**10-100% discharged to sea close to seabed*

### 8.7.2.2 Operations

During the operations phase, hydrocarbon extraction and transport is controlled by an electro-hydraulic subsea control system, of which the hydraulic component (also referred to as cores) of the umbilical is open loop, meaning hydraulic fluids are released to sea as part of normal operations. Other cores within the umbilical are used to transport chemicals, such as MEG and corrosion inhibitor to the wells as part of subsea flow and integrity maintenance. These chemical cores are closed loop; the chemicals are injected at the XT into the produced fluids which are transported to shore via the subsea pipeline network. During maintenance and repair activities, replacement, intervention and re-termination of umbilicals may be required. In this event hydraulic fluids and chemicals, such as injected corrosion inhibitor, may be released to sea. In order to access equipment for inspection, maintenance and repair, marine growth which accumulates on the subsea system over time may require removal from some pieces of equipment. Discharges associated with this process include chemicals, such as sulfamic acid or equivalent, used to clean-up or remove limescale. Collectively, these discharges are termed non-routine operational discharges. These discharges will occur intermittently throughout the activities, generally released in batches, typically lasting <24 hours

Table 8-57 details non-routine operational discharges to the marine environment. Pigging fluid volumes include a contingency of 50% based on the conservative flowline route length.

*Table 8-57: Volumes and locations of non-routine operational discharges*

| Discharge Type | Description of Discharge | Estimated Volumes |
|---|---|---|
| **Hydraulic fluids** | IMR activities and use of an electro-hydraulic subsea control system during hydrocarbon extraction and transport may result in discharge of hydraulic fluids.<br>Hydraulic fluids used in the open loop umbilical cores are generally a mix of water/glycol; they are designed to have lower potential for environmental impact compared to typical domestic hydraulic fluids used in closed loop system, transport etc., and are readily dispersible when displaced to sea during normal operation. | ~3 $m^3$<br>per year |
| **Pigging fluids** | Pigging fluids may be used in IMR activities and may include a mixture of MEG/gel, water treated with corrosion inhibitor, oxygen scavenger, biocide and dye, and will be discharged subsea. Pipeline inspection campaigns may occur ~1-3 times over the life of the project depending on Integrity maintenance planning and reviews. | Nominal 3,232 $m^3$ per inspection campaign |
| **Sulfamic acid (or equivalent)** | Sulfamic acid (or an equivalent such as citric acid) and water are typical chemicals used to remove marine growth or limescale. The fluid is applied subsea and disperses into the water column over a short time. | 3 $m^3$ per IMR campaign<br>(500 L batch applications) |

### 8.7.2.3 Decommissioning

During the decommissioning phase, best endeavours are made to clean and flush the flowline systems and subsea infrastructure. Where practicable, fluids used to flush the flowline system may be directed into the subsea wells, however, there is potential for 10-100% to be released into the marine environment post disconnection. Discharges associated with flushing and cleaning are similar to the installation and commissioning phase and include inhibited seawater, MEG and may include nitrogen gas (Table 8-56). These discharges will occur intermittently throughout the decommissioning activities, generally released in batches, typically lasting <24 hours. Any scale contaminants that may have accumulated within the flowline systems may also be flushed. Prior to the removal of subsea equipment marine growth may require removal; this may be via a combination of mechanical removal and use of cleaning fluids (sulfamic acid or equivalent such as citric acid).

#### 8.7.2.4 Support Operations

The East Coast Project would require support from vessels and a MODU for particular phases. The MODU will occur in the operational area during the drilling and decommissioning phases and may be required in the operations phase if well intervention is required.

Vessels will be present in the operational area temporarily during all phases within the scope of the East Coast Project. Vessel and MODUs will have intermittent routine discharges to sea (Section 8.7.1).

Table 8-58 details routine operational discharges to the marine environment based on a drilling activity utilising a MODU and three support vessels, with total POB of 320 within the operational area at once.

*Table 8-58: Volumes and location of total routine operational discharges*

| Discharge Type | Description of Discharge | ~Quantity |
|---|---|---|
| **Sewage and greywater** | Sewage and greywater are generated as a result of MODU and vessel cleaning activities, laundry, and kitchen operations and will be dependent on the number of people on board. | 144 $m^3$ per day (0.45 $m^3$ pp/day) |
| **Food waste** | Food waste is generated from galley facilities during MODU and vessel operations and are discharged to the sea surface under certain regulatory criteria. Where those criteria cannot be met, food waste is returned to shore. | 640 kg/day (2 kg pp/ day) |
| **Cooling water** | Cooling water is seawater that is utilised as a heat exchange medium for the cooling of machinery engines. Cooling water is dosed with chlorine following intake. Then and passed through heat exchangers and discharged. The discharges of seawater may have an elevated temperature (~2 to 5°C above ambient) and low residual chlorine concentrations. | ~8,400 $m^3$/day |
| **RO brine** | RO brine is the by-product of potable water production (i.e., removal of salt molecules and ions from seawater) through reverse osmosis. The brine solutions have an elevated salinity (~20-50% above ambient) and will be discharged to the sea surface. | 170 $m^3$/day |
| **Deck drainage and bilge water** | Deck drainage and bilge water is the result of water and fluids from rainfall, ocean spray, and washdown water that occurs on the deck of the vessel. Bilge water discharges are regulated and must meet strict conditions prior to discharge. Bilge water may be comprised of fresh water, sea water, oil, sediment, and other fluids such as hydraulic oil from equipment and storage spaces. Bilge water and is required to be treated through an oil-in-water separator prior to being discharged to the sea surface. If treatment criteria cannot be met, then it is sent ashore for treatment and disposal. | ~1.5 $m^3$/day |

#### 8.7.2.5 Concurrent activities

As described in Section 4.1.2, concurrent activities could occur. Cooper Energy assessed reasonably foreseeable concurrent activity scenarios and identified that the potential concurrent activities of drilling operations at Elanora-1 and flowline installation between Annie-2 and Casino-5 represents the activity scenario with the greatest number of vessels within the operational area, operating concurrently. This could involve 3 vessels and a MODU operating at once (further details in Section 8.2.2.5). These kinds of concurrent activities could occur over periods of ~50 days depending on the exact scope of works to be completed and availability of vessels and equipment.

### 8.7.3 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impacts from routine and non-routine operational discharges are:

- Change in water quality.
- Change in sediment quality.

Potential risks:

- Injury/mortality to marine fauna.

The discharge plume for the other operational discharges is expected to be restricted to the water column, with little or no interaction with the seabed and seabed habitats. The exception to this is discharges of grout.

Socio-economic impacts on commercial fisheries have not been evaluated further, as there are no discernible impacts to behaviour or distribution expected at the population level given the limited nature and scale of activities.

### 8.7.4 Impact and Risk Evaluation

#### *8.7.4.1 Impact: Change in Water Quality*

**Inherent Consequence Evaluation**

Operational discharges into the marine environment will result in localised and temporary changes in water quality during installation and commissioning, operations, decommissioning and support phases. Operational discharges include mixtures of fluids with the potential to introduce concentrations of particulates, nutrients, biocides, and oils to offshore waters. These contaminants have the potential to impact waters surrounding the discharge point by:

- Particulates discharged in fluid mixtures including excess cement (grout bags), sewage and greywater and food waste will temporarily elevate turbidity levels.
- Nutrients in fluid mixtures including sewage, greywater and food waste may locally increase nutrient levels, with potential for subsequent localised oxygen depletion as bacteria and plankton metabolise increased levels of food.
- Elevated water temperatures from cooling water discharges.
- Increased salinity concentrations from RO brine discharges.
- Increased chemical toxicity by introducing chemical additives within the marine environment from the discharge of chemicals such as sulfamic acid (or equivalent), and those found in inhibited seawater, pigging fluids, contaminated scale, bilge water, MEG and cooling water.
- Residual machinery oils in deck drainage and bilge water.

It is well recognised and established through common marine and industry practice (e.g. MARPOL, OSPAR) that discrete planned operational discharges, with appropriate treatments in place, have limited impact within the open ocean; discharges disperse quickly over a small area, such that there are expected to be no discernible changes at a regional or systems scale. Any potential impacts for these operational discharges have been further described below:

<u>Grout</u>
In the event that the grout bags are filled subsea from a hose on the vessel, excess grout may be released into the marine environment when the hose is flushed with seawater at the completion of operations. Excess grout released would result in increased local turbidity as the plume dilutes and disperses through the water column. The grout composition comprises cement, sand, and water, and it is classified under the OSPAR PLONOR list. The grout fluidity and setting speed may be managed through adding plasticizers and or retarders, respectively. These cement additives would be subject to the Cooper Energy Offshore Chemical Assessment Procedure. Filling grout bags is a contingency activity. If grout is discharged in the process of installing grout bags, it will be in a slurry for minor volumes (~0.3 $m^3$ for every bag). Given the high energy environment of the receiving the cement particles found in the grout mixture will disperse under the action of waves and currents and will rapidly settle out in the water column. Due to the low volumes and rapid dispersion characteristics of the offshore Otway environment, any impacts to receptors from changes in water quality are expected to be limited due to the localised and temporary nature of the changes to water quality.

<u>MEG</u>

MEG is classified internationally as posing little or no risk to the (marine) environment (PLONOR); it is effectively non-toxic in the marine environment, is readily biodegradable and has a low/no potential for bioaccumulation. MEG is readily dispersible in water and would only have a short-term, localised on water quality.

Inhibited Water

Inhibited water is seawater with chemical additives including corrosion inhibitor, scale inhibitor, oxygen scavenger, biocide and dye. Of these different chemical additives, biocide is typically of higher toxicity than the others. As such, the biocide has been selected for the impact assessment below. Table 8-59 provides the function, type, and toxicity of the biocides that may be used during the project.

*Table 8-59: Nominal Water Treatment Chemical*

| Required Chemical Function | Proxy Chemical | Toxicity (EC50 or LC50) | Initial Toxicity rating under OCNS |
|---|---|---|---|
| **Corrosion Inhibition inside of pipeline** | CORR11605A | 0.4 mg/l<br>*This toxicity relates to one component that comprises ~1% of the total product.* | Higher toxicity |
| **Scale inhibition inside of pipeline** | Gyptron 3220 | 100 mg/l | Low toxicity |
| **Scavenge oxygen inside of pipeline** | Oxygen Scav E2 Stick | 150 mg/l | Low toxicity |
| **Prevent marine growth inside of pipeline** | O-3670R | 0.18 mg/l<br>*This toxicity relates to one component that comprises ~20% of the total product. The product toxicity would therefore be expected to be lower.* | Highest toxicity |
| **Dye to identify if there is a defect in the pipeline, before hydrocarbons are introduced.** | Fluorescein liquid dye | 170mg/l | Low toxicity |

*Note: These products are commonly used offshore and are considered representative for assessment purposes. Chemical treatment programs are developed and assessed in detail closer to the time of the activity and so the actual products selected are subject to change. Water treatment chemicals comprise a small fraction of the total water volume used and are therefore significantly diluted (and toxicities significantly lower) even before the point of release to sea.*

Biocides are added to inhibited seawater to protect the inside of steel tubular equipment and are toxic when applied at pre-determined concentrations. Residual biocide released into the marine environment has the potential to be toxic to sensitive species with limited mobility, if the fluids were released in high concentrations and did not readily disperse. Whilst it is the case that biocides are applied at concentrations that will inhibit marine grown within a limited volume of water in the pipeline, once released into the open ocean, the concentration of biocide, and therefore its ability to inhibit marine growth dissipates to negligible levels rapidly. In addition, the biocides routinely used in the oil and gas industry are typically consumed by microorganisms (e.g. bacteria), and do not bioaccumulate once discharged to the marine environment (Shell, 2020). Chevron (2015)

Modelling by RPS on the discharge treated water, containing Hydrosure O—3670R, a representative biocide, was commissioned by Beach for the Otway Offshore Gas Victoria Project (Beach, 2025,

Appendix L). An impact threshold concentration value of 1 ppm (equivalent to 1 mg/L) was defined as per the ecotoxicological studies conducted for ConocoPhillips Barossa OPP (ConocoPhillips, 2018) and Shell Crux OPP (Shell, 2020) as cited by RPS (Beach, 2025, Appendix L). Concentrations below this threshold were not anticipated to result in significant environmental impacts. This threshold is considered conservative for the natural environment as ecotoxicological studies are typically undertaken using constant doses for periods ranging from 24 to 96 hours under controlled conditions when establishing ecotoxicological threshold of interest (Beach, 2025, Appendix L). The results for a discharge of 6,000 $m^3$ over a period of 42.9 hours (140 $m^3$/hr), 2 m above the seafloor, predicted biocide concentrations at the defined impact threshold to be limited to the immediate surrounds of the discharge release: 20 m and 156 m, respectively, for the 99th and 100th-percentile analysis (i.e. 99% and 100% of the time). The treated seawater was also predicted to have the same water temperature and salinity as the surrounding seawater (Beach, 2025).

The results from the modelling conducted by Beach (2025, Appendix L) is considered appropriate for this project as the environmental parameters used in the modelling for the Bass Strait is typical to those found in the Otway Basin, with average current speeds ranging between 0.08 to 0.11 m/s, near-seabed temperatures between 11.5 to 12.7 °C, and salinity levels 35.3 to 35.4 psu (RPS, 2023). Therefore, biocide concentrations are predicted to dissipate upon discharge and would dilute to below impact thresholds beyond distance of 156 m from the release location. In the offshore environment, where the currents are constantly moving and mixing the released treated seawater, the impact duration directly relates to the duration of the discharge, which in the case of the ESCP scenarios, would typically be <24h. As such, any change in water quality is expected to be localised and short-term given the conservative volume used in the modelling, the high biodegradable rates of biocide, and the high energy environment of the receiving waters.

Discharges of inhibited water would dilute within the receiving seawater, then be mixed and dispersed by prevailing waves and currents to below no effect levels. Furthermore, biocides (and other chemical contaminants) in operational discharges will be selected in accordance with the Cooper Energy Offshore Chemical Procedure to ensure ecotoxicity profiles are of an acceptable level.

Hydraulic Fluids

Hydraulic fluids will be used in the subsea systems, such as the open loop umbilical cores, and are generally a mix of water/glycol. The hydraulic fluid used within the existing CHN subsea systems, such as Castrol Transaqua™ HT2; a water-based-product that is readily miscible with seawater. For compatibility reasons, the ECSP controls system, which will piggyback off the exciting CHN system, will also likely be Castrol Transaqua HT2. Due to the relatively small release volumes expected, discharges limited to less than ~3 $m^3$/year, the intermittent and short duration of the discharge, and typical high energy environment of the receiving waters, any discharge is expected to rapidly dilute and dissipate into the marine environment.

The majority of the product (HT2) is non-toxic (99%), Readily biodegradable (>95%) and non-bioaccumulative (90%). An assessment of the potential impact range of control fluid releases at the existing CHN facility indicates that these intermittent discharges of control fluid are not expected to exceed predicted no-effect concentrations beyond a meter of the discharge point before they dissipate to no-effect levels (Figure 8-10) and given the distance between the ECSP wells being tens-to-thousands of meters, there is no risk of cumulative effects. The control fluid release regimes for ECSP are expected to be similar as existing CHN wells, and are subject to the same oceanographic conditions, and are therefore considered analogous for impact assessment purposes.

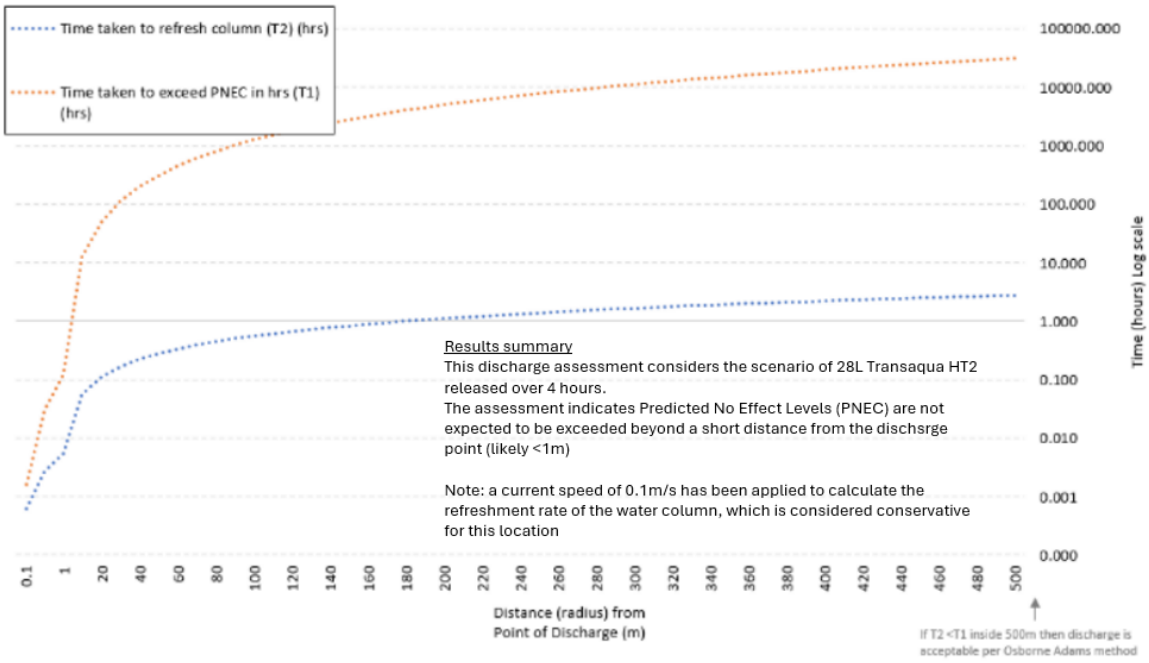



*Figure 8-10: Assessment of potential impact range of control fluid releases at the existing CHN facility*

All project chemicals are selected in accordance with the Cooper Energy Offshore Chemical Procedure to ensure ecotoxicity profiles are of an acceptable level. As such, any impact to water quality will be short-term and localised and will be restricted within proximity of the discharge source where concentrations are highest.

Sulfamic acid (or equivalent)

The volumes of the chemicals used for marine growth removal will be relatively small (3 $m^3$ per application and released in 500 L batches); these chemicals will be applied directly to the infrastructure during IMR campaigns. Discharge of these chemicals may result in a localised and temporary reduction in water quality. However, due to the small volumes released and the intermittent nature of the discharge (IMR campaigns conducted over ~2-4 weeks every few years (Section 4.3.4.3) these discharges are anticipated to rapidly disperse into the water column. Any changes to the water quality will be localised and short-term.

Contaminated scale

Studies have shown that elemental mercury may adsorb to surfaces in pipelines and bind to corrosion products (e.g. iron sulfides), and form sulfide species such as metacinnabar, forming a scale on the internal walls of pipelines (Gissi et al., 2022). The presence depends on the pipeline material, form of mercury, and presence of any internal coatings. Metal surfaces exposed to gas-phase hydrocarbons were identified as being the most likely locations for deposition of mercury scale (Kho et al., 2022). The interaction between mercury accumulation and flexible pipes or flowlines, anticipated to be used for the East Coast Project (see Section 4.2), are less well known and assumed to accumulate less deposit than rigid steel pipes (Kho et al., 2022).

The process of flushing and cleaning used to remove the scale may contribute to small quantities of mercury contaminants being released. Given the results of low mercury levels in the raw gas at the Athena Gas Plant and in the Annie-1 well (see Section 4.1.4), very low quantities of scale are expected. Furthermore, the predominant types of mercury that may be present within pipelines are typically insoluble (i.e., elemental mercury ($Hg^0$) and mercury sulfide (HgS) and will immediately disperse or mix in the surrounding sediments upon release (Kho et al., 2022). As such, changes to water quality are expected to be temporary.

Food waste and Sewage

The discharge of food waste and sewage, including any associated grey water, will result in a minor change the water quality when released into the marine environment. A reduction in water quality via eutrophication may occur as a result of increased nutrient levels (e.g. ammonia, nitrite, nitrate and orthophosphate) from these discharges. This has the potential to cause adverse changes to the ecosystem, such as increased growth of primary producers (i.e., phytoplankton) which can deplete oxygen in the water column and result in changes in biological processes. The discharge may also include some particulate matter resulting in increased turbidity of the receiving waters.

The NERA (2017) Environment Plan Reference Case for Planned Discharge of Sewage, Putrescible Waste and Grey Water determined that for fixed facilities with a POB up to 400, approximately 150 $m^3$/day of discharges were released into the offshore marine environment and was expected to remain within 500 m of the release. As the maximum POB for both the MODU and vessels is less than 400 (~140 to 200 POB for the MODU and between 20 to 140 for the vessels as per Section 4.3.6). As such, 500 m is assumed to be a suitable, and albeit, conservative spatial boundary.

Discharge of these wastes into the marine environment is a standard maritime practice. These discharges will all be made in accordance with relevant requirements including Australian legislation giving effect to MARPOL 73/78. Discharges are expected to generate a plume within the water column of the receiving waters. The change in water quality from operational discharges during the East Coast Project is expected to be intermittent and brief based on discharge quantities and dispersive characteristics of the receiving environment.

Intermittently elevated nutrient levels from sewage, food waste, and grey water discharges, will either dilute in the receiving waters, settle out of the water column, chemically break down or be consumed by microorganisms (bacteria) (NERA, 2017). Any change in water quality from these discharges will be limited to the receiving waters within a conservative 500 m from the release site. Due to the high energy environment of the receiving waters typical of the Otway Basin and the small discharge volumes expected any changes will be temporary and will not result in any lasting impacts.

Cooling Water

The discharge of used cooling water may result in elevated temperatures (~2 to 5°C above ambient) and low residual chlorine concentrations into the receiving waters. This could result in the potential for thermal impacts (from increased water temperatures) and toxicity impacts relating to the residual chemical additive concentrations (e.g., chlorine).

Cooling water containing chemical additives such as chlorine are inherently safe due to the low dosages used. The chemical additives are also typically consumed in the inhibition process, so there is often little or no residual chemical concentration remaining upon discharge into the marine environment. A previous study which investigated the effects of chlorination (from low levels of biofouling agents used in seawater cooling units) on coastal and estuarine environments found very limited impact of the chemical additives and the associated chlorination on receiving waters, both in terms of plume toxicity or any more widespread ecotoxicological influence (Taylor, 2006).

Modelling on cooling water discharges was undertaken by RPS commissioning by Woodside for its Torosa South-1 drilling program located in the Scott Reef complex on the North West Shelf (RPS, 2019; Woodside, 2019). The study assessed 720,000 $m^3$/day of cooling water released ~12 m below the water surface, at a discharge temperature of 50°C and chlorine concentrations ranging between 0.2 ppm to 0.5 ppm. Ambient seawater temperatures within the North West Shelf are higher than those expected for the Otway Basin, with mean maximum temperatures varying between 27°C in winter up to 31°C in summer (Woodside, 2019). However, the discharge temperature of 50°C used within the modelling is considerably higher than the discharge temperatures expected for this project of ~2-5°C above ambient temperature (Table 8-58). As such, this study has been considered a suitable, and albeit very conservative, modelling analogue due to the significantly larger cooling water discharge volume and temperature used by Woodside (RPS, 2019) compared to that expected for this project (Table 8-58).

The cooling water temperature was shown to decrease rapidly when mixed within the receiving waters; with water temperatures above the identified impact threshold (3°C above ambient temperatures) predicted at a maximum of 120 m from the source across all seasons (RPS, 2019; Woodside, 2019). The study highlighted that the primary factor influencing the dilution of the plume was the strength of the ambient currents (RPS, 2019; Woodside, 2019). Given the average current speeds found in the Otway Basin (0.15 to 0.24 m/s, Section 6.4.5.1) are stronger than the average current speeds used by RPS (2019) for the Torosa location within the Northwest Shelf (0.09 to 0.15 m/s), it can be expected that an even higher level of mixing with the receiving waters would occur within the Otway Basin. As such, any changes to the water quality will be localised to the discharge point and temporary.

A turbulent mixing zone is expected within the immediate vicinity of the discharge source. The plume was predicted rapidly dilute within the receiving waters within 16 m (vertically) and 42.4 m (horizontally) of the discharge point based to the near-field modelling results (RPS, 2019; Woodside, 2019). Therefore, a change in water quality due to the residual chlorine concentrations, and any associated impacts, are expected to be highly localised and short-term.

Deck Drainage and Bilge Water

Deck and surface drainage, including bilge water, from project vessels and the topsides will mainly comprise of wash down water, sea water spray and rainwater. However, these discharges may contain small quantities of oil, grease, metals, detergents (surfactants) and other residual chemicals present on the deck, which have the potential to cause a reduction in water quality when released into the marine environment. The discharge will be intermittent and occurs at or near the surface of the water.

The bilge system of a vessel is designed to properly collect, hold, and discharge of oily water to reduce or avoid dumping hydrocarbons into the maritime environment. Before being released to sea, bilge water is treated using an oil-water separator. As per MARPOL requirements, any discharge of oily water from vessels will be treated to $\leq$15 ppm and platform discharges from open drain systems will be reduced to $\leq$30 ppm. These oily bilge discharges are predicted to dilute and disperse in surface waters due to the action of waves and currents characteristic of the receiving environment, and any volatile elements in the light, non-persistent oil will rapidly dissipate into the air or dissolve into the water column.

Summary

Change to water quality from contaminants in operational discharges is expected to be short-term and localised to waters surrounding the discharge point based on the following:

- All project chemicals are selected in accordance with the Cooper Energy Offshore Chemical Procedure to ensure ecotoxicity profiles are of an acceptable level.
- The major constituents of the fluids that may be released during operational activities are generally soluble, readily biodegradable and/or dispersible.
- Subsea discharges will for brief periods appear as a plume within the receiving waters. These discharges will rapidly dissipate, disperse and mix into the receiving environment due to the nature of the releases, together with the prevailing waves and currents present characteristics of the area, with any minor toxic constituents (e.g., biocide) being diluted to predict no effect levels near the discharge point.
- Elevated nutrient levels from sewage, food waste, and grey water waste will be intermittent, short-term and localised, with discharges expected to dilute, break-down or be consumed once released into the marine environment.
- Elevated water temperature from cooling water discharges are predicted to be less than 3°C above ambient temperatures within 120 m of the discharge point, and rapidly decrease once mixed within the receiving waters (RPS, 2019).
- Water quality within the operational area is expected to be representative of the expected quality found in the Otway Basin; an area which has provided for marine industries including fishing, shipping, tourism and energy for decades.

- Given the high energy marine environment of the Otway Basin, discharges during operations will dissipate rapidly; any change in water quality will be localised and temporary.

**Inherent Consequence Level**

Changes to water quality are likely to be localised and temporary based upon the relatively small volumes associated with operational discharges. There are no continuous discharges over the life of the project. The consequence of this impact has been evaluated as **Level 1**, as water quality levels will return to existing ambient levels shortly after the discharge occurs with no remedial or recovery work required.

#### *8.7.4.2 Impact: Change in Sediment Quality*

**Inherent Consequence Evaluation**

Operational discharges to the environment are expected to enter the water column, and due to the high energy environment of the receiving waters, discharges are expected to rapidly mix and disperse. As assessed in Section 8.7.4.1 the discharge plume for most of these operational discharge types are expected to remain within the water column, without reaching the seafloor, and subsequently not result in change to sediment quality. Those with potential to result in a change to sediment quality have been assessed below.

Grout

Residual grout from filling of the grout bags underwater may be released into the marine environment, where it is expected to mix with the receiving waters, and potentially settle out on the seafloor. Changes in sediment quality may include the introduction and accumulation of any contaminants in the grout (i.e., chemical additives within cement) and may result in a change in physical characteristics of seafloor sediments from subsea discharges of cement. The maximum extent of the cement overspill is expected to be within 10-50 m.

Discharges of the nature described for this project have been undertaken historically in the region, and have been shown to result in little to no impact on water or sediment quality and associated amenity (Section 6.4.6 and Section 6.4.7). Residual grout overspill would not be expected to significantly alter the overall character of the seabed, or its ecological amenity. Any impacts to epifauna would be localised and recoverable, with no threat to EPBC Act listed threatened benthic fauna. Given that discharges will be intermittent, brief, any changes to sediment quality would be highly localised and short-term.

Contaminated scale

Traces of scale found within the flowlines may be flushed out during the flushing and cleaning process. As discussed in Section 8.7.4.1, the scale has the potential to contain small qualities of contaminants, such as mercury, which may be released into the marine environment and have the potential to settle on the seafloor. Changes in sediment quality include the introduction and accumulation of mercury. Mercury is one of the most toxic metals in the environment and has been reported to have a range of effects on marine organisms. However, due to the low bioavailability of mercury; the toxicity effects are not immediate (Schanning et al., 2002). It is the adsorption and desorption processes of mercury by benthic sediments which are critical to the distribution of mercury and its transport, transformation, uptake, and ultimately its toxicity (Gissi et al., 2022).

A study was conducted by BHP on the mercury levels within the Minerva export pipeline, located immediately downstream of the Minerva-3 and Minerva-4 wells, within the Otway Basin (Woodside, 2024). The study analysed mercury concentrations using pXRF (portable X-ray Fluorescence),and found that majority of the sections tested had surface mercury concentrations below the pXRF limit of detection. Three representative coupons selected from along the length of the pipeline were analysed for total mercury in steel using acid digestion. Total mercury concentrations in these three coupons were low; between 0.004 mg/kg and 0.014 mg/kg, with very little soluble organic mercury present. Metal surfaces, such as those surveyed by the study, have been identified as being the

most likely locations for deposition of mercury scale (Kho et al., 2022). Therefore, the study is considered conservative for the East Coast Project's flexible flowlines.

Given the results of low mercury levels in the raw gas at the Athena Gas Plant and in the Annie-1 well (see Section 4.1.3), the low solubility and the very low quantities of scale expected; discharges of contaminated scale is anticipated to have low impacts to sediment quality.

**Inherent Consequence Level**

Changes to sediment quality are likely to be localised and temporary based upon the relatively small volumes associated with operational discharges. There are no continuous discharges over the life of the project. The consequence of this impact has been evaluated as **Level 1**, as sediment quality levels will return to existing ambient levels shortly after the discharge occurs with no remedial or recovery work required.

#### *8.7.4.3 Risk: Injury / Mortality to Marine Fauna*

**Inherent Consequence Evaluation**

Marine fauna at risk of injury / mortality from operational discharges include species that may pass through in-water discharge plumes:

- Plankton
- Fish
- Marine reptiles
- Marine mammals.

Plankton

Plankton, including fish eggs and larvae, are more susceptible to injury and mortality when exposed to in-water elevated turbidity levels, and toxic exposure from chemicals discharged during operations. This is due to the fact that they are less mobile and often lack the ability to move and avoid potential operational discharge plumes. Acute impacts may occur and would be limited to small numbers of juvenile fish, larvae, and planktonic organisms. The greater Bass Strait, including the Otway Basin, is known for a complex, high energy wave climate and strong ocean currents. High energy oceanographic processes in the operational area will result in rapid dispersion of the operational discharge plume. Therefore, the rapid dispersion expected of the plume prevents long-term exposure required for the onset of injury to occur to plankton, such as fish eggs and larvae.

Mortality rates for plankton are naturally high, with highly variable distribution linked to seasonal variances already identified to occur within the south-east region (Section 6.5.3). Plankton 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). Therefore, impacts from operational discharges are not expected to have discernible impacts at the population level.

Fish

As mentioned above, residual biocide found in inhibited water has the potential to be acutely toxic to sensitive species associated with benthic habitats, such as certain fish species(Chevron, 2015). However, high concentrations of biocide are required for toxicity effects to occur with larger species such as adult fish. The Safety Data Sheet for Hydrosure O-3670R states the 96-hour LC50 for fish in marine waters as 3.09 mg/L (3.09 ppm) and a 48-hour EC5028 of 5.66 mg/L (5.66 ppm) for aquatic invertebrates (Champion Technologies, 2013). Therefore, for fish to receive a lethal concentration of biocide, individuals will need to remain within proximity to the discharge location for 96 hours for a 50% chance of mortality. Biocides typically used in the industry are often soluble, highly reactive, and degrade rapidly (Black et al., 1994). These chemicals can be 'consumed' by microorganisms in the inhibition process and do not bioaccumulate, ensuring there is little or no residual chemical concentration remaining upon discharge (Shell, 2020). Given the short period of discharge, the release is expected to rapidly disperse into the marine environment when released. Dye, scale

inhibitor and corrosion inhibitor are expected to be less toxic than the biocide (see comparison above for typical products). Furthermore, biocides and other chemical contaminants in operational discharges will be selected in accordance with the Cooper Energy Offshore Chemical Procedure to ensure ecotoxicity profiles are of an acceptable level.

The potential release of elemental mercury contaminated scale may also impact marine organisms (Gissi et al., 2022). Both organic and inorganic forms of mercury have been reported to have a range of effects on marine organisms including reduced growth/development and reproduction, behavioural changes and lethality in acute exposures (Gissi et al., 2022). Limited chronic mercury toxicity data exists for marine species. In marine environments, the processes driving the bioaccumulation of mercury are less well understood. In general, mercury will biomagnify through the food web from the ingestion of methylmercury-containing food rather than the direct uptake of methylmercury from the water (Gissi et al., 2022). The Australian and New Zealand marine water quality guidelines report lethal effects to fish following exposures at 800 µg $Hg^{2+}$/L for >30 days (ANZG 2018).

Early life stages of fish (embryo and larvae) and other plankton are the most susceptible to toxic exposure from operational discharges as they have limited mobility, thus are more likely to be exposed to toxic effects compared to juvenile and adult fish. However, once the activity ceases, they are expected to rapidly recover as they are known to have high levels of natural mortality and a rapid replacement rate (UNEP, 1985). Therefore, significant impacts on population level of these organisms that would affect ecological diversity or productivity is not expected.

Pelagic species could be exposed to very low levels of chemicals for a very short time as they swim near the release of a chemical or treated water. Due to the intermittent and brief exposure nature of the discharges, the in-water operational discharge plumes are expected to preclude chronic exposure of marine organisms. To be impacted, fish species would need to pass directly through any discharge plume almost immediately upon release and remain within the plume for hours or days (see Section 8.7.4.1). Given discharges are intermittent and short-term, and that fish are typically mobile, injury/mortality from exposure to an operational discharge to adult or juvenile pelagic fish is not a credible event. Highly mobile adult and juvenile pelagic fish that swim through operational discharge plumes will be exposed to temporary elevated levels of turbidity. Mobile fish passing through the plume may experience behavioural or sub-lethal effects (Johnson, 2018). Observations from numerous studies have identified that adult fish can tolerate relatively high levels of turbidity and TSS for short periods (Johnson, 2018).

Fish species may become attracted to food waste discharged from the MODU and vessels. However, discharges will be intermittent over short durations and are not predicted to result in long term habituation. The intermittent discharge of food waste to the marine environment will result in a temporary localised increase in nutrients in the water column affecting ecological receptors within the operational area.

Thirty fish species are listed as having the potential to occur within the operational area in the EPBC Act PMST (26 of which are pipefish, pipehorses, seadragons and seahorses). There are 5 threatened species within this list that may be present in the operational area including blue warehou, southern bluefin tuna, Australian grayling, white shark and eastern school shark. Migratory species include species that may be present within the operational area include white shark, shortfin mako and mackerel porbeagle. Although a variety of fish species maybe be present in the area, impacts are not predicted as fish species would not be exposed to discharges for long enough periods to be effected.

Marine Reptiles

The intermittent and brief nature of in-water operational discharges will preclude chronic exposure of marine organisms. To be impacted, marine reptiles would need to pass directly through any discharge plume almost immediately upon release and remain within the plume for almost the entire duration of the residence time (see Section 8.7.4.1). Given there are no marine turtle BIAs or habitat critical to the survival of marine turtles located within the operational area, it is not expected that they would be exposed to concentrations above impact thresholds for an extended time. As a result, mortality to marine reptiles from increased toxicity is not a credible event.

Marine reptiles, specifically turtles, may adjust behaviour if exposed to temporary increases in water turbidity (Johnson, 2018). Marine turtles are dependent on vision to forage, communicate and move through the water. Increase in turbidity from operational discharges may result in minor avoidance by marine turtles when exposed to operational discharge plumes in the operational area (Johnson, 2018).

Chemical and terrestrial discharge are identified as a threat in the Recovery Plan for Marine Turtles in Australia (CoA, 2017). However, the proposed activities are located within a high energy offshore environment. There are no BIA's for marine turtles in the region. Discharges will rapidly dilute and disperse; as a result of oceanic conditions; when considered along with the transient nature of these species within the area, impacts are not predicted to occur. No population level impacts are expected.

Marine Mammals

The intermittent and brief exposure nature of in-water operational discharges will preclude chronic exposure of marine mammals, as individuals would need to pass directly through any discharge plume almost immediately upon release and remain within the plume for almost the entire duration of the residence time (see Section 8.6.4.1). Marine pollution by acute and chronic chemical discharge is identified as a threat that has minor consequences to pygmy blue whale individuals within the Blue Whale Conservation Management Plan (DoE, 2015a). Given marine mammals are highly mobile pelagic species, the minor consequence classification in the Conservation Management Plan, along with the expected rapid dilution of discharges resulting in brief and localised changes to water quality, injury/mortality to marine mammals from increased toxicity from operational discharges is not considered a credible event. Marine mammals exposed to temporary elevated levels of turbidity may experience minor behavioural effects (Johnson, 2018). Increase in turbidity from operational discharges may result in plume avoidance by marine mammals when exposed to turbid plumes (Johnson, 2018).

The operational area overlaps BIAs for the pygmy blue whale and southern right whale. The operational area is also within a region of the Bass Strait which is strongly influenced by the seasonal Bonney Upwelling system and is a known seasonal feeding aggregation area for pygmy blue whales. Pygmy blue whale aggregations may overlap the operational area and surrounds to feed from November and May (DoE, 2015a).

The Bonney Upwelling is a seasonal event that causes high natural variability of water column turbidity on the Victorian coastline. Marine mammals that regularly feed along the Victorian coastline are adapted to high natural variability of in-water turbidity. Given marine mammals in the region are adapted to temporary increases in turbidity, plumes generated by operational discharges are not expected to have a discernible effect on foraging behaviours or movement patterns of individuals, nor therefore at a population level.

Summary

The predicted level of impact, i.e. the consequence, to marine fauna as a result of operational discharges is evaluated to have a consequence of **Level 1** based on:

- The high energy oceanographic processes typical of the Otway Basin. Rapid dilution and dispersion of operational discharges plume is anticipated.
- Potential impacts to plankton are predicted to be localised and short term and are not predicted to result in discernible impacts at local or regional levels.
- Due to the intermittent and brief presence of operational discharge plumes in the operational area; discharges would be expected to disperse to below no-observed-effect-concentrations (NOEC) before marine fauna could be exposed for long enough to experience toxicity impacts.
- The operational area is subject to high natural variation in turbidity levels, therefore, marine fauna present within the operational area will be adapted to brief and high levels of turbidity.

- Potential minor behavioural impacts will be temporary and localised.

**Inherent Likelihood**

A range of marine fauna are known to occur within the operational area. Operational discharge plumes may result in some minor and temporary behavioural and/or physiological impacts; therefore, it is likely the risk event will occur.

The inherent likelihood of a **Level 1** consequence occurring is rated **B**.

**Inherent Risk Severity**

The predicted level of risk, i.e., inherent risk severity, to marine fauna as a result of injury/mortality is considered **Low**.

### 8.7.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 8-60.

*Table 8-60: Operational Discharges Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: Change in water quality | Consequence: Level 1 |
| | Impact: Change in sediment quality | Consequence: Level 1 |
| | Risk: Injury/mortality to marine fauna | Risk: Low |
| **Principles of ESD** | ‘A) ‘Integration principle’<br>Consistent with Cooper Energy’s risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 8.7.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the impacts and risks from planned discharges – operational are identified as:<br>• Level 1 consequence for changes in water quality and sediment quality<br>• Low risk for injury/mortality to marine fauna.<br>The above predicted levels of impact and risk due to planned discharges – operational from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) ‘Precautionary principle’<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy’s risk assessment methodology and Cooper Energy Offshore Chemical Assessment Procedure. | |

| | | | |
|---|---|---|---|
| | • The highest consequence ranking for operational discharges was Level 1 and the highest inherent risk was evaluated as Low; therefore, operational discharges from the East Coast Project will not result in serious or irreversible environmental damage.<br>The potential impacts and risks from operational discharges are well-understood, and management measures are well established and regulated in Australian waters. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest consequence ranking for operational discharges was Level 1 and the highest inherent risk was evaluated as Low and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.7.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to operational discharges were evaluated in Section 8.7.4 and the highest consequence ranking for operational discharges was Level 1 and the highest inherent risk was evaluated as Low.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.7.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* – Section 26F (implements MARPOL Annex I). | All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act (refer Discharge standards \| Australian Maritime Safety Authority).<br>Several MOs are enacted under this Act relating to offshore petroleum activities, including:<br>MO Part 91: Marine Pollution Prevention – Oil<br>MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances<br>MO Part 96: Marine pollution prevention – sewage | Adoption of the following control measures:<br>CM1: Marine Assurance Process<br>All wastewater discharges will comply with relevant MARPOL 73/78, *Navigation Act 2012*, *Protection of the Sea (Prevention of Pollution) Act 1983* and subsequent Marine Order requirements (as appropriate for vessel classification):<br>• AMSA MO 91 - Marine Pollution Prevention (Oil)<br>• MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances<br>• AMSA MO 96 - Marine Pollution Prevention (Sewage).<br>CM6: Cooper Energy Offshore Chemical Assessment Procedure<br>Project chemicals will meet the requirements of the Cooper Energy Offshore Chemical Assessment Procedure. This process is used to ensure the lowest toxicity, most |
| | Industrial Chemicals (Notification and | Project Chemicals will be considered under the requirements of this Act prior to use as relevant. | |

| | | | |
|---|---|---|---|
| | Assessment Act) 1989 | | biodegradable and least bioaccumulative chemicals are selected which meet the technical requirements, where their function necessitates discharge to sea. The process consults public chemical assessment repositories such as PLONOR list, OCNS Definitive Ranked List, OSPAR and OCNS listings for those chemicals to be discharged. Eco-toxicity is evaluated with any required control measures defined. Chemicals that are highly toxic, have high bioaccumulation potential, and have high persistence in organisms are screened out during the assessment process. Only chemicals that meet low ecotoxicity pre-screening criteria or are further justified as ALARP can be approved for discharge. An accepted chemical list is issued to the offshore project team detailing which products may be discharged and in what circumstances.<br>CM8: Emissions and Discharges Standards<br>Prior to commencing the offshore activity, the following will be verified, as relevant to vessel class:<br>• 2017 Guidelines for the Implementation of MARPOL Annex V to assist shipowners, masters and crews in applying the Annex V discharge requirements.<br>• Bilge water treated via a MARPOL (or equivalent) approved oily water separator and only discharge if oil content less than 15 ppm.<br>• Sewage discharged at sea is done so only in accordance with AMSA discharge standards and treated via a MARPOL (or equivalent) approved sewage treatment system as applicable.<br>• Food waste only discharged in accordance with AMSA, MARPOL and relevant State discharge standards.<br>CM20: Campaign Risk Review<br>The Cooper Energy Environmental Protocol describes how environmental impact and risk management, including risk assessments, is undertaken for activities including offshore campaigns.<br>As part of pre-campaign planning a risk review (refer Figure 12-5) will be undertaken to re-assess campaign environmental impacts and risks to ensure acceptability criteria are met and that impacts and risks are reduced to ALARP.<br>The risk review will consider aspects relevant to the campaign; where there is a risk that campaign discharges to sea |
| | Minamata Convention on Mercury | Cooper Energy will consider best available techniques and environmental practices to control releases of components containing mercury in future activity specific EPs. | |
| | Recovery Plan for Marine Turtles in Australia, 2017 – 2027 | Recovery objective:<br>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.<br>Interim objective 3:<br>Anthropogenic threats are demonstrably minimised.<br>No relevant management actions. | |

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|---|---|---|---|
| | | | may contain mercury, the risk review will consider the current best available techniques and environmental practices in order to control releases of mercury. |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | No feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures for operational discharges. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to planned operational discharges are AL2 and AL4, identified in Table 8-61. These acceptable levels defined for a change in water quality, sediment quality and injury / mortality to marine fauna are defined in Table 7-6.<br>The worst-case predicted impacts assessed in Section 8.7.4 are:<br>• Changes to water and sediment quality are likely to be localised and temporary based upon the relatively small volumes associated with operational discharges. There are no continuous discharges over the life of the project.<br>• Due to the intermittent and brief presence of operational discharge plumes in the operational area; discharges would be expected to disperse to below no-observed-effect-concentrations (NOEC) before marine fauna could be exposed for long enough to experience toxicity impacts.<br>• The greatest consequence ranking for operational discharges is Level 1, and highest level of risk is Low. Any impacts caused from operational discharges will be short term and highly localised.<br>Therefore, at its worst-case, the predicted impact from planned operational discharges would not:<br>• Lead to a substantial change in water quality which may adversely impact biodiversity and ecological integrity.<br>• Lead to changes to seabed quality that adversely affect biodiversity, and ecological integrity.<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species<br>• Lead to loss of habitat critical to the survival of species<br>Therefore, the predicted level of impact resulting from planned operational discharges from the East Coast Project is at or below the defined acceptable levels. | | |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to operational discharges are acceptable, based on:<br>• Predicted levels of impact (evaluated in Section 8.7.4) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors.<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes.<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD.<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES.<br>• No relevant feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures. | | |

| | |
|---|---|
| | To manage impacts to receptors to or below the defined acceptable levels the following EPOs have been applied:<br>**EPO4:** Only approved chemicals (which meet low ecotoxicity pre-screening criteria or are further justified as ALARP) will be discharged to sea.<br>**EPO7:** Planned vessel/ MODU discharges will meet AMSA Discharge Standards for operating in Australian waters. |

### 8.7.6 Environmental Performance

Table 8-61 lists the acceptable level and EPOs defined for operational discharges and the adopted control measures to achieve the outcome.

*Table 8-61: Environmental Performance Summary – Operational discharges*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL2:** Water quality beyond 1000 m of the discharge location is within the range for water typical of the wider Otway offshore marine environment, with any difference from regional baseline being temporary[11] . Planned drilling discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure. | **EPO4:** Only approved chemicals (which meet low ecotoxicity pre-screening criteria or are further justified as ALARP) will be discharged to sea.<br>**EPO7:** Planned vessel/ MODU discharges will meet AMSA Discharge Standards for operating in Australian waters. | CM1: Marine Assurance Process<br>CM6: Cooper Energy Offshore Chemical Assessment Procedure<br>CM8: Emissions and Discharges Standards<br>CM20: Campaign Risk Review |
| **AL4:** Sediment quality beyond 1000 m of the discharge location is within the range for sediments typical of the wider Otway offshore marine environment.<br>Planned drilling discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure | | |

## 8.8 Seabed Disturbance

### 8.8.1 Cause of Aspect

During each phase of the East Coast Project, there are interactions with the seabed; some disturbance is expected to the seabed and benthic assemblages.

An overview of activities that will result in seabed disturbance are defined in Table 8-62 and described in Section 8.8.2.

*Table 8-62: Activities undertaken during the East Coast Project that may cause seabed disturbance*

| Cause of Aspect / Phase | Activity component |
|---|---|
| **Survey** | Geotechnical survey |
| **Well Construction** | MODU positioning (mooring) |
| | Drilling operations* |
| | Drilling cuttings and fluids* |
| | Cementing operations* |
| **Installation and commissioning** | Pre-lay works |
| | Installation of flowline and umbilical systems |
| | Installation of subsea structures |

| Cause of Aspect / Phase | Activity component |
|---|---|
| | Post-lay works and commissioning* |
| **Operations** | Inspection |
| | Maintenance and repair |
| **Decommissioning** | Well abandonment |
| | Flowline and umbilical decommissioning* |
| | Removal of remaining subsea infrastructure |
| **Support Operations** | Vessel operations |
| | ROV Operations |

**Note: Discharges associated with these activities are described in Section 8.6.2.1 with impact and risks evaluated in Section 8.6.4.*

### 8.8.2 Aspect Characterisation

Apart from MODU positioning and minor geotechnical survey elements, seabed disturbance from the East Coast Project (Table 8-63) are expected to be equivalent to the following planned disturbance areas:

- 2.5 km radius for the MODU anchor spread per well location
- 100 m wide disturbance corridor for flowline and umbilical systems
- 200 m disturbance radius for well and manifold locations.

These disturbances can be categorised into long-term (i.e., the life of the project) or short-term (i.e., until the completion of the specific activity i.e., anchoring) disturbances depending on the activity being undertaken (as discussed in Table 8-63).

Table 8-63 summarises the total area of seabed disturbance from the East Coast Project. Further details on how each activity component interacts with the seabed is provided in the following subsections based on each phase.

*Table 8-63: Seabed disturbance estimated disturbance spatial extent*

| Planned Disturbance Area for the Project | Activity | Parameters | Estimated Disturbance Spatial Extent ($km^2$) | Total Estimated Disturbance Spatial Extent for the Project ($km^2$) |
|---|---|---|---|---|
| **Long-term** | | | | |
| Disturbance corridor of 100 m for flowline and umbilical systems | Installation of flowline and umbilical systems, including activities and infrastructure occurring along these systems, such as:<br>• geotechnical seabed sampling<br>• IMR activities<br>• subsea infrastructure (e.g., mattresses, transponders, spools, tie-in structures). | Total route length of:<br>• flowlines: 65.92 km<br>• umbilicals: 73.79 km. | Spatial extent with 100 m disturbance corridor:<br>• flowlines: 6.59 $km^2$<br>• umbilicals: 7.38 $km^2$. | Total disturbance spatial extent for the project*:<br>• subsea infrastructure (flowlines and umbilicals): ~14 $km^2$ |

| Planned Disturbance Area for the Project | Activity | Parameters | Estimated Disturbance Spatial Extent ($km^2$) | Total Estimated Disturbance Spatial Extent for the Project ($km^2$) |
|---|---|---|---|---|
| Disturbance radius of 200 m for well and manifold locations | Operational activities around the wells and manifold locations. Including seabed disturbance from related activities, such as:<br>• direct drilling of top-holes<br>• installation of subsea infrastructure (i.e., manifolds)<br>• decommissioning | • construction of up to 15 wells<br>• 3 manifolds<br>• well abandonment of up to 15 wells. | Within the disturbance area of 200 m radius** (0.126 $km^2$) per well and manifold location. | Total disturbance spatial extent for the project*:<br>• well construction: ~1.89 $km^2$<br>• subsea infrastructure (manifolds): ~0.38 $km^2$<br>• well abandonment: ~1.89 $km^2$ |
| **Short-term** | | | | |
| Disturbance within 2.5 km radius per well for the MODU positioning – anchor spread | MODU Positioning (i.e., transponders)<br>Mooring of the MODU at each well location for activities requiring the MODU, such as:<br>• well construction<br>• well abandonment<br>• well intervention (a non-routine activity that may occur during the Project when required). | Mooring at each well location will require between 8 and 12 anchors. Estimated footprint per anchor:<br>• 60 $m^2$ per anchor.<br>Typically mooring chains extend from the MODU with 1,200 m of grounded chain. A disturbance width of 5 m is applied accounting for some lateral movement of the chain during deployment, use and recovery.<br>Estimated spatial extent per chain:<br>• 6,000 $m^2$ grounded chain per line (0.006 $km^2$)<br>• Total for each mooring line and anchor = 0.00606 $km^2$. | Total estimated spatial extent per well:<br>• ~0.0727 $km^2$ | Total estimated spatial extent for Project:<br>• well construction: ~1.09 $km^{2***}$<br>• well abandonment: ~1.09 $km^2$<br>• well intervention: ~0.0727 $km^2$ per well****<br><br>Seabed disturbance of each well location is expected to be over the same area of seabed for each phase. |
| ROV Operations (all phases) | Seabed mooring during ROV support operations (i.e. ROV 'wet parking') is not a planned activity.<br>ROVs may be required to park or moor on the seabed and may temporarily sit on the seabed as a part of execution activities. | Typical ROV footprint is 4 $m^2$. In the unlikely event that parking is required, the disturbance footprint is estimated to be less than a conservative 10 $m^2$. | Maximum estimated spatial extent per activity approximately <10 $m^2$ (<0.00001 $km^2$). | <0.00001 $km^2$ per well: ~0.00015$km^2$ for the project |
| **Approximate total seabed disturbance for each phase:** | | | • subsea infrastructure: ~14.38 $km^2$<br>• well construction: ~2.98 $km^2$<br>• well abandonment: ~2.98 $km^2$ | |

| Planned Disturbance Area for the Project | Activity | Parameters | Estimated Disturbance Spatial Extent ($km^2$) | Total Estimated Disturbance Spatial Extent for the Project ($km^2$) |
|---|---|---|---|---|
| | | | • well intervention: ~0.07 $km^2$ | |
| **Approximate total seabed disturbance for Project:** | | | ~20.4 $km^2$ | |

**Note: As a conservative approach, there is some double counting of planned disturbance area where the disturbance radius for well/manifold may actually overlap with the flowline/umbilical disturbance corridor.*

***Note: As a conservative approach, a 200 m disturbance radius for the well and manifold locations has been adopted based on the furthest extent that drill cuttings may be deposited during drilling operations, as per the assessment within Section 8.6.4.*

****Note: The estimated footprint falls within the conservative 3 km radius allocated for the MODU positioning at individual well sites. Due to the way the anchors and chains are laid only a small portion of this 2.5 km radius area will be disturbed by mooring equipment.*

*****Note: As well intervention is a non-routine activity the estimated seabed disturbance spatial extent has not been included within the final estimated seabed disturbance areas; if well intervention does occur during the operational phase, the footprint would be the same or similar to the well construction and well abandonment footprints.*

#### *8.8.2.1 Surveys*

Geotechnical survey seabed sampling is expected to result in seabed disturbance.

Each piston / push sample results in a small hole (<1$m^3$). Approximately ~20 – 40 sample locations are expected within the scope of the OPP subject to detailed engineering requirements. Any direct disturbance to the seabed will be equivalent to the proposed disturbance corridor or survey areas.

#### *8.8.2.2 Well construction*

MODU Positioning / Installation

Mooring for the MODU will require between 8 and 12 anchors, ranging from 15 to 30 MT each (dependent on mooring analysis). The seabed disturbance spatial extent from anchors can vary between 30 m² and 60 m² at each well location. Mooring lines are also designed to partially lay on the seabed. Typically, mooring lines extend ~2,000 m – 2,500 m from the MODU with ~1,200 m of grounded chain, with an estimated 5 m width corridor within which the grounded chain may shift on the seabed.

Up to 15 production wells may be drilled in the East Coast Project within the scope of this OPP.

The seabed disturbance from the MODU positioning at each well location is expected to be over the same or similar area of seabed for each phase utilising the MODU (i.e. well construction, well abandonment, and well intervention if required).

Equipment to support accurate positioning of the MODU may include transponders. Transponders are typically placed on the seabed using gravity anchors or on a frame or ballast. Transponders are a short-term disturbance as they will be recovered when they no longer required for positioning. The placement of transponders on the seabed will result in a temporary disturbance of <2 m² for each transponder and associated frame within the planned disturbance area.

Based on the above parameters, the estimated total seabed disturbance spatial extent for MODU positioning of the 15 production wells is ~1.09 $km^2$.

Drilling Operations

The drilling of the surface hole sections for new wells will result in seabed disturbance from initial penetration of the seabed. The direct disturbance spatial extent of the top-hole at each well is approximately ~2 $m^2$.

Three new manifolds are proposed under the East Coast Project. The dimensions will be approximately 8 x 12 m for each manifold structure; however, this spatial extent will be within the disturbance radius of 200 m.

The seabed disturbance from drilling operations will be within the 200 m disturbance radius for each well locations, which has an estimated total seabed disturbance spatial extent of ~1.89 km$^2$ (based on drilling 15 production wells).

The discharge of cement, cuttings from the wellbore, and drilling fluids to the seabed during top-hole drilling this has been evaluated separately within Section 8.6 and 8.7.

#### *8.8.2.3 Installation and Commissioning*

Seabed disturbance during installation and commissioning may be long or short-term disturbances. Long-term disturbances will result from the installation of flowlines, umbilicals, mattresses, well and manifolds and other subsea infrastructure on the seafloor. Short-term disturbances will result from deployment of transponders on the seabed and temporary wet parking of equipment and infrastructure (e.g. during severe weather events). Both long-term and short-term disturbances are planned to occur within the planned disturbance areas (Table 8-63).

Seabed disturbance from flowlines and umbilicals will be within a footprint equivalent in area to the planned 100 m wide disturbance corridor for flowline and umbilical systems, which has a footprint of approximately 7.38 km² for umbilicals and approximately 6.59 km² for flowlines.

Mattresses will be used for stabilisation of the flowlines and umbilicals. Each mattress will have an approximate footprint of 18 m$^2$. The total number of concrete mattresses will not be known until the pre-lay and post-lay surveys are performed; however, at this concept stage there is confidence that the area disturbed will be equivalent to the area within the nominal disturbance corridor specified for flowline and umbilical systems.

Other subsea infrastructure, such as hot-tap tie-in structures, spools etc., are expected to have a footprint of less than 25 m² for the total project. This spatial extent will also be within the total disturbance footprint for the flowline and umbilical systems.

Equipment to support accurate positioning of subsea structures and ROVs may include transponders. Transponders are typically placed on the seabed using gravity anchors or on a frame or ballast. The transponders will be utilised for the duration that anchors are installed, and the MODU is on location. The placement of transponders on the seabed will result in a temporary disturbance of <2 m² for each transponder and associated frame within the planned disturbance areas.

During installation activities, some equipment and infrastructure may be temporarily wet parked on the seabed due to storm or emergency events. Wet parking will occur within the operational area and is accounted for in the planned disturbance areas. This will be a short-term activity whilst anchors or MODU are on location (Section 4.3).

#### *8.8.2.4 Operations*

Seabed disturbance during the operations phase may occur if maintenance and repair activities such as replacement of equipment on the seafloor is required. Nominally up to 25 m² disturbance may occur during an IMR campaign. This could increase in the case of pipeline or umbilical repair activities. However nominal seabed disturbances from an IMR campaign are expected to be within defined long and short-term disturbance areas for the project.

#### *8.8.2.5 Decommissioning*

During decommissioning, mooring of a MODU used for plug and abandonment of the wells will result in seabed disturbance. The seabed disturbance spatial extent for a moored MODU for well abandonment activities is expected to be the same as the footprint of a moored MODU used for drilling. A maximum of 15 wells will be abandoned under this OPP.

Seabed disturbance is also expected during the recovery and removal of flowlines and umbilicals and other subsea infrastructure such as spools and jumpers, subsea structures, controls structures, stabilisation equipment. Structures may need to be modified subsea to facilitate removal. The seabed around structure foundations may need to be excavated or structures may need to be toppled to break sediment suction and cutting may also be required. Structures such as trees and manifolds will be cut at or below the mudline and recovered on deck. The disturbance spatial extent is expected to be an area equivalent to the disturbance corridor for flowline and umbilical systems.

Seabed disturbance during other decommissioning activities is also expected to be within an area equivalent to the disturbance corridor for flowline and umbilical systems.

#### *8.8.2.6 Support Operations*

Seabed disturbance has the potential to occur during vessel and ROV operations associated with vessel anchoring or temporary ROV wet parking.

Vessels may deploy anchors to manage an emergency situation (such as engine failure). Seabed disturbance from emergency anchoring is estimated at 1300 $m^2$ (0.0013 $km^2$) accounting for deployment and some drag in heavy weather. The maximum number of vessels in the operational area at a time is expected during drilling activities and is expected to be 3 x anchor handler vessels or PSVs plus the MODU.

During ROV operations, seabed disturbance may occur if the ROV is set on seabed temporarily. The seabed disturbance from ROV wet parking is estimated to be <10 $m^2$ for each occurrence. This disturbance may occur within both the long-term disturbance corridor or could also be a short-term disturbance within the within the defined short term allocated areas.

#### *8.8.2.7 Concurrent activities*

The total area of seabed disturbance from the East Coast Project for all phases has been identified in Table 8-63, and has been used as the basis for impact assessment; therefore, concurrent activities have been considered.

### 8.8.3 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impacts from seabed disturbance are:

- Change in habitat.

Potential risks are:

- Injury / mortality to marine fauna
- Change to cultural heritage.

### 8.8.4 Impact and Risk Evaluation

#### *8.8.4.1 Impact: Change in Habitat*

**Inherent Consequence Evaluation**

As described in Section 6.4.7 and 6.5.1, Ramboll (2020a) and Ramboll (2020b) both found that benthic habitats within, and in close vicinity to the East Coast Project operational area to be characteristic of a seabed comprised of hard substrate and reef with patches of sand or gravelly / rubble; these substrates are well represented in the Bass Strait, particularly across the Otway region (Ramboll, 2020b).

Within the operational area, up to ~20.4 $km^2$ of seabed has the potential to be disturbed by temporary placement of equipment on the seabed and the installation of subsea infrastructure. Approximately ~1.09 $km^2$ of the ~20.4 $km^2$ of seabed that has the potential to be disturbed during the East Coast Project is from mooring of the MODU across up to 15 well locations (during well construction / abandonment phases). As a result, ~5% of planned seabed disturbance will be short-

term. Once the MODU has completed drilling, well intervention or well abandonment activities, the anchor system would be removed from the seabed which will allow for benthic habitats to recover.

Secondary impacts from scouring may occur. Scouring is a natural feature on the Otway shelf whereby currents may erode sediments around hard calcareous sediments resulting in secondary impacts (Ramboll, 2020b). Installation of subsea infrastructure will introduce the presence of hard features on the seabed which may encourage scouring processes in areas immediately surrounding seabed infrastructure installed for the East Coast Project.

The operational area may contain areas representative of some values associated with the Shelf rocky reefs and hard substrates KEF (see Section 6.6.6). There is no shape file available for this KEF but it is known to occur throughout the south-east marine region (CoA, 2015a). Surveys of parts of the operational area and surrounds observed areas of hard ground and patchy epifauna with the presence of several or occasional fish (Santos, 2004; Ramboll, 2020b). These areas are consistent with some values of the Shelf rocky reefs and hard substrates KEF, and values, in that they provide hard substrate for sessile marine life to attach to. From benthic surveys and inspection of existing equipment; the operational area is known to contain a lot of hard seabed that provides attachment sites for epifauna. Epifauna growth includes sponge communities, that are generally low density, but there can be patches where cover is dense, particularly on and around subsea equipment which provides additional hard and complex substrate for attachment. Sponges, being able to reproduce sexually and asexually, added to strong seabed current movement which would aid redistribution, results in relatively steady recovery of disturbed areas. This growth spreads to and establishes on the subsea equipment. The CHN equipment has been on the seabed for approximately 20-years and visual inspection in the field shows high levels of recovery of epifauna on areas of seabed that would have been disturbed during the installation phase, as well as additional growth on subsea equipment.

Modelling of mesophotic rocky reefs (as detailed in Section 6.6.6) is represented in the Natural Values Ecosystems data set (IMAS 2021) (Figure 6-65). Figure 8-11 represents the mesophotic rocky reef layer of the Natural Values Ecosystems data set (IMAS 2021) in relation to the operational area and disturbance corridors (Table 8-63). According to Figure 8-11 mesophotic rocky reef layer overlaps the long-term disturbance footprint at Pecten East only, with an estimated disturbance footprint of <0.01 $km^2$. Only the short-term disturbance footprint at Pecten East-2 overlaps Natural Values Ecosystems data set. This will consist of the 8 to 12 anchor spread with an approximate seabed disturbance footprint of 0.0727 $km^2$ per well.

Activities occurring within the operational area are likely to result in seabed disturbance to rocky reef and hard substrate habitats commonly found throughout the Otway region.

Recovery of benthic habitats following the removal of MODU mooring system is expected to begin within months (e.g. Morrisey et al., 2018). The placement of subsea infrastructure (i.e. flowlines and umbilicals) is anticipated to have a footprint on the seabed until the decommissioning of the infrastructure, estimated to be completed in 2049. Despite the long-term presence of subsea infrastructure, the disturbance will be localised within the operational area. The infrastructure, which adds structural diversity within the shelf environment, and provides attachment surfaces is expected to be progressively colonised by benthic assemblages. Subsea surveys of the flowlines, and umbilicals installed during Stage I & II of the CHN development demonstrated colonisation by sponges, bryozoans, and hydrozoans (Figure 6-16). Therefore, benthic habitats are expected to recolonise and recover to baseline levels following installation and again following the removal of the infrastructure.

The predicted level of impact, i.e., the consequence, as a result of a change in benthic habitat from seabed disturbance is evaluated to have a consequence of **Level 2** based on:

- Areas of hard ground and patchy epifauna occurs across the south east marine region and are likely to be overlapped by the operational area based on findings of the Ramboll (2020b) survey.
- benthic assemblages in the operational area have a scattered distribution, and do not contain threatened listed ecological communities or critical habitats.

- the operational area does not overlap AMPs.
- a geophysical seabed survey will be undertaken to inform the planning of well construction activities and subsea infrastructure installation considering seabed relief, substrate and hazards.
- the total estimated area of impact is predicted to be relatively small (~20.4 $km^2$ for the entire project) compared to the extent of the distribution of the benthic habitats and associated benthic marine fauna found within the operational areas and wider region.
- ~5% of the planned seabed disturbance area (~20.4 $km^2$) is expected to be from short-term mooring of a MODU during drilling, decommissioning, and well intervention (if required).
- seabed disturbance is anticipated to be localised and recoverable following infrastructure installation, and again during removal, and not impact ecosystem functioning of benthic habitats.

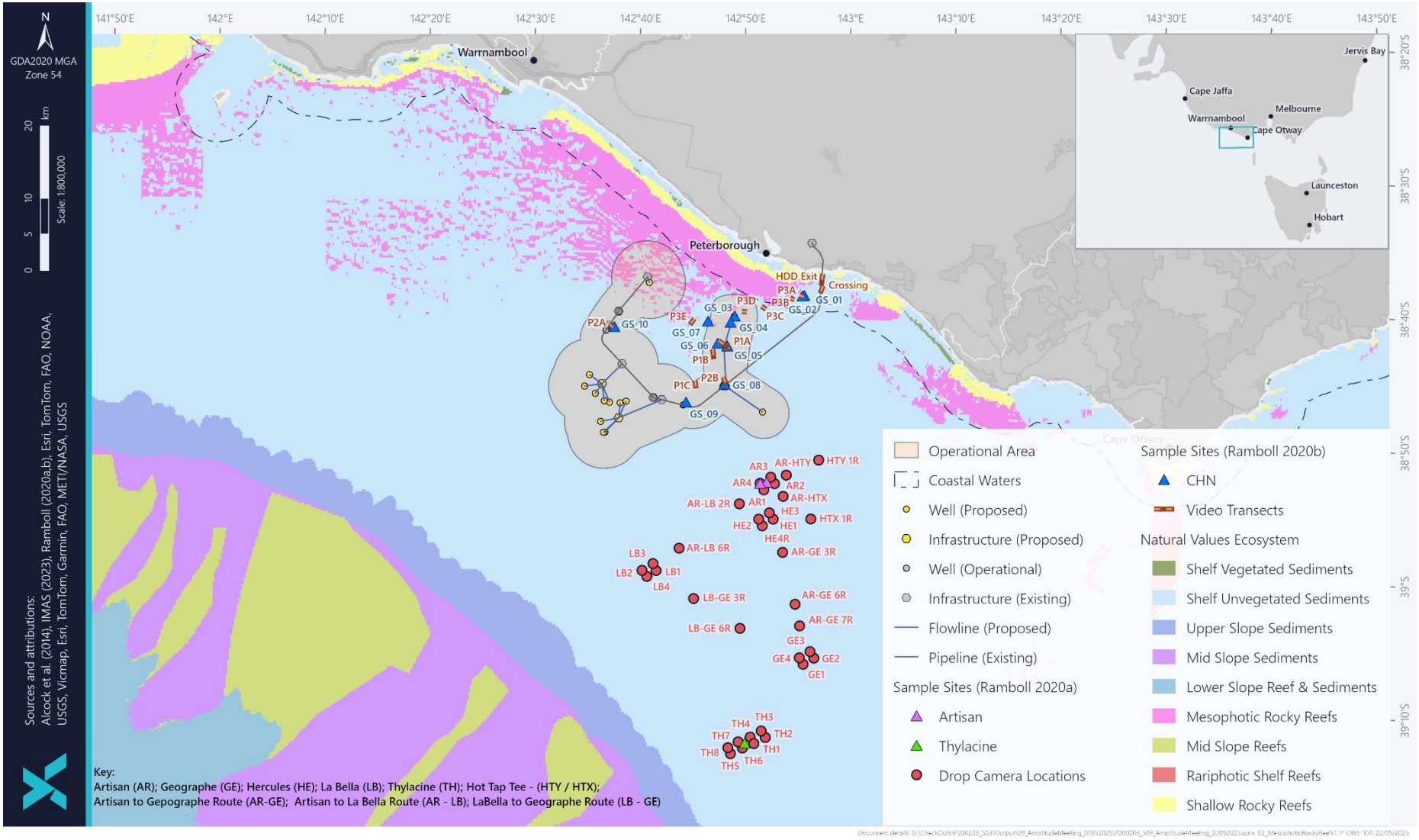



*Figure 8-11: Mesophotic rocky reef in relation to the operational area and disturbance corridors*

#### *8.8.4.2 Risk: Injury/Mortality to Marine Fauna*

**Inherent Consequence Evaluation**

Benthic assemblages and invertebrates

Seabed disturbance during the East Coast Project has the potential to result in the loss of benthic and demersal invertebrate communities within the planned disturbance area from physical modification of the benthic environment and physical smothering.

Benthic assemblages within and proximal to the operational area have been observed during subsea habitat surveys and facility inspections; the latest in 2020 (see Figure 6-17). Inspections identified hard ground and some sand, supporting patchy areas of abundant epibiota, typically bryozoans, gorgonian, cnidarians and sponges (Ramboll, 2020b). While there is some residual uncertainty on the composition of benthic assemblages in the south-western portion of the operational area as there is no historical survey data in that area; there is a high confidence in the type of benthic habitat that will be in these areas from survey of adjacent areas at similar water depths, and knowledge of the regional shelf habitats (Figure 6-17; Section 6.5.1), and which provide reasonable confidence for the purpose of impact and risk assessment.

The presence of these invertebrate communities is representative of what is expected throughout the Otway Basin. Injury/ mortality to benthic and demersal invertebrate communities from seabed disturbance is expected to be localised given the limited extent of the footprints associated with the activity, which has been minimised through concept design (Section 5.2.1). Benthic and demersal invertebrate communities within the planned disturbance area are highly represented throughout the region, and disturbed areas are expected to recover through natural dispersion and settlement of planktonic phase invertebrates and asexual regrowth of organisms such as sponges. Inspection of existing subsea equipment indicates high levels of recovery and colonisation of subsea equipment within 10-15 years of the disturbance occurring (Figure 8-12). Establishment of marine organisms on new equipment surfaces is progressive, starting with biofilm within the first year of installation, then more complex organisms such as sponge, coral and bryozoa within ~5 years, generally becoming more diverse and with greater coverage over time.Figure 8-12, from Ierodiaconou et al. (2023), describes the colonisation of subsea equipment installed off Victoria in >150m water depth on a sand/silt seabed. Recovery of disturbed areas of seabed in the project operational area would be expected to recover in a similar timeframe or in less time, given the surrounding seabed is also frequently hard with sessile invertebrates attached that would propagate into the disturbed area and the installed equipment.

Sediment-burrowing infauna and surface epifauna invertebrates (particularly filter feeders) which inhabit sandy areas of seabed directly around subsea infrastructure locations are expected to be impacted installation activities. There will be some loss and some displacement of infauna and epifauna, limited due to the small direct disturbance footprint and the relatively non-intrusive stabilisation proposed for the facility (laid on seabed rather than trenching into the seabed).

Dernie et al. (2003) conducted a large-scale field experiment that investigated the recovery of marine benthic communities in a variety of soft sediment types (i.e., clean sand, silty sand, muddy-sand and mud) following a physical disturbance. The physical disturbance within the experiment was performed at varying scales relevant to different anthropogenic activities, such as low intensity activities (i.e., bait digging and hand-raking) up to high intensity activities (i.e., trawling and suction-dredging) (Dernie et al., 2003). The results showed that full recovery of soft sediment assemblages from physical disturbance could take between 64 days for low intensity disturbances, and up to 208 days for higher intensity disturbances (Dernie et al., 2003). For the project activities, it is expected that following installation activities, the (see Table 8-63), disturbed areas will recolonise within ~1year or less, as identified by Dernie et al., (2003).

Molluscs, such as the Arrow squid (Kailola et al., 1993), and crustaceans, such as rock lobsters, have also been identified to be present within the activity area (Section 6.5.4). Mobile invertebrates, such as these molluscs and crustaceans, are generally less vulnerable to seabed disturbance activities given the ability to move away (Fraser et al., 2017).

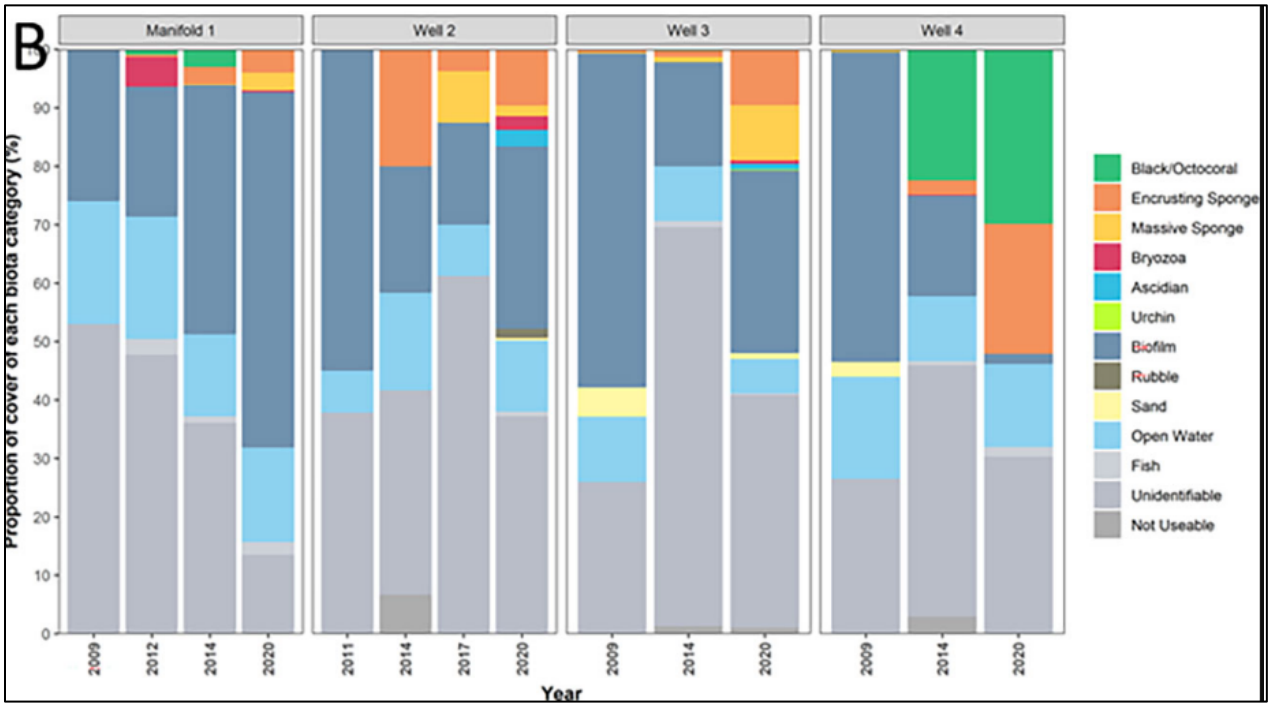



*Figure 8-12: Percentage cover of benthic biota on subsea structures offshore Victoria over a 10-year period.*

The disturbance to infauna and epibenthic communities is expected to be recoverable whereby surrounding infauna and epibenthic communities will recolonise impacted areas and likely colonise the surfaces of equipment installed on the seabed. Injury/mortality to benthic and demersal invertebrate communities from seabed disturbance is expected to be short term / recoverable based on observations of natural regrowth and recovery around existing facilities, within a period of 1 year (infauna) to ~5 years (epifauna).

The predicted level of impact, i.e. the consequence, to benthic assemblages and invertebrate communities from seabed disturbance is evaluated to have a consequence of **Level 2** based on:

- invertebrate communities in the operational area are representative of what is expected throughout the Otway Basin.
- no threatened benthic species, assemblages or ecological communities were identified within the operational area.
- the planned seabed disturbance area is subject to localised and naturally recoverable changes to benthic habitats with no permanent impact on habitat, diversity or productivity.

Fish

Seabed disturbance during the East Coast Project has the potential to impact fish species. Slow moving and site-attached fish species are particularly susceptible to habitat modification through physical smothering, and burial as they may not be able to quickly move away and avoid seabed disturbance. These animals could be displaced, injured and individuals may not recover. However the areas of direct disturbance are small, and the equipment being placed on the seabed adds to the hard substrate and complexity of the seabed, providing surfaces for site attachment. Within days, and then over the subsequent years, marine growth begins to establish on these structures, adding to the surrounding seabed habitat (refer above for discussion and images) (McLean et al., 2022).

Commercial fish and shark species that may occur within the operational are demersal-pelagic and will naturally move from one area to another. Subsequently injury/mortality of commercial fisheries are not expected to occur, any impacts would be limited to temporary and localised avoidance behaviour.

The operational area does not contain habitats to support aggregations or site fidelity for majority of the fish species that may be present within the operational area (Section 6.5.5). Except for sessile or slow-moving fish species, such as pipefish, pipehorses, seadragons and seahorses, all species are mobile and are expected to move away and avoid injury during seabed disturbance activities. Pipefish, pipehorses, seadragons and seahorses are found in a variety of habitats ranging from deep reefs to coastal algae, or weed or seagrass habitats (Kuiter, 2000). The seabed proximal to the operational area does not include weed or seagrass habitats (Ramboll, 2020b). The majority of the area within and proximal to the operational area is hard substrate and patches of sand and rubble. As such, it is unlikely that fauna such as pipefish, pipehorses, and seadragons, will be directly impacted by smothering or burial during seabed activities. Displacement of individuals would be expected to be localised and temporary, with recovery around the installed structures over time. Seabed disturbance within the operational area is not expected to result in a change in the viability of the population of fish species.

The predicted level of impact, i.e. the consequence, to fish and commercial fisheries from seabed disturbance is evaluated to have a consequence of **Level 1** based on:

- potential impacts to fish, including sessile species are expected to be limited to temporary and localised avoidance behaviours.
- potential impacts to commercial fish species are expected to be limited to temporary and localised avoidance behaviours.

Summary

The predicted level of impact, i.e. the consequence, to marine fauna from seabed disturbance is evaluated to have a consequence of **Level 2** based on:

- invertebrate communities in the operational area are representative of what is expected throughout the Otway Basin.
- no threatened benthic species, assemblages or ecological communities were identified within the operational area.
- localised disturbance to benthic and demersal invertebrate communities with high recovery rates and highly represented throughout the region.

**Inherent Likelihood**

Benthic assemblages have been observed during surveys and inspections within and proximal to the operational area. The surveys observed modified (around infrastructure) and unmodified marine environments with scattered areas of hard ground supporting patchy areas of abundant epibiota, typically bryozoans, gorgonian, cnidarians and sponges (Ramboll, 2020b). The scattered and patchy presence of benthic and demersal invertebrate communities is expected within the operational area and there will be some disturbance through the life of the project.

The inherent likelihood of a **Level 2** consequence occurring is therefore rated as Likely **B**.

**Inherent Risk Severity**

The inherent risk severity of disturbance (including injury/mortality) to benthic and demersal invertebrate communities is considered **Moderate**.

#### *8.8.4.3 Risk: Change to Cultural Heritage*

Seabed disturbance may result in changes to cultural heritage such as:

- Disturbance of underwater cultural heritage including shipwrecks, aircraft and other artefacts.

A search of the Australasian Underwater Cultural Heritage Database found one shipwreck, Alfred (<75 years old ID 11052), located near the border of the operational area. On further investigation and consultation with Heritage Victoria, the position given for the wreck was confirmed to be a search area centre point; these are provided when the location of a wreck is unknown. There are over 300 wrecks like this offshore Victoria (Consultation Event ID 1334); and written records further

indicate the Alfred is likely closer to Warrnambool, and not relevant to the operational area of the East Coast Project (Section 6.8.1).

No shipwrecks have been observed during survey or inspections within and proximal to the operational area to date. Most recent surveys and inspections were in 2020. Consultation with Heritage Victoria indicated that the risk of the project impacting cultural heritage was low, given the limited footprints involved. Landscape scale impacts (submerged landscapes) were also not expected given the limited seabed footprints involved (Consultation Event ID 1334); these impacts will be limited to the operational area.

Some of the area now offshore was a terrestrial landscape during previous glacial maxima periods out to approximately the 95 m isobath of the present day (De Decker et al., 2020). It is likely that it was inhabited by First Nations peoples and there may be features or artefacts of cultural heritage value in the offshore environment (pers comm DPC, 2024). The high energy nature of the ocean within the Otway region has eroded the seabed over the millennia since its inundation; this reduces the likelihood of finding cultural heritage artefacts in the area, though does not discount the possibility, and though features may have eroded over time, they may still remain features of a cultural landscape.

The Tyrendarra lava flow associated with the significant Budj Bim aquaculture system (Section 10) is identified as a landscape feature of particular cultural significance; its historical and current values have been specifically identified as of importance during consultation for environment plans in the region, and in review of First Nations' Country Plans. Tyrendarra is a newer volcanic province outcrop (~30K years old) located near Portland, and extends from Mount Eccles into the offshore environment, to Julia Reef. Cooper Energy geologists investigated whether these kind of landscape features may occur within the operational area for the activity. Analysis of shallow geology and volcanic features within the region, including review of 3D seismic data, indicates there are no newer volcanic complexes within the operational area (Figure 8-13).

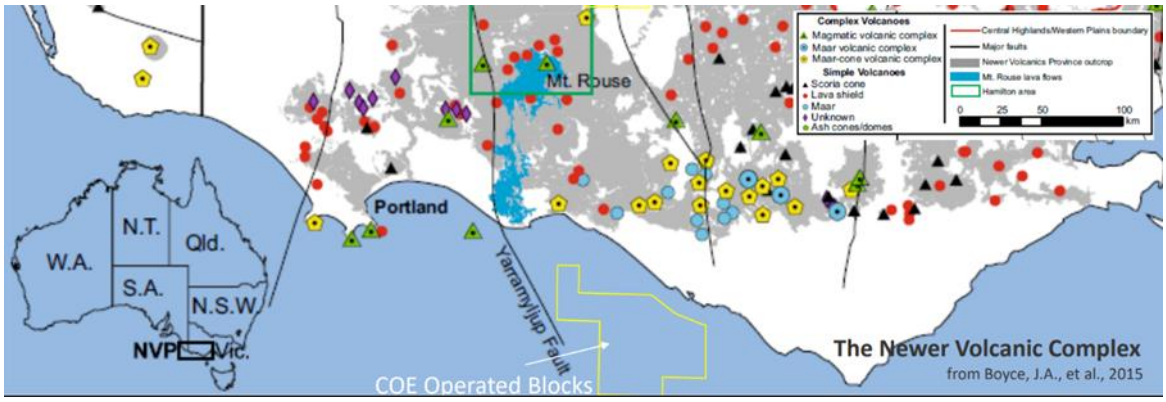



*Figure 8-13: Newer Volcanic Complexes in the Otway Region*

There is potential for unknown underwater cultural heritage to be disturbed from activities that may cause seabed disturbance. However, the predicted level of impact, i.e. the consequence, of change to cultural heritage from seabed disturbance is evaluated to have a consequence of **Level 1** given the absence of heritage to date, and that disturbance to cultural heritage (if it were unexpectedly found) is regulated, to avoid damage.

**Inherent Likelihood**

No known underwater cultural heritage including shipwrecks, aircraft, and other artefacts occur within the operational area however the potential remains. This region was once a terrestrial landscape and is likely to have been inhabited; therefore there may be features with heritage value. Seabed disturbance from the East Coast Project is not expected to result in damage to underwater cultural heritage. However, in exceptional circumstances there is a remote chance of change to

unknown underwater cultural heritage within the planned disturbance area during non-intrusive pre-install surveys, therefore there is a remote likelihood the risk event will occur.

As a result, the inherent likelihood of a **Level 1** consequence occurring is rated **Remote (E)**.

**Inherent Risk Severity**

The inherent risk severity of change to cultural heritage is considered **Low**.

Given the risk of damage to underwater cultural heritage cannot be eliminated at this stage of planning, additional control measures have been designed into the OPP, to be implemented before well construction activities commence. These measures provide assurance that underwater cultural heritage will be protected as required by the *Underwater Cultural Heritage Act 2018*.

### 8.8.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 8-64.

*Table 8-64: Seabed disturbance acceptability assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: Change in habitat | Consequence: Level 2 |
| | Risk: Injury/mortality to marine fauna | Risk: Moderate |
| | Risk: Change to cultural heritage | Risk: Low |
| **Principles of ESD** | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 8.8.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the impacts and risks from seabed disturbance are identified as:<br>• Level 2 consequence for change in habitat<br>• Moderate risk for injury/mortality to marine fauna<br>• Low risk for change cultural heritage.<br>The above predicted levels of impact and risk due to seabed disturbance from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology.<br>• The highest consequence ranking for seabed disturbance was Level 2 and the highest inherent risk was evaluated as Low; therefore, seabed disturbance from the East Coast Project will not result in serious or irreversible environmental damage. | |

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| | • The potential impacts and risks from seabed disturbance are well-understood, and management measures are well established and regulated in Australian waters.<br>• Uncertainty surrounding the benthic habitats and communities present within the direct disturbance spatial extent, will be managed by EPO12. Seabed surveys will be conducted prior to laying infrastructure on the seabed; the survey will collect data that will be used to identify the condition of existing sediment, the presence of cultural heritage and sensitive seabed features, to inform the field layout. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest consequence ranking for seabed disturbance was Level 2 and the highest inherent risk was evaluated as Moderate and therefore will not forego the health, diversity and productivity of the environment for future generations through protection of environmental values.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.8.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to seabed disturbance were evaluated in Section 8.8.4 and consequence ranking for seabed disturbance was Level 2 and the highest inherent risk was evaluated as Low.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.6.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained through protection of the values of the Commonwealth Marine Area as per the objectives of bioregional plans. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | Offshore Petroleum Decommissioning Guideline (DISER, 2018)<br><br>*These guidelines are considered as part of the decommissioning planning* | Options other than complete removal may be considered, however the titleholder must demonstrate that the alternative decommissioning approach delivers equal or better environmental, safety and well integrity outcomes compared to complete removal, and that the approach complies with all other legislative and regulatory requirements. | Adoption of the following control measures:<br>CM2: Offshore Operational Procedures<br>Mooring procedures for the MODU will reduce overlap/disturbance by ensuring:<br>• Adequate tensioning of mooring for the MODU is applied and maintained.<br>• Mooring equipment for the MODU is only installed or stored within the designed radius areas of the mooring spread.<br>The final selection of well locations, flowline paths, mooring and other infrastructure will consider survey observations to ensure: |
| | *Commonwealth Environment Protection (Sea Dumping) Act 1981* | A Sea Dumping Permit under the Commonwealth *Environment Protection (Sea Dumping) Act 1981* may need to be sought for proposals to decommission | |

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| | | the facilities other than by full removal. | • Areas of seabed habitat types including high relief outcrops, reefs and sponge beds will be avoided, or overlap with the Project footprint is reduced, where practicable.<br>• Underwater heritage, debris and hazards on the seafloor will be avoided and not overlapped with the Project footprint.<br>CM9: Underwater Cultural Heritage Disturbance Risk Management Measures<br>Cooper Energy Cultural Heritage Disturbance Risk Management Measures acknowledge legislative requirements and establishes the methods by which potential disturbance to cultural heritage is identified including via screening, consultation, and expert advice as required. The measures apply to the offshore project to ensure impacts and risks throughout the project remain within acceptable levels and are managed to ALARP.<br>Cooper Energy will ensure the activity is compliant with the *Underwater Cultural Heritage Act 2018* (Underwater Heritage Act) by:<br>• Ensuring seabed survey data is reviewed prior to well construction activities and used to inform equipment laydown locations to avoid impacts to underwater cultural heritage.<br>• Review of relevant seabed survey data will be conducted by a suitably qualified and experienced cultural heritage team.<br>• If cultural heritage is identified, it will be mapped, along with suitable exclusion zone and its location integrated into project inductions and procedures to ensure it is avoided during the project.<br>• Implementing a process for reporting and managing unexpected finds during the activity. Any subsequent management advice (e.g. exclusion zones) will be provided to Heritage Victoria and accounted for within project installation procedures.<br>CM10: Implement Cooper Energy's Decommissioning Protocol<br>The Cooper Energy Decommissioning Protocol acknowledges legislative |
| | *Section 572 Maintenance and removal of property Policy (NOPSEMA)* | All property is designed, installed and operated with the intention of being removed when it is no longer in use when a field permanently ceases production, all remaining property is removed if it is not to be used in connection with the operations a comparative assessment may be used in an EP as a method to evaluate feasible alternatives to removing property when an evaluation of impacts and risks are required by the OPGGS(E)R, they must incorporate a holistic evaluation of the impacts and risks of the alternative arrangements (including those impacts and risks that may arise from removing or relocating property outside the title area) and consider community interest. | |
| | Section 270 Consent to surrender Title | Prior to Title surrender, the following principles and conditions apply:<br>• Ecologically sustainable development.<br>• Impacts and risks are reduced to ALARP and are of an acceptable level.<br>• Wells have been plugged or closed off in accordance with section 569(1) of the OPGGS Act (Cwth).<br>• Other international and domestic requirements.<br>• The seabed within the Title Area is cleared of property installed, or authorised to be installed by the Titleholder, except where a deviation has been accepted by the Regulator.<br>• EPs (to be) developed for the decommissioning phases will address these principles and conditions and outline the studies and surveys required to demonstrate | |

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| | | compliance with Section 572 and Section 270. | requirements and illustrates the company's management system for integrating decommissioning planning and provisioning through a project's life cycle.<br>CM24: Seabed Survey<br>Seabed surveys (geophysical, geotechnical, visual and contaminant sampling) will be undertaken for the purposes of collecting information to manage risks to the Shelf rocky reefs and hard substrates KEF values (high relief outcrops, reefs and sponge beds), sediment quality, underwater heritage, debris and hazards on the seafloor. These surveys will be undertaken prior to finalising MODU position, location of mooring equipment, and finalising well and subsea infrastructure location. Details of relevant survey seabed findings (benthic environment, heritage, hazards) will be included in future EPs. |
| | Recovery Plan for the White Shark (*Carcharodon carcharias*) | Identifies habitat modification as a threat. No explicit relevant objectives. | |
| | *Underwater Cultural Heritage Act 2018* | The *Underwater Cultural Heritage Act 2018* (UCH Act) protects the integrity of Australia's underwater cultural heritage sites in-situ and individual artefacts associated with those sites. | |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | No feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures for seabed disturbance. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to seabed disturbance are AL6, AL7, AL12, AL16, AL17 and AL18 identified in Table 8-65. These acceptable levels defined for a change in habitat, cultural heritage and injury/mortality to marine fauna are defined in Table 7-6.<br>The worst-case predicted impacts assessed in Section 8.8.4 are:<br>• The total area of impact from seabed disturbance is expected to be limited to a localised area of ~20.4 $km^2$, within the Operational Area, which includes ~14.4 $km^2$ for subsea infrastructure, and ~1.89 $km^2$ for well construction and well abandonment.<br>• The short-term disturbance area is approximately ~5% of the total planned seabed disturbance area (1.09 $km^2$ of the ~20.4 $km^2$) which is expected to be from short-term mooring of a MODU.<br>• Recovery of benthic habitats following the removal of MODU mooring system is expected to commence within the following months (e.g. Morrisey et al., 2018). However, 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, and based on field observations it is expected that hard substrate communities will recover in ~5-10 years. The long-term disturbance area is based on the placement of subsea infrastructure (i.e. flowlines and umbilicals) which is anticipated to have a physical presence on the seabed until the decommissioning of the infrastructure, estimated to be completed in 2049. Despite the long-term impact, the disturbance will be localised within the operational area, and the infrastructure is expected to be progressively colonised by benthic assemblages. | | |

| | |
|---|---|
| | • Area of hard ground and patchy epifauna is ubiquitous with the Otway region and occurs across the south east marine region (Ramboll, 2020b).<br>• No threatened benthic species, assemblages or ecological communities were identified within the operational area. The highest consequence ranking for seabed disturbance was Level 2 and the highest inherent risk was evaluated as Moderate.<br>• Infauna and epibenthic communities are expected to recolonise impacted areas. Injury/mortality to benthic and demersal invertebrate communities from seabed disturbance is expected to be short term and recoverable based on observations of natural regrowth and recovery around existing facilities.<br>• Fish species are transient through the operational area, and impacts are predicted to be temporary and localised as the fauna can avoid the area during disturbance.<br>Therefore, at its worst-case, the predicted impact from seabed disturbance would not:<br>• Modify an important or substantial area of habitat which may adversely impact on biodiversity and ecological integrity.<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species<br>• Lead to loss of habitat critical to the survival of species<br>• Exceed levels which prevent protection and conservation of underwater cultural heritage as defined under the *Underwater Cultural Heritage Act 2018*.<br>• Not lead to injury or desecration of objects or areas declared for protection under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*.<br>• Not interfere with native title rights or users as defined under section 233 of the *Native Title Act 1993* (Cth).<br>Therefore, the predicted level of impact resulting from seabed disturbance from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to seabed disturbance are acceptable, based on:<br>• Predicted levels of impact (evaluated in Section 8.8.4.1) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors.<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes.<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD.<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES.<br>• No relevant feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.<br>To manage impacts to receptors to or below the defined acceptable levels the following EPOs have been applied:<br>**EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the *Underwater Cultural Heritage Act 2018*.<br>**EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts, including potential changes to seabed quality.<br>**EPO12:** Seabed disturbance limited to the planned disturbance areas defined in this OPP and limited to within the Operational Area.<br>**EPO19:** Impacts to commercially targeted species will be limited to temporary[16] and localised[16] change in fauna behaviours.<br>**EPO24**: No impact to underwater cultural heritage |

| | |
|---|---|
| | **EPO25:** Undertake Ongoing Engagement with relevant First Nations groups to ensure identified tangible and intangible cultural heritage and potential risks to cultural heritage values remains current and its protection is provided for within EPs for the activity. |

### 8.8.6 Environmental Performance

Table 8-65 lists the acceptable level and EPO defined for seabed disturbance and the adopted control measures to achieve the outcome.

*Table 8-65: Environmental Performance Summary – Seabed disturbance*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL6:** No unrecoverable impacts to seabed including shelf rocky reef and hard substrate KEF values[13]. **AL7:** Seabed disturbance will not occur outside the Operational Area. | **EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the Underwater Cultural Heritage Act 2018.<br>**EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts, including potential changes to seabed quality.<br>**EPO12:** Seabed disturbance limited to the planned disturbance areas defined in this OPP and limited to within the Operational Area . | CM2: Offshore Operational Procedures<br>CM10: Implement Cooper Energy's Decommissioning Protocol<br>CM24: Seabed Survey |
| **AL12:** Impacts and risks to commercially targeted species will not threaten Australian commercial fish stocks. | **EPO19:** Impacts to commercially targeted species will be limited to temporary[163] and localised[16] change in fauna behaviours. | |
| **AL16:** Impacts and risks from activities defined in this OPP will not prevent the protection and conservation of underwater cultural heritage as defined under the *Underwater Cultural Heritage Act 2018.*<br>**AL17:** Impacts and risks from activities defined in this OPP will not lead to injury or desecration of objects or areas declared for protection under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984.*<br>**AL18:** Impacts and risks from activities defined in this OPP will not interfere with native title rights or interests as defined under Section 233 of the *Native Title Act 1993* (Cth), to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the Titleholder. | **EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the Underwater Cultural Heritage Act 2018.<br>**EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts, including potential changes to seabed quality.<br>**EPO24**: No impact to underwater cultural heritage<br>**EPO25:** Undertake Ongoing Engagement with relevant First Nations groups to ensure identified tangible and intangible cultural heritage and potential risks to cultural heritage values remains current and its protection is provided for within EPs for the activity. | CM9: Underwater Cultural Heritage Disturbance Risk Management Measures<br>CM24: Seabed Survey |

## 8.9 Interaction with Other Marine Users

### 8.9.1 Cause of Aspect

The physical presence of survey vessels, the MODU and support vessels will temporarily displace any other marine users within the operational area, with exclusion areas requested via notice to mariners, issued by the Australian Hydrographic Office (AHO). Small Petroleum Safety Zones (PSZs) are typically established around wells, and sometimes other equipment; marine users will be excluded from PSZs for the life of the facility, or until the PSZ is revoked. PSZs are gazetted by NOPSEMA.

Displacement of marine users will occur as a result of East Coast Project activities, identified in Table 8-66, which are described in further detail in subsections below.

*Table 8-66: Activities undertaken during the East Coast Project that may cause displacement of marine users*

| Cause of Aspect / Phase | Activity component |
|---|---|
| **Equipment presence on the seabed / All Phases** | PSZ gazetted by NOPSEMA at the request of the Titleholder (typically 500m radius exclusion zone around wells and sometimes other equipment such as manifolds) |
| **Support operations** | MODU operations – temporary exclusion zone issued by the AHO |
| | Vessel operations – temporary exclusion zone issued by the AHO |

### 8.9.2 Aspect Characterisation

#### *8.9.2.1 Hydrocarbon extraction and transport*

Cooper Energy will typically apply for new PSZs to be put in place, where necessary, to protect the subsea assets and to ensure the vessels and equipment of other marine users are not put at risk (e.g. snagging fishing equipment).

PSZs are typically 500 m radius around each well site, or other equipment (as needed). Vessels or classes of vessel will be prohibited from being in these PSZs for the duration of the East Coast Project, typically until decommissioning activities are complete, or risks are otherwise managed, and PSZs revoked.

The subsea infrastructure will remain in place on the seabed until it is decommissioned as per the activity approach outlined within Section 4.3.5. As such, prior to decommissioning, there is potential for interaction of other marine users with this equipment, in the event that those marine users interact with the seabed.

#### *8.9.2.2 Support Operations*

The MODU will be present in the operational area during drilling, well intervention and for well abandonment activities (see Section 4.3 for indicative durations of these activities). The MODU will be stationary for most of the time in the operational area. During operations other marine users will typically be requested to avoid entering area surrounding the activity and a nominal exclusion area established:

- A 3 km radius cautionary zone around the MODU during well construction activities to allow for anchors, mooring chains and wire to be placed within the operational area.
- A Safety Exclusion Zone around temporary project vessels and the MODU, typically 500m radius and established via a ‘Notice to Mariners’ outlining the exclusion zone location, size and activity duration.

Project vessels will temporarily visit the operational area during all phases of the East Coast Project. ~3 anchor handler vessels or PSVs plus the MODU could be within the operational area during drilling and decommissioning activities.

The largest vessel required for the project is likely to be an Installation Support Vessel (ISV) or Reel-Lay vessel in which may be in field for ~45 days per campaign.

Interim vessel transiting to and from the operational area are managed under the Commonwealth *Navigation Act 2012* and therefore this activity is excluded from the scope of the OPP.

#### *8.9.2.3 Concurrent activities*

As described in Section 4.1.2, concurrent activities could occur. Cooper Energy assessed reasonably foreseeable concurrent activity scenarios and identified that the potential concurrent activities of drilling operations at Elanora-1 and flowline installation between Annie-2 and Casino-5 represents the activity scenario with the greatest number of vessels within the operational area, operating concurrently. This could involve 3 vessels and a MODU operating at once (further details in Section 8.2.2.5). These kinds of concurrent activities could occur over periods of ~50 days depending on the exact scope of works to be completed and availability of vessels and equipment. Drilling and related activities such as flaring would occur only from 1 well at a time.

Long term PSZs may be established around the near vicinity of each well; this is common practice offshore Victoria.

### 8.9.3 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impacts from the physical presence of survey vessels, the MODU and support vessels include changes to the function, interests, and activities of other marine users, including:

- shipping
- petroleum exploration and production
- other offshore infrastructure (i.e. renewable energy)
- defence
- recreation and tourism
- commercial fisheries.

### 8.9.4 Impact and Risk Evaluation

#### *8.9.4.1 Impact: Changes to the Functions, Interests and Activities of Other Marine Users*

The physical presence of infrastructure, and support operations (vessel and MODU operations) has the potential to impact on the following activities by the exclusion of other marine users into the operational area.

Shipping

The operational area sits at the norther edge of the shipping route that runs east/west along Australia's southern coastline. Moderate levels of shipping traffic are expected in the southern sections of the operational area, with the occasional vessel traversing in the northerly sections most likely related to surrounding hydrocarbon production and exploration activities. A total of 522 vessels intersected the proposed operational area in 2022 (AMSA, 2023) which is an average of 1.4 vessels per day.

There are no designated shipping lanes in the vicinity of the operational area (Australian Hydrographic Office, 2023).

Commercial shipping will need to physically avoid the temporary exclusion zones established around the MODU and other project vessels; and long-term PSZs in place above infrastructure during operations. These zones are small (typically 500 m radius); the MODU exclusion zone temporary for the duration of drilling.

Given this small area, moderate number of vessels transiting through the operational area and with known activities published via a notice to mariners, impacts to commercial shipping are likely to

minimal. Exclusion and traffic management areas not unusual off the southeast of Australia and are managed and communicated under existing protocols.

Petroleum exploration and production

Within the operational area there are a number of abandoned and production wells which were originally explored by Santos Limited, Shell Development (Australia) Proprietary Limited and Cooper Energy Pty. Ltd.

Cooper Energy's existing CHN facilities consist of the Casino, Henry and Netherby gas fields along with associated subsea infrastructure.

Beach Energy's Otway Gas Field Development and Woodside's Minerva Gas Development are ~5.2 km and 8.5 km respectively from the operational area. The Otway Gas Field is under operation; and Minerva is in the process of being decommissioned.

At the time of writing, the following EPs are under development or assessment, and propose to undertake activities in the Otway Region in the next 5-years:

- Regia MSS
- Beach Energy Otway Drilling Campaign
- Woodside Energy Minerva Facility Decommissioning
- Conoco Phillips Exploration Drilling.

CGG are planning to undertake the Regia 3D Marine Seismic Survey, which overlaps 76% of the East Coast Project operational area. The survey duration of 90 days, with an earliest start date is 1 November 2023 following regulatory approval; and latest finish date is 31 October 2028 (CGG, 2023).

Future Cooper Energy exploration drilling activities may be undertaken within the operational area, which will inform the final engineering design of the East Coast Project; and will be managed by Cooper Energy.

There is no direct overlap of infrastructure, and no crossings of third-party pipelines in the operational area. The East Coast Project operational area does overlap the operational area of the proposed Regia 3D Marine Seismic Survey. Therefore, apart from the proposed short term Regia 3D Marine Seismic Survey (90 days), it is expected that only transiting support vessels could be impacted by proposed exclusion zones for the East Coast Project.

Proposed exclusion zones (PSZ and cautionary zones) will result in the exclusion of support vessels. Given the limited size of PSZs (typically a 500 m radius) and cautionary zones (approximately 3 km), impacts to petroleum activities are expected to be minimal.

Other Offshore Infrastructure

There are currently no offshore renewable energy installations or areas 'declared to be suitable' for offshore wind by the Australian Government within the operational area. The closest area 'declared to be suitable' is the Southern Ocean Region, which is ~5 km from the operational area.

The Spinifex Offshore Wind Farm accepted the offer of a feasibility licence from the Australian Government in March 2025 and is currently in the pre-planning phase (Spinifex, 2025). The Spinifex feasibility licence area is situated approximately 25 km west of the operational area. East Coast Project and Spinifex Offshore Wind Farm activity areas will not overlap, therefore no further assessment is required.

Defence

There is no known Australian Defence Force (ADF) training, practice or prohibited area that intersect with the operational area, therefore no impact to defence activities from the East Coast Project are predicted.

Recreation and Tourism

Key tourist and recreational activities in the area include sight-seeing, surfing and fishing (including recreational, game, deep drop or charter fishing). However, these are generally land-based or near-shore activities and are not impacted by the proposed activities. Most recreational fishing typically occurs in nearshore coastal waters (shore or inshore vessels), and within bays and estuaries; offshore (>5 km) fishing only accounts for approximately 4% of recreational fishing activity in Australia.

Proposed exclusion zones (PSZ and cautionary zones) will result in exclusion of tourist and recreational marine users. Cautionary zones will result in temporary (<60 days per well) and localised (~3 km) exclusion from the area. PSZs will result in longer-term exclusion, however, are very localised (500 m) and are an accepted tool for managing risks to equipment and marine users. Given the limited size of PSZs and the temporary enforcement of cautionary zones, impacts to tourists and recreational fishers are expected to be minimal.

Commercial Fishing

Multiple fisheries from two fishing management jurisdictions (Commonwealth and Victorian) overlap the operational area, including:

- ten Commonwealth fisheries
- seven Victorian fisheries.

Table 8-67 identifies these fisheries and notes if recorded fishing activity has occurred within the operational areas within the period of 2016 to 2022 (ABARES, 2023).

*Table 8-67: Presence of commercial fisheries and fishing activity within the operational area*

| Fishery | Recorded fishing intensity in the operational area (2016 to 2022)[1] |
|---|---|
| **Commonwealth** | |
| **Bass Strait Central Zone Scallop Fishery (BSCZSF)** | X |
| **Eastern Skipjack Tuna Fishery (ESTF)** | X |
| **Eastern Tuna and Billfish Fishery (ETBF)** | X* |
| **Small Pelagic Fishery (SPF)** | X |
| **Southern and Eastern Scalefish and Shark Fishery – Commonwealth Trawl Sector (SESSF – CTS)** | ✓ |
| **Southern and Eastern Scalefish and Shark Fishery – Gillnet Hook Trap Sector Shark Gillnet sub-sector (SESSF – CGS)** | ✓ |
| **Southern and Eastern Scalefish and Shark Fishery – Gillnet Hook Trap Sector Shark Hook sub-sector (SESSF – CSHS)** | X* |
| **Southern and Eastern Scalefish and Shark Fishery SESSF – Scalefish Hook Sector (SESSF – SHS)** | X* |
| **Southern Bluefin Tuna Fishery (SBTF)** | X |
| **Southern Squid Jig Fishery (SSJF)** | ✓ |
| **Victorian** | |
| **Abalone** | X |
| **Giant Crab Fishery** | ✓ |
| **Multi-species Ocean Fishery** | ✓ |
| **Octopus** | ✓ |
| **Rock Lobster Fishery** | ✓ |

| Fishery | Recorded fishing intensity in the operational area (2016 to 2022)[1] |
|---|---|
| **Scallop Fishery** | X |
| **Wrasse Fishery** | ✓ |

1. ✓ = fishery recorded within operational area, X = fishery not recorded within operational area.

**operational area is not overlapped by an area reporting intensity data but is overlapped by an area designated as maximum area fished (Commonwealth reporting grid) at a resolution of one degree (approximately 111 x 111 km)*

**Commonwealth Fisheries**

Commonwealth fisheries are managed by the Australian Fisheries Management Authority (AFMA) under the *Fisheries Management Act 1991* (Cth). AFMA jurisdiction covers the area from 3 nm from the coast out to the 200 nm limit (the Australian Fishing Zone (AFZ)). Within Commonwealth fishery data sets, relative fishing intensity is an area where 5 or more fishing vessels operated and consists of the relative effort expended or the catch. The maximum area fished (Commonwealth reporting grid) is the total area where fishing occurred at a resolution of one degree (approximately 111 x 111 km). If fishing consists of <5 vessels, it is considered confidential by AFMA, and intensity data may not be reported.

Commonwealth fisheries which had a reporting grid or fishing intensity data intersecting with the operational area between 2016 and 2022 are detailed in the following sections.

Eastern Tuna and Billfish (ETBF)

No fishing intensity data between 2016 and 2022 overlaps the operational area. However, the operational area is overlapped by a single Commonwealth reporting grid. Between 2016 and 2022 fishing activity occurred within this Commonwealth reporting grid only in 2017. Little or no fishing activity from the Eastern Tuna and Billfish Fishery is expected within the operational area as fishing intensity data is shown to mostly occur in southern NSW and southern Tasmanian waters.

Therefore, activities from the East Coast Project are unlikely to have an impact to fishers within the ETBF fishery.

Southern and Eastern Scalefish and Shark Fishery – Commonwealth Trawl Sector (SESSF – CTS)

The Commonwealth Trawl Sector (CTS) includes both otter-board trawl fishing as wells as Danish-seine methods.

Intensity data for the SESSF – CTS (otter-board trawl) fishery is primarily active along the continental shelf spanning from South Australian offshore waters to NSW offshore waters plus the west and east coasts of Tasmania. The operational area overlaps the combined 2016 to 2022 five-year low intensity data by 0.03% and has no overlap with areas designated as moderate or high intensity fishing. Therefore, activities from the East Coast Project are unlikely to have an impact to fishers within the SESSF Commonwealth Trawl Sector fishery (otter-board trawl) fishery.

No fishing intensity data for the Danish-seine segment of the Commonwealth Trawl Sector overlaps the operational area between 2016 to 2022. However, the operational area is overlapped by one reporting grid resulting from activity occurring in the 2020 – 2021 fishing season. Fishing activity primarily occurs in the Gippsland area and to the east of Tasmania.

Therefore, activity from this fishery is not expected within the within the operational area with activities from the East Coast Project unlikely to have an impact to fishers within the SESSF Commonwealth Trawl Sector fishery (Danish-seine) fishery.

Southern and Eastern Scalefish and Shark Fishery – Gillnet Hook Trap Sector Shark Gillnet sub-sector (SESSF – CGS)

Data for the SESSF – Gillnet Hook Trap Sector Shark Gillnet sub-sector (SESSF – CGS) shows on overlap with both low and moderate intensity fishing between 2016 and 2022. However, the overlap is minimal with the operational area overlapping the low and moderate intensity areas by 0.49% and 0.21% respectively.

Therefore, activities from the East Coast Project are unlikely to have an impact to fishers within the SESSF – Gillnet Hook Trap Sector Shark Gillnet sub-sector (SESSF – CGS) fishery.

Southern and Eastern Scalefish and Shark Fishery – Gillnet Hook Trap Sector Shark Hook sub-sector (SESSF – CSHS)

No fishing intensity data for the SESSF – Gillnet Hook Trap Sector Shark Hook sub-sector (SESSF – CSHS) overlaps the operational area between 2016 and 2022. However, the operational area is overlapped by one reporting grid resulting from activity occurring in the 2020 – 2022 fishing season. The majority of fishing activity occurs in South Australia waters and north-eastern Tasmania.

Therefore, activities from the East Coast Project are unlikely to have an impact to fishers within the SESSF – Gillnet Hook Trap Sector Shark Hook sub-sector (SESSF – CSHS) fishery.

Southern and Eastern Scalefish and Shark Fishery – Scalefish Hook Sector (SESSF – SHS)

No fishing intensity data for the SESSF – Scalefish Hook Sector (SESSF – SHS) overlaps the operational area between 2016 and 2022. However, the operational area is overlapped by one reporting grid resulting from activity occurring in the 2020 – 2022 fishing season. The majority of fishing activity occurs in waters to the east and south of Tasmania.

Therefore, activities from the East Coast Project are unlikely to have an impact to fishers within the SESSF – Scalefish Hook Sector (SESSF – SHS) fishery.

Southern Squid Jig Fishery (SSJF)

Data for the Southern Squid Jig Fishery (SSJF) shows an overlap with low intensity fishing between 2016 and 2022. However, the overlap is minimal with the whole operational area overlapping the low intensity area by 4.02%. Moderate and high fishing intensity occurs to the west of the operational area and east of Tasmania.

Therefore, activities from the East Coast Project are unlikely to have an impact to fishers within the Southern Squid Jig Fishery (SSJF) fishery.

**Victorian Fisheries**

Victorian fisheries are managed by the Victorian Fisheries Authority (VFA) with their jurisdiction extending offshore to 3 nm. By agreement with the Commonwealth, the VFA also manages some fisheries beyond this limit.

Abalone

The operational area overlaps the central zone of the Victorian Abalone Fishery. However, catch data for the 34-licence holders within the zone is assessed as confidential. Abalone is collected by divers who use a chisel-like, iron bar to prise it from the rocks as is found on rocky reefs from the shore out into the sea to depths of 30 m (VFA, 2022b). Divers operating using hookah (light-weight surface supplied equipment), which is usually limited to a maximum of 30 m operating depth.

The shallowest section of the operational area is 49 m; therefore, based on water depths for fishing and habitat, overlap between the East Coast Project and stakeholder functions, interests, and activities is considered to be very unlikely.

Giant Crab Fishery

The Victorian giant crab fishery targets Giant Crab *(Pseudocarcinus gigas*) using baited lobster pots. The operational area is situated within the 'western zone' of this fishery defined as the area between Apollo Bay and the Victorian/South Australian border. VFA data shows that the greatest fishing intensity for the Victorian Giant Crab Fishery occurs along the continental shelf at depths between approximately 150 to 300 m which is to the south of the operational area. VFA data shows that the operational area intersects with 6 separate reporting grids. Four of these reporting grids are marked

as confidential due to <5 vessels operating between 2013 and 2023. The fifth and sixth reporting block reports 8 and 9 fished between 2013 and 2023.

As the highest degree of fishing intensity is situated to the south of the operational area, stakeholder functions, interests, and activities of the giant crab fishery are unlikely to be impacted by the East Coast Project.

Multi-species Ocean Fishery

The Victorian multi-species ocean fishery is comprised of the ocean fishery, the commercial permit fishery and the octopus fishery sub-sectors. Historically the octopus (eastern zone) fishery was included in the multi-species ocean fishery but was established as a standalone fishery in 2020. VFA data shows the greatest number of days fished occurring to the west of Portland and between Cape Otway and Cape Liptrap.

As the highest degree of fishing intensity data (not deemed confidential) is situated outside of the operational area, stakeholder functions, interests, and activities of the multi-species ocean fishery are unlikely to be impacted by the East Coast Project.

Octopus

The octopus (eastern zone) fishery was historically included in the multi-species ocean fishery; but was established as a standalone fishery in 2020. The target species the pale octopus (*Octopus pallidus*), are found in bays and coastal waters. Catch data shows that only one reporting grid overlaps the operational area which is assessed as confidential as <5 fishing vessels have reported fishing in the area. The majority of the fishing effort is shown to occur to the east of the operational area.

As the highest degree of fishing intensity data (that is not deemed confidential) is situated outside of the operational area, stakeholder functions, interests, and activities of the octopus fishery are unlikely to be impacted by the East Coast Project.

Rock Lobster Fishery

The operational area lies within the ‘western zone’ of the Victorian rock lobster fishery management area. Intensity data shows the highest reported value near the Victorian/South Australia border as 5,005 days fished between 2013 and 2023. Intensity data (VFA, 2022b) also shows that the operational area intersects with 9 reporting grids. Of these, 4 reporting days fished between 2013 and 2023 range between 5 and 100 days. The operational area also overlaps coastal reporting grids G11 and G12 which report values of days fished as 1,811 and 2,110 respectively between 2013 and 2023. However, the whole operational area only overlaps G11 and G12 by 19.02% and 0.46% respectively.

As the highest degree of fishing intensity data (not deemed confidential) is situated outside of the operational area, stakeholder functions, interests, and activities of the Victorian southern rock lobster fishery are unlikely to be impacted by the East Coast Project.

Wrasse Fishery

The Victorian wrasse (ocean) fishery is divided into three commercial management zones and extends along the length of the Victorian coastline and out to 20 nm offshore, excluding marine reserves. Intensity data shows the highest intensity of fishing effort occurs in reporting grids adjacent to Port Fairy and Warrnambool (441 to 564 days fished) and to the south of Mornington Peninsula (968 days fished) outside of the operational area. Whilst the operational area overlaps reporting grids G11 and G12, VFA data lists low values of 43 and 37 days fished respectively between 2013 and 2023. In addition, the whole operational area only intersects with G11 and G12 by 19.02% and 0.46% respectively.

As the highest degree of fishing intensity data (not deemed confidential) is situated outside of the operational area, stakeholder functions, interests, and activities of the Victorian wrasse fishery are unlikely to be impacted by the East Coast Project.

Summary

The predicted level of impact, i.e., the consequence, to commercial fisheries from having a substantial adverse effect on the sustainability of a commercial fishery is evaluated to have a consequence of **Level 1**, based on:

- Exclusion areas are small and are temporary (<60 days per well) are a well-established method to avoid interactions between marine users.
- Long-term PSZs (typically established around the wells) would also have a small spatial extent (500 m) and are an accepted tool for managing risks to equipment and marine users.
- The level of use of the operational area by shipping, petroleum exploration and production and recreation and tourism are expected to be low based on the current low usage.
- The level of use of the operational area by commercial fisheries is relatively low. For most of the fisheries identified, the highest degree of fishing intensity data is situated outside of the operational area, therefore stakeholder functions, interests, and activities of fisheries are unlikely to be impacted by the East Coast Project.
- The operational area covers only a small percentage of the identified Victorian and Commonwealth fishery management areas.
- The physical presence of subsea infrastructure (present prior to decommissioning activities are undertaken as per Section 4.3.5) is not expected to impact the sustainability of commercial fisheries. One commercial fishery that operates within the operational area undertakes trawling, however the combined 2016 to 2022 five-year fishing intensity data shows that it there is a 0.03% overlap of low fishing intensity, therefore impacts are unlikely.

### 8.9.5 Demonstration of Acceptability

To demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 8-68.

*Table 8-68: Interaction with other marine users acceptability assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Impact: changes to the functions, interests and activities of other marine users | Consequence: Level 1 – commercial shipping<br>Consequence: Level 1 – other offshore industry<br>Consequence: Level 1 – recreation and tourism<br>Consequence: Level 1 – commercial fisheries |
| **Principles of ESD** | ‘A) ‘Integration principle’<br>Consistent with Cooper Energy’s risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 8.9.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met. | |

| | | | |
|---|---|---|---|
| | By meeting relevant requirements and with implementing the control measures (refer below) the impacts from interaction with other marine users are identified as:<br>• Level 1 consequence for changes to the functions, interests and activities of other marine users.<br>The above predicted levels of impact due to interaction with other marine users from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology.<br>• The highest consequence ranking for interaction with other marine users was Level 1; therefore, interaction with other marine users from the East Coast Project will not result in serious or irreversible environmental damage.<br>• The potential impacts and risks from interaction with other marine users are well-understood, and management measures are well established and regulated in Australian waters. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest consequence ranking for interaction with other marine users was Level 1 and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.9.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations generations through ensuring the rights of other marine users or sustainability of fisheries are not compromised as per the OPGGS Act. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to interaction with other marine users were evaluated in Section 8.9.4 and the highest consequence ranking for seabed disturbance was evaluated as Level 1.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 8.9.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained. | | |
| | E) 'Valuation principle'<br>The East Coast Project is consistent with the principle of ESD (e) for this aspect by adopting controls such as the Fisheries Damages Protocol which includes provision for a compensation mechanism to ensure acceptable levels and EPOs are met. | | |
| | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |

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| **Legislative and Other Requirements** | *Offshore Petroleum and Greenhouse Gas Storage Act 2010* (OPGGSA) (& Regulations 2021) | Objective:<br>Demonstrate 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.<br>Management Action:<br>Address 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). | Adoption of the following control measures:<br>CM1: Marine Assurance Process<br>The vessels and MODU will adhere to navigational safety requirements under the *Navigation Act 2012* and associated Marine Orders, including but not limited to:<br>• AMSA MO 21 – Safety and Emergency Arrangements<br>• AMSA MO 27 - Safety of Navigation and Radio Equipment<br>• AMSA MO 30 - Prevention of Collisions.<br>• AMSA MO 31: SOLAS and non-SOLAS certification<br>CM11: Fisheries Damages Protocol<br>Fisheries Damage Protocol will be in place to provide a compensation mechanism to fishers who damage fishing equipment on East Coast Project infrastructure outside of the PSZ.<br>CM12: Marine exclusion, caution and petroleum safety zones<br>May include:<br>• A temporary 3 km cautionary zone around the MODU during the drilling program.<br>• A temporary 500 m exclusion/caution zones to be established via Notice to Mariners around vessels undertaking petroleum activities.<br>• PSZs will be gazetted around wells and other equipment where required for equipment integrity management. Subsea infrastructure will be marked on navigational charts for awareness.<br>CM13: Ongoing Engagement<br>Further engagement will take place during the development and implementation of component EPs. This will include: |
| | *Navigation Act 2012* | Objective:<br>Regulates international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters.<br>The Act gives effect to the relevant international conventions (MARPOL 73/78, COLREGS 1972) relating to maritime issues to which Australia is a signatory.<br>The Act also has subordinate legislation contained in Regulations and Marine Orders.<br>Management Action:<br>All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act.<br>Several Marine Orders (MO) are enacted under this Act which relate to offshore petroleum activities, including:<br>MO 21: Safety and emergency arrangements<br>MO 27 - Safety of Navigation and Radio Equipment<br>MO 30: Prevention of collisions<br>MO 31: SOLAS and non-SOLAS certification | |

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| | *Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act).* - Section 616 (2) | This section of the Act requires the establishment and maintenance of petroleum safety zones around wells, offshore structures or equipment which prohibits vessels entering without written consent.<br>For the purposes of protecting a petroleum or greenhouse gas well, structure or any equipment in an offshore area NOPSEMA can prohibit vessels from entering or being present in a specified area (the safety zone).<br>A safety zone can extend up to 500m from the outer edge of the well, structure or equipment, and are established via a notice published in the Gazette. | • details relating to notification of third-party stakeholders,<br>• engagement with other titleholders in the Otway with respect to each other's ongoing activities and the potential for cumulative impacts.<br>Relevant information received will be included within the EPs as appropriate. |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11)<br>• External Affairs & Stakeholder Management (MS05).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | No feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.<br>Cooper Energy has participated in consultation with commercial fishers since acquiring the CHN facilities. Previous consultation (Cooper Energy, 2019) has not indicated that the proposed activities and associated exclusion zones located within the vicinity of the existing CHN development would result in further objections or claims. Impacts to commercial fisheries are predicted to be minimal due to the localised nature of exclusion and safety zones.<br>AMSA have not raised claims or objections to the Project and have not previously raised claims or objections to previous Cooper Energy exploration activities (Cooper Energy, 2019). | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impact relevant to interactions with other marine users is AL14 identified in Table 8-69. This acceptable level defined for changes to the functions, interests and activities of other marine users are defined in Table 7-6.<br>The worst-case predicted impacts assessed in Section 8.9.4 are:<br>• The level of usage of the operational area by commercial fisheries, shipping, petroleum and tourism are expected to be low.<br>• Areas defined for the purpose of safe operations include the exclusion areas which are small and temporary (<60 days per well); and long-term PSZs (typically established around the wells) would also have a small spatial extent (500 m).<br>• The physical presence of subsea infrastructure (present prior to decommissioning activities are undertaken as per Section 4.3.5) is not expected to impact the sustainability of commercial fisheries. One commercial fishery that operates within the operational area undertakes trawling, however the combined 2016 to 2022 five-year fishing intensity data shows that it there is only a 0.03% overlap of low fishing intensity. | | |

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| | • The highest consequence ranking for interaction with other marine users was Level 1.<br>Therefore, at its worst-case, the predicted impact from interactions with other marine users would not:<br>• Lead to substantial adverse effects on the sustainability of commercial fisheries.<br>• Prevent the maintenance of social and commercial amenity values of the Commonwealth Marine Area within the region consistent with the rights of all marine users.<br>Therefore, the predicted level of impact resulting from interactions with other marine users resulting from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to interactions with other marine users are acceptable, based on:<br>• Predicted levels of impact (evaluated in 8.9.4) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors.<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes.<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD.<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES.<br>• No feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.<br>To manage impacts to receptors to or below the defined acceptable levels the following EPO have been applied:<br>**EPO22**: Implement Fisheries Damages Protocol to provide a compensation mechanism to fishers who damage fishing equipment on East Coast Project infrastructure outside of the PSZ.<br>**EPO23:** No unplanned interactions between the project vessels and other marine users. |

### 8.9.6 Environmental Performance

Table 8-69 lists the acceptable level and EPO defined for the displacement of marine users and the adopted control measures to achieve the outcome.

*Table 8-69: Environmental Performance Summary – Interaction with other marine users*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL14:** No interference with other marine users to a greater extent than is necessary for the reasonable exercise of the rights and performance of duties as conferred by the titles granted to Cooper Energy. | **EPO22**: Implement Fisheries Damages Protocol to provide a compensation mechanism to fishers who damage fishing equipment on East Coast Project infrastructure outside of the PSZ.<br>**EPO23:** No unplanned interactions between the project vessels and other marine users. | CM1: Marine Assurance Process |
| | | CM12: Marine exclusion, caution and petroleum safety zones |
| | | CM11: Fisheries Damages Protocol |
| | | CM13: Ongoing Engagement |

# 9 Risk Assessment

## 9.1 Loss of Materials or Waste Overboard

### 9.1.1 Cause of Aspect

The use of equipment and materials on vessels may result in the unplanned loss of materials overboard during the East Coast Project. The unplanned loss of materials overboard could occur during the phases and activities identified in Table 9-1.

*Table 9-1: Activities undertaken in the East Coast Project that could result in the Loss of Materials Overboard*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Well Construction** | Drilling operations |
| **Installation and Commissioning** | Pre-lay works |
| | Flowline and umbilicals |
| | Installation of subsea structures |
| | Post-lay works |
| | Testing, preservation and start-up |
| **Support Operations** | MODU operations |
| | Vessel operations |
| | ROV operations |
| **Decommissioning** | Well abandonment |
| | Flowline and umbilical decommissioning |
| | Removal of remaining subsea infrastructure |

### 9.1.2 Aspect Characterisation

#### *9.1.2.1 Well Construction*

Drilling will be carried out using a semisubmersible rig referred to as a MODU for the East Coast Project. There is potential for loss of equipment to the marine environment during well construction.

#### *9.1.2.2 Installation and Commissioning*

During installation and commissioning operations, there is potential for subsea equipment including manifolds, mattresses, jumpers, spools and so on, to be accidentally dropped during lifting operations as a result of lifting equipment malfunctions, loading incidents or improper handling.

#### *9.1.2.3 Support Operations*

MODU, vessel, and ROV operations include the use and transfer of hazardous or non/hazardous materials including waste and apply throughout the life cycle of the project including drilling, IMR, survey, and decommissioning activities.

The unplanned loss of materials overboard during support operations may result from rough ocean conditions when items may be washed or blown off the deck, improper or unsuitable waste storage, human error, or failure of waste storage equipment.

The unplanned loss of materials overboard could include hazardous solid materials such as batteries, aerosol cans, empty paint cans, printer cartridges, fluorescent tubes, hydrocarbon-contaminated materials (e.g., oily rags, oil filters, oily PPE) etc. The unplanned loss of materials overboard could also include non-hazardous solid materials such as paper, cardboard, wooden pallets, scrap steel, metal, aluminium, cans, glass, plastics etc.

Solid materials that are non-buoyant are expected to sink to the seabed and remain in the operational area. Any buoyant materials, such as wood and plastic packaging or equipment components, lost overboard have the potential to be transported by wind, waves and currents outside of the operational area.

Waste generated on-board vessels will be handled in accordance with AMSA Discharge Standards, relevant State requirement, and vessel Garbage Management Plans (GMP); these require that wastes are managed so that it is not lost or discarded overboard.

#### *9.1.2.4 Decommissioning*

Full removal of all subsea infrastructure is considered as the base case for decommissioning. Parts of subsea infrastructure have the potential to be dropped during their recovery to surface within the operational area.

### 9.1.3 Potential Environmental Impacts and/or Risks.

Potential risks from the loss of materials or waste overboard are:

- Change in habitat
- Injury / mortality to marine fauna.

Socio-economic impacts on commercial fisheries have not been evaluated further, as there are no discernible impacts to behaviour and distribution expected at the population level given the limited nature and scale of activities associated with loss of materials or waste overboard.

### 9.1.4 Impact and Risk Evaluation

#### *9.1.4.1 Risk: Change in Habitat*

**Inherent Consequence Evaluation**

The loss of materials overboard during drilling, installation and commissioning and decommissioning phases may result in localised and temporary disturbance to benthic habitats.

The impact footprint on benthic habitats would align with the size of the object dropped overboard. The largest potential impact footprint is from the overboard loss of a manifold (8 x 12 m) and therefore considered highly localised. A dropped object has the potential to release limited quantities of chemicals or hydrocarbons. This risk of contamination from chemicals or hydrocarbons is anticipated to be localised and minor (see Section 9.2 for the evaluation of minor loss of containment). Once a dropped object has been recovered, the seabed is expected to recover naturally.

As described in Section 6.5.1 Ramboll (2020b) found that benthic assemblages within and adjacent to the East Coast Project operational area to be representative of the characteristics of the rocky reef and hard substrate KEF that are well represented in the Otway and wider Bass Strait region (see Section 6.6.6). Benthic assemblages have been observed during offshore surveys; these surveys have reported scattered areas of hard ground supporting patchy areas of abundant epibiota, typically bryozoans, gorgonian, cnidarians and sponges (Ramboll, 2020b); benthic fauna have also been observed to be colonising existing subsea infrastructure also (Figure 6-16). While there is some residual uncertainty on the exact benthic assemblage composition in the south-western portion of the operational area, as there is no historical survey data in that area; Ramboll (2020a) surveyed sites at a similar water depth and distance offshore in a neighbouring title area (Figure 6-17; Section 6.5.1) and which provide a reasonable proxy for the purpose of impact and risk assessment. No ecological communities listed as threatened under the EPBC Act were observed and the operational area does not overlap AMPs.

The predicted level of impact, i.e., the consequence, to benthic habitats is evaluated to have a consequence of **Level 2**, based on:

- benthic assemblages have a scattered distribution in the operational area and do not contain listed ecological communities
- the shelf rocky reefs KEF exists throughout the Otway region
- the potential impact footprint is highly localised (maximum footprint of 96 $m^2$ in the event of a loss of a manifold overboard)
- seabed disturbance would be expected to recover naturally, as described in Section 8.8.

**Inherent Likelihood**

A combination of factors would be required for a loss of materials or equipment overboard, such as rough ocean conditions combined with unsuitable equipment, improper deck management, human error and equipment failure. The risk event is considered conceivable and could occur during the East Coast Project.

The likelihood of disturbance to benthic habitats from loss of material overboard is considered **Unlikely (D).**

**Inherent Risk Severity**

The predicted level of risk, i.e., inherent risk severity, of disturbance to benthic habitats is considered **Low**.

#### *9.1.4.2 Risk: Injury/Mortality to Marine Fauna*

**Inherent Consequence Evaluation**

Marine fauna susceptible to injury or death from loss of materials overboard include:

- Fish
- Marine reptiles
- Seabirds
- Marine mammals.

Fish

The loss of materials overboard has the potential to cause injury/mortality to fish from entanglement and ingestion. Plastics, if lost overboard, degrade over time, forming micro (and smaller) plastic particles. Fish may ingest wastes and microplastics found floating at the surface, buoyant within the water column, or on/in the seabed. Studies show that ingestion of microplastics by fish is relatively common, with over a third of all fish examined in studies in European waters having microplastics within their gastrointestinal tract (Murphy et al., 2017). Although pelagic or demersal fish may ingest microplastics, the impact on fish is expected to be relatively small and is not expected to result in a change to the viability of populations.

Marine Reptiles

Marine reptiles, specifically turtles, may be impacted through ingestion or entanglement from materials lost overboard. Turtles are known to be indiscriminate feeders and may mistake plastic for jellyfish (Mrosovsky et al., 2009). Ingestion of debris can cause internal wounds, suffocation, prevent feeding leading to starvation and can create intestinal blockages that increase buoyance and stop a turtle from diving (DEE, 2017).

The operational area does not intersect any recognised BIAs for marine turtles and therefore low numbers are expected in the area. Furthermore, areas where marine turtle foraging, feeding or related behaviours are not known to occur within the operational area (see Table 6-7). As a result, potential injury/mortality to marine reptiles from a loss of material or waste overboard would be limited to entanglement, with ingestion of material not expected to occur. Any impacts would be expected to be limited to individual turtles transiting through the area, with no population impacts are expected.

Seabirds

Seabirds are highly susceptible to injury/mortality from the loss of materials overboard because of potential entanglements and ingestion of in-water materials. Plastic debris adrift in the ocean are covered in biofilm which attracts albatrosses and petrels, and consequently, seabirds are highly likely to mistake plastic particles for food and ingest them (DCCEEW, 2022e). Ingestion of plastics can potentially cause impacts such as gut obstruction or reduced stomach volume, resulting in a loss of fitness and starvation (Wilcox et al., 2015). However, there is currently no evidence to suggest that ingestion or entanglement of marine debris are posing a significant threat to any Australian seabird species at the population level (CoA, 2020).

No habitats critical to the survival of threatened albatross and petrel species occur within the operational area, this including no known nesting sites. Suitable albatross and petrel breeding islands in Australia are limited to remote offshore islands of which the closest is Albatross Island located 250 km southeast of the operational area (CoA, 2022b). However, the operational area intersects with 8 foraging seabird BIAs, for albatross and petrel species. Based on the absence of habitats critical to the survival of threatened albatross and petrel species, it is inferred that albatrosses and petrels will forage within the operational area but not in high numbers.

No habitats critical to the survival of threatened shearwater species occur within the operational area. However, the short-tailed shearwater breeding site, Muttonbird Island, is located approximately 18 km from the operational area. Based on a buffer of Muttonbird Island, the operational area overlaps the short-tailed shearwater breeding and foraging BIA in accordance with the Australian Marine Spatial Information System (AMSIS, 2025). The operational area does not overlap foraging (in high numbers) BIAs for the short-tailed shearwater. Short-tailed shearwaters are expected within the operational area for offshore foraging during breeding season between September and April, however not in high numbers.

Potential injury/mortality to seabirds from entanglements and ingestion of materials overboard would be expected to be limited to individual foraging seabirds, no population impacts are expected.

Marine Mammals

The loss of materials overboard has the potential to cause injury/mortality to marine mammals from entanglement and ingestion. Entanglement can harm or kill individual marine mammals and can reduce the fitness of an individual by restricting mobility and impairing breathing, swimming or feeding ability (DCCEEW, 2022a). Entanglement causes physical damages, through cutting of skin and blubber, and exposing the animal to infection and amputation or death. The operational area overlaps BIAs for both the pygmy blue whale and southern right whale (see Table 6-9).

DAWE (2022a) 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). The Threat Abatement Plan (2018) suggests that most marine plastic debris are associated with shipping, fishing and household activities (fishing gear and plastic household items). The loss of plastic debris is also possible during vessel operations for the East Coast Project. No injury of marine fauna has been reported during Cooper Energy Offshore Operations to date. Any impacts would be expected to be limited to individuals, with no population level effects.

There is potential to harm an individual marine mammal from the loss of materials overboard. The impact is not expected to result in a change to the viability of marine mammal populations.

**Inherent Consequence**

The predicted level of impact, i.e. the consequence, to marine fauna is evaluated to have a consequence of **Level 2**, based on:

- the limited inventory of material which has the potential to be lost overboard
- any impacts to seabirds, marine mammals, marine reptiles and fish from materials lost overboard will be to individuals only and no population impacts are expected.

**Inherent Likelihood**

Waste generated on board vessels will be handled in accordance with AMSA Discharge Standards, relevant State requirements, and respective vessel Garbage Management Plans (GMP); these

require that particular wastes are managed so they are not lost or discarded overboard. Given this, loss of materials overboard such as plastics to the marine environment will be an uncommon event.

This assessment considers any indirect impacts to species arising from theoretical exposure to materials lost overboard. While the impact is conceivable and could occur, from this activity, which is relatively short term, it is considered **Unlikely (D).**

**Inherent Risk Severity**

The inherent risk severity to marine fauna is considered **Low**.

#### *9.1.4.3 Risk: Change to Cultural Heritage*

Loss of materials or waste overboard may result in changes to cultural heritage such as:

- Disturbance of underwater cultural heritage including shipwrecks, aircraft and other artefacts.

No shipwrecks or other artefacts have been identified along existing pipeline routes or seabed proximal to the existing facilities (Section 6.7.4.1)

**Inherent Consequence**

The predicted level of impact, i.e. the consequence, of change to cultural heritage from seabed disturbance is evaluated to have a consequence of **Level 1** based on:

- No expected underwater cultural heritage artefacts within the operational area based on screening assessments, previous inspection and survey and stakeholder engagement.

**Inherent Likelihood**

Waste generated on board vessels will be handled in accordance with AMSA Discharge Standards and respective vessel Garbage Management Plans (GMP); these require that particular wastes are managed so they are not lost or discarded overboard. Given this, loss of materials overboard such as plastics to the marine environment is not expected.

This assessment considers any indirect impacts to cultural heritage arising from theoretical exposure to materials lost overboard. While the impact is conceivable and could occur, from this activity, which is has a limited footprint, it is considered **Unlikely (D).**

**Inherent Risk Severity**

The inherent risk severity of the change to cultural heritage is considered **Low**.

### 9.1.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 9-2.

*Table 9-2: Loss of material or waste overboard acceptability assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Risk: Change in habitat | Risk: Low |
| | Risk: Injury/mortality to marine fauna | Risk: Low |
| | Risk: Change to cultural heritage | Risk: Low |
| | A) ‘Integration principle’ | |

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| **Principles of ESD** | Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 9.1.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the risks from loss of materials or waste overboard are identified as:<br>• Low risk for change in habitat<br>• Low risk for injury/mortality to marine fauna<br>• Low risk for change to cultural heritage.<br>The above predicted levels of risk due to loss of materials or waste overboard from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology.<br>• The highest consequence ranking for loss of material or waste overboard was evaluated as Level 2 and the highest inherent risk for loss of material or waste overboard was evaluated as Low; therefore, loss of material overboard from the East Coast Project will not result in serious or irreversible environmental damage.<br>• The potential impacts and risks from loss of material or waste overboard are well-understood, and management measures are well established and regulated in Australian waters. |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risk for loss of material or waste overboard was evaluated as Low and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.1.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to loss of material or waste overboard were evaluated in Section 9.1.4 and highest inherent risk for loss of material or waste overboard was evaluated as Low.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.1.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained. |
| | E) 'Valuation principle' |

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| | The East Coast Project is consistent with the principle of ESD (e) for this aspect by holding financial assurance under Section 571(2) of the *OPGGS Act* to ensure the project aligns with the 'polluter pays' principle. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* – Section 26F (implements MARPOL Annex I). | All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act.<br>Several Marine Orders (MO) are enacted under this Act relating to offshore petroleum activities, including:<br>• MO Part 95: Marine Pollution Prevention – Garbage | Adoption of the following control measures to prevent unplanned release of waste to the marine environment:<br>CM1: Marine Assurance Process<br>MODU and vessels will comply with relevant MARPOL Commonwealth requirements and subsequent Marine Orders for waste management practices.<br>CM2: Offshore Operational Procedures<br>In accordance with Marine Order 42 (Carriage, stowage and securing of cargoes and containers), where relevant, to ensure cargo is packed, loaded, stowed and secured throughout each voyage.<br>CM8: Emissions and Discharge Standards<br>Prior to commencing the offshore activity, the following will be verified, as relevant to vessel class:<br>2017 Guidelines for the Implementation of MARPOL Annex V to assist shipowners, masters and crews in applying the Annex V discharge requirements. |
| | *Navigation Act 2012* (Cth) – Chapter 4 (Prevention of Pollution) | Regulates international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters.<br>Several MOs are enacted under this Act which relate to offshore petroleum activities, including:<br>• MO 21: Safety and emergency arrangements<br>• MO 91 and 94: In Commonwealth waters AMSA is the Statutory Agency for vessels and must be notified of all incidents involving a vessel. | |
| | Wildlife Conservation Plan for Seabirds (CoA, 2020) | Relevant objective 2:<br>Seabirds and their habitats are identified, protected and managed in Australia.<br>Action 2e: Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas. | |
| | National Recovery Plan for Albatrosses and Petrels 2022 (DCCEEW, 2022e) | Relevant objective (Strategy 5):<br>Improve understanding of generalised threats to albatrosses and petrels breeding and foraging within Australia's jurisdiction.<br>Action 5c<br>Risk based response strategies for marine pollution incidents are developed. | |

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|---|---|---|---|
| | Recovery plan for marine turtles in Australia 2017–2027 | Relevant objective (Action Area A3):<br>Reduce the impacts from marine debris.<br>Actions:<br>Describe and quantify the impact of ingestion of debris on marine turtles, particularly those life phases using the open ocean.<br>Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life. | |
| | Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (CoA, 2018) | Relevant objective:<br>Contribute to long-term prevention of the incidence of marine debris.<br>Action 1.02:<br>Limit the amount of single use plastic material lost to the environment in Australia. | |
| | Recovery Plan for the White Shark (*Carcharodon carcharias*) | Identifies habitat modification as a threat. No explicit relevant objectives. | |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11)<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | Cooper Energy has previously been contacted by Beach Patrol 3280-3284 during consultation for existing operations. Beach Patrol 3280-3284 are a voluntary organisation based in Warrnambool. The community-based organisation has dedicated thousands of hours to cleaning up local beaches and requested further information from Cooper Energy as to the measures in place to prevent debris and hydrocarbons (including tar balls) entering the marine environment. Cooper Energy responded with further information as to the types of activities undertaken by Cooper Energy, the regulatory requirements and arrangements in place (as described in this OPP) to prevent loss of materials and loss of hydrocarbons into the marine environment. Subsequently, no further information was requested, or concerns raised. Beach Patrol 3280-3284 have been listed as a relevant person for the purposes of EP preparation which will enable their continued input into the management of activity specific impacts and risks. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to loss of materials or waste overboard is AL8 identified in Table 9-3. This acceptable level is defined for change in habitat, and injury/mortality to marine fauna such that a loss of materials or waste overboard event is unacceptable. Control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent a loss of materials or waste overboard event from occurring, ensuring that AL8 is met and achieved. | | |

| | |
|---|---|
| | This acceptable level defined for change in habitat is detailed in Table 7-6.<br>The worst-case predicted impacts assessed in Section 9.1.4 are:<br>• The potential impact footprint is highly localised (maximum footprint of 96 $m^2$ in the event of a loss of a manifold overboard)<br>• Shelf rocky reef KEF is ubiquitous with the Otway region and occurs across the south east marine region (Ramboll, 2020b).<br>• Any impacts to seabirds, marine mammals, marine reptiles and fish from materials lost overboard will be to individuals only and no population impacts are expected.<br>• No threatened benthic species, assemblages or ecological communities were identified within the operational area.<br>• The highest consequence ranking for loss of material or waste overboard was evaluated as Level 2 and the highest inherent risk for loss of material or waste overboard was evaluated as Low.<br>Therefore, at its worst-case, the predicted impact from a loss of materials or waste overboard would not:<br>• Exceed levels which prevent conservation of biodiversity, recovery and protection of threatened species, maintenance of ecosystem health and the ecological integrity and functioning of the Commonwealth Marine Area<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species<br>• Lead to loss of habitat critical to the survival of species<br>• Not exceed levels which prevent protection and conservation of underwater cultural heritage as defined under the Underwater Cultural Heritage Act 2018.<br>• Not lead to injury or desecration of objects or areas declared for protection under the Aboriginal and Torres Strait Islander Heritage Protection Act 1984.<br>• Not interfere with native title rights or users as defined under section 233 of the *Native Title Act 1993* (Cth).<br>Therefore, the predicted level of impact resulting from s a loss of materials or waste overboard from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined risks relating to loss of materials or waste overboard are acceptable, based on:<br>• control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent a loss of materials or waste overboard IMS event from occurring.<br>• Predicted levels of impact (evaluated in 9.1.4) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advice, and significant impact guidelines for MNES<br>• Relevant feedback from stakeholders has been received, reviewed and assessed that informs the management of impacts and risks associated with the East Coast Project.<br>To manage impacts to receptors to, at or below the defined acceptable levels the following EPOs have been applied:<br>**EPO13:** No unplanned release of waste to the marine environment |

### 9.1.6 Environmental Performance

Table 9-3 lists the acceptable levels and EPOs defined for loss of materials or waste overboard and the adopted control measures to achieve the outcome.

*Table 9-3: Environmental Performance Summary – Loss of materials overboard*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL8:** Unplanned release of waste from project activities to the marine environment is unacceptable.. | **EPO13:** No unplanned release of waste to the marine environment | CM1: Marine Assurance Process |
| | | CM2: Offshore Operational Procedures |
| | | CM8: Emissions and Discharges Standards |
| | | |

## 9.2 Loss of Containment

### 9.2.1 Cause of Aspect

During the East Coast Project, there is a risk of volumes of chemicals or hydrocarbons being spilled to the marine environment, also referred to as Loss of Containment (LOC).

The risk of major spills of hydrocarbons is evaluated in Section 9.5 and 9.6, for MDO and condensate respectively.

Table 9-4 identifies the project activities which carry a risk of LOC; Table 9-5 provides a summary of the types of fluids that could be released in the event of a LOC.

*Table 9-4: Activities undertaken in the East Coast Project that could result in a LOC*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Well Construction** | Well clean-up and flowback |
| **Installation and Commissioning** | Testing, preservation and start-up |
| **Operations** | Inspection, Maintenance and Repair |
| **Support Operations** | MODU operations |
| | Vessel operations |
| | Helicopter operations |
| | ROV operations |

### 9.2.2 Aspect Characterisation

#### *9.2.2.1 Well Construction*

Following completion of each well, well testing and clean-up will be undertaken to ensure the wells are cleared of drilling fluids and brines. The base oil and reservoir fluids will be directed to a flare boom, via a surface well test package. Flow from the well continues until the well clean-up criteria are met. During well testing and clean-up there is a potential for accidental LOC from a drop out of base oil.

#### *9.2.2.2 Installation and Commissioning*

Installation and commissioning phases will include the installation of flowlines and other subsea infrastructure plus testing activities. Refer to Section 4.1.2 for indicative activity sequences and durations.

During installation and commissioning activities, there is a potential for the accidental LOC from a dropped object, resulting in damage to the dropped equipment or equipment within the potential drop zone. During the installation and commissioning phase, some equipment will contain chemicals,

such as hydraulic fluid, MEG or inhibited seawater; depending on the type of damage sustained, these fluids have the potential to leak from equipment into the marine environment.

#### *9.2.2.3 Operations*

During operations and IMR activities, there is a potential for the accidental LOC from a dropped object, resulting in damage to the dropped equipment or equipment within the potential drop zone. During the operations phase, some equipment will contain treated water and chemicals. An accident that damages the subsea infrastructure could result in a loss of chemicals, such as hydraulic fluid, MEG or inhibited seawater; depending on the type of damage sustained, these fluids have the potential to leak from equipment, into the marine environment.

Corrosion of the flowline could also result in pipeline rupture anywhere along the length of the flowlines. Such a rupture could result in a release over several minutes as the system shuts in and pipeline pressure falls to ambient. The flowline contains primarily gas; however a nominal volume of condensate would also be distributed along the length of the flowline system. There are multiple controls in place to prevent a leak. For a leak to occur requires the failure of multiple different controls at each level in the control hierarchy. These are described in detail and managed under the facility specific Safety Case. The Safety Case must be accepted by NOPSEMA before an activity can occur, and these plans must be implemented.

#### *9.2.2.4 Support Operations*

Support operations expected during the project life include MODU and vessels activities for drilling, supply runs, IMR activities including subsea inspection, survey, and decommissioning, and helicopter, ROV and diver operations. See Section 4.3.6 for further details on support activities for the East Coast Project.

An accidental LOC of hydrocarbons and/or chemicals may occur during these support activities due to deck spills (from handling error or failure in containment from storage error), hydraulic line failure from equipment (including ROV), dropped objects (as described in sections 9.2.2.1 and 9.2.2.3), anchor drag (resulting in a loss of inventory from existing subsea infrastructure) and bulk transfer failure (i.e., hose failure/leak).

LOC scenarios are identified in Table 9-5.

*Table 9-5: Types of fluids that may be released during LOC*

| LOC Fluids | Phase / Activity | Source of releases | Maximum expected volume of release |
|---|---|---|---|
| **Mono Ethylene Glycol (MEG)** | Installation, IMR | Spill to deck: Vessel equipment, bulk storage or package chemical leak may be accidentally released to marine environment.<br>Dropped object: damaging subsea equipment and resulting in the accidental release of chemicals. | <10 m³ |
| **Inhibited water (seawater with chemical additives including corrosion inhibitor, oxygen scavenger, biocide and dye)** | Installation, IMR | Dropped object: damaging subsea equipment and resulting in the accidental release of chemicals. | <25 m³<br>Based on typical large isotainer size |
| **Methanol** | Operations | Spill to deck: Vessel equipment, bulk storage or package chemical leak may be accidentally released to marine environment. | <10 m³ |

| LOC Fluids | Phase / Activity | Source of releases | Maximum expected volume of release |
|---|---|---|---|
| **Hydraulic fluids** | Installation, MODU operations, vessel operations, ROV operations | Failure of hydraulic hose: from ROV, geotechnical equipment, from vessel/MODU deck.<br>Dropped object: damaging subsea infrastructure and resulting in the accidental release of fluids from the umbilical. | 1 – 10 $m^3$ |
| **Base oil** | Well construction | Drop out base oil during well clean-up and flowback. | 1 – 10 L for a drop-out event |
| **Condensate** | Well construction, MODU operations, vessel operations, Subsea flowline operations | Damage to existing subsea flowline or infrastructure (e.g., dropped objects, anchor drag).<br>Pipeline rupture (external impact, or through corrosion of the pipeline) release over several minutes as system shuts in and pipeline pressure falls to ambient. | 50 $m^3$ condensate<br>Based on a loss of inventory from the pipeline system.<br>50 $m^3$ provides a nominal conservative estimate release from a single rupture point in the pipeline system as the system shuts in. |
| **Marine diesel oil (MDO)** | MODU operations, vessel operations | Bulk transfer hose failure: hydrocarbons are transferred between a supply vessel and other vessels and MODU. Hoses could be mis-aligned. Partial or total failure of bulk transfer hoses or associated couplings could occur during refuelling. | <50 $m^3$<br>Assuming 200 $m^3$/h transfer rate, released for 15 minutes. |
| **Aviation jet fuel (Jet A1)** | Helicopter operations | Unplanned release: Equipment malfunction leading to helicopter ditching into ocean.<br>Spill to deck: Fuel tank compromised during landing resulting in a release of fuel to sea. | 3 $m^3$ (entire fuel tank volume) |
| **Drilling muds or fluids** | MODU activities | Unplanned surface release during drilling operations. | <25 $m^3$ |
| **Cement** | MODU activities | Unplanned surface release during drilling operations.<br>Bulk transfer: cement is transferred between a supply vessel and MODU. Hoses could be mis-aligned and hoses or couplings could break during transfers. | <50 $m^3$ |
| **Other various chemicals stored on vessels / MODU** | MODU operations, vessel operations | Spill to deck: Vessel equipment, bulk storage or package chemical leak may be accidentally released to marine environment. | Other chemicals are anticipated to be of small volume <5 $m^3$. |

### 9.2.3 Predicted Environmental Impacts and/or Risks (Consequence)

The presence of hydrocarbons and chemicals in the marine environment following an unplanned LOC has the potential to result in these impacts:

- Change in water quality.

Hydrocarbons or chemicals from a LOC are unlikely to result in a change to sediment quality due to the small volumes released which would quickly dilute and disperse into the water column.

If marine fauna passes directly through a release, any impacts are expected to be highly localised, and any release of LOC is not expected to result in a change in the viability of the population of any species. Given the small volumes, short potential exposure time due to rapid dilution through wave and current action, impacts to marine fauna are not expected and therefore have not been assessed further.

### 9.2.4 Impact and Risk Evaluation

#### *9.2.4.1 Risk: Change in Water Quality*

**Inherent Consequence Evaluation**

A LOC of hydrocarbons or chemicals has the potential to result in a change in water quality in both surface waters and the pelagic environment, through the introduction of anthropogenic materials that have the potential to be toxic depending on the presence of sensitivities, and the level and duration of exposure.

Potential volumes of chemicals and hydrocarbons that could be lost to the environment during the East Coast Project are summarized in Table 9-5; with the largest being a <50 $m^3$ MDO spill during refuelling or 50$m^3$ condensate leak from subsea flowline system. The potential impact of these different chemicals is evaluated below.

All project chemicals are selected in accordance with the Cooper Energy Offshore Chemical Procedure to ensure ecotoxicity profiles are of an acceptable level. Fluids that may be used for IMR campaigns, such as MEG or inhibited water, are generally of limited efficacy outside of their specified application, readily degradable or dispersible. Subsea releases would be expected to rapidly dissipate into the water column with any toxic constituents (e.g., biocide) being diluted rapidly to no effect levels.

MEG

MEG is classified internationally as posing little or no risk to the (marine) environment (PLONOR); it is effectively non-toxic in the marine environment, is readily biodegradable and has a low/no potential for bioaccumulation. MEG is readily dispersible in water and would only have a short-term, localised effect on water quality. The volume of MEG from an LOC scenario is estimated as in the order of up to 10 $m^3$.

Inhibited Water

It is sometimes necessary to inhibit water used within the subsea system with chemical additives including corrosion inhibitor, oxygen scavenger, biocide and dye. Biocide is toxic by design but is diluted rapidly to below no effect levels if released to the offshore marine environment.

Larger planned releases of inhibited water during hydrotesting and commissioning are evaluated in Section 8.7. The volume that may be accidentally released during a LOC (a maximum of ~25 $m^3$) is comparatively much smaller than that evaluated in Section 8.7 (3,232 $m^3$).

Control fluids

Hydraulic fluids are required to operate tools and manipulators on subsea ROV units and may be used for other vessel equipment. Hydraulic fluids used in open loop systems are designed to be dispersible and biodegradable . An LOC event could result in the order of 10 $m^3$ being released. By design, the fluids would rapidly dilute and dissipate in the offshore marine environment; changes to

water quality would be brief, and impacts of the same nature and scale as described in Section 8.7.4.

Base Oil

Base oil is circulated into the wellbore immediately before well flowback. It under balances the well, allowing the reservoir to flow and produce gas and condensate. The burner and flare are selected and integrated into the MODU system to ensure that base oil, condensate and gas are burned efficiently. If there is a system failure (e.g. flame is extinguished), there is potential for dropout of base oil into the sea, in the order of ~10 litres. The burner and flare have redundant ignitors to enable the burner and flare to re-ignite, and a flare watch to monitor burn efficiency.

Condensate

CHN condensates are a light non-persistent hydrocarbons; there are no heavy residual components. Considering the location of the activities, the risk of either dropped objects or anchor drag impacting the pipeline is limited to the offshore extent of the pipeline in proximity to the proposed well sites. If spilled, CHN condensate would be expected to dissolve and disperse into the water column, with condensate rising and evaporating from the waters surface quickly (Otway Offshore Operations EP, Cooper Energy 2024b). In later stage of the project, it is possible that Annie-condensate (or similar) would be carried through the CHN pipeline; this condensate is classified as light-persistent, and has a residual proportion of 17.5%. This means the condensate will evaporate readily when on the water surface, with the persistent components weathered over time through processes such as bacterial degradation and photodegradation. See Section 9.6.3.1 provides further information on the modelled condensate.

The actual area of exposure for an individual event of the maximum 50 $m^3$ would be relatively small, with exposure expected to be localised and temporary due to the influence of waves, currents and weathering processes, as indicated by modelling of larger release scenarios (a major release of condensate (i.e. from a LOWC) is evaluated in Section 9.6). Any impacts from a change in water quality is not expected to effect local ecosystem function. This assessment considers the energetic offshore environment in the Otway fields which would be expected to quickly disperse minimal volume (maximum 50 $m^3$) releases of this nature, resulting in minor local impacts.

This assessment considers any indirect impacts to species arising from theoretical exposure would be low level and brief given the limited exposure duration and extent due to rapid dispersion and return to ambient conditions post event.

MDO

The fate of oil such as MDO in the marine environment depends on a number of factors including the physical and chemical properties of the hydrocarbon, the volume released, the prevailing environmental conditions and whether the oil remains at sea or accumulates on a shoreline (ITOPF 2011a).

MDO is classified as a light persistent oil, has a low specific gravity (and therefore will tend to remain afloat) and has a high proportion (~97.3%) of volatile components and only a small (10%) residual component. Due to the nature of MDO. Most would be expected to evaporate from the water surface or become entrained. Both processes are accelerated by wind / wave energy. In a study completed by RPS which investigated the weathering and fate of a hypothetical MDO spill, approximately 24 hours after the spill of 250 $m^3$, 36% of the MDO has been shown to have evaporated and a further 54% is shown to have evaporated after several days, leaving only a small proportion of the oil floating on the water surface (1.3%) (RPS, 2023a).

The actual area of exposure for an individual spill event of the maximum 50$m^3$ would be relatively small, with exposure shown to be transient and temporary due to the influence of waves, currents and weathering processes.

A major release of MDO (i.e. from a vessel collision) is evaluated in Section 9.5.

Aviation jet fuel

In the unlikely event of a failure during helicopter operations, ~3 $m^3$ Jet A-1 fuel could be lost to sea. Jet A-1 is classified as a light persistent oil. It is lighter than MDO and would weather more rapidly in the active marine environment.

Drilling fluids

The main constituents of water-based drilling fluids are typically regarded as PLONOR. Discharge could increase turbidity within the water column, and some of the minor constituents within drilling fluids have the potential to be toxic. Within 100 m of the discharge point, drilling fluids released at the surface with have diluted by a factor of at least 10,000 (Hinwood et al., 1994). Unplanned discharges from the surface are anticipated to impact a larger area than subsea discharges, but discharges are expected to be dispersed rapidly within the offshore marine environment, resulting in a relatively localised and fleeting change in water quality.

Planned drilling discharges are assessed in Section 8.6.

Cement

An unplanned release of ~50 $m^3$ of cement could be released to the marine environment during bulk transfer. Cement is typically regarded as PLONOR. Discharges of cement may impact the localised water quality at the sea surface and within the water column, with an increase in turbidity. These 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.

Modelling of surface cement discharges (approximately 78 $m^3$ over a one-hour period) was undertaken by BP (2013). It showed that within two hours, suspended solid concentrations ranged between 0.005-0.05 $mg/m^3$ within the extent of the plume, which was ~150 m horizontal and 10 m vertical. By four hours post-discharge, concentrations were <0.005 $mg/m^3$. These volumes are greater than the expected cement wash volumes during IMR, and results are considered conservative.

Summary

Impacts to ambient water quality are likely to be localised and temporary based upon the volumes associated with minor spill scenarios (nominally <0.2 $m^3$ but up to ~50 $m^3$). Due to the relatively small volumes which have the potential to be spilled in a LOC any hydrocarbons or chemicals would become well mixed and diluted within the water column due to wave action and local ocean currents, with a smaller proportion potentially evaporating.

The predicted level of impact, i.e. the consequence, to water quality from a LOC is evaluated to have a consequence of **Level 2**, based on:

- the limited frequency of LOC events
- nominal scenario volume in the order of 50 $m^3$
- the dispersive offshore environment in and surrounding the operational area.

**Inherent Likelihood**

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, it would require a rare combination of factors and is therefore considered **Unlikely (D).**

**Inherent Risk Severity**

The inherent risk severity of water quality is considered **Low**.

### 9.2.5 Demonstration of Acceptability

To demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or

risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 9-6.

*Table 9-6: LOC Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Risk: Change in water quality | Risk: Low |
| **Principles of ESD** | ‘A) ‘Integration principle’<br>Consistent with Cooper Energy’s risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 9.2.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the risks from a loss of containment was identified as:<br>• Low risk for change in water quality.<br>The above predicted level of risk due to a loss of containment from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) ‘Precautionary principle’<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy’s risk assessment methodology.<br>• The highest consequence ranking was evaluated as Level 2 and the highest inherent risk for a LOC was evaluated as Low; therefore, LOC from the East Coast Project will not result in serious or irreversible environmental damage.<br>The potential impacts and risks from a LOC are well-understood, and management measures are well established and regulated in Australian waters. | |
| | C) ‘Intergenerational principle’<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risk for a LOC was evaluated as Low and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.2.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | |
| | D) ‘Biodiversity principle’<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making. | |

<table>
<tr><th>Acceptability Criteria</th><th colspan="3">Demonstration of Acceptability</th></tr>
<tr><td></td><td colspan="3">The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<ul><li>The relevant environmental values and sensitivities to a LOC were evaluated in Section 9.2.4 and highest inherent risk for a LOC was evaluated as Low.</li><li>The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.2.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained.</li></ul></td></tr>
<tr><td></td><td colspan="3">E) ‘Valuation principle’<br>The East Coast Project is consistent with the principle of ESD (e) for this aspect by holding financial assurance under Section 571(2) of the OPGGS Act to ensure the project aligns with the ‘polluter pays’ principle.</td></tr>
<tr><td rowspan="3">Legislative and Other Requirements</td><td>Requirement</td><td>Relevant Objective / Action</td><td>Demonstration of Requirement</td></tr>
<tr><td>Protection of the Sea (Prevention of Pollution from Ships) Act 1983 – Section 26F (implements MARPOL Annex I).</td><td>All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act.<br>Several MOs are enacted under this Act relating to offshore petroleum activities, including:<br>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.<br>MO Part 91: Marine Pollution Prevention – Oil<br>MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances</td><td rowspan="2">Adoption of the following control measures to prevent accidental releases of chemicals or hydrocarbons to the marine environment:<br>CM1: Marine Assurance Process<br>Vessels shall meet the AMSA Marine Order (MO) requirements, including:<ul><li>AMSA MO 21: Safety and emergency arrangements</li><li>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.</li><li>AMSA MO Part 91: Marine Pollution Prevention – Oil</li><li>AMSA MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances</li></ul>From 1 January 2026 applicable vessels will not use or store firefighting foams containing PFOS, as adopted by the International Maritime Organisation (IMO)<br>CM2: Offshore Operational Procedures<br>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. To prepare for a spill<br>event, the SMPEP/SOPEP details:<ul><li>response equipment available to control a spill event.</li></ul></td></tr>
<tr><td>Navigation Act 2012 – Chapter 4 (Prevention of Pollution).</td><td>All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act.<br>Several Marine Orders (MO) are enacted under this Act which relate to offshore petroleum activities, including:<br>MO 21: Safety and emergency arrangements</td></tr>
</table>

| Acceptability Criteria | Demonstration of Acceptability | | |
|---|---|---|---|
| | AMSA Marine Orders 91 and 94 | In Commonwealth waters AMSA is the Statutory Agency for vessels and must be notified of all incidents involving a vessel. | • review cycle to ensure that the SMPEP/SOPEP is kept up to date and<br>• testing requirements, including the frequency and nature of these tests.<br>In the event of a spill, the SMPEP/SOPEP details:<br>• reporting/ notification requirements and a list of authorities to be contacted.<br>• activities to be undertaken to control the discharge of hydrocarbon.<br>Bunkering / bulk liquids will be transferred in accordance with operational procedure(s) to reduce the risk of an unintentional release to sea during transfer.<br>CM6: Cooper Energy Offshore Chemical Assessment Procedure<br>Project chemicals will meet the requirements of the Cooper Energy Offshore Chemical Assessment Procedure. This process is used to ensure the lowest toxicity, most biodegradable and least bioaccumulative chemicals are selected which meet the technical requirements, where their function necessitates discharge to sea. The process consults public chemical assessment repositories such as PLONOR list, OCNS Definitive Ranked List, OSPAR and OCNS listings for those chemicals to be discharged. Eco-toxicity is evaluated with any required control measures defined. Chemicals that are highly toxic, have high bioaccumulation potential, and have high persistence in organisms are screened out during the assessment process. Only chemicals that meet low ecotoxicity pre-screening criteria or are further justified as ALARP can be approved for discharge. An accepted chemical list is issued to the offshore project team detailing which products may be discharged and in what circumstances.<br>CM8: Emissions and Discharge Standards<br>Prior to commencing the offshore activity, the following will be verified, as relevant to vessel class:<br>2017 Guidelines for the Implementation of MARPOL Annex V to assist shipowners, masters and |
| | Industrial Chemicals (Notification and Assessment Act) 1989 | Project Chemicals will be considered under the requirements of this Act prior to use. | |

| Acceptability Criteria | Demonstration of Acceptability | | |
|---|---|---|---|
| | | | crews in applying the Annex V discharge requirements.<br>CM12: Marine exclusion, caution and petroleum safety zones<br>May Include:<br>• a temporary 3 km exclusion/cautionary zone around the MODU during the drilling program<br>• a temporary 500 m exclusion/caution zones to be established via Notice to Mariners around vessels undertaking petroleum activities<br>• PSZs will be gazetted around wells and other equipment where required for integrity management. Subsea infrastructure will be marked on navigational charts for awareness.<br>CM13: Ongoing Engagement<br>Further engagement will take place during the development and implementation of component EPs. This will include:<br>• details relating to notification of third-party stakeholders,<br>• engagement with other titleholders in the Otway with respect to each others ongoing activities and potential cumulative impacts.<br>Relevant information received will be included within the EPs as appropriate.<br>CM14: Facility Safety and Integrity Management Plans<br>A NOPSEMA accepted safety case is required before any development activities can be undertaken. All activities will be managed in accordance with accepted safety cases.<br>CM17: OPEP<br>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 subsea LOWC, the OPEP will be implemented.<br>Cooper Energy acknowledges that any response will be implemented in accordance with the requirements described within the OPEP. |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03) | | |

| Acceptability Criteria | Demonstration of Acceptability |
|---|---|
| | • Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). |
| **External Context** | Cooper Energy has previously communicated with Beach Patrol 3280-3284 during consultation activities for existing operations. Beach Patrol 3280-3284 are a voluntary organisation based in Warrnambool. The community-based organisation has dedicated thousands of hours to cleaning up local beaches and requested further information from Cooper Energy as to the measures in place to prevent debris and hydrocarbons (including tar balls) entering the marine environment. Cooper Energy responded with further information as to the types of activities undertaken by Cooper Energy, the regulatory requirements and arrangements in place (as described in this OPP) to prevent loss of materials and loss of containment into the marine environment. Subsequently, no further information was requested, or concerns raised. Beach Patrol 3280-3284 have been listed as a relevant person for the purposes of EP preparation which will enable their continued input into the management of activity specific impacts and risks. |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to a LOC is AL3 identified in Table 9-7. This acceptable level is defined for change in water quality, such that a LOC event is unacceptable. Control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent a LOC event from occurring, ensuring that AL3 is met and achieved.<br>This acceptable level defined for a change in water quality is detailed in Table 7-6.<br>The worst-case predicted impacts assessed in Section 9.2.4 are:<br>• Changes to water quality are likely to be localised and temporary based upon the relatively small volumes associated with a LOC (<50 $m^3$).<br>• The highest consequence ranking was evaluated as Level 2 and the highest inherent risk for a LOC was evaluated as Low.<br>Therefore, at its worst-case, the predicted impact from a minor LOC would not:<br>• Exceed levels which prevent conservation of biodiversity, recovery and protection of threatened species, maintenance of ecosystem health and the ecological integrity and functioning of the Commonwealth Marine Area.<br>• Lead to a change in biodiversity beyond natural variability.<br>Therefore, the predicted level of impact resulting from a LOC resulting from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to a LOC are acceptable, based on:<br>• Control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent a LOC event from occurring.<br>• Predicted levels of impact (evaluated in Section 9.3.4) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors.<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes.<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD.<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advice, and significant impact guidelines for MNES.<br>Relevant feedback from stakeholders has been received, reviewed and assessed that informs the management of impacts and risks associated with the East Coast Project. To manage impacts to receptors to or below the defined acceptable levels the following EPOs have been applied: |

| Acceptability Criteria | Demonstration of Acceptability |
|---|---|
| | **EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment. |

### 9.2.6 Environmental Performance

Table 9-7 lists the acceptable level and EPOs defined for minor LOC and the adopted control measures to achieve the outcome.

*Table 9-7: Environmental Performance Summary –LOC*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL3:** Unplanned loss of containment (hydrocarbons and chemicals) is unacceptable. | **EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment. | CM1: Marine Assurance Process |
| | | CM2: Offshore Operational Procedures |
| | | CM6: Cooper Energy Offshore Chemical Assessment Procedure |
| | | CM8: Emissions and Discharges Standards |
| | | CM12: Marine Exclusion and Caution Zones |
| | | CM13: Ongoing Engagement |
| | | CM14: Facility Safety and Integrity Management Plans |
| | | CM17: OPEP |

## 9.3 Interaction with Marine Fauna

### 9.3.1 Cause of Aspect

Unplanned interactions with fauna could occur because of MODU, vessel and helicopter movements within the operational area. These interactions could include vessel/ MODU strike (collision between marine fauna and a moving vessel/ MODU) and bird strike (collision between a bird and a helicopter).

The activities within each phase that have potential for unplanned interactions with marine fauna are identified in Table 9-8 and described in the subsections below.

*Table 9-8: Activities undertaken in the East Coast Project that could cause unplanned interaction with marine fauna*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Installation and Commissioning** | Testing, preservation and start-up |
| **Support Operations** | MODU operations |
| | Vessel operations |
| | Helicopter operations |

### 9.3.2 Aspect Characterisation

#### *9.3.2.1 Installation and Commissioning*

Seawater is typically used for commissioning operations. Water intake during flooding or dewatering operations has the potential to entrain or entrap small marine fauna, either against the intake screen or within the intake itself if small enough (e.g., zooplankton).

Commissioning is only expected to be undertaken once for each flowline and is a short-term activity as the East Coast Project flowlines are not long, and volumes required are small (Section 4.3.3.5).

#### *9.3.2.2 Support Operations*

Vessel and helicopter movements will occur within the operational area throughout the life of the East Coast Project.

Multiple vessels are expected during offshore construction and decommissioning activities. Installation and commissioning activities are included in the pre-operation phase, which is expected to last up to 6 years for all gas development opportunities and confirmed fields. The post-operations phase is predicted to last between 3 to 5 years.

The largest vessel is which may be used for the project, is likely to be an Installation Support Vessel (ISV) or Reel-Lay vessel and would be expected to be in field for ~45 days per campaign. Vessels undertaking project activities could collide with large marine fauna that swim at or near the water surface. Vessels undertaking petroleum activities described in this project will typically be holding station or travelling at speeds slower than typical shipping traffic (Figure 6-103) and therefore exhibit a lower risk of interactions with marine fauna.

The MODU will be present in the operational area during drilling, well intervention and for well abandonment activities. Up to 15 production wells may be drilled for the East Coast Project within the scope of this OPP, each well taking up to 60 days. The MODU will be stationary for most of the time in the operational area, with little travel between fields. When required, movement will be assisted by up to 3 vessels (anchor handler vessels or PSV). When under tow, the MODU speed is limited (below 10 knots).

Helicopters will be used when needed, throughout the life of the project, primarily for crew change and medical evacuation, with occasional equipment and material transfers when a MODU or ISV is working offshore for the project. Helicopters may complete 5-8 round trips per week during these activities. There is potential for bird strikes, though this is limited, and would be unusual; there have been no reports of bird strikes during Cooper Energy's offshore operations in the Otway to date, including MODU campaigns in 2018 and 2019.

### 9.3.3 Predicted Environmental Impacts and/or Risks (Consequence)

Potential risks from interaction with marine fauna are:

- Injury/mortality to large marine fauna from vessel strike, and to birds from collision with helicopter.

### 9.3.4 Impact and Risk Evaluation

#### *9.3.4.1 Risk: Injury/Mortality to Marine fauna*

**Inherent Consequence Evaluation**

Fish

Vessels transiting within the operational area have the potential to collide with large fish species that may occur within the Otway Basin. The EPBC Act listed 33 species of fish and sharks occurring in the operational area. Large, slow-moving fish species that bask or feed at the surface are the most vulnerable to vessel collisions.

The white shark (*Carcharodon carcharias*) has a foraging BIA 30 km west of the operational area and may be transient through the operational area. The Recovery plan for white sharks lists the principal threats and likely contributors to the lack of white shark recovery in Australia. Some of the reasons are linked to accidental or illegal capture by commercial and recreational fishers and illegal trade in white shark products, however, there is no mention of vessel collision. The white shark has not been identified as a culturally significant food source for First Nations people. No collisions between vessels and white sharks associated with Cooper Energy's activities in the Otway region have occurred to date. There are also no examples of a vessel collision with a white shark from

other operators within Australia. Therefore, vessel collisions with white sharks are not expected to occur during the East Coast Project.

Seabirds

Helicopters arriving to, or departing from, the MODU or installation vessel have the potential to collide with birds and potentially result in injury/mortality. Helicopter transfers could occur 5 – 8 times a week during drilling, installation and commissioning and decommissioning phases.

The operational area does not host roosting or nesting habitat. The absence of these features decreases the chances of high numbers of birds at potentially vulnerable life stages within the operational area, reducing the chances of a bird strike event. It is expected that any birds within the operational area would be foraging, rafting, or travelling through. There are 34 EPBC listed marine bird species that may occur within the operational area, of which 9 species have foraging BIAs overlapping the operational area (7 albatross, one petrel and one shearwater). Some seabirds are culturally significant to First Nations people as a food resource. These culturally significant species are not expected to be impacted as the cultural connection relates to collection of seabirds from coastal and riverine environments (Table 10-) which is not expected due to the absence of roosting and nesting habitats.

The Wildlife Conservation Plan for Seabirds does not identify aircraft collisions as a specific threat to any species; the plan identifies that transport, such as aircraft, flying low over breeding colonies may cause excessive disturbance to breeding individuals. There are no breeding/nesting sites within the operational areas, within the vicinity of where helicopters may land and take off from a MODU or vessels used for the project. The plan also identifies a threat of bird mortality due to collisions with oil and gas platforms, particularly as the night lighting from offshore oil and gas platforms could attract higher than average seabird numbers; with seabirds potentially habituating to the structures (CoA, 2020). There are no permanent structures associated with the project which are above water, such as an oil and gas platform; the vessels and MODUs which may be used for project activities are temporary which limits the potential for habituation. Albatross and petrel are covered under the National Recovery Plan for Albatross and Petrel; this plan does not list aircraft as a threat to these species (DCCEEW, 2023e). The short-tailed shearwater has a foraging BIA overlapping the operational area. Foraging individuals could be impacted by a collision with the East Coast Project, though considered unlikely as offshore foraging occurs close to the water's surface, whereas helicopters fly well above it. Though there is some potential for interaction between birds and helicopters, it would be unusual; there have been no reports of bird strikes during Cooper Energy's offshore operations in the Otway to date, including MODU campaigns in 2018 and 2019. Given the temporary nature and limited scale of offshore activities and associated helicopter use, any interactions would be expected to be with individuals only.

Marine reptiles

Moving vessels have the potential to collide with marine reptile species when they surface to breathe. Vessels movements will occur within the operational area throughout the entire project life, but less frequently during the operations phase.

The Recovery Plan for Marine Turtles in Australia 2017-2027 identifies vessel disturbance as a threat to the species, however the threat is focused on shallow coastal foraging habitats and internesting areas (CoA, 2017). There are 3 species of marine turtles that may occur within the operational area; however, this occurrence is expected to only be of a transient nature due to the absence of suitable coastal habitat in the south-east marine region. No BIAs or habitat critical to the survival of marine turtles occurs within the operational area or wider south-east marine region. Individual turtles may be transiting through the region,

The risk of collisions between turtles and vessels increases with vessel speed (Hazel et al., 2007). For the majority of time, vessels working on the project and within the operational area will be stationary or moving slowly between operational locations; this reduces the potential severity and likelihood of collision.

Marine mammals

There are multiple species of marine mammal that may or do occur within the operational area (Section 6.5.8). Of these species, two have BIAs that overlap the operational area:

- Pygmy blue whale (foraging and distribution)
- Southern right whale (migration).

Pygmy blue whales are known to forage in the Otway Basin from November to June with peak foraging occurring during February to March, which is linked to the Bonney upwelling. Southern right whales are regularly present during migration in the Otway region between early April to early November, with peak reproductive behaviours occurring in the Otway mid-July through to August. Other whale species including the fin whale, humpback whale, and sei whale are known to be present in the area during Bonney Upwelling events (see species seasonality in Table 6-10).

Vessel strikes are a known threat, particularly for some whale species (e.g., DoE, 2015a). Marine mammals that are within surface waters and breach often are most at risk from interactions with vessels operating for the project. Marine mammals must surface to breathe periodically and may spend much of their time at or near the surface. This behaviour makes marine mammals, particularly large mammals such as baleen whales, vulnerable to vessel strikes. A response of baleen whales to the presence of a vessel may be to avoid the vessel, either by moving away (e.g. increasing swimming speed) or by diving (Corkeron 1995; Scheidat et al., 2004), though marine mammals often do not display avoidance behaviour and may approach vessels, as observed during recent offshore activities (Figure 6-48 and Figure 6-49).

The International Whaling Commission (IWC) (2022) report around 900 cases of vessel strikes with cetaceans across the globe inclusive of all historical records; 35 of those strikes were identified as within Australian jurisdictions. Most collisions involved fin whales, humpback whales and sperm whales; Peel et al. (2016) indicates the number of strikes in Australian waters may be more like 109 and includes strikes with southern right whales and pygmy blue whales. Fin, humpback, pygmy blue and southern right whales are known to occur in off the southeast Australian coast and are likely to occur in the project operational area (Table 6-9). Collisions between larger vessels with reduced manoeuvrability and large, slow-moving cetaceans occur more frequently where there is high vessel traffic and cetacean habitat (Whale and Dolphin Conservation Society, 2003). Laist et al. (2001) identified that larger vessels with reduced manoeuvrability moving more than 10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels such as tankers travelling faster than 14 knots and with limited manoeuvrability. Vessels used to support the East Coast Project activities do not have the same limitations on manoeuvrability. Vessel speed influences the probability and severity of strikes between a cetacean and a vessel. Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale because of a vessel strike increases from about 20% at 8.6 knots to 80% at 15 knots. The IWC (2022) reports that of the historical vessel strikes reported globally, the highest number of identified vessels involved were ferries, including fast ferries and high-speed ferries, followed by sailing yachts, passenger vessels including cruise ships, and motor yachts. Less frequent were interactions between cetaceans and whale watching vessels, then navy and container ships, followed by general cargo vessels.

For most of the time, vessels working on the project and within the operational area will be stationary or moving slowly between operational locations; this reduces the potential severity and likelihood of collision. The occurrence of reported vessel strikes is low within the Australian offshore energy industry; there have been no incidents of vessel strikes during Cooper Energy's offshore activities in the Otway region.

Summary

The occurrence of physical interactions with marine fauna is very low. In the event that an individual animal suffers injury or death as the result of helicopter or vessel strike during the East Coast Project, it would not be expected to manifest in population level impacts. The consequence of the potential impact is assessed as **Level 2**, as short-term impacts to species or habitats of recognized conservation value, not affecting local ecosystem function.

**Inherent Likelihood**

Cooper Energy have had no incidents of physical interactions with marine fauna that have resulted in injury/mortality to marine fauna over the course of their offshore operations off the coast of southeast Australia.

Recorded marine fauna interactions during Cooper's operations across the Bass Strait are limited to those indicative of passive coexistence, such as:

- frequent sightings of Humpback Whales during their migrations.
- observations of seabirds temporarily perched on vessel handrails.
- observations of an owl seeking refuge on a MODU.

Given the nature of the proposed activity, the impact is conceivable and could occur, however, it would require a rare combination of factors for physical interactions to result in injury/mortality. Therefore, the inherent likelihood is considered **Unlikely (D).**

**Inherent Risk Severity**

The inherent risk severity of support operations activities interacting negatively with marine fauna within East Coast Project operational area is considered **Low**.

### 9.3.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 9-9.

*Table 9-9: Interaction with Marine Fauna Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Risk: Injury/mortality to marine fauna | Risk: Low |
| **Principles of ESD** | 'A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 9.3.4) with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the risks from interaction with marine fauna was identified as:<br>• Low risk for injury/mortality to marine fauna.<br>The above predicted level of risk due to interaction with marine fauna from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as: | |

| | | | |
|---|---|---|---|
| | • Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology and the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA, 2024).<br>• The highest consequence ranking for interaction with marine fauna was evaluated as Level 2 and the highest inherent risk for interaction with marine fauna was evaluated as Low; therefore, interaction with marine fauna from the East Coast Project will not result in serious or irreversible environmental damage.<br>The potential impacts and risks from interaction with marine fauna are well-understood, and management measures are well established and regulated in Australian waters. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risk for interaction with marine fauna was evaluated as Low and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.3.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to interaction with marine fauna were evaluated in Section 9.3.4 and highest inherent risk for interaction with marine fauna was evaluated as Low.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.3.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna | Objective 3: Mitigation – reduce the likelihood and severity of megafauna vessel collision.<br>Management action:<br>• ensure all vessel strike incidents are reported in the National Vessel Strike Database (AMMC)<br>• identify mitigation measures and a set of criteria. | Adoption of the following control measures to prevent vessel strike with EPBC Act listed threatened or migratory marine mammals:<br>CM2: Offshore Operational Procedures<br>All helicopters and vessels will adhere to the distances and vessel management practices of EPBC Regulations (Part 8 Division 8.1 interacting with cetaceans).<br>CM3: Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process. |
| | Blue Whale Conservation Management Plan 2015 - 2025 (2015) | Recovery objective: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list.<br>Interim objective 4: Anthropogenic threats are demonstrably minimised. | |

| | | | |
|---|---|---|---|
| | | Management action A.4.2: Ensure all vessel strike incidents are reported in the National Ship Strike Database (AMMC)<br>Management action A.4.3: 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, implement appropriate mitigation measures | The Whale Disturbance Risk Management Process communicates how whale interaction and disturbance risks are to be managed by offshore project teams, and crews on offshore vessels involved in offshore projects.<br>The procedure provides details on the level of whale observation effort, triggers for actions and the actions to be taken to manage potential impacts to whales. This includes caution and no approach zones which meet or exceed regulatory standards under the EPBC Act.<br>Reporting of vessel strike incidents in the National Vessel Strike Database is required and described in Section 12.13. |
| | National Recovery Plan for the Southern Right Whale (DCCEEW, 2024l) | Long term recovery objective is that the population has increased in size to a level that the conservation status has improved, and the species no longer qualifies for listing as threatened under any of the EPBC Act listing criteria.<br>Interim Objective 2: Anthropogenic threats are managed consistent with ecologically sustainable development principles to facilitate recovery of southern right whales.<br>Management action A.6: Manage, minimise, and mitigate the threat of vessel strike. | |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | GMTOAC has previously communicated values and sensitivities relevant to the risk of vessel strike. GMTOAC highlighted Gunditjmara's strong connection to whales and responsibility for their care. Cooper Energy briefed GMTOAC on the kinds of activities undertaken by Cooper Energy which carry a risk of interaction with whales and discussed with members the measures taken by Cooper Energy to avoid interactions. GMTOAC are listed as a relevant person for the purposes of EP preparation which will enable their continued input into the management of activity specific impacts and risks. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to interactions with marine fauna is AL13 identified in Table 9-10. This acceptable level is defined for injury / mortality to fauna, such that a vessel strike event is unacceptable. Control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent a vessel strike event from occurring, ensuring that AL13 is met and achieved.<br>This acceptable level defined for injury / mortality to marine fauna is detailed in Table 7-6.<br>The worst-case predicted impacts assessed in Section 9.3.4 are:<br>• The occurrence of physical interactions with marine fauna is very low. In the event that an individual animal suffers injury or death as the result of helicopter or vessel strike during the East Coast Project, it would not be expected to manifest in population level impacts.<br>• The highest consequence ranking for interaction with marine fauna was evaluated as Level 2 and the highest inherent risk for interaction with marine fauna was evaluated as Low. | | |

| | |
|---|---|
| | Therefore, at its worst-case, the predicted impact from interactions with marine fauna would not:<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species<br>• Lead to loss of habitat critical to the survival of species.<br>Therefore, the predicted level of impact resulting from interactions with marine fauna resulting from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to interactions with marine fauna are acceptable, based on:<br>• Control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent a fauna strike event from occurring.<br>• Predicted levels of impact (evaluated in Section 9.3.4) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• The proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES<br>• Feedback has been received from stakeholders that has informed the values and sensitivities / existing environment description, impacts and risks, performance outcomes and / or mitigation measures.<br>To manage impacts to receptors to or below the defined acceptable levels the following EPO have been applied:<br>**EPO21:** No vessel strike with EPBC Act listed threatened, migratory or cetacean species. |

### 9.3.6 Environmental Performance

Table 9-10 lists the acceptable level and EPO defined for interaction with marine fauna and the adopted control measures to achieve the outcome.

*Table 9-10: Environmental Performance Summary – Interaction with marine fauna*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL13:** Unplanned vessel strike to EPBC Act listed threatened, migratory or cetacean species due to this project's activities is unacceptable. | **EPO21:** No vessel strike with EPBC Act listed threatened, migratory or cetacean species. | CM2: Offshore Operational Procedures |
| | | CM3: Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process |

## 9.4 Introduction, Establishment and Spread of IMS

### 9.4.1 Cause of Aspect

Invasive Marine Species (IMS) are marine plants or animals which have been introduced into a region beyond their natural range and have the potential to 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 depend on environmental factors such as water temperature, depth, salinity, nutrient levels, habitat type and competition.

The main pathways for IMS introduction into Australian waters are through ballast water and biofouling (DAWR, 2018), both of which are described below. Table 9-12 provides an overview of the related project activities that could cause introduction, establishment and spread of IMS.

#### *9.4.1.1 Ballast water*

Ballast water can contain aquatic microbes, plants and animals from all life stages, which can be transferred globally as a vessel releases ballast water. Vessel ballast and seawater systems provide suitable habitats and conditions for IMS to survive and have the potential of spreading between ports and other facilities via vessels acting as a vector. Some vessels and MODUs are required to adjust their ballast water during operations to maintain stability, balance, and trim.

If IMS are present in ballast water and released within the operational area, they could settle on the seafloor or subsea structures where they could establish. An estimated 25% of Australia's established IMS was the result of ballast water exchange (DAWR, 2019). All vessels that are designed to carry ballast water are required to carry and implement a Ballast Water Management Plan and follow the Australian Ballast Water Management Requirements (DAWE, 2018).

#### *9.4.1.2 Biofouling*

The submerged parts of a vessel, such as propeller, anchors, hull and other areas, are subject to biofouling when attachment and establishment of organisms occur. Internal seawater systems can also become fouled. IMS could be present as biofouling on vessels/MODUs, be translocated to the operational area; and transferred directly to the seafloor or seabed structures via dislodgement or reproduction.

Equipment that is submerged in water, particularly equipment that is stationary for days or longer can start to become bio-fouled. Installed infrastructure including flowlines, manifolds and other subsea equipment can provide marine organisms, including IMS, with a substrate to attach to.

IMS on MODU or vessels can be dislodged to the seabed. IMS can then become established if conditions and habitat are suitable. Once established IMS may spread by itself. Other anthropogenic influences (e.g., vessel transit, fishing) could spread IMS within and outside of the field.

Vessels entering Australia from International waters are required to comply with Australian biofouling management requirements (DAWE, 2022).

Details of the pathways for potential introduction, establishment and spread of IMS are shown in Table 9-11.

*Table 9-11: Pathways for potential introduction, establishment and spread of IMS*

| Risk Event | Pathway to introduction | Means of establishment | Mechanisms of spreading |
|---|---|---|---|
| **IMS are transferred into the field, becomes established and spreads** | IMS within biofouling on vessels dislodged to the seabed<br>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, IMS may spread by itself if conditions are suitable.<br>In field equipment may provide connectivity allowing spread across infrastructure.<br>Other anthropogenic influence (e.g., fishing) could spread established IMS within and outside of the field. |
| **IMS are transferred between vessels, establishes on vessels** | Discharge of ballast water containing IMS. | Suitable habitat and conditions available for IMS on vessels and within | IMS spreads between ports and other facilities via vessels acting as a vector. |

| Risk Event | Pathway to introduction | Means of establishment | Mechanisms of spreading |
|---|---|---|---|
| **and is spread to other areas (e.g., ports)** | | ballast and seawater systems. | |
| **IMS are 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, IMS may spread by itself if conditions are suitable.<br>May become established on structures at ports, and from there spread to vessels which then become a vector for the spread of IMS. |

The transfer of IMS can occur within the operational area through natural or anthropogenic influences. For example, IMS may be dislodged, established and spread when subsea equipment and infrastructure is recovered or removed during decommissioning or operational activities, or during marine growth removal which may be required during IMR activities.

If IMS are translocated to the operational area, they could, theoretically, be subsequently transferred between the project vessels / MODUs, and by extension to marine environments beyond the operational area.

Activities associated with the East Coast Project that could result in the introduction, establishment and spread of IMS are identified in Table 9-12 and described in further detail in the subsections below.

*Table 9-12: Activities undertaken in the East Coast Project that could cause unplanned introduction, establishment and spread of IMS*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Operations** | Maintenance and repair |
| **Decommissioning** | Flowline and umbilical decommissioning |
| | Removal of remaining subsea infrastructure |
| **Support Operations** | MODU operations |
| | Vessel operations |
| | ROV operations |

### 9.4.2 Aspect Characterisation

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 (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 9-13 provides a consolidated list of high-risk marine species that are of concern to Victoria and other Australian jurisdictions that were identified following advice from the State Government Biosecurity Department (pers comms, 3rd May 2023) as well as IMS listings on the Australian Government Marine Pest website, and IMS listed as of most concern on the Victorian Parks website (Australian Government, 2019; Parks Victoria, 2019).

*Table 9-13: High-risk marine species of concern to Australia*

| Scientific name | Common Name | Key Ports in the Region (✓= confirmed IMS w = keep watch for) | |
|---|---|---|---|
| Invasive Marine Species | | Portland (Otway) | Melbourne (Gippsland) |
| *Balanus improvises* | Barnacle | - | - |
| *Caprella mutica* | Japanese skeleton shrimp | - | - |
| *Caulerpa taxifolia (exotic strains only)* | Green macroalga | - | - |
| *Charybdis japonica* | Lady crab, Asian paddle crab | - | - |
| *Corbula (Potamocorbula) amurensis* | Asian clam, brackish-water corbula | w | w |
| *Crepidula fornicate* | American slipper limpet | w | w |
| *Ensis directus* | Jack-knife clam | - | - |
| *Eriocheir sinensis* | Chinese mitten crab | w | w |
| *Hemigrapsus takanoi/penicillatus* | Brush-clawed shore crab | - | - |
| *Marenzelleria spp. (invasive species, marine/estuarine incursions)* | Red gilled mudworm | - | - |
| *Mnemiopsis leidyi* | Comb jelly | - | - |
| *Mya arenaria and japonica* | Soft shell clam | w | w |
| *Mytella strigata* | Charru mussel | w | w |
| *Mytilopsis sallei* | Black striped false mussel | w | w |
| *Neogobius melanostomus (marine/estuarine incursions)* | Round goby | - | - |
| *Perna canaliculus* | New Zealand green-lipped mussel | - | - |
| *Perna perna* | Brown mussel | - | - |
| *Perna viridis* | Asian green mussel | w | w |
| *Rapana venosa (syn. Rapana thomasiana)* | Rapa whelk | w | w |
| *Rhithropanopeus harisii* | Harris' mud crab | - | - |
| *Sargassum muticum* | Asian seaweed | - | - |
| *Siganus rivulatus* | Marbled spinefoot, rabbit fish | - | - |
| *Urosalpinx cinerea* | Atlantic oyster drill | - | - |
| **Established in Australia** | | | |
| *Asterias amurensis* | Northern Pacific sea star | - | ✓ |
| *Arcuatula senhousia* | Asian bag mussel, Asian date mussel | ✓ | ✓ |
| *Carcinus maenas* | European green crab | - | ✓ |
| *Codium fragile spp. Tomentosodies* | Green macroalga | - | - |
| *Didemnum perlucidum* | White colonial sea | - | - |
| *Didemnum vexillum* | Carpet sea squirt | - | - |
| *Grateloupia turuturu* | Red macroalga | - | - |

| Scientific name | Common Name | Key Ports in the Region (✓ = confirmed IMS w = keep watch for) | |
|---|---|---|---|
| Invasive Marine Species | | Portland (Otway) | Melbourne (Gippsland) |
| *Hemigrapsus sanguineus* | Asian shore crab | w | ✓ |
| *Maoricolpus roseus* | New Zealand screwshell | - | ✓ |
| *Sabella spallanzanii* | European fan worm | ✓ | ✓ |
| *Undaria pinnatifida* | Wakame | - | - |
| *Varicorbula gibba* | European clam | - | - |
| **Holoplankton high-risk species** | | | |
| *Alexandrium monilatum, Dinophysis norvegica and Pfiesteria piscicda* | Toxic dinoflagellate species | - | - |
| *Chaetoceros concavicornis and Chaetoceros convolutes* | Centric diatom species | - | - |
| *Pseudo-nitzschia seriata* | Pennate diatom | - | - |

IMS associated with the East Coast Project

Prior to and during operations, the Cooper Energy IMS Risk Management Protocol will be implemented for all vessels and submersible equipment and will consider all regions of operation prior to the campaign (international and domestic).

#### *9.4.2.1 Operations*

Marine growth removal may be required during maintenance and repair, in order to provide access to subsea infrastructure.

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 accumulations of carbonate on infrastructure, such as tooling interfaces.

#### *9.4.2.2 Decommissioning*

Marine growth removal may be required during decommissioning to access lifting points for equipment.

Marine growth may also become dislodged when flowlines, umbilicals or other structures are retrieved to deck, subsequently falling onto the seabed.

#### *9.4.2.3 Support Operations*

Support operations have the potential to introduce IMS to the operational area from the discharge of ballast water or biofouling. Support operations that are at risk of introduction of IMS during the project life include MODU operations during drilling, well intervention and well abandonment, and vessel operations.

For any support activities, vessels, MODU and equipment may be sourced internationally or domestically. During the activity, vessels will transit between the operational area and domestic ports. Any vessel has the potential to host IMS.

Support operations expected during the project life include MODU activity and vessels for drilling, supply runs, IMR including subsea inspection, survey, and decommissioning (see Section 4.3.6 for further details)

Prior to and during support operations, the Cooper Energy IMS Risk Management Protocol will be implemented for all vessels, MODU and submersible equipment, and will consider all regions of operation prior to the campaign (international and domestic).

### 9.4.3 Predicted Environmental Impacts and/or Risks (Consequence)

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

- Displacement of native marine species
- Change to the functions, interests and activities of other marine users.

### 9.4.4 Impact and Risk Evaluation

#### *9.4.4.1 Risk: Displacement of Native Marine Species*

**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 new environment.

Once an IMS is established, it's level of invasiveness and ecosystem damage is determined by a range of factors described 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).

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.

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. The operational area contains hard substrate, that is typical of the broader Otway at this water depth.

Benthic Habitats

As described in Section 6.4.7 and 6.5.1 Ramboll (2020a) and Ramboll (2020b) both found that benthic habitats within and adjacent to the operational area are characterised by sand or gravelly / rubble and hard platform substrates. Invertebrate species located in the vicinity of the Otway offshore pipeline alignment include sponges, annelids, ascidians, hydrozoans, bryozoans, molluscs and crustaceans.

The benthic habitat of the operational area is typical of the broader area at this water depth and does not intersect any Australian Marine Parks. The operational area overlaps the shelf rocky reefs KEF (see Section 6.6.6); areas of rocky reefs and hard substrates along the continental shelf which provide habitat for diverse assemblages of species and aligns with the benthic fauna observations in the Ramboll (2020b) survey (see Section 6.5.1.3). This KEF does not have a delineated shape / boundary within the southeast marine region, as it is common with some large areas of hard

substrate, and some small, isolated sections. Any IMS that is introduced into the operational area has the potential to establish itself on the seabed, including seabed which may be characteristic of the shelf rocky reef KEF. Organisms at risk of displacement by IMS include sponges, sessile invertebrates and soft corals.

Marine Fauna

Fur seals are known to occur within the region and may occur within the operational area. Fur seals are known to forage offshore benthic habitats and have been observed foraging along subsea pipelines associated with oil and gas facilities (Arnould et al., 2015). Changes to benthic communities, structure, diversity and abundance because of IMS, may have the potential to affect foraging success of fur seals in localised areas; with individuals or groups potentially modifying foraging ranges according to food availability. This kind of adaptation has been observed in Australian Fur Seals in response to climatic changes, to regional, large and local-scale environmental variability (Kliska et al., 2022).

Fish

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).

Once introduced, and if it did colonise an area, IMS may prey on local species (which had previously not been subject to this kind of predation and therefore not have evolved protective measures against the attack), they could outcompete indigenous species for food, space or light and could also interbreed with local species, creating hybrids such that the endemic species is lost. These changes to the local marine environment result in changes to the natural ecosystem.

The risk of an IMS being able to successfully establish itself would depend on depth, distance from the coast, water movement and latitude. The probability of successful IMS settlement and recruitment decreases in well-mixed, deep ocean waters away from coastal habitats.

If IMS were transferred between support vessels 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 and listed marine fish species.

The risk scenario of IMS introduction and establishment is evaluated to have a consequence of **Level 4**, based on:

- Species present in operational area of conservation value.
- Ability of IMS impacts to extend beyond the operational area.
- Difficulty to eradicate IMS once established and potential long-term effects.

**Inherent Likelihood**

Any IMS introduced to the operational area would be expected to remain fragmented and isolated, and only within the vicinity of its point of introduction. The chances of successful colonisation inside the operational area are considered small given:

- The operational areas distance from shore of greater than 8 km: Establishment of IMS is dependent on distance to shore where highly disturbed shallow-water marine environments are more susceptible to IMS colonisation (Dafforn et al., 2009). Modelling by the Bureau of Rural Sciences (BRS) has shown that the risk of IMS colonisation decreases with distance to shore with estimates as follows (BRS, 2007):
  - 33% chance of colonisation at 3 nm (5.6 km)
  - 8% chance at 12 nm (22 km)
  - 2% chance at 24 nm (44.5 km).

- Based on these risk estimates and the operational areas distance to shore (8 km or 4.3 nm) there is a very low likelihood that IMS would colonise.
- New subsea infrastructure brought into the project area originates from onshore fabrication and storage facilities and would therefore be biofouling free.
- The activities which have the potential to introduce IMS (vessel or MODU activities) are infrequent and relatively short in duration.
- Subsea equipment such as ROVs and baskets deployed to seabed during IMR activities are maintained cleaned to reduce the potential for IMS transfer.
- The operational area will not have any long-term platforms, FPSO or moored vessels, with the MODU and vessels being in the operational area temporarily; as vessels and MODUs will be moving relatively frequently, the risk of attachment of IMS and colonisation of the facilities is reduced compared to a permanent or semi-permanent vessel presence.
- Practices for minimising the risk of IMS spread are well established within the marine industry and there are clear requirements set by the DAFF.

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 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 vessels:

- 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**.

#### *9.4.4.2 Risk: Changes to the Functions, Interests and Activities of Other Marine Users*

**Inherent Consequence Evaluation**

The establishment of IMS has the potential to cause changes to the functions, interests or activities of other marine users such as:

- Commercial fisheries
- Marine industry (shipping, petroleum, renewables)
- Tourism.

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 which are previously discussed in Displacement of native marine species. 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, as described above, and commercial fisheries and tourism operators that may utilise the operational area and protected marine areas present in the wider region. Eleven managed fisheries have previously been identified in the operational area, of which three have recorded fishing efforts. Species include elephant fish, gummy shark, sawshark and lobster and abalone species. Further, tourism operators may utilise the operational area for a number of activities such as fishing charters which commonly target bluefin tuna, gummy, school and mako sharks and reef species such as snapper. Habitats for these resources exist across the greater region, any colonisation of IMS in the area around the Otway offshore facilities are unlikely to represent a limited resource for native species.

The establishment of IMS has a potential to disrupt the activities of other marine users, including the oil and gas industry or shipping by increasing the risk of further translocation of IMS within and beyond the region.

In the unlikely event of IMS being transferred between vessels/MODU whilst working within the operational area, IMS may 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 on vessels. If an IMS is spread, there is the potential for local impacts to receptors where IMS has become established, including fisheries and offshore industry.

The predicted level of impact, i.e., the consequence, to changes to the functions, interests or activities of other users as a result of the introduction of IMS is evaluated to have a consequence of **Level 4**, based on:

- potential impacts to commercial fisheries and tourism operators due to species displacement
- potential to translocated IMS out of operational area on project vessels or MODU, and
- multiple industries and operators are active in the region.

**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. The chances of successful colonisation inside the operational are considered small given:

- the Australian Government Bureau of Resource Sciences (BRS) established that the relative risk of IMS incursion decreases with distance from the coast. The operational area ranges from approximately 8 to 35 km from shore and 55 to 85 m water depth; decreasing the probability of IMS colonising and impacting the values of other marine users
- the activity is not typically conducive to the establishment of marine organisms onto a new surface with vessels frequently moving and the absence of long-term platforms, FPSO or moored vessels remaining within the field
- there are several international and national management measures which already manage the potential introduction of IMS
- there have been no IMS introductions recorded from Cooper Energy's activities offshore in the southeast.

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 a change to the functions, interests and activities of other marine users is considered **Moderate**.

### 9.4.5 Demonstration of Acceptability

In order to demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 9-14.

*Table 9-14: Introduction, Establishment and Spread of IMS Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Process** | Risk: Displacement of native marine species | Risk: Moderate |
| | Risk: Changes to the functions, interests or activities of other users | Risk: Moderate |
| **Principles of ESD** | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 9.4.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the risks from introduction, establishment and spread of IMS are identified as:<br>• Moderate risk for displacement of native marine species<br>• Moderate risk for changes to the functions, interests or activities of other users.<br>The above predicted levels of risk due to introduction, establishment and spread of IMS from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology, Cooper Energy's Invasive Marine Species Risk Management Process, and Australian IMS prevention guidelines.<br>• The highest consequence ranking for the successful introduction, establishment and spread of IMS was evaluated as Level 4, however the likelihood of IMS being established was considered Remote, therefore the inherent risk for introduction, establishment and spread of IMS was evaluated as Moderate. Therefore, introduction, establishment and spread of IMS from the East Coast Project will not result in serious or irreversible environmental damage.<br>• There is little scientific uncertainty associated with predicted environmental impact (should be risk be realised prior to establishment) and the anticipated effectiveness of management measures. | |

| | | | |
|---|---|---|---|
| | • The potential impacts and risks from introduction, establishment and spread of IMS are well-understood, and management measures are well established and regulated in Australian waters. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risk for introduction, establishment and spread of IMS was evaluated as Moderate and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.4.6). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to introduction, establishment and spread of IMS were evaluated in Section 9.4.4 and highest inherent risk for introduction, establishment and spread of IMS was evaluated as Moderate.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.4.6). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | *Biosecurity Act 2015* (Cth) | Vessels entering into the Australian territorial seas from outside Australian territory must complete pre-arrival reporting. | Adoption of the following control measures to prevent introduction, establishment or spread of IMS :<br>CM15: Cooper Energy IMS Risk Management Process<br>The Cooper Energy IMS Risk Management Process acknowledges legislative requirements and the different sources of IMS risk for different types of project activity. The Process details the regulatory and any additional company requirements to manage biofouling and ballast water risks to levels that are acceptable and ALARP. |
| | *Biosecurity Amendment (Biofouling Management) Regulations 2021* | Vessels entering into Australia must complete pre-arrival reporting requirements on biofouling practices. | |
| | *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) | All ships involved in offshore petroleum activities in Australian waters are required to abide to the requirements under this Act. | |
| | Australian Ballast Water Management Requirements | Details Australia's commitment to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Convention) (IMO 2017). International marine vessels must comply with these key requirements:<br>• non-discharge of 'high-risk' ballast water in Australian ports or waters<br>• full ballast exchange outside Australian territorial seas | |

| | | | |
|---|---|---|---|
| | | • documentation of all ballast exchange activities. | |
| | Australian biofouling management requirements (DAFF, 2023) | Describes requirements that operators of all vessels need to provide on biofouling practices prior to arriving in Australia | |
| | Marine Pest Plan 2018-2023: National Strategic Plan for Marine Pest Biosecurity (2018-2023) (CoA, 2018) | Provides Australia's national strategic plan for marine pest biosecurity. It outlines a coordinated approach to building Australia's capacity to manage the threat of marine pests over five years.<br>The key relevant objective is to minimise the risk of marine pest introduction, establishment and spread. | |
| **Guideline** | | **Relevant Considerations** | **Where Guideline is Considered** |
| | National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (CoA, 2009) | Guides operators on:<br>• evaluating biofouling risk of types of structure/facilities<br>• biofouling management and decommissioning.<br>Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species. | Adoption of the following control measures:<br>CM15: Cooper Energy IMS Risk Management Process<br>The Cooper Energy IMS Risk Management Process acknowledges legislative requirements and the different sources of IMS risk for different types of project activity. The process details the regulatory and any additional company requirements to manage biofouling and ballast water risks to levels that are acceptable and ALARP. |
| | National biofouling management guidelines for commercial vessels (CoA, 2009b) | Guidance for evaluation of biofouling risk of types of vessels; and on biofouling. Used as guidance for Cooper Energy's Invasive Marine Species Risk Management Process. | |
| | Reducing marine pest biosecurity risks through good practice biofouling management | Provides guidance that is consistent with the expectations of all jurisdictions responsible for regulating biofouling management within the Australian marine environment. Used as guidance for Cooper Energy's Invasive Marine Species Risk Management Process. | |
| | Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) 2011 | Internationally agreed guidance for vessel operators to develop vessel-specific biofouling management plans. | |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11) | | |

| | |
|---|---|
| | • Operations Management (MS07)<br>• External Affairs & Stakeholder Management (MS05).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). |
| **External Context** | Through ongoing communications with the Victorian Government Biosecurity Section Cooper Energy has received information relating to IMS which may be relevant to particular activities and circumstances. This information is included in the OPP where applicable and is revisited during the detailed planning phase of an activity to inform the assessment of risk and management of vessels accounting for their operational history. |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to the introduction, establishment and spread of IMS is AL9 identified in Table 9-15. This acceptable level is defined for change in habitat, such that an introduction, establishment and spread of IMS event is unacceptable. Control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent an introduction, establishment and spread of IMS event from occurring, ensuring that AL9 is met and achieved.<br>This acceptable level defined for change in habitat is detailed in Table 7-6.<br>The worst-case predicted impacts assessed in Section 9.4.4 are:<br>• Potentially long-term impacts to native marine species and other marine users if IMS are able to successfully establish in the operational area, due to difficulty to eradicate and potential to translocate beyond the operational area.<br>• Likelihood of success establishment is remote due to distance from shore, water depth, no long-term presence of topsides infrastructure or vessels, and relatively infrequent vessel and MODU movements.<br>• The highest consequence ranking for the successful introduction, establishment and spread of IMS was evaluated as Level 4, however, the likelihood of IMS being established was considered Remote, therefore the inherent risk for introduction, establishment and spread of IMS was evaluated as Moderate.<br>Therefore, at its worst-case, the predicted impact from the introduction, establishment and spread of IMS would not:<br>• Lead to substantial adverse effects on the sustainability of commercial fisheries; and that<br>• Social and commercial amenity values of the Commonwealth Marine Area within the region are maintained consistent with the rights of all marine users.<br>Therefore, the predicted level of impact resulting from the introduction, establishment and spread of IMS resulting from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to the introduction, establishment and spread of IMS are acceptable, based on:<br>• control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent an introduction, establishment and spread of IMS event from occurring.<br>• predicted levels of impact (evaluated in Section 9.4.4) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors<br>• the planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• the activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• the proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES<br>• no feedback from stakeholders has been received that would inform the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.<br>To manage impacts to receptors to or below the defined acceptable levels the following EPO have been applied: |

| | |
|---|---|
| | **EPO14**: No introduction, establishment or spread of invasive marine species |

### 9.4.6 Environmental Performance

Table 9-15 lists the acceptable level and EPO defined for the introduction, establishment and spread of IMS and the adopted control measures to achieve the outcome.

*Table 9-15: Environmental Performance Summary – Introduction of IMS*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| AL9: Introduction, establishment or spread of invasive marine species is unacceptable. | **EPO14**: No introduction, establishment or spread of invasive marine species | CM17: Cooper Energy IMS Risk Management Process |

## 9.5 Accidental Release – MDO

### 9.5.1 Cause of Aspect

Loss of containment (LOC) of hydrocarbons (MDO) into the marine environment could occur because of the East Coast Project activities, identified in Table 9-16, which are described in further detail in subsections below.

*Table 9-16: Activities undertaken in the East Coast Project that could result in an accidental release of MDO*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Support Operations** | Vessel operations |
| | MODU operations |

### 9.5.2 Aspect Characterisation

There is the possibility of an unplanned collision between the project vessels, a project vessel and the MODU, or a project vessel and a third-party passing vessel within the operational area. Vessel grounding is not a risk because there are no shallow areas or emergent features in the operational area.

Diesel spill modelling is included in the OPP as one of a number of indicative spill scenarios. It is not the worst-case spill scenario for the East Coast Project and does not drive the EMBA for the purposes of the assessment of impacts and risks under the OPP. The LOWC scenario is the worst-case scenario for the OPP. Depending on the delineation of activities for EP preparation, LOWC may not be applicable to each EP for the East Coast Project, for example a site survey EP may carry a vessel diesel spill as its worst case. Modelling will be revisited and re-vised for the purposes of the development of individual EPs and associated OPEPs to ensure worst case discharges for the activities within the scope of the EP are provided for.

#### *9.5.2.1 Support Operations*

Support operations expected during the project life include vessel operations for drilling, supply runs, and IMR including subsea inspection, survey, and decommissioning.

To support the risk evaluation, Cooper Energy assessed the worst-case credible spill scenario that could result from a vessel collision. For the risk evaluation 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, 2023).

The worst-case scenario vessel LOC (MDO) scenario used for the assessment was:

- An instantaneous release of MDO because of a vessel collision rupturing a vessel fuel tank (~250 $m^{3*}$ of MDO over 6 hours).

**Additional context as to the vessel fuel spill scenario presented in the OPP: To identify an indicative vessel fuel spill scenario for the OPP, Cooper Energy refers to the AMSA 2023 Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities. The guideline states 'Generally, the WCS assumes a failure of one or two levels of spill prevention or control'. For a typical vessel operating offshore, the loss of full inventory from a vessel fuel tank as a result of the failure of two control measures could result from:*

1. *Failure of Procedural Control: Loss of station keeping and / or monitoring on the bridge, leading to a collision with another vessel, and then,*
2. *Failure of Engineering Control: Collision impact breaches the skin of the vessel hull into a fuel tank leading to loss of inventory.*

*Cooper Energy reviewed applicable vessel safety cases and/or tank plans of vessels indicative of those that could be used for the ECSP. The vessels reviewed have an additional level of control engineered into their design; vessel fuel tanks are not housed directly inside of the hull but are housed in the centre of the hull (example diagram below). This positioning of fuel tanks provides additional protection against a collision leading to the breach of a fuel tank, and third layer of control that would need to fail for a breach to eventuate. Following the AMSA 2023 guidance, a full breach of a vessel fuel tank which is within the centre of the vessel hull would not meet criteria for a WCS. Cooper Energy has modelled a 250$m^3$ fuel spill for the purpose of providing an indicative scenario for the OPP; whilst aware there are myriad vessel tank sizes and tank arrangements that could eventuate over the life of the East Coast Project (~25 years), though none of these would be orders of magnitude greater than the current modelled scenario, and none would result in an EMBA greater than the overall WCD for the project, which is a LOWC scenario. Nonetheless there is additional conservatism built into the vessel fuel spill scenario selected for the OPP, being an instantaneous release of 250$m^3$, which is considered less likely than a lower release rate (leak-type) scenario given there are also a range of reactive controls to manage the source of a fuel release. These measures typically include ballast transfer to change the pitch and depth of the hull, and fuel tank transfer to move fuel out of the tank which may have been breached and are described in the SOPEP (or SMPEP) for each individual vessel.*

*Oil spill modelling reviews will be conducted during the development of each EP and as part of pre-campaign vessel checks. Revisiting this at the EP stage will provide more certainty around the specific vessel to be used, to validate that the scenarios, tank capacities and thresholds defined within the East Coast Project OPP remain appropriate for the proposed activity.*

### 9.5.3 Quantitative Hydrocarbon Spill Modelling

Cooper Energy commissioned RPS Group to conduct stochastic modelling and deterministic analysis (RPS, 2023a) on the scenario of a surface spill of 250 $m^3$ of MDO following a vessel collision at the Annie-2 location (Table 9-17).

The modelling was undertaken in 2023 using NOPSEMA's contemporary modelling thresholds (NOPSEMA, 2019); provided in Table 9-3.

The Annie-2 field was considered an appropriate location for the modelling as it is the closest Cooper Energy gas field to the shore. A spill from this location is anticipated to potentially result in the largest shoreline accumulation with shortest time to shoreline contact. Subsequently, providing a conservative modelling output for vessel LOC incidents that may occur at other locations covered within the East Coast Project.

The model used during the assessment was SIMAP (Spill Impact Mapping and Analysis Program), which is a three-dimensional hydrocarbon spill trajectory and weathering model. It is designed to simulate the transport, spreading and weathering of specific hydrocarbon types under the influence of variable meteorological and oceanographic conditions in the Otway.

Stochastic oil spill modelling is created by overlaying ≥100 individual, computer-simulated hypothetical spills (NOPSEMA, 2018) and is a common means of assessing the potential risks from oil spills related to new projects and facilities. In other words, only a fraction of the area within the EMBAs have the potential to be impacted from a given spill.

Stochastic modelling utilises hydrodynamic data for the location in combination with historic wind data. 100 or more iterations of the model are run utilising the data that is most relevant to the season or timing of the project, or in the case of the East Coast Project, all seasons were accounted for. The outcomes are used for risk assessment purposes in view to understand the range of environments that may be affected or impacted by a spill, as well as to understand and plan for the resources required to respond effectively to a wide range of spill. Detailed response planning occurs during the development of activity specific EPs, and which include a comprehensive oil spill pollution emergency response plan (OPEP).

Modelling inputs are provided in Table 9-17.

*Table 9-17: MDO Spill Modelling Parameters*

| Parameter | Scenario |
|---|---|
| **Scenario** | Vessel LOC |
| **Location** | Annie-2 well<br>Lat: 38.68375° S<br>Long: 142.82456° E |
| **Maximum credible spill volume (total)** | 250 $m^3$ |
| **Number of randomly selected spill start times** | 100 per season (200 per scenario) |
| **Model period** | Summer (November to April)<br>Winter (May to October) |
| **Hydrocarbon type** | MDO |
| **Release type (depth (m))** | Surface |
| **Release duration (hours)** | 6 |
| **Simulation length (days)** | 30 |
| **Surface oil concentration thresholds ($g/m^2$)*** | 1 (low); 10 (moderate); 50 (high) |
| **Shoreline oil accumulation thresholds ($g/m^2$)*** | 10 (low); 100 (moderate); 1,000 (high) |
| **Dissolved hydrocarbon concentrations (ppb)*** | 10 (low); 50 (moderate); 400 (high) |
| **Entrained hydrocarbon concentrations (ppb)*** | 10 (low); 100 (high) |

**Thresholds based on NOPSEMA (2019); Table 9-18*

### *9.5.3.1 Hydrocarbon Impact Thresholds*

Table 9-18 describes the concentration thresholds used in the impact assessment for the different exposure types (surface, shoreline, and in-water (dissolved and entrained)). These impact thresholds and exposure pathways are then applied at a receptor level with the consequence

evaluations. The thresholds used align with the NOPSEMA environmental bulletin 'Oil spill modelling' (NOPSEMA, 2019).

*Table 9-18: Justification for Hydrocarbon Impact Thresholds*

| Exposure Level | Impact Threshold | Description |
|---|---|---|
| **Surface Oil** | | |
| **Low** | 1 g/m$^2$ | Approximates range of socioeconomic effects and establishes planning area for scientific monitoring. |
| **Moderate** | 10 g/m$^2$ | Approximates lower limit for harmful exposures to birds and marine mammals. |
| **High** | 50 g/m$^2$ | Approximates surface oil slick and informs response planning. |
| **Shoreline** | | |
| **Low** | 10 g/m$^2$ | Predicts potential for some socio-economic impact. |
| **Moderate** | 100 g/m$^2$ | Loading predicts area likely to require clean-up effort. |
| **High** | >1000 g/m$^2$ | Loading predicts area likely to require intensive clean-up effort. |
| **In-water - Dissolved** | | |
| **Low** | 10 ppb | Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers. |
| **Moderate** | 50 ppb | Approximates potential toxic effects, particularly sublethal effects to sensitive species. |
| **High** | 400 ppb | Approximates toxic effects including lethal effects to sensitive species. |
| **In-water - Entrained** | | |
| **Low** | 10 ppb | Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers |
| **High** | 100 ppb | As appropriate given oil characteristics for informing risk evaluation |

### *9.5.3.2 Hydrocarbon Characteristics*

The MDO selected for modelling is a light persistent hydrocarbon (classified as Group II by the International Tankers Owners Pollution Federation (ITOPF, 2011b), with a low dynamic viscosity and low pour point (Table 9-19). The hydrocarbon has low (10%) residual component (i.e., the component that tends not to evaporate and that may persist in the marine environment) (Table 9-19).

*Table 9-19: Physical Characteristics of the MDO*

| | | | | | Non-Persistent | | | Persistent |
|---|---|---|---|---|---|---|---|---|
| **Type** | **API** | **Pour Point (°C)** | **Density kg/m$^3$ (at 25 °C)** | **Viscosity cP (at 25°C)** | **Volatiles (BP < 180°C)** | **Semi-volatiles (180°C < BP < 265°C)** | **Low Volatiles (265°C < BP < 380°C)** | **Residuals (BP > 380)** |
| **MDO** | 24 | -9 | 890 | 14.0 | 4% | 32% | 54% | 10% |

### *9.5.3.3 Weathering and Fate*

The modelling included a series of weather tests to illustrate the potential behaviour of the MDO when exposed to idealised and representative environmental conditions (RPS, 2023a). The two tests

included a model under calm wind conditions (5 knots) and under variable weather conditions (1-23 knots), both assuming low seasonal water temperature (15°C) and ambient tidal and drift currents.

The mass balance forecast for the constant-wind case (Figure 9-1) for MDO shows that approximately 34.3% of the hydrocarbon is predicted to evaporate within 24 hours (RPS, 2023a). Under these calm conditions, most of the remaining hydrocarbon on the water surface will weather at a slower rate due to being comprised of the low volatile, longer-chain compounds. Evaporation of the residual compounds will cease when the residual compounds remain, and they will be subject to more gradual decay through biological and photochemical processes.

Under the variable-wind case (Figure 9-2) where the winds are of greater strength on average, entrainment of MDO into the water column is shown to increase. Approximately 24 hours after the spill, 83.1% of the hydrocarbon mass is shown to have entrained and a further 11.4% is shown to have evaporated, leaving only a small proportion of the hydrocarbon floating on the water surface (1.3%).

The increased level of entrainment in the variable-wind case result in a higher percentage decaying at an approximate rate of 3% per day with 22% after 7 days, compared to 0.4% per day and a total of 2.6% after 7 days for the constant-wind case (RPS, 2023a). Given the proportion of entrained hydrocarbon and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over time scales of several weeks.

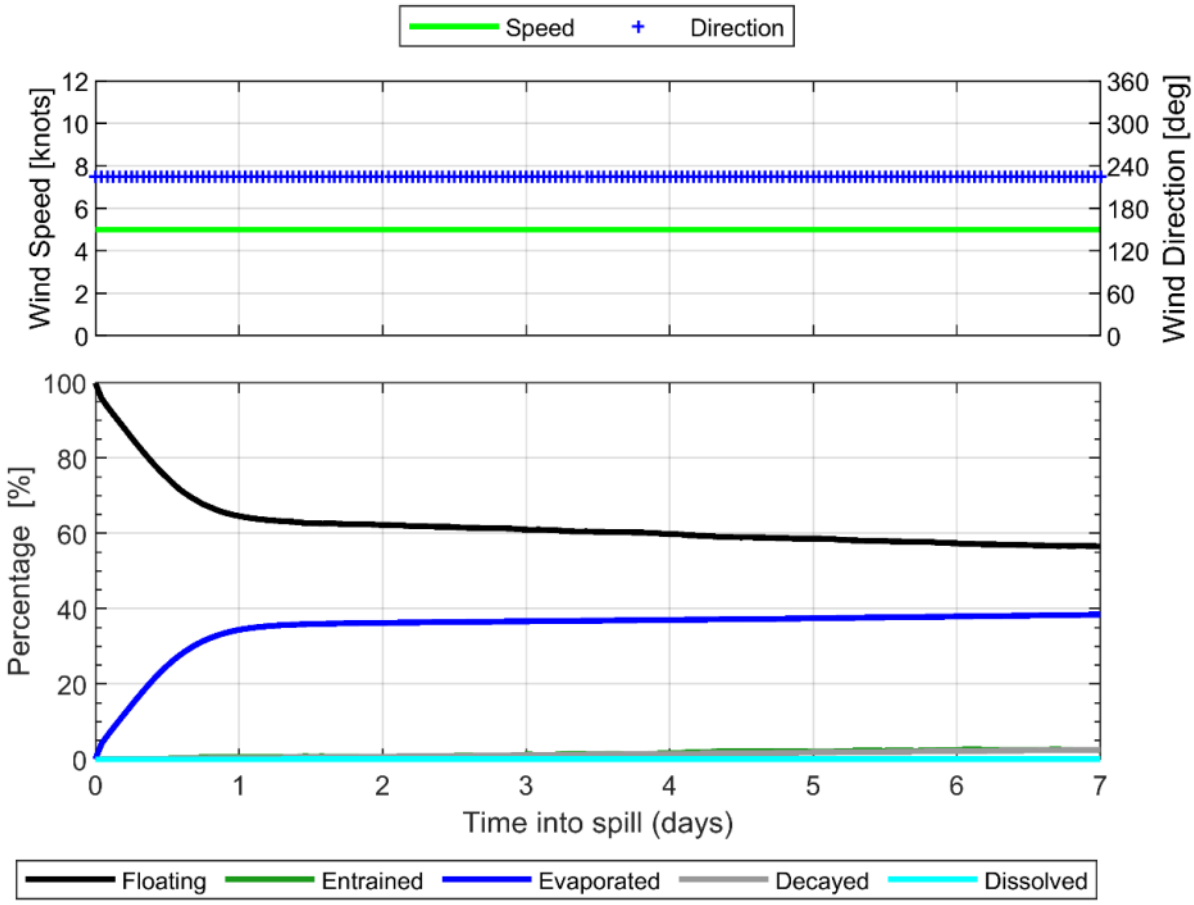



*Figure 9-1: Proportional mass balance plot representing the weathering of MDO spilled onto the water surface over 1 hour and subject to a constant 5 knots wind speed at 15°C water temperature (RPS, 2023a).*

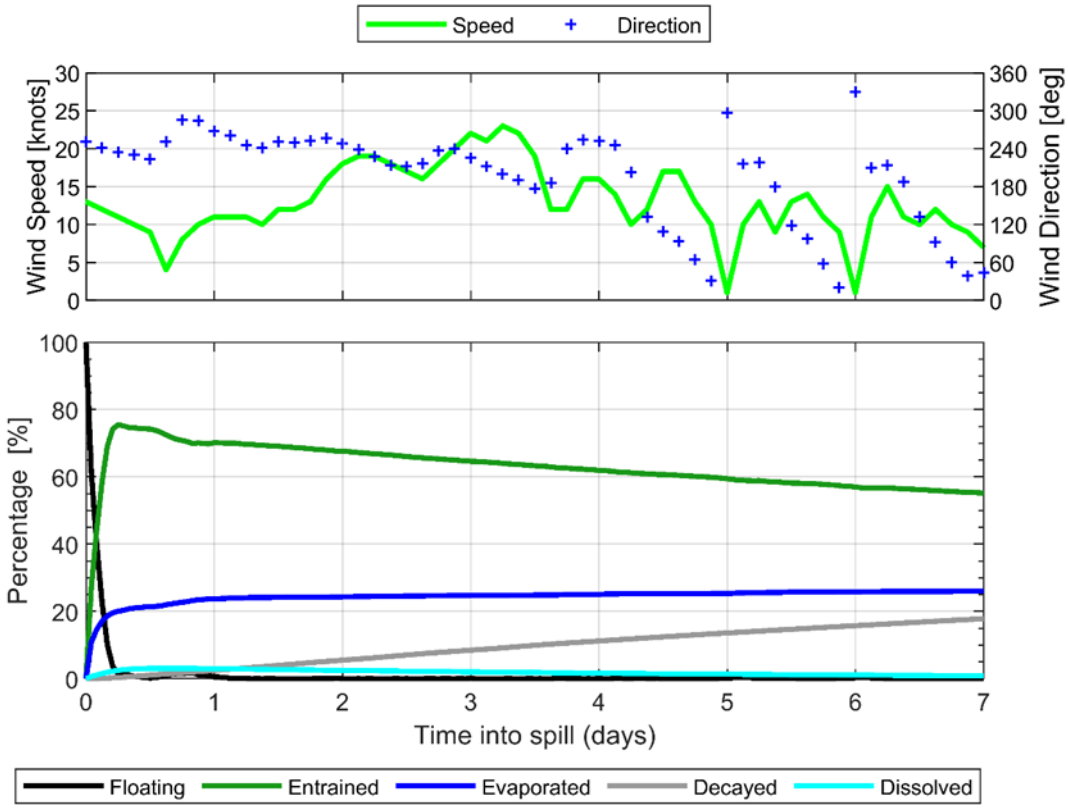



*Figure 9-2: Proportional mass balance plot representing the weathering of MDO spilled onto the water over 1 hour and subject to variable wind speeds (1-23 knots) at 15°C water temperature (RPS, 2023a).*

### 9.5.3.4 *Modelling Outputs*

Table 9-20 provides a summary of the results from the stochastic modelling report (RPS, 2023a). Figure 9-3 displays the MDO EMBAs (Ecological, Social, and Monitoring) obtained from the stochastic modelling results (RPS, 2023a). See Table 6-1 for further details on the EMBA descriptions ad specific thresholds.

*Table 9-20: Modelling Output Summary for MDO*

| Exposure Values | Summary of worst-case predicted exposure |
|---|---|
| **Floating** | |
| **Low (1 g/m²)** | Floating hydrocarbon at this level is expected to be visually detectable but not have ecological impacts.<br>• The maximum distance for floating hydrocarbon exposure from the source was predicted to be 32.5 km.<br>• Would intersect with BIAs for seabird and cetacean species.<br>• Would intersect with the Twelve Apostles Marine Park. |
| **Moderate (10 g/m²)** | Floating hydrocarbon at this level has the potential to cause ecological impacts.<br>• The maximum distance for floating hydrocarbon exposure from the source was predicted to be 10.3 km.<br>• Would intersect with BIAs for seabird and cetacean species. |
| **Shoreline** | |
| **Low (10 g/m²)** | Shoreline hydrocarbon at this level is expected to be visually detectable but not have ecological impacts. |

| Exposure Values | Summary of worst-case predicted exposure |
|---|---|
| | • The probability of hydrocarbon accumulation on any shoreline at or above the low threshold was 60%.<br>• The minimum time to shore at or above the low threshold was 22 hours.<br>• The maximum total volume of hydrocarbon ashore for a single spill trajectory was 43.2 $m^3$<br>• The maximum length of hydrocarbon ashore above the low threshold was 32 km. |
| **Moderate (100 g/$m^2$)** | Shoreline hydrocarbon at this level has the potential to cause ecological impacts.<br>• The minimum time to shore at or above the moderate threshold was 1 day.<br>• The highest maximum probability of shoreline accumulation is 28% at Corangamite.<br>• The maximum length of hydrocarbon ashore above the moderate threshold was 11 km. |
| **In-Water- Dissolved** | |
| **Low (10 ppb)** | Dissolved hydrocarbon at this level is not expected to have ecological impacts.<br>• The minimum time to dissolved hydrocarbon exposure at any given receptor(s) was 2 hours.<br>• The probability of intersect with the Twelve Apostles Marine Park is 1%.<br>• Would intersect with BIAs for cetacean and shark species. |
| **Moderate (50 ppb)** | Dissolved hydrocarbon at this level has the potential to cause ecological impacts.<br>• The minimum time to dissolved hydrocarbon exposure at any given receptor(s) was 5 hours<br>• Would intersect with BIAs for cetacean and shark species. |
| **In-Water- Entrained** | |
| **Low (10 ppb)** | Entrained hydrocarbon at this level is not expected to have ecological impacts.<br>• The minimum time to entrained hydrocarbon exposure at any given receptor(s) was 1 day<br>• Would intersect with BIAs for cetacean and shark species. |
| **High (100 ppb)** | Entrained hydrocarbon at this level has the potential to cause ecological impacts.<br>• The minimum time to entrained hydrocarbon exposure at any given receptor(s) was 1 day<br>• Would intersect with BIAs for cetacean and shark species. |

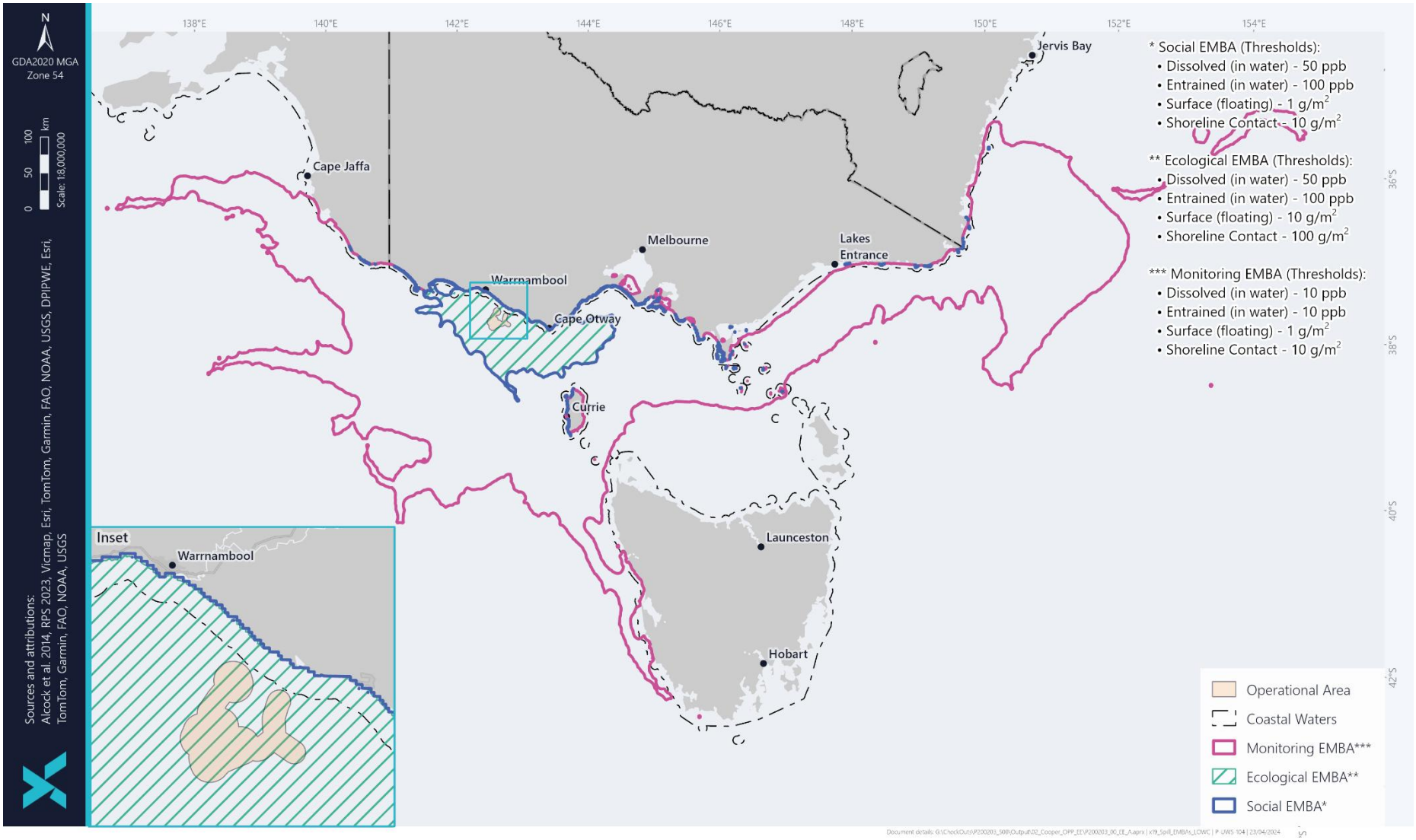



*Figure 9-3 East Coast Project operational area and MDO EMBAs (EMBA, extent of potential SEI and Monitoring) for a surface release of 250m$^3$ of MDO over 6 hours. Results calculated from 100 spill simulations (RPS, 2023a)*

### 9.5.4 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impacts from an accidental release of MDO are:

- Change in water quality.

Potential risk:

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

### 9.5.5 Impact and Risk Evaluation

The potential impacts on environmental receptors from general hydrocarbon spills are summarised in Table 9-21. The below sections evaluate the potential impact from a specific accidental release of MDO for the East Coast Project in more detail.

The extent of potential SEI and EMBA for MDO spill modelling represent the area where hydrocarbons could occur above social or ecological impact thresholds (Figure 9-3). Only a fraction of the area within the EMBAs have the potential to be impacted from a given spill.

*Table 9-21: Potential impacts of Hydrocarbon Exposure on receptors*

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| **Ecological environment** | | | |
| **Benthic assemblages** | No exposure pathway. | Marine invertebrate species, such as crustaceans, molluscs, cnidarians, and porifera, including commercially important species, may be impacted by in-water exposure of hydrocarbon expected to occur within the upper 0 – 10 m of the water column and shallow coastal areas.<br>Water quality in benthic habitats exposed to entrained hydrocarbons would be expected to return to background conditions within weeks to months of contact. Several studies have indicated that rapid recovery rates may occur even in cases of heavy oiling (National Academies Press, 2003). | No exposure pathway. |
| **Coastal habitats – Rocky shorelines** | No exposure pathway. | No exposure pathway. | The sensitivity of a rocky shoreline to oiling is dependent on a number of factors including its topography and composition, position, and exposure to oceanic waves and currents. Exposed rocky shorelines have been shown to be less sensitive than sheltered rocky shorelines.<br>Rocky shorelines provide habitats for invertebrates (e.g., sea anemones, sponges, sea-squirts, molluscs), and can also be utilised by some pinniped (haul-out sites) and bird species. Foraging and breeding/nesting by birds typically occurs above high tide line (see Section 6.5.7 for further details).<br>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). |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | | | Due to the tidal action and constant wave washing on this type of shoreline, rapid weathering of any hydrocarbons in the intertidal area is expected and it is unlikely that toxicity or smothering effects to exposed fauna will occur on this type of shoreline. |
| **Coastal habitats – Sandy shorelines** | No exposure pathway. | No exposure pathway. | Sandy beaches are considered to have a low sensitivity to hydrocarbon exposure.<br>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.<br>A sandy beach may also 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. |
| **Coastal habitats - Mangroves** | No exposure pathway. | 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 in-water 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).<br>The change in toxicity levels within the marine environment can penetrate the root surfaces, via the respiratory capabilities of the roots, poisoning the plant.<br>Acute impacts to mangroves can be observed within weeks of exposure, whereas chronic impacts may take months to years to detect. | 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 exposed aerial roots can be smothered by hydrocarbons. |
| **Coastal habitats - Saltmarsh** | No exposure pathway. | No exposure pathway. | Saltmarsh is considered to have a high sensitivity to hydrocarbon exposure. Hydrocarbon (in liquid form) will readily adhere |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | | | to the marshes, coating the stems from tidal height to sediment surface.<br>Oil can enter saltmarsh systems during the tidal cycles if the estuary/inlet is open to the ocean. Saltmarsh vegetation offers a large surface area for oil absorption and tends to trap oil. 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.<br>Evidence from case histories and experiments shows that the damage resulting from oiling, and recovery times of oiled marsh vegetation, are highly 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 damaged, but recovery can be relatively rapid, occurring the following growing season or earlier. However, when oil penetrates the soil and the initial mortality of the vegetation is extensive, recovery to reference conditions may take 3–4 years (Hester and Mendelssohn, 2000). |
| **Coastal habitats - Macroalgae** | No exposure pathway. | The effect of hydrocarbons, however, is largely dependent on the degree of direct exposure and how much of the hydrocarbon adheres to algae, which will vary depending on the oils physical state and relative 'stickiness'. The morphological features of macroalgae, such as the presence of a mucilage layer or the presence of fine 'hairs' will influence the amount of hydrocarbon that will adhere to the algae.<br>A review of field studies conducted after spill events by Connell and Miller (1981) indicated a high degree of variability in the level of impact, but in all instances, the algae appeared to be able to recover rapidly from even very heavy oiling. The rapid recovery of algae was attributed to the fact that for most algae, new growth is produced from near the base of the plant while the distal parts (which would be exposed to the oil contamination) are continually lost. Other studies have indicated that kelp beds oiled by crude oil had a 90% recovery within 3-4 years of impact, however full | No exposure pathway. |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | | recovery to pre-spill diversity may not occur for long periods after the spill (French- McCay, 2004).<br>Intertidal macroalgal beds are more prone to oil spills than subtidal beds because, although the mucous coating prevents oil adherence, oil that is trapped in the upper canopy may be more persistent, which impacts site-attached species. Additionally, when oil sticks to dry fronds on the shore, they can become heavy and break as a result of wave action (IPIECA, 2002).<br>The toxicity of hydrocarbons to macroalgae varies for the different macroalgal life stages, with water-soluble hydrocarbons more toxic (Van Overbeek and Blondeau 1954; Kauss et al., 1973; cited in O'Brien and Dixon, 1976). Gametes, larvae and zygote stages are more sensitive to petroleum oil exposure than adult growth stages (Thursby and Steele, 2004; Lewis and Pryor, 2013).<br>Entrained hydrocarbon within the water column can affect light qualities and the ability of macrophytes, including macroalgae, to photosynthesise. | |
| **Coastal habitats - Seagrass** | No exposure pathway. | Intertidal and subtidal seagrass ecosystems can be damaged in several ways. In addition to direct mortality from smothering, petroleum fractions may be absorbed into the seagrass tissues, which can then lower the organism's tolerance to other stressors and reduce growth rates (Zieman et al., 1984) (Runcie et al., 2010). Sub-lethal impacts from physical contact, are more likely to occur than lethal impacts because much of seagrasses' biomass is underground in their rhizomes and less likely to be exposed to hydrocarbons (Zieman et al., 1984). However, exposure can also take place via uptake of hydrocarbons through plant membranes and seeds may be affected by contact with oil contained within sediments (NRDA, 2012).<br>Studies of offshore benthic seaweeds in the northwest Gulf of Mexico prior to and after the Macondo well blowout at Sackett and Ewing banks (in water depths of 55–75 m) found a dramatic die-off of seaweeds after the spill (60 species pre-spill compared with 10 | No exposure pathway. |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | | species post-spill) (Felder et al., 2014). However, these banks are exposed to influences from Mississippi River discharges that vary year to year, so definitive links to the oil spill were not possible. Petroleum residues were observed on Ewing Bank, and it is possible that this may have caused localised mortalities (Felder et al., 2014).<br>Entrained hydrocarbon within the water column can affect light qualities and the ability of macrophytes, including seagrasses, to photosynthesise.<br>In-water exposure (dissolved or entrained) is only predicted to occur within the upper 0 – 10 m of the water column; therefore, benthic habitat, such as seagrass, within intertidal or shallow nearshore waters has the potential to be exposed. | |
| **Plankton** | Phytoplankton can bloom rapidly, due to their small size and high surface area to volume ratio, therefore populations are typically not sensitive to the impacts of oil (Hook et al., 2016). However, if phytoplankton are exposed to hydrocarbons at the sea surface, their ability to photosynthesise may be directly affected and could have implications for the next trophic level in the food chain (e.g., small fish) (Hook et al., 2016) depending on the extent and duration of effects on phytoplankton.<br>A reduction in the rate of photosynthesis may inhibit growth, depending on the concentration range. For example, photosynthesis is stimulated by low concentrations of oil in the water column (10-30 ppb) but becomes progressively inhibited above 50 ppb. Conversely, photosynthesis can be stimulated below 100 ppb for exposure to weathered oil (Volkman et al., 1994). | Plankton are generally abundant in the upper layers of the water column and form the basis of the marine food web. Zooplankton, such as rotifers, copepods and krill, are vulnerable to hydrocarbons due to their small size and high surface area to volume ratio. Some zooplankton also have high lipid content, which facilitates hydrocarbon uptake and bioaccumulation (Hook et al., 2016). Water column organisms that come into contact with oil risk exposure through ingestion, inhalation and dermal contact (NRDA, 2012), which can cause immediate mortality or declines in egg production and hatching rates along with a decline in swimming speeds (Hook et al., 2016).<br>The distribution of zooplankton, such as krill, is closely linked to spatial and temporal patterns in primary production by phytoplankton, which in turn is closely linked to the supply of nutrients and oceanographic processes (see Section 6.5.3). Variations in the temporal scale of oceanographic processes have a greater influence on plankton communities than the direct effect of spilled hydrocarbons. This is because reproduction by survivors or migration from unaffected areas is likely to rapidly replenish any losses from permanent zooplankton (Volkman et al., 1994). The Otway is characterised by strong currents which transfer large | No exposure pathway. |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | | volumes of water into and out of the region (Section 6.4.5.1),<br>Studies have shown minimal or transient effects on marine plankton (Volkman et al., 1994). Once background water quality conditions have re-established, the plankton community may take weeks to months to recover due to short generation times (ITOPF, 2011a), allowing for seasonal influences on the assemblage characteristics | |
| **Invertebrates** | No exposure pathway. | The primary modes of exposure for marine invertebrate communities include:<br>Direct exposure to dispersed oil (e.g., physical smothering) from a subsea release of hydrocarbon which remains at the sea floor.<br>Direct exposure to dispersed and non-dispersed oil (e.g., physical smothering) where oil sinks down from higher depths of the ocean<br>Direct exposure to dispersed and non-dispersed oil dissolved in sea water and/or partitioned onto sediment particles.<br>Indirect exposure to dispersed and non-dispersed oil through the food web (e.g., uptake of oiled plankton, detritus, prey, etc.) (NRDA, 2012)<br>Acute or chronic exposure through surface contact and/or ingestion can result in toxicological risks.<br>Entrained and dissolved hydrocarbons can have negative impacts on marine invertebrates and associated larval forms. Impacts to some adult species (e.g. crustaceans) is reduced as a result of the presence of an exoskeleton, while others with no exoskeleton and larval forms may be more prone to impacts.<br>Localised impacts to larval stages may occur which could impact population recruitment. If invertebrates are contaminated by hydrocarbons, tissue taint can remain for several months, although taint may eventually be lost. For example, it has been demonstrated that it took 2-5 months for lobsters to lose their taint when exposed to a light hydrocarbon (NOAA, 2002). | No exposure pathway. |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | | Exposure to microscopic oil droplets may also impact aquatic biota either mechanically (especially filter feeders) or act as a conduit for exposure to semi-soluble hydrocarbons (that might be taken up by the gills or digestive tract) (French-McCay, 2009). Toxicity is primarily attributed to water soluble polycyclic aromatic hydrocarbons (PAHs), specifically the substituted naphthalene (C2 and C3) as the higher C-ring compounds become insoluble and are not bioavailable.<br>Other possible impacts from the presence of dispersed and non-dispersed oil include effects of oxygen depletion in bottom waters due to bacterial metabolism of oil (and/or dispersants), and light deprivation under surface oil (NRDA, 2012). | |
| **Fish** | No exposure pathway.<br>Since fish and sharks do not generally break the sea surface, the impacts of surface hydrocarbons to fish and shark species are unlikely to occur. Near the sea surface, fish are able to detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Volkman et al., 1994). | Any pelagic fish and shark species that occupy the water column, specifically within the upper 0 – 10 m of the water column the surface layers of the water column (where in-water hydrocarbon exposure is predicted), are more susceptible to entrained and dissolved hydrocarbons.<br>Fish and sharks can be exposed to in-water hydrocarbon droplets through a variety of pathways, including:<br>Direct dermal contact (e.g. whilst swimming through oil or waters with elevated dissolved hydrocarbon concentrations and other constituents, with diffusion across their gills (Hook et al., 2016)),<br>Ingestion (e.g. directly or via food base, fish that have recently ingested contaminated prey may themselves be a source of contamination for their predators), and<br>Inhalation (e.g. elevated dissolved contaminant concentrations in water passing over the gills).<br>Exposure to hydrocarbons entrained or dissolved in the water column can be toxic to fish. Studies have shown a range of impacts including changes in abundance, decreased size, inhibited swimming ability, changes to oxygen consumption and respiration, changes to reproduction, immune system responses, DNA damage, visible skin and organ lesions and increased parasitism. However, many fish | No exposure pathway. |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | | species can metabolise toxic hydrocarbons, which reduces the risk of bioaccumulation of contaminants in the food web (NRDA, 2012).<br>Sub-lethal impacts in adult fish include altered heart and respiratory rates, gill hyperplasia, enlarged liver, reduced growth, fin erosion, impaired endocrine systems, behavioural modifications and alterations in feeding, migration, reproduction, swimming, schooling, and burrowing behaviour (Kennish, 1996). Fish exposed to aromatics in the water have been shown to have a reduced aerobic capacity, which may be a result of the process to eliminate ingested oil from the fish (Cohen et al., 2005). However, generally these species are highly mobile, and their patterns of movement make it unlikely they will remain in an area long enough to experience sub-lethal impacts (ITOPF, 2010). The exception would be in areas such as reefs and other seabed features where species are less likely to move away into open waters (i.e., site-attached species).<br>Fish are most vulnerable to hydrocarbons during their embryonic, larval and juvenile life stages. Embryos and larvae may sustain mechanical damage to feeding and breathing apparatus from contact with oil droplets, and genetic damage, physical deformities and altered developmental timing from hydrocarbons in water (Fodrie and Heck, 2011). There may also be chronic effects to fish exposed to hydrocarbons in early life stages, such as disruption of predator avoidance behaviour (Hjermann et al., 2007). Eggs and larvae exposed to weathered concentrations of hydrocarbons in water for a prolonged period of time have been shown to be immunosuppressed (Hjermann et al., 2007).<br>Hydrocarbons in the water column can physically affect fish with high site fidelity. When exposed for an extended duration (weeks to months) coating of gills may lead to lethal and sub-lethal effects from reduced oxygen exchange and coating of body surfaces may lead to increased incidence of irritation and infection. Fish may also ingest hydrocarbon droplets or | |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | | contaminated food, leading to reduced growth (Volkman et al., 1994).<br>Studies of impacts on bony fishes report that light, volatile oils are likely to be more toxic to fish. Many studies conclude that exposure to PAHs and soluble compounds are responsible for the majority of toxic impacts observed in fish (e.g., Carls et al., 2008; Ramachandran et al., 2004). Toxicity in adult fish has been reported in response to crude oils, HFO and diesel (Holdway, 2002; Shigenaka, 2011). Uptake of hydrocarbons has been demonstrated in bony fish after exposure to the water-soluble fraction of between 24 and 48 hours. However, large scale fish kills have rarely been observed as a result of hydrocarbon spills (ITOPF, 2011a) (though mortality in aquaculture pens has been reported), which is likely to be because vertebrates can rapidly metabolise and excrete hydrocarbons (Hook et al., 2016).<br>The majority of studies, either from laboratory trials or of fish collected after spill events (including the Hebei Spirit, Macondo, and Sea Empress spills), found evidence of elimination of PAHs in fish tissues returning to reference levels within two months of exposure when subsequently exposed to clean water (Challenger and Mauseth, 2011; Davis et al. 2002; Gagnon and Rawson, 2011; Gohlke et al., 2011; Jung, 2011; Law 1997; Rawson et al., 2011).<br>Recovery of fish assemblages depends on the intensity and duration of an unplanned discharge, the composition of the discharge and whether dispersants are used, as each of these factors influences the level of exposure to potential toxicants. Recovery would also depend on the life cycle attributes of fishes. Species that are abundant, short-lived and highly fecund may recover rapidly. However less abundant, long-lived species may take longer to recover. The range of movement of fishes will also influence recovery. The nature of the receiving environment would influence the level of impact on fishes. | |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| **Marine reptiles** | Sea turtles are vulnerable to the effects of oil at all life stages—eggs, post-hatchlings, juveniles, and adults in nearshore waters. Several aspects of sea turtle biology and behaviour place them at particular risk (NOAA, 2010a), including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations. Oil exposure affects different turtle life stages in different ways. Turtles may be exposed to chemicals in oil in two ways:<br>Internally – eating or swallowing oil, consuming prey containing oil-based chemicals, or inhaling of volatile oil related compounds<br>Externally – swimming in oil or dispersants, or oil or dispersants on skin and body. | | |
| | Marine turtles make large, rapid inhalations before they dive which may result in inhalation of toxic vapours from hydrocarbons in surface waters (Milton and Lutz, 2003). This can lead to respiratory irritation, inflammation, emphysema or pneumonia (NOAA, 2010a).<br>Ingested oil may cause harm to the internal organs of turtles. Visibly oiled turtles showed higher indicators of polycyclic aromatic hydrocarbons (PAH) in tissues, stomach content, colon content and faeces compared to non-visibly oiled turtles (Ylitalo et al., 2017). This exposure pathway may cause an increase in the production of white blood cells and may affect the functioning of their salt gland (Lutcavage et al., 1995). Oiling has the potential to cause mortality depending on the size of the individual and the extent of oiling (DWH Natural Resource Damage Assessment Trustees, 2016). | Some individual marine reptiles could encounter low, moderate and high in-water hydrocarbon exposure while swimming or feeding.<br>Entrained hydrocarbons can adhere to body surfaces (Gagnon and Rawson 2010) and can enter cavities such as the eyes, nostrils, or mouth. This can cause an elevated susceptibility to infections (NOAA 2010a).<br>Records of oiled wildlife during spills rarely include marine turtles, even from areas where they are known to be relatively abundant (Wallace et al., 2020). An exception to this was the large number of marine turtles collected during the Macondo spill in the Gulf of Mexico, although many of these animals did not show any sign of oil exposure (Stacy, 2012). Of the captured animals, most were later released, suggesting that oiling does not inevitably lead to mortality. | No exposure pathway (no nesting occurs within the EMBA). |
| **Seabirds and shorebirds** | Seabirds rafting, resting, diving or feeding within surface hydrocarbons at moderate exposure levels (>10 g/m$^2$) could experience damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs (ITOPF, 2011a).<br>Birds foraging at sea have the potential to directly interact with oil on the sea surface some considerable distance from breeding sites in the course of normal foraging activities. Species most at risk include those that readily rest on the sea surface (such as shearwaters) and surface plunging species such as terns and boobies.<br>Toxic effects could result where oil is ingested as the bird attempts to preen its feathers (ITOPF, 2011a). The preening process may also | Seabirds could potentially be impacted by in-water hydrocarbon exposure from direct contact whilst diving through the water column foraging, or indirectly, by consuming hydrocarbon-tainted fish, resulting in sub-lethal or toxic impacts.<br>Penguins may be especially vulnerable to oil because they spend a high portion of their time in the water and readily lose insulation and buoyancy if their feathers are oiled. The Iron Baron vessel spill, of 325 tonnes of bunker fuel in Tasmania in 1995, is estimated to have resulted in the death of up to 20,000 penguins (Hook et al., 2016).<br>As seabirds are top order predators, any impact on other marine life (e.g., pelagic fish) from hydrocarbon exposure may disrupt and limit food supply both for | Shorebird species foraging for invertebrates within the intertidal foraging areas, such as exposed sand and mud flats at lower tides, will be at potential risk of both direct impacts through contamination of individual birds (ingestion or soiling of feathers) and indirect impacts through the contamination of foraging areas that may result in a reduction in available prey items (Clarke, 2010).<br>Any direct impact of oil on terrestrial habitats has the potential to contaminate seabirds present at the breeding sites (Clarke, 2010). Bird eggs may also be damaged if an oiled adult sits on the nest. Fresh crude was shown to be more toxic than weathered crude, which had a medial lethal dose of 21.3 mg/egg (Clarke, 2010). Studies of contamination of duck eggs by small quantities |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | spread oil over otherwise clean areas of the body (ITOPF, 2011a). Whether this toxicity ultimately results in mortality will depend on the amount consumed and other factors relating to the health and sensitivity of the bird. Birds that are coated in oil also suffer from damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs.<br>In the case of seabirds, direct contact with hydrocarbons is likely to foul plumage, which may result in hypothermia due to a reduction in the ability of the bird to thermo-regulate and impaired waterproofing (ITOPF, 2011a). A bird suffering from cold, exhaustion and a loss of buoyancy (resulting from fouling of plumage) may dehydrate, drown or starve (ITOPF, 2011; DSEWPaC, 2011a; AMSA, 2013). It may also result in impaired navigation and flight performance (Hook et al., 2016). Increased heat loss as a result of a loss of water-proofing results in an increased metabolism of food reserves in the body, which is not countered by a corresponding increase in food intake, and may lead to emaciation (DSEWPaC, 2011a). The greatest vulnerability in this case occurs when birds are feeding or resting at the sea surface (Peakall et al., 1987). In a review of 45 marine hydrocarbon spills, there was no correlation between the numbers of bird deaths and the volume of the spill (Burger, 1993). | the maintenance of adults and the provisioning of young. | of crude oil, mimicking the effect of oil transfer by parent birds, have been shown to result in mortality of developing embryos (French-McCay, 2009).<br>Shoreline accumulation would be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA, 1995). As breeding activities of shorebirds and seabirds generally occurs above the high tide mark, exposure to hydrocarbons is considered unlikely to occur.<br>However, oiled bird species could track oil into their nests, which may then have subsequent impacts on any eggs present. The little penguin, is the species where this would be the highest risk, as they have to move through the intertidal area to reach nesting sites. |
| **Marine mammals - Cetaceans** | Cetaceans may come into contact with surface hydrocarbons when surfacing. However, direct surface oil contact with hydrocarbons is considered to have little deleterious effect on whales, and any effect is likely to be minor and temporary. This may be due to the skin's effectiveness as a barrier to toxicity (Geraci and St Aubin, 1988). Cetaceans have mostly smooth skins with limited areas of pelage (hair covered skin) or rough surfaces such as barnacled skin. Oil tends to adhere to rough surfaces, hair or | Cetaceans exposed 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.<br>Physical impacts from ingested hydrocarbon with subsequent lethal or sub-lethal impacts are possible with entrained oil, however, the susceptibility varies with feeding habits. Baleen whales (such as blue, southern right and humpback whales) are not particularly susceptible to ingestion of oil in the water | No exposure pathway. |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | calluses of animals, so contact with hydrocarbons by cetaceans is expected to cause only minor hydrocarbon adherence.<br>The inhalation of oil droplets, vapours and fumes may occur if whales' surface in slicks to breathe. Exposure to hydrocarbons in this way could damage mucous membranes, damage airways, or even cause death.<br>Geraci and St Aubin (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 habitat, such as foraging, resting or breeding areas. | column but are susceptible to oil at the sea surface as they feed by skimming the surface. Oil may stick to the baleen while they 'filter feed' near slicks. Sticky, tar-like residues are particularly likely to foul the baleen plates.<br>Specifically, toothed whales and dolphins may be susceptible to ingestion of dissolved and entrained oil as they gulp feed at depth. There are reports of declines in the health of individual pods of killer whales (a toothed whale species), though not the population as a whole, in Prince William Sound after the Exxon Valdez vessel spill (heavy oil) (Hook et al., 2016).<br>It has been stated that pelagic species will avoid hydrocarbon, mainly because of its noxious odours, but this has not been proven. The strong attraction to specific areas for breeding or feeding (e.g., use of the Warrnambool coastline as a nursery area for southern right whales) may override any tendency for cetaceans to avoid the noxious presence of hydrocarbons.<br>Dolphin populations from Barataria Bay, Louisiana, USA, which were exposed to prolonged and continuous oiling from the Macondo oil spill in 2010, had higher incidences of lung and kidney disease than those in the other urbanised environments (Hook et al., 2016). The spill may have also contributed to unusually high perinatal mortality in bottlenose dolphins (Hook et al., 2016).<br>As highly mobile species, in general it is very unlikely that cetaceans will be exposed to concentrations of hydrocarbons in the water column for continuous durations that would lead to chronic toxicity effects. | |
| **Marine mammals - Pinnipeds** | Pinnipeds are vulnerable to sea surface exposures given they spend much of their time on or near the surface of the water. They need to surface every few minutes to breathe and regularly haul out on to beaches.<br>Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. As a result of exposure to surface | Pinnipeds are sensitive to in-water hydrocarbon exposure as they will stay near established colonies and haul-out areas, meaning they are less likely to practice avoidance behaviours. This is corroborated by Geraci and St. Aubin (1988) who suggest seals, sea- lions and fur-seals have been observed swimming in oil slicks during a number of documented spills. | Pinniped breeding colonies may be sensitive to hydrocarbon spills. Following the Iron Baron oil spill (in Tasmania 1995) nearby seal colonies were monitored. The report concluded that reduced pup production was evident on islands close to the spill, but not evident on islands more distant (Pemberton, 1999). |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | oils, pinnipeds, with their relatively large, protruding eyes are particularly vulnerable to effects such as irritation to mucous membranes that surround the eyes. Irritation may also occur to mucous membranes that line the oral cavity, respiratory surfaces, and anal and urogenital orifices. Hook et al. (2016) reports that seals appear not to be very sensitive to contact with oil, but instead to the toxic impacts from the inhalation of volatile components.<br>For some pinnipeds, fur is an effective thermal barrier because it traps air and repels water. Petroleum stuck to fur reduces its insulative value by removing natural oils that waterproof the pelage. Consequently, the rate of heat transfer through fur-seal pelts can double after oiling (Geraci and St. Aubin, 1988), adding an energetic burden to the animal. Kooyman et al. (1976) suggest that fouling of approximately one-third of the body surface resulted in 50% greater heat loss in fur-seals immersed in water at various temperatures. Heavy oil coating and tar deposits on fur-seals may result in reduced swimming ability and lack of mobility out of the water.<br>However, pinnipeds other than fur-seals are less threatened by thermal effects of fouling, if at all. Oil has no effect on the relatively poor insulative capacity of sea-lion and bearded and ringed seal pelts, and oiled Weddell seal samples show some increase in conductance (Oritsland 1975; Kooyman et al., 1976; 1977). ITOPF (2011a) demonstrates that species that rely on fur to regulate their body temperature (such as fur-seals) are most vulnerable to oil, as the animals may die from hypothermia or overheating, depending on the season, if the fur becomes matted with oil.<br>It is reported that most pinnipeds scratch themselves vigorously with their flippers and do not lick or groom themselves, so are less likely to ingest oil from skin surfaces (Geraci and St. | Hydrocarbons within the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds. | |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| | Aubin 1988). However, mothers trying to clean an oiled pup may ingest oil. Ingested hydrocarbons can irritate or destroy epithelial cells that line the stomach and intestine, thereby affecting motility, digestion and absorption.<br>However, pinnipeds have been found to have the enzyme systems necessary to convert absorbed hydrocarbons into polar metabolites, which can be excreted in urine (Engelhardt, 1982; Addison and Brodie 1984; Addison et al. 1986). Geraci and St. Aubin (1988) suggest that a small phocid weighing 50 kg might have to ingest approximately 1 L of oil to be at risk.<br>Volkman et al. (1994) report that benzene and naphthalene ingested by seals is quickly absorbed into the blood through the gut, causing acute stress, with damage to the liver considered likely. If ingested in large volumes, hydrocarbons may not be completely metabolised, which may result in death. Poisoning from ingestion of hydrocarbons may lead to reduced foraging and reproductive fitness or mortality (DSEWPAC, 2013d). | | |
| **Conservation values and sensitivities** | | | |
| **Protected areas** | Impacts to coastal habitats, marine fauna and protected areas as discussed in rows above.<br>Injury / mortality or behavioural disruption to marine fauna.<br>Death or impairment of habitats within protected areas.<br>Reduction in the quality of the marine environment within protected areas.<br>Environmental value of protected areas is degraded. | Impacts to benthic habitats, marine fauna and protected areas as discussed in rows above.<br>Injury / mortality or behavioural disruption to marine fauna.<br>Death or impairment of habitats within protected areas.<br>Reduction in the quality of the marine environment within protected areas.<br>Environmental value of protected areas is degraded. | Impacts to benthic and coastal habitats, marine fauna and protected areas as discussed in rows above.<br>Injury / mortality or behavioural disruption to marine fauna.<br>Death or impairment of habitats within protected areas.<br>Reduction in the quality of the marine environment within protected areas.<br>Environmental value of protected areas is degraded. |
| **Socio-economic environment** | | | |
| **Coastal settlements, commercial** | Impacts to coastal habitats, marine fauna and protected areas as discussed in rows above. | Impacts to benthic habitats, marine fauna and protected areas as discussed in rows above. | Impacts to benthic and coastal habitats, marine fauna and protected areas as discussed in rows above. |

| Receptors | Surface | In-water (Dissolved & Entrained) | Shoreline |
|---|---|---|---|
| **fisheries, other offshore industry, recreation and tourism** | Possible disruption to tourism, recreation, coastal settlements or other offshore industries.<br>Possible reduction in resource available for commercial and recreational fisheries. | Possible disruption to tourism, recreation, coastal settlements or other offshore industries.<br>Possible reduction in resource available for commercial and recreational fisheries. | Possible disruption to tourism, recreation, coastal settlements or other offshore industries.<br>Possible reduction in resource available for commercial and recreational fisheries. |
| **Cultural environment** | | | |
| **Underwater cultural heritage, indigenous heritage** | Impacts to coastal habitats, marine fauna and protected areas as discussed in rows above.<br>Possible degradation of underwater cultural heritage or indigenous heritage sites and values.<br>Possible disruption to ability to continue conducting traditional cultural practices. | Impacts to benthic habitats, marine fauna and protected areas as discussed in rows above.<br>Possible degradation of underwater cultural heritage or indigenous heritage sites and values.<br>Possible disruption to ability to continue conducting traditional cultural practices. | Impacts to benthic and coastal habitats, marine fauna and protected areas as discussed in rows above.<br>Possible degradation of underwater cultural heritage or indigenous heritage sites and values.<br>Possible disruption to ability to continue conducting traditional cultural practices. |

#### *9.5.5.1 Impact: Change in Water Quality*

**Inherent Consequence Evaluation**

An accidental release of MDO into the marine environment will result in a change in water quality. MDO is classified as a light persistent hydrocarbon (Group II hydrocarbon), containing a high proportion of volatile components and only a small proportion of non-volatile (persistent) components.

Under favourable evaporation conditions, approximately 36% of the released MDO is anticipated to evaporate from the water surface within the first 24 hours, with a further 54% evaporating over several days, leaving approximately 10% remaining as persistent (see Section 9.5.3.3). Whereas in the presence of moderate to strong winds (>12 knots) and breaking waves, MDO has a strong tendency to entrain within the upper water column, leaving a small proportion remaining on the water surface (see Section 9.5.3.3). High proportions of entrained hydrocarbons reduce the proportion being evaporated; however, it also increases the rates of hydrocarbon decay when mixed in the water column. Entrained hydrocarbon will often remain in the upper water column until conditions are calm then will float to the surface and reform as a slick.

Given the nature of the hydrocarbon, the forecasted weathering processes, and the offshore metocean conditions, the area of exposure following a spill event is anticipated to be localised and short-term. The water quality of the area exposed to hydrocarbons is expected to return to pre-spill conditions relatively rapidly. Long-term adverse impacts to the water quality are not anticipated. Matters relating to potentially impacted receptors from a change in water quality within the exposed area are discussed for the specific receptors below.

Therefore, the predicted level of impact, i.e., the consequence of a change in water quality from an accidental release of MDO is evaluated as **Level 2**.

#### *9.5.5.2 Risk: Change in Habitat*

**Inherent Consequence Evaluation**

A release of hydrocarbons into the marine environment has the potential to impact shoreline habitats, from shoreline accumulation resulting in toxins accumulating within the shoreline habitat or intertidal area and adversely impacting receptors. A surface release of MDO following a vessel collision is not anticipated to impact the seabed environment, as any in-water hydrocarbon exposure (dissolved and entrained) will remain with the 0–10 m water depths of the water column, therefore only coastal habitats have been assessed.

A moderate shoreline accumulation threshold has been identified as the threshold that would potentially harm the fauna which inhabit these habitats (i.e. shorebirds, marine invertebrates, and marine reptiles) based on studies for sub-lethal and lethal impacts (French et al., 1996 and French-McCay, 2009). However, certain habitat types can be important socio-economically, therefore, risk assessment often use the conservative low threshold of shoreline accumulation (10 g/m$^2$) to assess impacts to shoreline habitats.

The probability of shoreline accumulation at or above the low exposure was approximately 60%, with shoreline contact at this threshold anticipated within 22 hours for the worst-case credible modelled scenario (RPS, 2023a). The maximum total volume ashore for a single spill trajectory was 43.2 m$^3$, and the maximum length of shoreline with accumulation above the low, moderate and high thresholds were 32 km, 11 km and 1 km, respectively. The shoreline at Corangamite recorded the highest maximum probability of shoreline loading (47% at the low threshold) and the highest potential volume onshore (43.1 m$^3$).

Habitats that may be impacted by an accidental release of MDO following a vessel collision include:

- Rocky shorelines
- Sandy beaches
- Mangroves
- Saltmarshes

- Macroalgae
- Seagrass.

Table 9-22 provides details on the presence of habitats within the area exposed to MDO at the EMBA for MDO, the potential impact and the resulting inherent consequence level for each type.

*Table 9-22: Inherent Consequence Levels – Accidental release of MDO – Change in Habitat*

| Receptor | Presence within EMBA (MDO) | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Shorelines - Rocky** | The modelling predicted the maximum probability of shoreline loading at or above the moderate exposure was approximately 28% with shoreline contact at this threshold anticipated within 1 day for the worst-case credible modelled scenario (RPS, 2023a).<br>The modelling also predicted rapid evaporation during the first 24 hours following the release of MDO, and depending on the weather conditions (i.e. wind speeds) the remainder of the MDO is predicted to readily entrain into the water column (more entrainment under higher wind speeds) (Section 9.5.3.3). | Rocky shorelines provide habitat for marine invertebrates (e.g., sea anemones, sponges, sea-squirts, molluscs) (Section 6.5.2.1).<br>The impact of hydrocarbon on any organism depends on the toxicity, viscosity and amount of hydrocarbon, the sensitivity of the organism and the length of time it is exposed to the hydrocarbon.<br>In general, MDO is not a sticky or viscous hydrocarbon, and therefore, will often wash off surfaces if exposed to tidal action. Marine invertebrate communities exposed to hydrocarbon are less likely to result in long-term damage, with communities shown to recover within 2 or 3 years (IPIECA, 1995).<br>Due to the highly volatile nature of MDO, the actual area of exposure for an individual spill event will be relatively small, and exposure is expected to be temporary with only a very small residual component.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised medium-term impacts to habitats of recognized conservation value or to local ecosystem function. | Level 3 |
| **Shorelines - Sandy** | Sandy shorelines are the dominant shoreline type along the Victoria coastline where hydrocarbons will come into contact in the unlikely event that they are released into the marine environment.<br>The maximum length of shoreline impacted at the moderate threshold was 10 km, with a maximum peak volume ashore of 43.1 $m^3$ – both at the Corangamite LGA (RPS, 2023a). Therefore, sandy beaches have the potential to be exposed to hydrocarbons at, or above the low, moderate, and high threshold (RPS, 2023a). | Sandy beaches may provide habitat for a diverse assemblage of infauna including nematodes, copepods, polychaetes, and macroinvertebrates (e.g., crustaceans) (see Section 6.5.2.1). In the event of shoreline accumulation, MDO may penetrate the porous sediments and become buried.<br>Due to proximity to shore (~8 km) from the Annie-2 release location, a release of MDO may reach the shoreline prior to it completely weathering and consequently impacts to shorelines may occur. However, NOAA (2014) note that as MDO is readily and completely degraded by naturally occurring microbes, it could be expected to disappear from shorelines within one to two months.<br>The actual area of exposure for an individual spill event will be relatively small, with only a very small residual component having the potential to impact shorelines, due to the highly volatile nature of the MDO. Furthermore, due to the hydrocarbon characteristics of MDO being a light non-persistent hydrocarbon, MDO on certain shorelines, such as sandy shorelines, may easily by washed off in the presence of tidal and/or wave action.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to habitats of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

| Receptor | Presence within EMBA (MDO) | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Mangroves** | Mangroves are not a dominant habitat found within the area potentially exposed to hydrocarbons.<br>However, a few isolated patches of mangroves can be found along the Victorian coastline, predominantly with inlets or bay (Section 6.5.2.2).<br>These mangroves have the potential to be exposed to hydrocarbons within the EMBA (MDO) (RPS, 2023a). | Mangroves are considered to have a high sensitivity to hydrocarbon exposure. Hydrocarbons can be deposited on the aerial roots and sediment surface by tidal action (IPIECA, 1993; NOAA, 2014). Physical smothering of aerial roots by hydrocarbons can block the trees' breathing pores used for oxygen intake and result in the asphyxiation of sub-surface roots (IPIECA, 1993). Heavy or viscous oil, or emulsification, can kill mangroves via this process. 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.<br>Given the non-viscous nature of MDO, 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 conservatively based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. | Localised medium-term impacts to habitats of recognized conservation value or to local ecosystem function. | Level 3 |
| **Saltmarsh** | Saltmarshes may potentially be exposed to hydrocarbons in the event of shoreline accumulation following a loss of containment from a vessel collision. Saltmarsh habitats are present within estuaries, inlets, and riverine systems in many parts along the Victorian coast (Section 6.5.2.3). The saltmarsh habitats identified by the modelling to be exposed to shoreline accumulated include subtropical and temperate saltmarsh TECs. | Saltmarshes are generally considered to be highly sensitive to hydrocarbon exposure due to the low tidal and wave action restricting hydrocarbon degradation. Hydrocarbon can enter saltmarsh systems during the tidal cycles if the estuary/inlet is open to the ocean, and will readily adhere to the marshes, coating the stems from tidal height to sediment surface.<br>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.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised medium-term impacts to habitats of recognized conservation value or to local ecosystem function. | Level 3 |
| **Macroalgae** | Macroalgae may be present within areas predicted to be exposed to in-water hydrocarbons. In-water hydrocarbon exposure in nearshore, intertidal, and subtidal areas is predicted to occur at moderate thresholds for dissolved hydrocarbons, with some sites of macroalgae (RPS, 2023a). However, | Macroalgal systems are an important source of food and shelter for many ocean species; including in their unattached drift or wrack forms (McClatchie et al., 2006).<br>The physical effects of smothering, fouling and asphyxiation has been documented from oil contamination in marine plants (Blumer 1971; Cintron et al., 1981). Reported toxic responses to hydrocarbons have included a variety of physiological changes to | Localised short-term impacts to habitats of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

| Receptor | Presence within EMBA (MDO) | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | it is not a dominant habitat feature within the EMBA (MDO) (Section 6.5.2.4) | enzyme systems, photosynthesis, respiration, and nucleic acid synthesis (Lewis and Pryor, 2013).<br>In macroalgae, oil can act as a physical barrier for the diffusion of $CO_2$ across cell walls (O'Brien and Dixon, 1976).<br>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.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |
| **Seagrass** | Seagrasses may be present within the EMBA (MDO) (Section 6.5.2.5). | Seagrass meadows are important in stabilising seabed sediments, and providing nursery grounds for fish and crustaceans, and a protective habitat for the juvenile fish and invertebrates species (Huisman, 2000; Kirkman, 1997). 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).<br>Given the restricted range of exposure (shallow nearshore and intertidal waters only) and the predicted low concentrations of hydrocarbons expected to be in these waters, any impact to seagrass is not expected to result in long-term or irreversible damage.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to habitats of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

Summary

The potential consequence to habitats from an accidental release of MDO is assessed to be Level 3 based on the potential for localised medium-term impacts to species or habitats of recognised conservation value or to local ecosystem function.

**Inherent Likelihood**

A LOC from a petroleum industry vessel following a collision is uncommon. AMSA's Annual Report 2021-22 of serious pollution incidents within the marine environment (Level 2 or higher) identified only two shipping incidents which had been reported within the last four years from marine operations (AMSA, 2022), with neither related to the petroleum industry.

Cooper Energy has been operating facilities in the Otway for ~10 years and has utilised a variety of vessels and MODU in the region during that time with no vessel collisions or associated LOCs. The risks associated with vessel collision are considered well understood. In addition, control measures, such as navigational aids and exclusion zones, will be adopted by the East Coast Project, further reducing the likelihood of a vessel collision resulting in a LOC of MDO.

Due to the nature of this activity, the control measures that will be implemented, and based on previous occurrences, the impact is considered conceivable and could occur, however, it would require a rare combination of factors. Therefore, the inherent likelihood of a vessel collision (MDO) causing a change to water quality is considered **Unlikely (D).**

**Inherent Risk Severity**

The inherent risk severity of an accidental release of MDO causing impacts to habitat is considered **Moderate**.

#### *9.5.5.3 Risk: Change in Fauna Behaviour*

**Inherent Consequence Evaluation**

An accidental release of MDO into the marine environment has the potential to impact the behaviour of certain marine fauna within the environment. Marine fauna that has been shown to exhibit changes to behaviour include:

- Fish and Sharks
- Seabirds and Shorebirds
- Marine Reptiles
- Marine Mammals (including pinnipeds and cetaceans).

Table 9-23 describes the presence of marine fauna within the EMBA (MDO), the potential impact and the resulting inherent consequence level for each type.

*Table 9-23: Inherent Consequence Levels - Accidental release of MDO - Change in Fauna Behaviour*

| Receptor | Presence within EMBA (MDO) | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Fish** | Several fish species may be present within the EMBA (MDO) (see Section 6.5.5 for all EPBC-listed fish species).<br>BIAs identified within the EMBA (MDO) are:<br>• Foraging BIA for the white shark for entrained exposure only. | Multiple fish species are listed on the EPBC Act PMST were identified to occur within the EMBA (MDO) (Section 6.5.5).<br>Since fish and sharks do not generally break the sea surface, the risk from hydrocarbon spills is more likely to occur from entrained and dissolved hydrocarbon components.<br>A release of hydrocarbon within the marine environment may cause behavioural modifications and alterations in feeding and/or migration patterns as fish and shark species attempt to avoid an area impacted by a spill (Kennish, 1996). However, generally these species are highly mobile species, and their patterns of movements makes it unlikely for them to remain within the area long enough to be exposed to hydrocarbons to experience sub-lethal impacts (ITOPF, 2010). Furthermore, the modelling predicted that majority of the MDO would evaporate within a few days following a release (see Section 9.5.3.3); therefore, reducing the potential of exposure to fish species that may be present within the EMBA.<br>White sharks have been shown to routinely move between surface and to depths or >30 m, and in offshore regions can spend most of their time near the seafloor (DSEWPaC, 2012), thus decreasing the chance of exposure.<br>Pelagic species, such as white sharks, and other fish species identified within the EMBA, are generally highly mobile, with wide-spread distribution ranges. Therefore, these species are not likely to be severely impacted from the temporary avoidance that may occur following a spill event.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |
| **Seabirds and shorebirds** | 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. The area potentially at risk from floating and/or shoreline exposure includes known foraging habitats for shoreline and migratory bird species, such as albatross, | 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. Furthermore, the actual area of exposure for an individual spill event being relatively small compared to the typically large foraging area, with exposure shown to be transient and temporary due to the influence of waves, currents and weathering processes. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

| Receptor | Presence within EMBA (MDO) | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | petrels and shearwater species (some with associated BIAs) (Section 6.5.7).<br>Several threatened, migratory and/or listed marine seabirds or shorebirds species may be present within the EMBA (Section 6.5.7).<br>Several foraging BIAs for several albatross, shearwater and petrel species was identified within the EMBA (MDO).<br>• Antipodean albatross<br>• Wandering albatross<br>• Buller's albatross<br>• Indian yellow-nosed albatross<br>• Shy albatross<br>• Campbell albatross<br>• Black-browed albatross<br>• Common diving-petrel<br>• White-faced storm-petrel<br>• White-tailed shearwater<br>• Short-tailed shearwater<br>• Australasian gannet.<br>Breeding BIAs were also identified within the EMBA:<br>• Short-tailed shearwater. | 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 >10 g/m$^2$ out to 10.3 km) and temporary (~18 hrs) due to the rapid weathering of the MDO.<br>Therefore, impacts to these species are not anticipated to be long-term, or affect population functioning.<br>Shoreline accumulation following a spill event from a vessel collision, or the associated spill response activities, may cause disruption to foraging habitats for shorebirds and migratory birds (see Section 6.5.7), which predominantly occur along the shoreline.<br>Shoreline impacts are not anticipated to impacts areas above the high tide mark, therefore, will not impact breeding areas identified within the EMBA (MDO).<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |
| **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.<br>Four EPBC listed marine turtle species were identified to be present within the EMBA (MDO); these include: loggerhead, green, leather | Marine turtles which are within the area could be displaced by a release of MDO into the marine environment.<br>The area exposed by moderate levels of surface hydrocarbons from a vessel collision event is limited to offshore open waters (10.3 km from the release site) over a maximum period of 18 hours.<br>However, there are no BIAs or habitat critical to the survival of species within the shoreline or environment potentially affected (Section 6.5.6).<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

| Receptor | Presence within EMBA (MDO) | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | back and hawksbill turtle (Section 6.5.6).<br>Marine turtles may be exposed to hydrocarbon when transiting through the in-water hydrocarbons, surfacing to breathe within the surface slick, or nesting on oiled shorelines. | | | |
| **Marine mammals - Pinnipeds** | There may be pinnipeds in the area predicted to affected by surface hydrocarbons at moderate exposure levels (Section 6.5.8).<br>Pinnipeds that are present within the EMBA (MDO) have the potential to be impacted by surface hydrocarbons when surfacing to breathe, in-water hydrocarbons when transiting through the area, and shoreline accumulated hydrocarbons that occur at haul-out sites along the coastline.<br>No BIAs for pinnipeds were identified within the EMBA (MDO). | Pinnipeds, such as the Australian sea lion, and the New Zealand and Australian fur-seals, which occur within Victoria and Tasmania may be impacted by shoreline accumulation resulting in a displacement from haul-out sites or entrained and dissolved hydrocarbons affecting movement through the affected area. Heavy oil coating and tar deposits on fur-seals may result in reduced swimming ability and lack of mobility out of the water.<br>Breeding colonies may be sensitive to hydrocarbon spills in the event of shoreline accumulation. Individual adults may also be impacted by oil whilst transiting through the nearshore environments at haul-out sites that may be impacted from the spill event.<br>However, impacts to pinnipeds at a population level are considered very unlikely given the localised and temporary presence of hydrocarbons at relevant thresholds, the absence of haul out sites within or near the operational area, the transient, highly mobile nature of pinnipeds, over typically extensive foraging grounds. There are no BIAs or habitat critical to survival of species within the EMBAs.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised medium-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 3 |

| Receptor | Presence within EMBA (MDO) | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Marine mammals - Cetaceans** | Several threatened, migratory and/or listed marine cetacean species have the potential to be migrating, resting or foraging within the EMBA (Section 6.5.8).<br>The following BIAs are within the area exposed to hydrocarbons at moderate exposure levels (EMBA):<br>• Pygmy blue whale known foraging and distribution BIA<br>• Southern right whale migration and reproduction BIAs. | A MDO spill could disrupt natural behaviours and displace animals. Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behaviour disturbance (including avoidance of the area) may occur. Active avoidance of an area may disrupt behaviours such as migration, or displace individuals from areas where they are foraging, resting or breeding. Certain whales, particularly those with coastal migration and reproduction, can display strong site fidelity to specific resting, breeding and feeding habitats, as well as to their migratory paths, subsequently these species may be affected more.<br>However, the potential extent of hydrocarbon exposure is significantly smaller than the extent of the BIAs for each species and their much broader range. Cetaceans are highly mobile, pelagic species, with wide-spread distribution ranges, therefore, it is unlikely that individuals will be severely impacted from the temporary displacement that may occur following a spill event.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

Summary

The potential consequence to marine fauna from an accidental release of MDO event is assessed as Level 3 based on the potential for localised medium-term impacts to species of recognised conservation value, but not affecting local ecosystem functioning.

**Inherent Likelihood**

Due to the nature of this activity, the adopted control measures, and limited previous occurrences, the impact is considered conceivable and could occur, however, it would require a rare combination of factors. Therefore, the inherent likelihood of a vessel collision (MDO) causing **Level 3** consequences to marine fauna behaviour is considered **Unlikely (D)**.

**Inherent Risk Severity**

The inherent risk severity of a vessel collision (MDO) causing impacts to fauna behaviour is considered **Moderate**.

#### *9.5.5.4 Risk: Injury/Mortality to Fauna*

An accidental release of MDO into the marine environment has the potential to result in injury and/or mortality to marine fauna within the vicinity. In general, moderate thresholds of surface and moderate to high of in-water hydrocarbons (dissolved and entrained) have been shown to cause sub-lethal and lethal ecological impact (French et al., 1996 and French-McCay, 2009). The marine fauna that may be present within the EMBA and impacted by an unplanned release of MDO include:

- Plankton
- Invertebrates
- Fish
- Seabirds and Shorebirds
- Marine reptiles
- Marine mammals

Table 9-24 provides details on the presence of receptors within the EMBA (MDO), the potential impact and the resulting inherent consequence level for each type.

*Table 9-24: Inherent Consequence Levels – accidental release of MDO – Injury/mortality Fauna*

| Receptor | Presence within moderate threshold | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Plankton** | Plankton is found in nearshore and open waters in the water column.<br>Plankton population distributions 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 (Section 6.5.3). Therefore, plankton populations may be present within the area potentially exposed to hydrocarbons in the EMBA (MDO). | Injury/mortality to planktonic species may occur due to a change in water quality following an unplanned hydrocarbon release (see Section 9.5.5.1 for further details on a change to water quality). Plankton are widely dispersed throughout the water column, although exposure is predicted to occur within the 0-10 m water depth, where plankton are most abundant.<br>Effects will be greatest in the area close to the spill source where hydrocarbon concentrations are likely to be highest. 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, however, the potential impacts from in-water exposure (dissolved or entrained) will be greater.<br>Entrained MDO could intersect the Bonney Upwelling KEF, however, only at the low threshold (8% probability of exposure) (RPS, 2023a). While a spill would not affect the upwelling itself, if the spill occurs at the time of an upwelling event, it may result in higher levels of krill being exposed to low (effects) level entrained phase MDO. Species which feed on the krill, such as the pygmy blue whales, may suffer from reduced prey. However, these impacts would be expected to be localised and temporary.<br>MDO has higher toxicity levels when initially release due to the presence of the volatile components (Di Toro et al., 2007), however, with rapid weathering expected, this toxicity decreases. Furthermore, the actual area of exposure is expected to be extremely localised and temporary due to the influence of waves, currents and weathering processes. Once background water quality is re-established, plankton has been shown to take weeks to months to recover (ITOPF, 2011b), therefore long-term impacts are not anticipated.<br>Due to the hydrocarbon characteristics, expected weathering and fate of MDO, the relatively quick recovery times of plankton, unplanned releases of MDO are not expected to have a substantial adverse effect on plankton life cycle and spatial distribution and therefore unlikely to affect populations at the regional scale or affect local ecosystem functioning.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localized and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |

| Receptor | Presence within moderate threshold | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Invertebrates** | Marine invertebrate species, such as crustaceans, molluscs, cnidarians, and porifera, including commercially important species, may be present within the area exposed to hydrocarbons.<br>Impacts by direct contact with hydrocarbon is only expected to potentially occur within the 0-10 m section of the water column and shallow coastal areas of the EMBA, where the highest diversity of invertebrate species is found, given the surface nature of the spill and the water depths throughout much of the EMBA (MDO).<br>Sediment sampling by Parry et al. (1990) in shallow in-shore water also demonstrated high diversity, although patchy distribution, within shallow waters, with crustaceans, polychaetes and molluscs being the dominant species (Section 6.5.4). | Exposure in nearshore and intertidal areas is predicted to occur at low thresholds of dissolved and entrained, moderate thresholds of dissolved, with some sites predicted to be exposed to high thresholds of entrained for the worst-case scenario modelled.<br>No exposure at high thresholds was predicted for dissolved in-water hydrocarbons from either scenario (RPS, 2023a).<br>Entrained and dissolved hydrocarbons can have negative impacts on marine invertebrates and associated larval forms. Impacts to some adult species (e.g., crustaceans) is reduced as a result of the presence of an exoskeleton, while others with no exoskeleton and larval forms may be more prone to impacts.<br>Localised impacts to larval stages may occur which could impact population recruitment.<br>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.<br>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 (Section 6.5.4). See Section 9.5.5.5 for the consequence evaluation to commercial fisheries.<br>Water quality in benthic habitats exposed to entrained hydrocarbons would be expected to return to background conditions within weeks to months of contact.<br>Due to the hydrocarbon characteristics of the MDO and the well-mixed nature of the waters, coating of benthic assemblages and prolonged exposure to hydrocarbons is considered highly unlikely. At this threshold, there may be ecological impacts to benthic assemblages stranded on the shoreline. However, wave action at the shoreline will rapidly disperse and weather the hydrocarbons naturally.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |
| **Fish** | Several fish species may be present within the EMBA (MDO) (Section 6.5.5). | Pelagic fish and shark species that occupy the water column, specifically the surface layers of the water column (where in-water | Localised short-term impacts to species of recognised | Level 2 |

| Receptor | Presence within moderate threshold | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | BIAs identified within the EMBA (MDO) are:<br>• Foraging BIA for the white shark for entrained exposure only. | hydrocarbon exposure is predicted to be highest), are more susceptible to entrained and dissolved hydrocarbons.<br>Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from hydrocarbon spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2010).<br>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 hydrocarbon affected populations.<br>Since fish and sharks do not generally break the sea surface, the impacts of surface hydrocarbons to fish and shark species are unlikely to occur. Near the sea surface, fish are able to detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Volkman et al., 2004).<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | conservation value but not affecting local ecosystem functioning. | |
| **Seabirds and shorebirds** | Several threatened, migratory and/or listed marine seabirds or shorebirds species may be present within the area exposed to MDO (Section 6.5.7).<br>There are several seabird BIAs identified within the EMBA (MDO); however, these species are oceanic, not shoreline foragers. No habitat critical to the survival of the species have been identified (Section 6.5.7).<br>Several foraging BIAs for several albatross, shearwater and petrel species was identified within the EMBA (MDO).<br>• Antipodean albatross<br>• Wandering albatross<br>• Buller's albatross<br>• Indian yellow-nosed albatross | Birds have the potential to be rafting, resting, diving and feeding within the area predicted to be contacted by surface hydrocarbons; diving or foraging within in-water hydrocarbons; and foraging and nesting within shoreline exposure.<br>The presence of birds within in-water hydrocarbons at moderate exposure levels is expected to be limited, due to the transitory nature of foraging individuals, and given the absence of offshore aggregation areas in the area.<br>Breeding birds may be impacted via contamination of breeding sites, including contamination of eggs by contaminated adults (Clarke, 2010).<br>Direct hydrocarbon contamination 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, exposed fauna may track hydrocarbon 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. | Localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. | Level 2 |

| Receptor | Presence within moderate threshold | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | • Shy albatross<br>• Campbell albatross<br>• Black-browed albatross<br>• Common diving-petrel<br>• White-faced storm-petrel<br>• White-tailed shearwater<br>• Short-tailed shearwater<br>• Australasian gannet.<br>Breeding BIAs were also identified within the EMBA:<br>• Short-tailed shearwater. | There are no known breeding locations for penguins along the Otway mainland coast at risk of shoreline hydrocarbon accumulation.<br>In addition, shoreline accumulation will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA, 1995). As breeding activities of shorebirds and seabirds generally occurs above the high tide mark, exposure to hydrocarbons is considered unlikely to occur.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |
| **Marine reptiles** | There may be marine turtles in the area predicted to be exposed to hydrocarbons. Injury/mortality to species may occur due to a change in water quality following an unplanned hydrocarbon release relevant exposure levels. However, there are no BIAs or habitat critical to the survival of the species within this area.<br>Four of the five EPBC listed species which have the potential to be present within the area were identified to be present within the EMBA (MDO), these include: loggerhead, green, leather back and hawksbill turtle (Section 6.5.6). | Marine turtles may be exposed to hydrocarbon when transiting through the in-water hydrocarbons, surfacing to breathe within the surface slick, or nesting on oiled shorelines.<br>The area exposed by moderate levels of surface hydrocarbons from a vessel collision event is limited to offshore open waters (10.3 km from the release site) over a maximum period of 18 hours.<br>The number of marine turtles that may be exposed to hydrocarbons during a LOWC event is expected to be low due to the localised and temporary presence of hydrocarbons at moderate exposure levels, the low number of turtles foraging or migrating through Bass Strait in general, 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.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |
| **Marine mammals - Pinnipeds** | There may be pinnipeds, such as the Australian sea lion, and the New Zealand and Australian fur-seals, within the spatial extent of moderate threshold.<br>No BIAs or habitat critical to survival of species for pinnipeds were identified within the environment potentially affected (Section 6.5.8). | Pinnipeds that are present within the area exposed to hydrocarbons have the potential to be impact by surface hydrocarbons when surfacing to breathe, in-water hydrocarbons when transiting through the area, and shoreline accumulated hydrocarbons that occur at haul-out sites along the coastline.<br>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, | Localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. | Level 3 |

| Receptor | Presence within moderate threshold | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | resulting in reduced foraging and reproductive fitness or death (DSEWPaC, 2013).<br>The area exposed by moderate levels of surface hydrocarbons from a vessel collision event is limited to offshore open waters (10.3 km from the release site within the operational area) over a maximum period of 18 hours.<br>Hydrocarbons within the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds.<br>Given condensate is considered a light hydrocarbon that rapidly evaporates, the absence of BIAs within the impacted area and the transient, highly mobile nature of the species, over typically extensive foraging grounds; impacts to pinnipeds at a population level are considered very unlikely.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |
| **Marine mammals - Cetaceans** | Several threatened, migratory and/or listed marine cetacean species have the potential to be migrating, resting or foraging within the EMBA.<br>The following BIAs are within the EMBA (MDO) exposed to surface hydrocarbons:<br>• Pygmy blue whale known foraging and distribution BIA<br>• Southern right whale migration and reproduction BIAs. | 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.<br>The area exposed by moderate levels of surface hydrocarbons from a vessel collision event is limited to offshore open waters (10.3 km from the release site within the operational area) over a maximum period of 18 hours. No surface exposure at the high threshold was modelled for any scenario (RPS, 2023a).<br>Inhalation of surface hydrocarbons could damage mucous membranes, damage airways, or even cause death. Furthermore, ingestion of contaminated prey could cause toxic impacts.<br>Cetaceans exposed to entrained hydrocarbons can result in physical coating as well as ingestion (Geraci and St Aubin, 1988). Physical impacts from ingested hydrocarbon with subsequent lethal or sub-lethal impacts are possible with entrained oil.<br>As highly mobile species, in general it is very unlikely that cetaceans will be constantly exposed to concentrations of hydrocarbons in the water column for continuous durations (e.g., >96 hours) that would lead to chronic toxicity effects.<br>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, | Localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. | Level 2 |

| Receptor | Presence within moderate threshold | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | resulting in short-term and localised consequences, with no long-term population viability effect.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |

Summary

The potential consequence to marine fauna from an accidental release of MDO event is assessed as Level 3 based on the potential for localised and medium-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.

**Inherent Likelihood**

Due to the nature of this activity, the adopted control measures, and limited previous occurrences, the impact is considered conceivable and could occur, however, it would require a rare combination of factors. Therefore, the inherent likelihood of a vessel collision (MDO) causing **Level 3** consequences of injury / mortality to marine fauna is considered **Unlikely (D)**.

**Inherent Risk Severity**

The inherent risk severity of an accidental release of MDO resulting from a vessel collision causing impacts to receptors is considered **Moderate**.

#### *9.5.5.5 Risk: Changes to the Functions, Interests, or Activities of Other Users*

Inherent Consequence Evaluation

The unplanned release of MDO into the marine environment has the potential to affect the functions, interests, or activities of other users of the sea. Risk assessments often use the conservative low threshold levels of hydrocarbon exposure, specifically floating hydrocarbon threshold (1 g/m$^2$), shoreline accumulation threshold (10 g/m$^2$), and entrained/dissolved thresholds (10 ppm) to assess socio-economic impacts. These thresholds are considered the levels which could trigger temporary closures of areas (i.e., fishing grounds, shorelines) as a precautionary measure due to the visibility of the hydrocarbon on the sea surface or shoreline. These thresholds may also trigger the need for shoreline clean-up on beaches or man-made features/amenities (breakwaters, jetties, marinas, etc.) depending on the socio-economic value of the shoreline (French-McCay et al., 2005a; 2005b).

The probability of shoreline accumulation at or above the low exposure (10 g/m$^2$) was approximately 60%, with shoreline contact at this threshold anticipated within 22 hours for the worst-case credible modelled scenario (RPS, 2023a). The shoreline at Corangamite recorded the highest maximum probability of shoreline loading (47% at the low threshold) and the highest potential volume onshore (43.1 m$^3$).

Functions, interests, or activities of other users that may be present within EMBA include:

- Conservation values and sensitivities:
  - World and National Heritage Areas
  - Australian Marine Parks
  - Wetlands
  - State Parks and Reserve
  - Key Ecological Features
  - TECs
- Socio-economic environment:
  - Coastal settlements.
  - Commercial fisheries
  - Other offshore industry
  - Recreation and tourism.

Table 9-24 provides details on the presence of receptors within the extent of potential SEI (MDO), the potential impact and the resulting inherent consequence level for each type.

*Table 9-25: Inherent Consequence Levels - accidental release of MDO - Changes to functions, interests and activities of other users*

| Receptor | Presence within extent of potential SEI (MDO | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Conservation values and sensitivities** | | | | |
| **World and National heritage areas** | Modelling predicted that one National heritage area could be contacted by hydrocarbon exposure within the extent of potential SEI (MDO); and no World heritage areas (RPS, 2023a):<br>• Great Ocean Road and its Scenic Environs. | The values identified of these World and National heritage areas have the potential to be exposed to shoreline hydrocarbons at, or above, the low threshold.<br>Visible shoreline hydrocarbons may have the potential to reduce the visual, social and cultural amenity of the area temporarily.<br>Given the non-persistent nature of the hydrocarbon, waves and tidal action are anticipated to continue the weathering process if shoreline contact occurs.<br>Refer also to potential impact to habitats (Section 9.5.5.2) and coastal settlements (below). | Localized and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |
| **AMPs** | Modelling predicted one AMP could be contacted by hydrocarbon exposure within the extent of potential SEI (MDO):<br>• Apollo AMP (Multiple Use Zone (IUCN VI)).<br>The major conservation values for this AMP have been identified within Section 6.6.3 of the EP and include foraging areas for some EPBC listed species of birds (e.g., petrels, shearwaters, albatross), and cetaceans (e.g., pygmy blue and southern right whales).<br>The AMP is associated with unique seafloor features, which influence the formation of large eddies mixing warm waters with cool nutrient-rich waters increasing marine biodiversity; these features would not be expected to be affected (see Section 6.6.3). | The values identified within the Apollo AMP have the potential to be exposed to surface hydrocarbons at, or above, the low threshold, in the event of a release of MDO following a vessel collision.<br>Seabirds are the value which has been identified for this AMP that may be impacted by surface hydrocarbons by rafting, resting, diving or feeding within the surface slick. Impact to seabirds from direct or indirect exposure to surface hydrocarbons may cause a subsequent negative impact to the value of the AMP, however any impact is expected to be limited to a small number of individuals, with no impacts to regional populations.<br>However, the exposure of entrained hydrocarbons will be greatest within the upper 0-10 m of the water column and areas close to the spill source. The Apollo AMP is located within waters 80-120 m; therefore, conservation values within this AMP, such as ecosystems, habitats and sea-floor features are not predicted to be impacted.<br>Furthermore, the modelling predicted no entrained hydrocarbon exposure at the high threshold; and only 25% at low (RPS, 2023a).<br>The Apollo AMP is important foraging areas for seabirds. There is a low probability that seabirds would forage only within the area exposed to hydrocarbons given their extensive foraging grounds. Therefore, there is a chance that foraging seabirds will experience sub-lethal impacts from consuming contaminated prey, however, | Localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning. | Level 3 |

| Receptor | Presence within extent of potential SEI (MDO | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | impacts will be limited to individuals and are not expected to cause impacts at a population-level.<br>The Apollo AMP also overlaps areas where cetaceans could be moving through (i.e. humpback, blue, fin, and sei whales) (see Section 6.6.3). As cetaceans are highly mobile pelagic animals, they are unlikely to be within the exposure area 0-10 m of the water column for prolonged periods of time.<br>Refer to potential impact to marine fauna (Sections 9.5.5.3 and 9.5.5.4) and to habitats (Section 9.5.5.2). | | |
| **Wetlands** | Wetlands could be exposed to hydrocarbons in the event of shoreline accumulation following a vessel collision. There are no wetlands of International Importance (RAMSAR) identified within the EMBA (MDO) (Section 6.6.4.1).<br>Three wetland communities with TEC status are present within the area predicted to be exposed to hydrocarbons ashore:<br>• Karst springs and associated alkaline fens of the Naracoorte Coastal Plain Bioregion<br>• assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community<br>• natural Damp Grassland of the Victorian Coastal Plains.<br>The major values for these wetlands have been identified within Section 6.6.4 of the EP.<br>Furthermore, a number of these wetlands are associated with First Nations cultural values (see Section 6.6.4). | Wetlands are saline marsh areas and estuarine environments that are a continuation from the marine environment. Therefore, depending on where the shoreline contact occurs there is a potential for shoreline oil to move into the estuary and wetlands, potentially impacting the aesthetic and ecological value of the wetland.<br>Shoreline hydrocarbon exposure at, or above, the low threshold may impact the key receptors of wetlands (e.g. waterbirds, fish and invertebrates) which may cause a subsequent negative impact to the value of the wetland, however, is expected to be limited to a small number of individuals, with no impacts to regional populations.<br>Refer to potential impact to marine fauna (Sections 9.5.5.3 and 9.5.5.4) and to habitats (Section 9.5.5.2) and cultural heritage (Section 6.8.3.7). | Localized and medium-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 3 |
| **State parks and reserves** | The modelling identified one State Park and reserve present within the extent of potential SEI (MDO):<br>• Twelve Apostle Marine National Park.<br>Conservation values for this protected area are detailed within Section 6.6.5 and include high levels of marine fauna and flora diversity, | The values identified within the identified State Park and reserve that has the potential to be exposed to surface hydrocarbons at, or above, the low threshold.<br>Visible surface hydrocarbons (i.e. a rainbow sheen) may have the potential to reduce the visual amenity of the area, also impacting the value. | Localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning. | Level 3 |

| Receptor | Presence within extent of potential SEI (MDO | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | including fish and invertebrate assemblages and benthic coverage (sponges, soft corals, macroalgae). | The values identified within this marine park have the potential to be exposed to entrained hydrocarbons at, or above, the low threshold (RPS, 2023a). The modelling predicted 29% probability of hydrocarbon exposure for entrained (high threshold); and no dissolved hydrocarbons above the low threshold (RPS, 2023a).<br>However, the exposure of entrained hydrocarbons will be greatest within the upper 0-10 m of the water column and areas close to the spill source. Therefore, conservation values within Twelve Apostles Marine National Park, such as benthic and pelagic species, ecosystems, habitats and sea-floor features are not predicted to be impacted.<br>Given the light, non-persistent nature of MDO, impacts from entrained exposure are likely be localised and short-term, and not affect fish at a population level, or affect local ecosystem functioning.<br>Also refer to potential impact to marine fauna (Sections 9.5.5.3 and 9.5.5.4) and to habitats (Section 9.5.5.2). | | |
| **KEFs** | Modelling predicted exposure from in-water hydrocarbons at, or above low exposure levels, was shown to overlap two KEFs (RPS, 2023a):<br>• Bonney Coast upwelling<br>• shelf rock reefs.<br>Values associated with the Bonney Coast Upwelling include the upwelling of cold nutrient rich water to the sea surface which supports regionally high productivity and high species diversity. Whales and other 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 within the area (Section 6.6.6).<br>The KEF is associated with unique sea-floor features of ecological significance, and habitat forming species, such as sponges, attached megafauna, and hard substrate formations | The values identified within the Bonney Coast Upwelling KEF and shelf rocky reef KEFs have the potential to be exposed to entrained hydrocarbons at, or above, the low threshold. There is no exposure to surface hydrocarbons at any threshold.<br>However, the exposure of entrained hydrocarbons will be greatest within the upper 0-10 m of the water column and areas close to the spill source. Therefore, the spill is unlikely to intersect with majority of the values of the KEFs which are concentrated within the water column >10 m deep or along the seafloor at varying water depths.<br>The Bonney Coast Upwelling is also an area of high abundance of plankton, such as krill which acts as a food source to many seabirds, fish and cetacean species. Plankton populations may be impacted by hydrocarbon exposure, however, would be expected to be limited to a small proportion of the productivity driven by the Bonney upwelling, with no impacts to the overall system and productivity across the region.<br>The modelling predicted only a small portion of the Bonney Coast Upwelling could be exposed (low probability of 8%) of entrained hydrocarbon exposure at or above low thresholds of MDO (RPS, 2023a). Therefore, any impacts are anticipated to localised and not impact the overall value of the KEF. | Localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning. | Level 3 |

| Receptor | Presence within extent of potential SEI (MDO | Potential impact | Description of consequence | Inherent consequence |
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| | and canyons which create a habitat for diverse species.<br>Shelf rocky reefs KEF supports a variety of benthic communities, such as coral, sponges and benthic communities, along the continental shelf within the temperate east marine region (see Section 6.6.6). | Given the nature of the hydrocarbon, the relatively short duration of the spill, and the small area of exposure, any impacts are anticipated to be localised and short-term.<br>Refer to potential impact to marine fauna (Sections 9.5.5.3 and 9.5.5.4) and to habitats (Section 9.5.5.2). | | |
| **TECs** | Modelling predicted exposure from shoreline hydrocarbons at, or above low exposure levels, to overlap several TECs within the extent of potential SEI (MDO).<br>Three wetland communities with TEC status are present within the area predicted to be exposed to hydrocarbons ashore:<br>• Karst springs and associated alkaline fens of the Naracoorte Coastal Plain Bioregion<br>• assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community<br>• natural Damp Grassland of the Victorian Coastal Plains.<br>Values associated with these TECs (see Section 6.6.7) are listed as critically endangered, endangered or vulnerable, and can be sensitive to hydrocarbon exposure. | TECs have the potential to be exposed to shoreline hydrocarbons at, or above, the low threshold. Any hydrocarbon exposure to the key receptors of the TECs may cause a subsequent negative impact to the value of the TECs, However, potential impacts to socio-economic receptors (tourism, cultural and/or other social values associated with the TECs) are more likely to occur because of a reduction in the visual amenity, rather than ecological impacts of hydrocarbon exposure at low threshold.<br>Shoreline hydrocarbons can become concentrated as they strand ashore. However, most of the oil is concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA, 1995). The majority of the TECs are located above the high tide mark, therefore, impacts are not anticipated to occur.<br>Shoreline hydrocarbon exposure at, or above, the low threshold may impact the key receptors of wetlands (e.g. waterbirds, fish and invertebrates) which may cause a subsequent negative impact to the value of the wetland, however, is expected to be limited, with no long term impacts local populations or regional occurrences.<br>Refer to potential impact to marine fauna (Sections 9.5.5.3 and 9.5.5.4) and to habitats (Section 9.5.5.2), cultural heritage (Section 6.8.3.7); and Wetlands (above). | Localised and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |
| **Socio-economic environment** | | | | |
| **Coastal settlements** | There are several local government areas identified as potentially being overlapped by the spatial extent of shoreline hydrocarbon exposure at the low threshold.<br>Stochastic modelling undertaken for the surface release of MDO indicated that there was a 60% probability of shoreline accumulation of hydrocarbon at or above the low threshold. The contact was predicted to occur within 22 hours, with the average total | Coastal settlements may be vulnerable to shoreline accumulation from a hydrocarbon spill of MDO as visible hydrocarbons have the potential to reduce the visual amenity of the area. Closure of these shorelines may impact public use and public activities.<br>The shoreline segments exposed, with Corangamite having the highest probability of accumulation above all three thresholds (47% at the low threshold), are not densely populated stretches of coast. Furthermore, most of the hydrocarbon will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA, 1995) and expected to be visible, therefore | Localised, short-term impacts. | Level 2 |

| Receptor | Presence within extent of potential SEI (MDO | Potential impact | Description of consequence | Inherent consequence |
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| | volume of hydrocarbons ashore being 7.5 $m^3$ (RPS 2023a).<br>Corangamite was the shoreline segment predicted to have the highest probability of shoreline exposure at the low threshold level (47%) (RPS, 2023a).<br>No exposure at any threshold was predicted for Tasmanian state waters. | the impact to coastal settlements is expected to be relatively low or not occur.<br>Given the hydrocarbon characteristics of MDO as a light-persistent hydrocarbon, expected rapid weathering, relatively small volumes predicted ashore, and the potential for tidal flushing, any impact is anticipated to be localised short-term.<br>Refer to potential impact to habitats (Section 9.5.5.2). | | |
| **Commercial fisheries** | In-water exposure to entrained MDO may result in a reduction in commercially targeted marine species or marketability of catch, resulting in impacts to commercial fishing and aquaculture. Several commercial fisheries operate in the extent of potential SEI (MDO) and overlap the spatial extent of the water column hydrocarbon predictions (Section 6.7.2.1). | In-water hydrocarbon exposure could result in a reduction in commercially targeted marine species (i.e. fish and invertebrate species). 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.<br>Physical displacement of commercial fishers may occur due to the establishment of exclusion zones during the spill response. However, the maximum distance from the release location at the low threshold (10 $g/m^2$) was 32.5 km from the release site, therefore, any exclusion zones required are not anticipated to be required for a large area.<br>The low dissolved/entrained threshold (10 ppb) represents the lowest concentration where impacts could potentially occur. However, these thresholds require a relatively long exposure time (>24 hours) for the exposure to be significant to fish species (RPS, 2023a). Therefore, 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 would likely be localised and short-term, and not affect fish at a population level, or affect local ecosystem functioning.<br>Visible surface hydrocarbons (i.e. a rainbow sheen) could impact public perception of the industry products, potentially causing a negative economic impact.<br>Due to the nature of the MDO, being a light non-persistent hydrocarbon, with high anticipated evaporation and entrainment rates, exclusion zones are not expected to be long-term or encompass entire fisheries.<br>Refer to potential impact to habitats (Section 9.5.5.2); specifically, Fish and Invertebrates. | Localised, short-term impacts. | Level 2 |

| Receptor | Presence within extent of potential SEI (MDO | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Other offshore industry** | Other offshore industry, such as shipping, petroleum exploration and production, other offshore infrastructure and defence activities, may occur within the extent of potential SEI (MDO) (Section 6.7.3). | Physical displacement of other offshore industry may occur due to the establishment of exclusion zones during the spill response. This has the potential to cause negative economic impact.<br>However, due to the nature of the MDO, being a light non-persistent hydrocarbon, and the relatively short duration of surface exposure (i.e. 34% evaporated within 24 hours in calm conditions, and 81% entrained under variable wind conditions) impacts are expected to be localised and short term. | Localised, short-term impacts. | Level 2 |
| **Recreation and tourism** | The Victorian coast and marine region provide a diverse range of land-based and near-shore tourism opportunities, including scuba diving, fishing, whale and wildlife watching, sailing, snorkelling and kayaking (Section 6.7.4).<br>Modelling predicted low exposure thresholds of surface hydrocarbons are predicted up to 32.5 km (west) of the release location. Areas where low threshold surface hydrocarbon is predicted include Twelve Apostle MNP, Corangamite, and Moonlight Head.<br>No exposure at any threshold was predicted for Tasmanian state waters.<br>In general, recreational and tourism activities are restricted to shallower coastal waters and shorelines. | 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. MDO is known to rapidly spread and thin out on release and consequently, a large area may be exposed to surface hydrocarbons.<br>Precautionary exclusion from shorelines may be implemented by local governments until water quality monitoring verifies the absence of residual hydrocarbons. This could cause disruption to some recreational and tourism activities within that area.<br>Any impact to receptors that provide nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism activities.<br>Given the nature of the hydrocarbon type, the relatively short duration of the spill, and the small area of exposure, any impacts to recreation and tourism are anticipated to be localised and short-term.<br>Refer to potential impact to marine fauna (Sections 9.5.5.3 and 9.5.5.4) | Localised, short-term impacts. | Level 2 |

Summary

The potential consequence to the functions, interests or activities of other users is assessed as **Level 3** based on the potential for localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning.

**Inherent Likelihood**

Due to the nature of this activity, the adopted control measures, and limited previous occurrences, the impact is considered conceivable and could occur, however, it would require a rare combination of factors. Therefore, the inherent likelihood of a vessel collision (MDO) causing **Level 3** consequences to the functions, interests and activities of other users is considered **Unlikely (D)**.

**Inherent Risk Severity**

The inherent risk severity of an accidental release of MDO resulting from a vessel collision causing impacts to socio-economic receptors is considered **Moderate**.

### 9.5.6 Demonstration of Acceptability

To demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 9-26.

*Table 9-26: Accidental release - MDO Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Potential impact: Change in water quality | Consequence: Level 2 |
| | Risk: Change in habitat | Risk: Moderate |
| | Risk: Change in fauna behaviour | Risk: Moderate |
| | Risk: Injury/mortality to fauna | Risk: Moderate |
| | Risk: Change to the functions, interests, or activities of other users. | Risk: Moderate |
| **Principles of ESD** | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 9.5.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the potential impact and risks from accidental release – MDO are identified as:<br>• Level 2 consequence for change in water quality<br>• Moderate risk for change in habitat<br>• Moderate risk for change in fauna behaviour<br>• Moderate risk for injury/mortality to fauna<br>• Moderate risk for change to the functions, interests or activities of other users.<br>The above predicted levels of impact and risk due to accidental release – MDO from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | |
| | B) 'Precautionary principle' | |

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| | If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology.<br>• The consequence ranking for an accidental release of MDO was Level 3, and the highest inherent risk was evaluated as Moderate; therefore, an accidental release of MDO from the East Coast Project will not result in serious or irreversible environmental damage.<br>• The potential impacts and risks from an accidental release of MDO are well-understood, and management measures are well established and regulated in Australian waters.<br>• Any uncertainty surrounding the suitability of modelled oil spill scenarios and thresholds will be addressed by EPO20 which establishes a modelling review to ensure that scenarios and thresholds remain appropriate for activity specific environment plans. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risks for an accidental release of MDO was evaluated as Moderate and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.5.7). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to an accidental release of MDO were evaluated in Section 9.5.5 and the highest inherent risk for an accidental release of MDO was evaluated as Moderate.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.5.7). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained. | | |
| | E) 'Valuation principle'<br>The East Coast Project is consistent with the principle of ESD (e) for this aspect by holding financial assurance under Section 571(2) of the *OPGGS Act* to ensure the project aligns with the 'polluter pays' principle. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | OPPGS(E)R | An EP, including an OPEP and emergency response arrangements, must be place for any petroleum activity prior to activities commencing, and must be implemented. | Adoption or the following control measures to prevent (and mitigate) unplanned release of chemicals or hydrocarbons:<br>CM1: Marine Assurance Process<br>The vessels and MODU will adhere to navigational safety |
| | *Protection of the Sea (Prevention of* | All ships involved in petroleum activities in | |

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| | *Pollution from Ships) Act 1983* – Section 26F (implements MARPOL Annex I). | Australian waters are required to abide to the requirements under this Act.<br>Several MOs are enacted under this Act relating to offshore petroleum activities, including:<br>MO Part 91: Marine Pollution Prevention – Oil<br>MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances | requirements under the *Navigation Act 2012* and associated Marine Orders, including but not limited to:<br>• AMSA MO 21 – Safety and Emergency Arrangements<br>• AMSA MO 27 - Safety of Navigation and Radio Equipment<br>• AMSA MO 30 - Prevention of Collisions.<br>• AMSA MO 70 – Seafarer certification<br>• In accordance with MARPOL Annex I and AMSA MO 91 [Marine Pollution Prevention – oil], a SMPEP or SOPEP (according to class) is required for each vessel and MODU. Response equipment will be available in accordance with the SMPEP / SOPEP.<br>• AMSA MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances<br>Training and testing will be undertaken in accordance with the SMPEP/SOPEP exercise schedule. In the event of a spill, the SMPEP/SOPEP details:<br>• Reporting requirements and a list of authorities to be contacted.<br>• Activities to be undertaken to control the discharge of hydrocarbon; and Vessels shall meet the AMSA Marine Order (MO) requirements, including:<br>○ 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.<br>○ 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.<br>○ AMSA MO 30 - Prevention of collisions |
| | Navigation Act 2012 – Chapter 4 (Prevention of Pollution). | All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act.<br>Several Marine Orders (MO) are enacted under this Act which relate to offshore petroleum activities, including:<br>MO 21: Safety and emergency arrangements | |
| | AMSA Marine Orders 91 and 94 | In Commonwealth waters AMSA is the Statutory Agency for vessels and must be notified of all incidents involving a vessel. | |
| | Recovery plan for marine turtles in Australia 2017–2027 | 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.<br>Interim objective 3: Anthropogenic threats are demonstrably minimised.<br>No relevant management actions. | |
| | National Recovery Plan for Albatrosses and Petrels 2022 (DCCEEW 2022e) | Recovery objective: To improve the conservation status of albatrosses and petrels so that these species are on a trajectory towards no longer being threatened in Australia's jurisdiction.<br>No relevant management actions. | |
| | Wildlife Conservation Plan for Seabirds (CoA 2020) | Objective 2: Seabirds and their habitats are identified, protected and managed in Australia.<br>Objective 3. The long-term survival of seabirds and their habitats is achieved | |

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| | | through supporting priority research programs, coordinated monitoring, on-ground management and conservation.<br>No relevant management actions. | requires that onboard navigation, radar equipment, and lighting meets the International Rules for Preventing Collisions at Sea (COLREGs) and industry standards.<br>○ AMSA MO 70 - Seafarer certification meets the requirements for qualifications and training.<br>CM12: Marine exclusion, caution and petroleum safety zones<br>May include:<br>• A temporary 3 km exclusion/cautionary zone around the MODU during the drilling program<br>• A temporary 500 m exclusion/caution zones to be established via Notice to Mariners around vessels undertaking petroleum activities<br>• PSZs may be gazetted around wells and other equipment where required for integrity management. Subsea infrastructure will be marked on navigational charts for awareness.<br>CM13: Ongoing Engagement<br>Further engagement will take place during the development and implementation of component EPs. This will include:<br>• details relating to notification of third-party stakeholders,<br>• engagement with other titleholders in the Otway with respect to each others ongoing activities and potential cumulative impacts.<br>Relevant information received will be included within the EPs as appropriate.<br>CM16: OSMP<br>Cooper Energy's OSMP details the arrangements and capability in place for:<br>• Operational monitoring of a hydrocarbon spill to inform response activities<br>• Scientific monitoring of environmental impacts of the spill and response activities. |
| | Blue Whale Conservation Management Plan 2015 - 2025 (2015) | Recovery objective: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list.<br>Interim objective 4: Anthropogenic threats are demonstrably minimised.<br>Management action A.4.2: Ensure all vessel strike incidents are reported in the National Ship Strike Database (AMMC).<br>Management action A.4.3: 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, implement appropriate mitigation measures. | |
| | National Recovery Plan for the Southern Right Whale (DCCEEW, 2024l) | Long term recovery objective: is that the population has increased in size to a level that the conservation status has improved, and the species no longer qualifies for listing as threatened under any of the EPBC Act listing criteria.<br>Interim Objective 2: Anthropogenic threats are managed consistent with ecologically sustainable development principles to facilitate recovery of southern right whales. | |
| | 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.<br>No relevant management actions. | |
| | Approved Conservation Advice for *Balaenoptera physalus* (Fin Whale) | Determine population abundance, trends and population structure for fin whales, and establish a long-term monitoring | |

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| | | program in Australian waters.<br>No relevant management actions. | CM17: OPEP<br>Under the Regulations, the petroleum activity must have an accepted OPEP in place before the activity commences. In the event of a surface release of MDO following a vessel collision, the OPEP will be implemented.<br>Cooper Energy acknowledges that any response will be implemented in accordance with the requirements described within the OPEP.<br>CM18: Regulatory Safety and Integrity Management Plans<br>A NOPSEMA accepted safety case is required before applicable activities can be undertaken. Applicable activities will be managed in accordance with the accepted safety case revisions.<br>CM22: Modelling Review<br>Modelling studies used to inform the Activity Environment Plan will use scenarios that are representative of the activity, and current, published thresholds that are suitable for sensitive receptors.<br>CM29: MODU Material Transfer Process<br>MODU will have a bulk fluid transfer process in place before commencing operations. This process will include:<br>• MODU-to-vessel communication protocols<br>• Transfer hose integrity checks<br>• Transfer hose pressure test<br>• Continuous visual monitoring during transfers<br>• Tank volume monitoring.<br>• Avoidance of bulk hydrocarbon transfers at night, or otherwise artificial illumination of the of the operational areas on the MODU, vessel and water between them during the transfer.<br>• Weather limitations for bulk transfers. |
| | Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (2013a)<br>Conservation Advice for the *Neophoca cinerea* (Australian sea lion) | Overarching objective: 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:<br>Improving the population status leading to the future removal of the Australian sea lion from the threatened species list of the EPBC Act<br>Ensuring that anthropogenic activities do not hinder recovery in the near future or impact on the conservation status of the species in the future.<br>No relevant management actions. | |
| | Recovery Plan for the White Shark (*Carcharodon carcharias*) | 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.<br>No relevant management actions. | |
| | Conservation Advice for Subtropical and Temperate Coastal Saltmarsh (DSEWPAC, 2013) | No relevant objectives.<br>Management action: 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. | |
| | Approved Conservation Advice for *Botaurus poiciloptilus* (Australasian bittern) | Provide guidance for actions that will expand the range and the number of Australasian Bitterns in Australia.<br>No relevant management actions. | |
| | Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) | Australian Objective:<br>Reduce disturbance at key roosting and feeding sites.<br>No relevant management actions. | |

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|---|---|---|---|
| | Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) | Australian objectives:<br>Achieve a stable or increasing population.<br>Maintain and enhance important habitat.<br>Reduce disturbance at key roosting and feeding sites.<br>No relevant management actions. | |
| | National Recovery Plan for (*Sternula nereis nereis*) (Australian Fairy Tern)<br>Approved Conservation Advice for *Sternula nereis* (Australian Fairy Tern) | Long-term Vision:<br>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.<br>No relevant management actions. | |
| | Approved Conservation Advice for *Thinornis rubricollis* (Hooded Plover, Eastern) | Primary Conservation Objectives:<br>Achieve stable numbers of adults in the population and maintain a stable number of occupied and active breeding territories.<br>Maintain, enhance and restore habitat, and integrate the subspecies' needs into coastal planning.<br>No relevant management actions. | |
| | Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan | Specific recovery objective: To identify and manage the threats operating at sites where the subspecies occurs.<br>No relevant management actions. | |
| | National Recovery Plan for the *Lathamus discolour* (swift parrot)<br>Conservation Advice *Lathamus discolor* Swift Parrot | Overall objectives:<br>To prevent further decline of the Swift Parrot population.<br>To achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat to increase carrying capacity.<br>No relevant management actions. | |
| | National Recovery Plan for the Orange-bellied Parrot (*Neophema chrysogaster*) | Objective 1. To achieve a stable or increasing population in the wild within five years.<br>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.<br>Objective 3. To protect and enhance habitat to maintain, and support growth of, the wild population.<br>Objective 4. To ensure effective adaptive implementation of the plan.<br>No relevant management actions. | |
| | Commonwealth Conservation Advice on *Dermochelys coriacea* (2008) | These EPBC management plans identify habitat degradation / modification or pollution / contamination as a threat; but do not include any relevant objectives or relevant management actions. | |
| | Approved Conservation Advice for *Calidris canutus* (Red Knot) | | |
| | Approved Conservation Advice for *Charadrius leschenaultia* (Greater Sand Plover) | | |
| | Approved Conservation Advice for *Halobaena caerulea* (Blue Petrel) | | |
| | Approved Conservation Advice for *Limosa lapponica bauera* (Bar-tailed Godwit (western Alaskan) | | |
| | Approved Conservation Advice for *Pachyptila subantarctica* (Fairy Prion (southern)) | | |
| | Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) | | |
| | Approved Conservation Advice for *Thalassarche Chrysostoma*, Greyheaded Albatross) | | |
| | Conservation Advice *Thalassarche cauta* Shy Albatross | | |
| | Conservation Advice *Falco hypoleucos* Grey Falcon | | |

| | | | |
|---|---|---|---|
| | Conservation Advice *Hirundapus caudacutus* White-throated Needletail | | |
| | Conservation Advice for Dendronephthya australis Cauliflower Soft Coral (TSSC, 2020) | | |
| | Approved Conservation Advice for Giant Kelp Marine Forests of Southeast Australia (TEC) (DSEWPAC, 2012) | | |
| | Approved Conservation Advice for the Littoral Rainforest and Coastal Vine Thickets of Eastern Australia ecological community (DoE, 2015) | | |
| **Internal Context** | Relevant management system processes adopted include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11)<br>• External Affairs & Stakeholder Management (MS05).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | Stakeholder feedback received.<br>GMTOAC has previously communicated values and sensitivities relevant to the risk. GMTOAC highlighted Gunditjmara' strong connection to Sea Country and responsibility for its care. Cooper Energy briefed GMTOAC on the kinds of activities undertaken by Cooper Energy which carry a risk of spills, and the plans in place to prevent and respond to spills. During the briefing, members queried whether Cooper Energy had ever had a large hydrocarbon spill (February 2024). Cooper Energy clarified that no hydrocarbon spills have occurred during Cooper Energy's time operating within the Otway. GMTOAC indicated Gunditjmara's responsibility for Country extended to a spill response along the coast and would expect to be contacted in the event of a spill which threatens Gunditjmara Country. GMTOAC are listed as a relevant person for the purposes of EP preparation which will enable their continued input into the management of activity specific impacts and risks. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to an accidental release of MDO is AL3 identified in Table 9-27. This acceptable level is defined for change in water quality, change in habitat and injury / mortality to fauna, such that an accidental release of MDO is unacceptable. Control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent an accidental release of MDO event from occurring, ensuring that AL3 is met and achieved.<br>This acceptable level defined for a change in water quality and habitat is detailed in Table 7-6.<br>The worst-case predicted impacts assessed in Section 9.5.5 are:<br>• Given the nature of the activity, implementation of control measures and based on previous occurrences, the inherent likelihood of a vessel collision (MDO) causing a change to habitat, injury/ mortality to fauna, change in fauna behaviour or change to the functions, interests and activities of other users is considered Unlikely (D). | | |

| | |
|---|---|
| | • Highest consequence for change in habitat from accidental release MDO is Level 3, for shorelines – rocky, saltmarsh and mangroves. These are localised medium-term impacts to habitats of recognized conservation value or to local ecosystem function.<br>• Highest consequence to marine fauna is Level 3, for pinnipeds. Breeding colonies may be sensitive to hydrocarbon spills in the event of shoreline accumulation and individuals have the potential to be impact by surface hydrocarbons when surfacing to breathe, in-water hydrocarbons when transiting through the area. Impacts to pinnipeds at a population level are considered very unlikely given the localised and temporary presence of hydrocarbons at relevant thresholds, the absence of haul out sites within or near the operational area, the transient, highly mobile nature of pinnipeds, over typically extensive foraging grounds.<br>• Impacts to plankton, invertebrates, cetaceans, fish, marine reptiles, seabirds and shorebirds are localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.<br>• The highest consequence to the functions, interests or activities of other users is assessed as Level 3 based on the potential for localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning.<br>• The highest consequence ranking for an accidental release of MDO was Level 3, and the highest inherent risk was evaluated as Moderate.<br>Therefore, at its worst-case, the predicted impact from accidental release of MDO would not:<br>• Exceed levels which prevent conservation of biodiversity, recovery and protection of threatened species, maintenance of ecosystem health and the ecological integrity and functioning of the Commonwealth Marine Area.<br>• Lead to a change in biodiversity beyond natural variability.<br>Therefore, the predicted level of impact resulting from an accidental release of MDO from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to an accidental release of MDO are acceptable, based on:<br>• control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent an accidental release of MDO event from occurring.<br>• predicted levels of impact (evaluated in Section 9.5) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors<br>• the planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• the activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• the proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES<br>• feedback has been received from stakeholders that has informed the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.<br>To manage impacts to receptors to or below the defined acceptable levels the following EPOs have been applied:<br>**EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment.<br>**EPO20:** For activity specific environment plans undertake review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds,and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable |

### 9.5.7 Environmental Performance

Table 9-27 lists the acceptable level and EPOs defined for the introduction, establishment and spread of IMS and the adopted control measures to achieve the outcome.

*Table 9-27: Environmental Performance Summary – Accidental release of MDO*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL3:** Unplanned loss of containment (hydrocarbons and chemicals) is unacceptable. | **EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment.<br>**EPO20:** For activity specific environment plans undertake review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds,and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. | CM1: Marine Assurance Process |
| | | CM12: Marine Exclusion and Caution Zones |
| | | CM13: Ongoing Engagement |
| | | CM16: OSMP |
| | | CM17: OPEP |
| | | CM18: Regulatory Safety and Integrity Management Plans |
| | | CM22: Modelling Review |
| | | CM29: MODU Material Transfer Process |

## 9.6 Accidental Release – LOWC

### 9.6.1 Cause of Aspect

An accidental release of condensate into the marine environment has the potential to occur during the East Coast Project activities (Table 9-28).

*Table 9-28: Activities undertaken in the East Coast Project that may result in an accidental release of condensate*

| Cause of Aspect / Phase | Activity Component |
|---|---|
| **Well Construction** | Drilling operations |
| **Operations** | Hydrocarbon extraction and transport<br>Well intervention |
| **Decommissioning** | Well abandonment |

### 9.6.2 Aspect Characterisation

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).

An accidental release of condensate could occur from the East Coast Project as a result of:

- Accidental release of condensate from a subsea flowline, and/or
- Accidental release of condensate from a well; from a leak or a LOWC.

Credible scenarios are presented in Table 9-29.

*Table 9-29: Causes and estimated volumes of accidental release of condensate*

| Activity Component | Accidental Hydrocarbon Release | Cause of Aspect | Fluid Type and Volume | Release location |
|---|---|---|---|---|
| **Drilling, well intervention and well abandonment** | Loss of well control (LOWC) | There are multiple controls in place to prevent a LOWC. For a LOWC to occur requires the failure of multiple different controls at each level in the control hierarchy. These are described in detail, and managed | Gas / condensate mix.<br>Total maximum credible spill volume:<br>10,562 $m^3$ to 16,740 $m^3$, depending on the well. Refer to Table 9-30. | Wells |

| Activity Component | Accidental Hydrocarbon Release | Cause of Aspect | Fluid Type and Volume | Release location |
|---|---|---|---|---|
| | | under a Well Operations Management Plan, and facility specific Safety Case. Both documents must be accepted by NOPSEMA before an activity can occur, and these plans must be implemented. | | |
| **Hydrocarbon extraction and transport** | Subsea well LOC (leak from SST) | There are multiple controls in place to prevent a leak. For a leak to occur requires the failure of multiple different controls at each level in the control hierarchy. These are described in detail, and managed under the Well Operations Management Plan, and facility specific Safety Case. Both documents must be accepted by NOPSEMA before an activity can occur, and these plans must be implemented. | Gas / condensate mix.<br>The worst-case discharge rate of release from the wells with all barriers removed is 41 MMscf/d. There are no situations in which all well barriers would be removed during the operational period. Any release from the well would be a low leak rate via tortuous leak path through subsurface and surface equipment.<br>Nominal rate ~100 L/day. | Wells |

#### *9.6.2.1 Drilling Operations*

Fifteen production wells are within the scope of this OPP. A MODU will be used to drill the wells; each well may require ~60 days to construct.

The project is in offshore waters adjacent the Otway coastline. The Annie gas field is the closest to shore, situated ~9 km from the Otway Coastline and in ~55 m water depth. The identified prospect, Heera, is the furthest offshore, ~35 km from the coastline and in ~85 m water depth.

Potential causes of a LOWC, and hypothetical worse-case release volumes are presented in Table 9-29.

#### *9.6.2.2 Operations*

The East Coast Project wells have an indicative productive duration of 5 -12 years (see Section 4.1.2). During this phase, in which hydrocarbons are moving through the well, there is potential for a loss of containment to occur from the subsea well equipment and subsea flowline system, which could result from a loss of integrity, such as from inadvertent 3rd party interaction, or corrosion defects. Whilst these aspects are managed through a hierarchy of control measures, there remains a risk. During the operations phase, wells may require maintenance, also called a workover, or downhole intervention. These maintenance activities involve re-entering the well bore and also carry the risk of LOWC scenario described in Section 9.6.2.1.

Table 9-29 identifies causes of an LOC, and hypothetical worst-case release volumes.

#### *9.6.2.3 Decommissioning*

Well plug and abandonment activities will be undertaken from a MODU and are expected to take ~25 days per well, for up to 15 wells. Abandonment operations involve setting a series of mechanical and cement plugs within the wellbore, to isolate the reservoir and prevent any further flow from the well.

Abandonment activities have a similar potential for LOWC as drilling operations (Section 9.6.2.1), albeit generally lower pressures and volumes as at the time of decommissioning, the gas reservoirs would likely have been depleted over time by production.

### 9.6.3 Quantitative Hydrocarbon Spill Modelling

Of the potential scenarios identified in Table 9-29, LOWC is the worst-case credible volume for an unplanned release of condensate. Therefore, this scenario has been used as the basis for the impact assessment.

Cooper Energy commissioned RPS Group to conduct stochastic modelling and deterministic analysis (RPS, 2024) of three separate worst-case credible scenarios of a subsea release of 16,740 $m^3$, 13,239 $m^3$ and 10,562 $m^3$ of condensate during a LOWC at Elanora-ST1, Pecten East-2 and Annie-2 locations (Table 9-30).

Like the modelling undertaken for MDO in Section 9.5, SIMAP was used to simulate the transport, spreading and weathering of specific hydrocarbon types under the influence of changing meteorological and oceanographic forces.

Modelling inputs are presented in Table 9-30.

*Table 9-30: Condensate Spill Modelling Parameters*

| Parameter | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| **Scenario** | LOWC at Elanora-ST1 | LOWC at Pecten East-2 | LOWC at Annie-2 |
| **Location** | Lat: 38° 47' 41.5" S<br>Long: 142° 37' 56.5" E | Lat: 38° 37' 59.7" S<br>Long: 142° 40' 9.7" E | Lat: 38° 41' 1.68" S<br>Long: 142° 49' 28.56" E |
| **Maximum credible spill volume (total)** | 105,289 bbl<br>(16,740 $m^3$) | 83,273 bbl<br>(13,239 $m^3$) | 66,430 bbl<br>(10,562 $m^3$) |
| **Number of randomly selected spill start times** | 100 per season (200 per scenario) | | |
| **Model period** | Summer (November to April)<br>Winter (May to October) | | |
| **Hydrocarbon type** | Annie-2 condensate | | |
| **Release type (depth (m))** | Subsurface<br>54 m | Subsurface<br>34 m | Subsurface<br>36 m |
| **Release duration (days) **** | 102 | 102 | 104 |
| **Simulation length (days)** | 116 | | 118 |
| **Surface oil concentration thresholds ($g/m^2$)*** | 1 (low); 10 (moderate); 50 (high) | | |
| **Shoreline oil accumulation thresholds ($g/m^2$)*** | 10 (low); 100 (moderate); 1,000 (high) | | |
| **Dissolved hydrocarbon concentrations (ppb)*** | 10 (low); 50 (moderate); 400 (high) | | |
| **Entrained hydrocarbon concentrations (ppb)*** | 10 (low); 100 (high) | | |

**Thresholds based on NOPSEMA (2019); Table 9-3*

***Note: A conservative release duration has been selected, which accounts for the estimated time which would be required to drill a relief well and control the source of the release, if a secondary MODU were required to be mobilised from outside of the region. There are multiple different source control options which would be implemented prior to finally 'killing' the well via a relief well. These options could include subsea intervention and capping depending on the circumstances. The 104-day release duration assumes for conservatism, that each option fails to control the source, and the release continues until the relief well is drilled.*

### 9.6.3.1 Hydrocarbon Characteristics

The condensate modelled for all scenarios was Annie condensate; a light persistent hydrocarbon (Group II according to International Tankers Owners Pollution Federation (ITOPF, 2020) classification), with a low dynamic viscosity and low pour point (Table 9-30).

Annie condensate has been modelled as it is a conservative proxy for all fields. Based on the most recent analysis from the drilling of Annie-1 well; Annie condensate is the only condensate within the offshore East Coast Project which has been classified as a Group II (light persistent) oil, with all of the others classified as Group I (non-persistent) oil. Therefore, it is expected that Annie-2 condensate will have a higher proportion of residual (heavier / persistent) hydrocarbons compared to the other prospect fields within the scope of the OPP, based on most appropriate geological analogues.

A few physical characteristics were not available for Annie-1 condensate (see Table 9-31). Therefore, this information was supplemented from the Minerva condensate assay, found in a nearby reservoir and considered an appropriate analogue for this information. The condensate comprises a significant portion of volatiles and semi- to low volatiles (82.5% total) with 17.5% residual components. This means the condensate will evaporate readily when on the water surface, with the persistent components to remain on the water surface or become entrained over time (Table 9-31).

*Table 9-31: Physical Characteristics of Annie Condensate*

| | | | | | Non-Persistent | | | Persistent |
|---|---|---|---|---|---|---|---|---|
| **Type** | **API** | **Pour Point (°C)** | **Density kg/m³ (at 16 °C)** | **Viscosity cP (at 20°C)** | Volatiles (BP < 180°C) | Semi-volatiles (180°C < BP < 265°C) | Low Volatiles (265°C < BP < 380°C) | Residuals (BP > 380) |
| **Annie-1 condensate** | 41 | -30* | 820 | 1.063* | 8% | 46.5% | 28% | 17.5% |

** data extracted from Minerva condensate assay.*

### 9.6.3.2 Weathering and Fate

The modelling included a series of weather tests to illustrate the potential behaviour of the condensate when exposed to idealised and representative environmental conditions (RPS, 2024). The two tests included a surface release model under calm wind conditions (5 knots) and under variable weather conditions (1-23 knots), both assuming low seasonal water temperature (15°C) and ambient tidal and drift currents. Note, a surface release is used in the weathering test to solely focus on the weathering and fates of the hydrocarbons when exposed to atmospheric conditions.

The mass balance forecast for the constant-wind case (Figure 9-4) shows that 52.4% of the condensate is expected to evaporate within 24 hours (RPS, 2024). Under these calm conditions, most of the remaining hydrocarbon on the water surface will weather at a slower rate due to being comprised of the low volatile, longer-chain compounds. Evaporation of the residual compounds will cease when the residual compounds remain, and they will be subject to more gradual decay through biological and photochemical processes.

Under the variable-wind case (Figure 9-5), where the winds are of greater strength on average, entrainment of condensate into the water column is shown to increase. Approximately 24 hours after the spill, 70.1% of the mass is shown to have entrained and a further 23.8% has evaporated, leaving only a small proportion floating on the water surface (<1%) (RPS, 2024).

The increased level of entrainment in the variable-wind case result in a higher percentage decaying at an approximate rate of ~2.5% per day with 17.8% after 7 days, compared to <0.7% per day and a total of 0.1% after 7 days for the constant-wind case (RPS, 2024). Given the proportion of entrained condensate and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over time scales of several weeks.

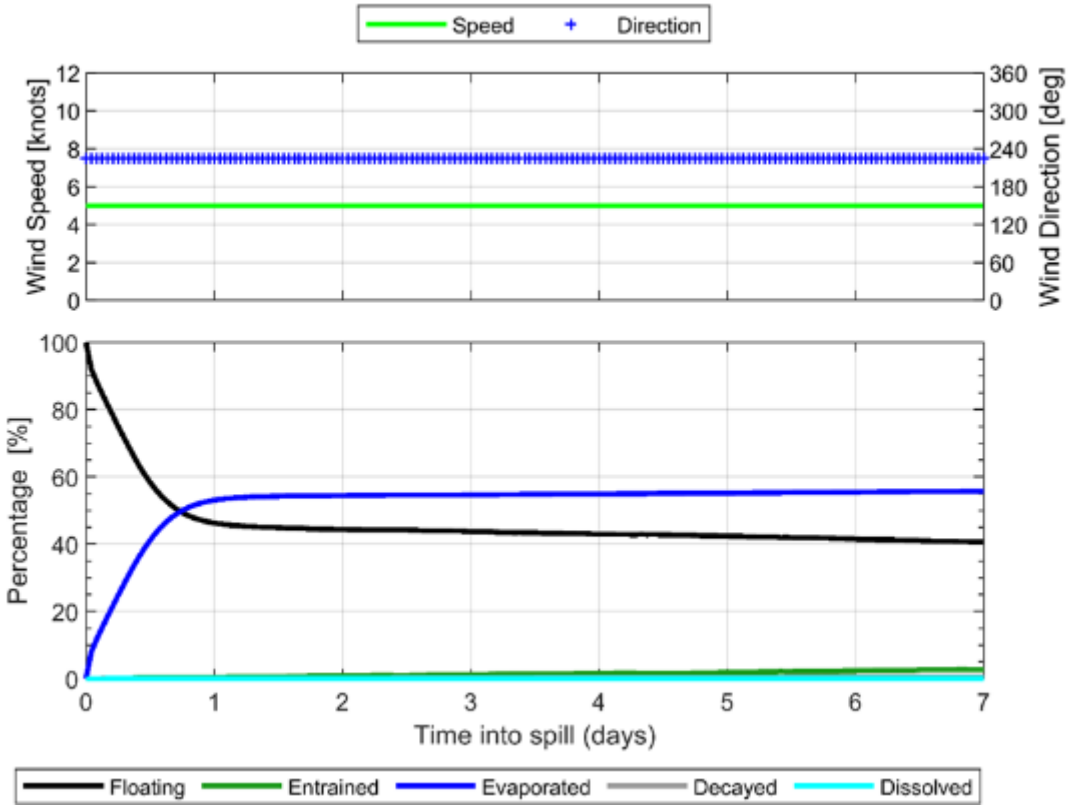



*Figure 9-4: Proportional mass balance plot representing the weathering of Annie-2 condensate spilled onto the water surface over 1-hour and subject to a constant 5 knots wind speed at 15°C water temperature (RPS, 2024).*

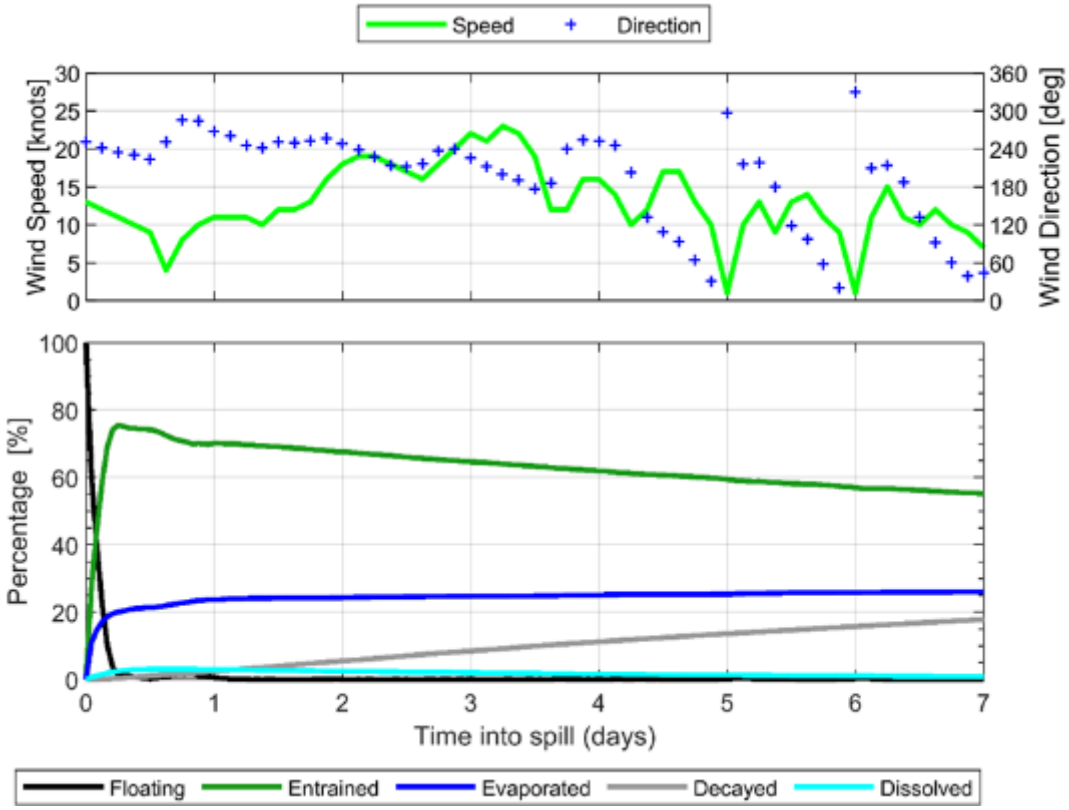



*Figure 9-5: Proportional mass balance plot representing the weathering of Annie-2 condensate spilled onto the water over 1-hour and subject to variable wind speeds (1-23 knots) at 15°C water temperature (RPS, 2024).*

### 9.6.3.3 Modelling Outputs

Table 9-32 provides a summary of the results from the stochastic modelling report provided in (RPS, 2024) for the maximum credible scenarios identified for the East Coast Project (see Table 9-29).

Figure 9-6 displays the LOWC EMBAs (EMBA, extent of potential SEI, and Monitoring) obtained from the stochastic modelling results (RPS, 2024). See Table 6-1 for further details on the EMBA descriptions and specific thresholds.

*Table 9-32: Modelling Output Summary for LOWC*

| Exposure Values | Summary of worst-case predicted exposure |
|---|---|
| **Floating** | |
| **Low (1 g/m$^2$)** | Floating hydrocarbon at this level is expected to be visually detectable but not have ecological impacts.<br>• Worst-case maximum distance from the source was predicted at Elanora-ST1 as 75.7 km.<br>• Worst-case scenario could intersect with the Bonney Coast Upwelling KEF and the Twelve Apostles Marine Park (from Pecten East-2).<br>• Would intersect with BIAs for seabird and cetacean species. |
| **Moderate (10 g/m$^2$)** | Floating hydrocarbon at this level has the potential to cause ecological impacts.<br>• Worst-case maximum distance from the source was predicted at Pecten East-2 as 15.2 km.<br>• Would intersect with BIAs for seabird and cetacean species.<br>• Floating oil above this threshold is not predicted to reach Victorian State waters.<br>• Floating oil above this threshold is not predicted to contact the Twelve Apostles Marine Park or the Bonney Coast Upwelling KEF. |
| **Shoreline** | |
| **Low (10 g/m$^2$)** | Shoreline hydrocarbon at this level is expected to be visually detectable but not have ecological impacts.<br>• The probability of shoreline accumulation is 100% at the following LGAs:<br>  ○ Apollo Bay, Colac Otway, Corangamite, Moyne and Bay of Islands<br>• The worst-case minimum time to shore at or above the low threshold was predicted 0.96 day (from Annie-2).<br>• The worst-case maximum total volume of hydrocarbon ashore was predicted from Pecten East-2 of 406.6 m$^3$.<br>• The worst-case maximum length of hydrocarbon ashore was predicted as 295 km (from Elanora-ST1). |
| **Moderate (100 g/m$^2$)** | Shoreline hydrocarbon at this level has the potential to cause ecological impacts.<br>• The probability of shoreline accumulation is 100% at the following LGAs:<br>  ○ Corangamite.<br>• The worst-case minimum time to shore at or above the moderate threshold was predicted in 1.25 days (from Annie-2).<br>• The worst-case maximum length of hydrocarbon ashore at the moderate threshold 76 km (Pecten East-2). |
| **In-Water – Dissolved** | |
| **Low (10 ppb)** | Dissolved hydrocarbon at this level is not expected to have ecological impacts.<br>• The worst-case minimum time to dissolved hydrocarbon exposure at any given receptor(s) was 0.42 days from Elanora-ST1.<br>• Worst case scenario probabilities of intersect with the following conservation values and sensitivities:<br>  ○ Bonney Coast Upwelling KEF (2%) at Pecten East-2<br>  ○ West Tasmanian Canyons KEF (1%) at Elanora-ST1<br>  ○ Apollo AMP (10%) at Elanora-ST1<br>  ○ Twelve Apostles Marine Park (69%) at Pecten East-2 |

| | |
|---|---|
| | ○ Would intersect with BIAs for cetacean and shark species. |
| **Moderate (50 ppb)** | Dissolved hydrocarbon at this level has the potential to cause ecological impacts.<br>• The worst-case minimum time to dissolved hydrocarbon exposure at any given receptor(s) was 5.79 days from Elanora-ST1.<br>• Would intersect with BIAs for cetacean and shark species.<br>• Low probabilities (1%) would intersect Victorian State Waters. |
| **In-Water – Entrained** | |
| **Low (10 ppb)** | Entrained hydrocarbon at this level is not expected to have ecological impacts.<br>• The worst-case minimum time to entrained hydrocarbon exposure at any given receptor(s) was 0.04 day across all locations.<br>• Worst case scenario probabilities of intersect with the following conservation values and sensitivities:<br>○ Big Horseshoe Canyon (2%) at Pecten East-2<br>○ Bonney Coast Upwelling KEF (73%) at Pecten East-2<br>○ Canyons on the eastern Continental Slope (2%) at Pecten East-2<br>○ Shelf rocky reefs (6%) at Pecten East-2<br>○ Upwelling East of Eden (21%) at Pecten East-2<br>○ West Tasmanian Canyons KEF (23%) at Pecten East-2<br>○ Apollo (93%), Beagle (59%), East Gippsland (3%), Franklin (3%), Nelson (6%), and Zeehan (15%) at Pecten-East-2.<br>• Would intersect with BIAs for cetacean and shark species.<br>• Would intersect with New South Whales, South Australian, Tasmanian and Victorian State Waters. |
| **High (100) ppb** | Entrained hydrocarbon at this level has the potential to cause ecological impacts.<br>• The worst-case minimum time to entrained hydrocarbon exposure at any given receptor(s) was 0.04 day from Elanora-ST1 and Pecten East-2.<br>• Worst case scenario probabilities of intersect with the following conservation values and sensitivities:<br>○ Bonney Coast Upwelling KEF (19%) at Pecten East-2<br>○ Apollo AMP (31%) at Pecten-East-2<br>○ Twelve Apostles Marine Park (100%) at Pecten East-2.<br>• Would intersect with BIAs for cetacean and shark species.<br>• Would intersect with Victorian State Waters. |

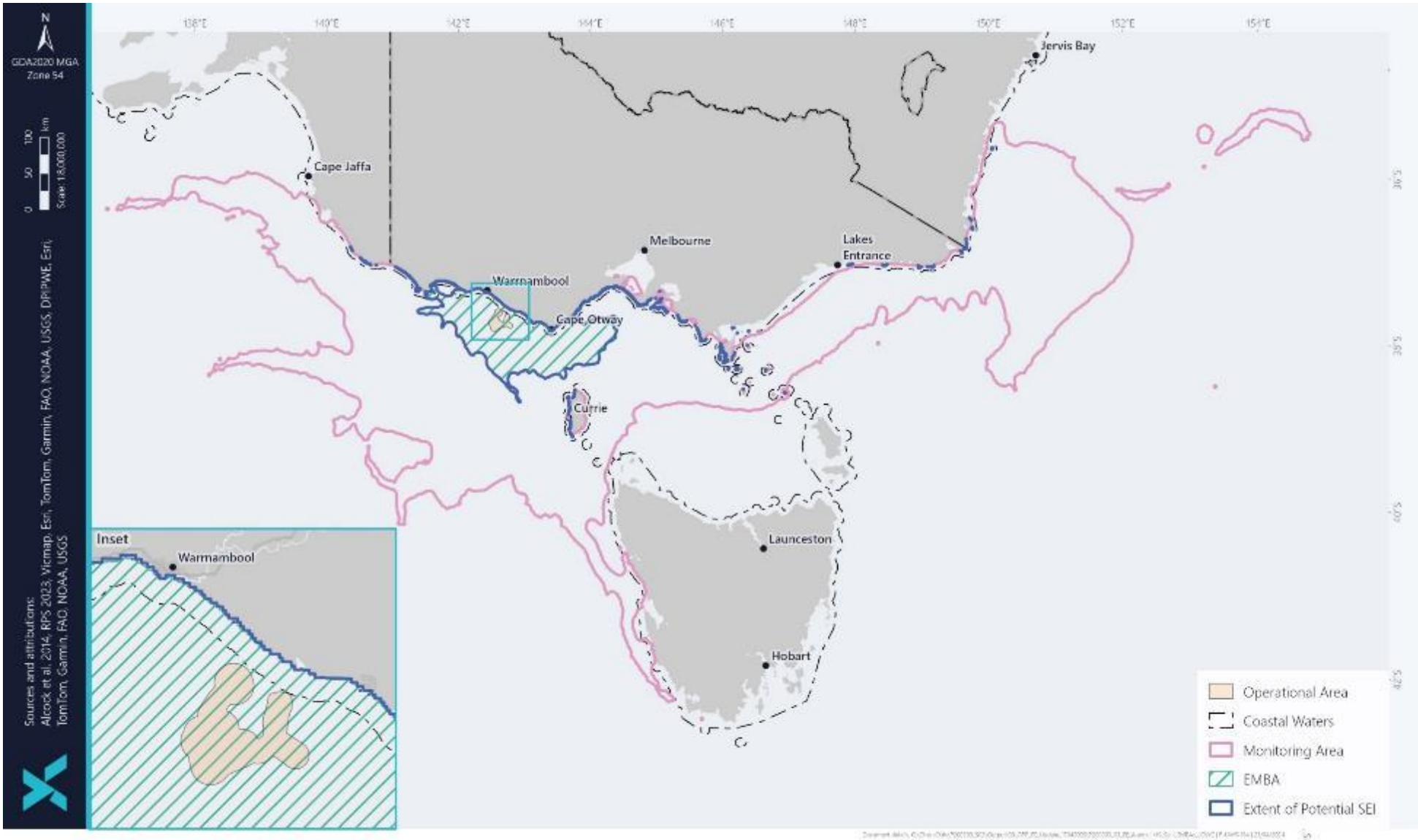



*Figure 9-6: East Coast Project operational area and LOWC EMBAs (EMBA, extent of potential SEI and Monitoring) from the combined results of a subsea Loss of Well Control (LOWC) release of Annie-2 Condensate at Annie-2 (10,562 $m^3$), Pecten-East-2 (13,239 $m^3$), and Elanora-1 (16,740 $m^3$)*

### 9.6.4 Predicted Environmental Impacts and/or Risks (Consequence)

Potential impacts from an accidental release of condensate are:

- Change in water quality.

Potential risk:

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

### 9.6.5 Impact and Risk Evaluation

The potential impacts on environmental receptors from hydrocarbon spills are summarised in Table 9-21 (in the MDO section). The below sections evaluate the potential impact from an accidental release of condensate for the East Coast Project in more detail. The extent of potential SEI and EMBA for Condensate spill modelling represents the area where hydrocarbons could occur above extent of potential SEI or ecological impact thresholds (Figure 9-6). Only a fraction of the area within the EMBAs have the potential to be impacted from a given spill.

#### *9.6.5.1 Impact: Change in Water Quality*

**Inherent Consequence Evaluation**

An accidental release of condensate into the marine environment will result in a change in water quality. Annie condensate is classified as a light persistent hydrocarbon (Group II hydrocarbon), containing a high proportion of volatile components and only a small proportion of non-volatile (persistent) components.

Under constant wind, 52.4% of the condensate is expected to evaporate within 24 hours (Section 9.6.3.2).

Under the variable-wind case, where the winds are of greater strength on average, entrainment of condensate into the water column is shown to increase. Approximately 24 hours after the spill, 70.1% of the mass is shown to have entrained and a further 23.8% has evaporated, leaving only a small proportion floating on the water surface (<1%). Given the proportion of entrained condensate and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over time scales of several weeks.

A change in water quality is expected to be short-term based on the weathering behaviour described above. At the moderate threshold for floating hydrocarbons, the maximum spatial extent for any scenario is 12.7 km.

Given the nature of the hydrocarbon, the forecasted weathering processes, and the offshore metocean conditions, the area of exposure following a spill event is anticipated to be localised and short-term. The water quality of the area exposed to hydrocarbons is expected to return to pre-spill conditions relatively quickly following evaporation and dispersion into the water quality. Long-term adverse impacts to the water quality are not anticipated. Matters relating to potentially impacted receptors from a change in water quality are discussed for the specific receptors below.

Therefore, the predicted level of potential impact, i.e., the consequence of a change in water quality from an accidental release of condensate is evaluated as **Level 2**.

#### *9.6.5.2 Risk: Change in Habitat*

**Inherent Consequence Evaluation**

An accidental release of condensate into the marine environment has the potential to impact shoreline habitats if hydrocarbons accumulate within them. A moderate shoreline accumulation threshold has been identified as the concentration of hydrocarbons that could harm the fauna which

inhabit the shoreline (i.e., shorebirds, marine invertebrates, and marine reptiles) based on studies for sub-lethal and lethal impacts (French et al., 1996 and French-McCay, 2009).

The probability of accumulation on any shoreline at, or above, the low threshold was 100% throughout the year. The minimum time before oil accumulation at, or above, the low threshold was 1.17 days. The maximum total volume ashore for a single spill trajectory was 406.6 $m^3$, and the maximum length of shoreline with accumulation above the low, moderate and high thresholds were 269.0 km (summer), 75.0 km (summer) and 6.0 km (winter), respectively.

Habitats that could be impacted by an unplanned release of condensate following a LOWC include:

- Rocky shorelines
- Sandy beaches
- Mangroves
- Saltmarshes
- Macroalgae
- Seagrass.

Table 9-33 describes the habitats that occur within the EMBA, the potential impact from a spill, and the resulting inherent consequence level for each type of habitat.

*Table 9-33: Inherent Consequence Levels – Accidental release of condensate – Change in habitat*

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Shorelines - Rocky** | The modelling predicted shoreline accumulation to occur at, or above, the low, moderate, and high thresholds at 100%, 100%, and 27% probabilities, respectively, for various shoreline locations (RPS, 2024).<br>Shoreline contact at this threshold anticipated within 1.25 days for the worst-case credible modelled scenario. The worst-case maximum total volume of hydrocarbon ashore was predicted as 406.6 $m^3$.<br>The modelling also predicted rapid evaporation during the first 24 hours following the release of condensate and depending on the weather conditions (i.e. wind speeds) the remainder of the condensate is predicted to readily entrain into the water column (more entrainment under higher wind speeds) (see Section 9.6.3.2). | 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 have been shown to be less sensitive than sheltered rocky shorelines.<br>Rocky shorelines provide habitats for invertebrates (e.g., sea anemones, sponges, sea-squirts, molluscs), and can also be utilised by some pinniped (haul-out sites) and bird species; noting that foraging and breeding/nesting typically occurs above high tide line (Section 6.5.8).<br>Due to the tidal action and constant wave washing on this type of shoreline rapid weathering of any hydrocarbons in the intertidal area is expected and it is unlikely that toxicity or smothering effects to exposed fauna will occur on this type of shoreline.<br>Hydrocarbons can become concentrated as it strands ashore. However, most of the oil is concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA, 1995).<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised medium-term impacts to habitats of recognized conservation value or to local ecosystem function. | Level 3 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Shorelines - Sandy** | Sandy beaches are the predominant habitat type within the stretch of coast where shoreline contact could be expected from a LOWC event (i.e. between Port Fairy and east of Cape Otway). Therefore, sandy beaches have the potential to be exposed to hydrocarbons at, or above the low, moderate, and high threshold (RPS, 2024). | Sandy beaches are considered to have a low sensitivity to hydrocarbon exposure.<br>Sandy beaches provide habitat for a diverse assemblage (although not always abundant) of infauna (including nematodes, copepods and polychaetes); and macroinvertebrates (e.g. crustaceans).<br>The stretch of shoreline located at Corangamite was the area predicted to have the highest probability of shoreline accumulation from the worst-case scenario modelled, with 100% probability predicted for low, and moderate thresholds, and 27% for high threshold. The minimum time before shoreline accumulation ranged from 2 days to 42 days for the low to high thresholds, with a maximum volume of 238 $m^2$ predicted ashore (RPS, 2024). This stretch of shoreline is dominated by sandy habitats.<br>The modelling predicted rapid evaporation during the first 24 hours following the release of condensate and depending on the weather conditions (i.e. wind speeds) the remainder of the condensate is predicted to readily entrain into the water column (more entrainment under higher wind speeds) (see Section 9.6.3.2). Therefore, as the volatile components of the hydrocarbon weathers, the risk of exposure decreases.<br>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.<br>A sandy beach may also 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.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to habitats of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |
| **Mangroves** | Mangroves are not a dominant habitat found within the area potentially exposed to hydrocarbons.<br>However, a few isolated patches of mangroves can be found along the Victorian coastline, predominantly with inlets or bay (Section 6.5.2). These mangroves have the potential to be | Mangroves are considered to have a high sensitivity to hydrocarbon exposure.<br>Hydrocarbon can enter mangrove forests when the tide is high and be deposited on the aerial roots and sediment surface as the tide recedes. Physical covering of the trees' breathing pores, thus asphyxiating the subsurface roots, which depend on the pores for oxygen. | Localised medium-term impacts to habitats of recognized conservation value or to local ecosystem function. | Level 3 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | exposed to hydrocarbons within the EMBA (RPS, 2024). | The change in toxicity levels within the marine environment can penetrate the root surfaces, via the respiratory capabilities of the roots, poisoning the plant.<br>Mangroves can also take up in-water 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).<br>However, heavy oil coating is unlikely due to the highly volatile nature of the condensate hydrocarbon. As the volatile components evaporate and the minimal remaining oil weathers, the oil will resolidify, and the risk of exposure decreases.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |
| **Saltmarsh** | Saltmarsh is within some estuaries and inlet/riverine systems along the Victorian coastline, and which occur within the EMBAs. Modelling predicted hydrocarbon exposure at, or above the low, moderate, and high threshold predominantly between Port Fairy and east of Cape Otway along the Victorian coastline, a shoreline accumulation at the low threshold along the west coast of King Island (RPS, 2024).<br>Some of the saltmarsh habitat along this coast will be representative of the Subtropical and Temperate Saltmarsh TEC (see Section 6.6.7 for further details). | Saltmarsh is considered to have a high sensitivity to hydrocarbon exposure. Hydrocarbon (in liquid form) will readily adhere to the marshes, coating the stems from tidal height to sediment surface. However, heavy oil coating is unlikely due to the highly volatile nature of the condensate hydrocarbon.<br>As the volatile components evaporate and the minimal remaining oil weathers, the oil will resolidify, and the risk of exposure decreases.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised medium-term impacts to habitats of recognized conservation value or to local ecosystem function. | Level 3 |
| **Macroalgae** | Macroalgae could be exposed to in-water hydrocarbons according to modelling results. In-water hydrocarbon exposure in nearshore, intertidal, and subtidal areas is predicted to occur at moderate thresholds for dissolved hydrocarbons, with some sites (such as Colac Otway, Corangamite and Cape Otway) predicted to be exposed to high thresholds of entrained (RPS, 2024). | In-water exposure (entrained and dissolved) is only predicted to occur within the upper 0–10 m of the water column; therefore, benthic habitats, such as macroalgae, within intertidal or shallow nearshore waters has the potential to be exposed.<br>The physical effects of smothering, fouling and asphyxiation has been documented from oil contamination in marine plants such as macroalgae (Lewis and 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 hydrocarbon exposure. | Localised short-term impacts to habitats of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | Exposure to entrained hydrocarbons at the high threshold level are only predicted within Victorian State Waters, not within Tasmanian State waters. | As a light, non-persistent hydrocarbon, the impacts of condensate are expected to be less since the toxicity of light hydrocarbons declines as the volatile components weather. The highest level of toxicity is anticipated to be at the site of the release; any exposure of macroalgae to hydrocarbons is anticipated to have been weathered.<br>Intertidal macroalgal beds are more prone to effects from oil spills than subtidal beds because, although the mucous coating prevents oil adherence, oil that is trapped in the upper canopy may be more persistent, which can impact site-attached species. (IPIECA 2002).<br>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.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |
| **Seagrass** | Seagrass meadows may be present within the EMBA (condensate). Hydrocarbon exposure in nearshore and intertidal areas is predicted to occur mostly at moderate thresholds for dissolved hydrocarbons, with some sites (such as Colac Otway, Corangamite and Cape Otway) predicted to be exposed to high thresholds of entrained for the worst-case scenario modelled (RPS, 2024).<br>Exposure to entrained hydrocarbons at the high threshold level are only predicted within Victorian State Waters, not within Tasmanian State waters. | Benthic habitats, such as seagrass meadows, within intertidal or shallow nearshore waters has the potential to be exposed to in-water exposure (entrained and dissolved) is only predicted to occur within the upper 0–10 m of the water column.<br>Seagrass ecosystems exposed to hydrocarbons can result in direct mortality from smothering. Also, petroleum fractions may be absorbed into the seagrass tissues, which can then lower the organism's tolerance to other stressors and reduce growth rates (Zieman et al., 1984).<br>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.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to habitats of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

Summary

The potential consequence to habitats from an accidental release of condensate is assessed as **Level 3** based on the potential for localised medium-term impacts to species or habitats of recognised conservation value or to local ecosystem function.

**Inherent Likelihood**

An assessment of historical LOWC incidents was undertaken using the IOGP Risk Assessment Data Directory (2019). Blowout events during development drilling has been reported at a frequency for a gas well of 4.2 x $10^{-5}$ per drilled well: for development drilling operations of North Sea standard (IOGP, 2019). This frequency is based on two blowout incidents occurring in the UK between 1980 and 2014 during development drilling (IOGP, 2019); and represents the frequency of the cause (i.e., LOWC); additional environmental factors would be necessary for the worst-case consequences to habitats to eventuate.

Cooper Energy implements industry standard practice in well design and construction. In the context of the Australian regulatory regime, well operations management plans describe the design, construction, operation and decommissioning of each offshore well; through the development of this plan industry lessons and improvements in practice are adopted as appropriate. In the company's history operating within Australia, it has not experienced any LOWC events or LOC incidents from its subsea wells.

There are multiple levels of control measures to prevent a Subsea LOWC. These controls are checked and tested via various assurance activities; it would require multiple failures at each level of the control hierarchy for an LOWC to eventuate. 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.

There are a number of potential failure modes which have the potential to result in a LOC from a flowline; these include external impact and corrosion. Each potential failure mode, and preventative measures is described within the facility integrity management plan. The facility integrity management plan also assigns a likelihood to each potential failure mode, termed frequency / probability of failure. Therefore, the impact is considered conceivable and could occur, however, it would require a rare combination of factors. Therefore, the inherent likelihood of a subsea LOC causing a change in habitat is considered **Unlikely (D).**

**Inherent Risk Severity**

The inherent risk severity of an accidental release of condensate causing impacts to habitat is considered **Moderate**.

#### *9.6.5.3 Risk: Change in Fauna Behaviour*

**Inherent Consequence Evaluation**

An accidental release of condensate into the marine environment has the potential to impact the behaviour of certain marine fauna within the environment. Marine fauna that has been shown to exhibit changes to behaviour include:

- Fish
- Seabirds and shorebirds
- Marine reptiles
- Marine mammals.

Table 9-34 describes the presence of marine fauna within the EMBA, the potential impact and the resulting inherent consequence level for each type.

*Table 9-34: Inherent Consequence Levels – Accidental release of condensate – Change in fauna behaviour*

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Fish** | Several fish species may be present within the EMBA (see Section 6.5.5 for all EPBC-listed fish species).<br>BIAs overlapped are:<br>• foraging BIA for the white shark. | Multiple fish species are listed on the EPBC Act PMST were identified to occur within the EMBA (LOWC) (Section 6.5.5).<br>Sub-lethal behavioural impacts in adult fish have been shown to include behavioural modifications, including alterations in feeding, migration, reproduction, swimming, schooling, and burrowing behaviour (Kennish, 1996). However, generally these species are highly mobile species, and their patterns of movements makes it unlikely for them to remain within the area long enough to be exposed to hydrocarbons to experience sub-lethal impacts (ITOPF, 2010). Furthermore, the modelling predicted that majority of the condensate would evaporate within a few days following a release (see Section 9.6.3.2); therefore, reducing the potential of exposure to fish species that may be present within the EMBA.<br>There is a known foraging BIA for the white shark in the area exposed to in-water hydrocarbons (RPS, 2024), however, given their range of movement throughout the water column and between coastal and offshore waters, it is not expected that individuals would be exposed for long periods to the higher concentrations predicted in surface water layers (within the 0-10 m water depth) within the slick extent.<br>Pelagic species are generally highly mobile, with wide-spread distribution ranges. Therefore, these species are not likely to be severely impacted from the temporary avoidance that may occur following a spill event.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |
| **Seabirds and shorebirds** | Several threatened, migratory and/or listed marine seabirds or shorebirds species may be present within the EMBA (LOWC) (Section 6.5.7).<br>Several foraging BIAs for several albatross, shearwater and petrel species was identified within EMBA.<br>• Antipodean albatross<br>• Wandering albatross | Shoreline accumulation following a spill event from a LOWC, may cause disruption to foraging habitats identified for shorebirds and migratory birds (see Section 6.5.7).<br>Shoreline impacts are not anticipated above the high tide mark, therefore, will not impact breeding areas available.<br>Impacts to these species are not anticipated to be long-term or affect population functioning due to the widespread areas available for foraging and breeding, the transitory nature of foraging birds, and the weathering properties of the condensate. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | • Buller's albatross<br>• Indian yellow-nosed albatross<br>• Shy albatross<br>• Campbell albatross<br>• Black-browed albatross<br>• Common diving-petrel<br>• White-faced storm-petrel<br>• White-tailed shearwater<br>• Short-tailed shearwater<br>• Australasian gannet.<br>Breeding BIAs were also identified within the EMBA:<br>• Short-tailed shearwater.<br>see Section 6.5.7 for further details. | See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |
| **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.<br>Four of the five EPBC listed species which have the potential to be present within the area were identified to be present within the EMBA, these include: loggerhead, green, leather back and hawksbill turtle (see Section 6.5.6 for further details).<br>Marine turtles may be exposed to hydrocarbon when transiting through the in-water hydrocarbons, surfacing to breathe within the surface slick. | Marine turtles which are within the area could be displaced by a release of condensate into the marine environment.<br>However, there are no BIAs or habitat critical to the survival of species within the shoreline or environment potentially affected.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |
| **Marine mammals - Pinnipeds** | There may be pinnipeds in the area predicted to affected by surface hydrocarbons at moderate exposure levels (Section 6.5.8). | Pinnipeds present within the area exposed to shoreline accumulation may be displaced from haul-out sites or have movement affected to avoid areas exposed to entrained and dissolved hydrocarbons. Heavy oil coating and tar deposits on | Localised medium-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 3 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | Pinnipeds that are present within the EMBA (LOWC) have the potential to be impact by surface hydrocarbons when surfacing to breathe, in-water hydrocarbons when transiting through the area, and shoreline accumulated hydrocarbons that occur at haul-out sites along the coastline.<br>No BIAs or habitat critical to the survival of species for pinnipeds were identified within the EMBA (LOWC). | fur-seals may result in reduced swimming ability and lack of mobility out of the water.<br>However, impacts to pinnipeds at a population level are considered very unlikely given the localized and temporary presence of hydrocarbons at relevant thresholds, the absence of haul out sites within or near the operational area, the transient, highly mobile nature of pinnipeds, over typically extensive foraging grounds. There are no BIAs or habitat critical to survival of species within the EMBAs.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | | |
| **Marine mammals - Cetaceans** | Several threatened, migratory and/or listed marine cetacean species have the potential to be migrating, resting or foraging within the EMBA (Section 6.5.8).<br>The following BIAs are within the area exposed to hydrocarbons at moderate exposure levels (EMBA):<br>• Pygmy blue whale known foraging and distribution BIA<br>• Southern right whale migration and reproduction BIAs. | A condensate spill could disrupt natural behaviours and displace animals. It has been stated that pelagic species, such as cetaceans, will avoid hydrocarbon (Geraci 1988), mainly because of its noxious odours, but this has not been proven.<br>Certain whales, particularly those with coastal migration and reproduction, can display strong site fidelity to specific resting, breeding and feeding habitats, as well as to their migratory paths, subsequently these species may be affected more.<br>However, the strong attraction to specific areas for breeding or feeding (e.g., use of the Warrnambool coastline as a nursery area for southern right whales) may override any tendency for cetaceans to avoid the noxious presence of hydrocarbons.<br>However, the potential extent of hydrocarbon exposure is significantly smaller than the extent of the BIAs for each species and their much broader range. Cetaceans are highly mobile, pelagic species, with wide-spread distribution ranges, therefore, it is unlikely that individuals will be severely impacted from the temporary displacement that may occur following a LOWC.<br>See Table 9-21 for further details on the potential impacts of hydrocarbon exposure on this receptor. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

Summary

The potential consequence to marine fauna from an accidental release of condensate event is assessed as **Level 3** based on the potential for localised and short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.

**Inherent Likelihood**

Blowout events during development drilling has been reported at a frequency for a gas well of 4.2 x $10^{-5}$ per drilled well (IOGP, 2019). This represents the frequency of the cause (i.e., a LOWC); additional environmental factors would be necessary for the worst-case consequences to species of recognised conservation value to eventuate.

Due to the nature of this activity, and based on previous occurrences, the impact is considered conceivable and could occur, however, it would require a rare combination of factors. Therefore, the inherent likelihood of an accidental release of condensate causing **Level 3** consequences to fauna behaviour is considered **Unlikely (D)**.

**Inherent Risk Severity**

The inherent risk severity of an accidental release of condensate causing impacts to fauna behaviour is considered **Moderate**.

#### *9.6.5.4 Risk: Injury/Mortality to Fauna*

**Inherent Consequence Evaluation**

An accidental release of condensate into the marine environment has the potential to result in injury and/or mortality to marine fauna within the vicinity. In general, moderate thresholds of surface and moderate to high of in-water hydrocarbons (dissolved and entrained) have been shown to cause sub-lethal and lethal ecological impact (French et al., 1996 and French-McCay, 2009). The marine fauna that may be present within the EMBA and impacted by an accidental release of condensate include:

- Plankton
- Invertebrates
- Fish
- Seabirds and shorebirds
- Marine reptiles
- Marine mammals.

Table 9-35 provides details on the presence of marine fauna within the EMBA, the potential impact and the resulting inherent consequence level for each type.

*Table 9-35: Inherent Consequence Levels – Accidental release of condensate – Injury / mortality to fauna*

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Plankton** | Plankton is found in nearshore and open waters in the water column.<br>Plankton population distributions 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 (see Section 6.5.3). Therefore, plankton populations may be present within the area potentially exposed to hydrocarbons in the EMBA (LOWC). | Injury/mortality to planktonic species may occur due to a change in water quality following an unplanned hydrocarbon release<br>Plankton are likely to be exposed to in-water hydrocarbons within the upper 0 – 10 m of the water column. Effects will be greatest in the area close to the spill source where hydrocarbon concentrations are likely to be highest. These organisms migrate vertically through the water column to feed in surface waters at night (NRDA, 2012).<br>As they move close to the sea surface it is possible that they may be exposed to surface hydrocarbons, however, the potential impacts from in-water exposure (dissolved or entrained) will be greater. | Localized and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |
| **Benthic assemblages** | Benthic assemblages are made up of the seabed substrates and biological communities which inhabit the seabed. The assemblages within the shallow depth close to shore consisted of kelp reef, red and brown algae; offshore there are areas of hard substrates which is home to a range of epifauna including sponges, ascidians, crustaceans, polychaetes and bivalve molluscs. | The few benthic organisms that colonise the well equipment post installation could be exposed to in-water hydrocarbons as the subsea plume rises from the opening of the well, through the water column.<br>However, the benthic assemblages which are identified to occur within the shallow water environment (0-8 m) are the main species which may be impacted by exposure to hydrocarbons, as in-water exposure of hydrocarbon is only expected to occur within the upper 0–10 m of the water column (see Section 6.5.1).<br>Exposure in nearshore, intertidal and subtidal areas is predicted to occur mostly in low for dissolved and entrained hydrocarbons, moderate thresholds for dissolved, with some sites predicted to be exposed to high thresholds of entrained for the worst-case scenario modelled (RPS, 2024).<br>No exposure at high thresholds was predicted for dissolved in-water hydrocarbons from either scenario (RPS, 2024).<br>Benthic assemblages within the intertidal area may be exposed moderate, and greater threshold in the event of a condensate spill scenario.<br>Water quality in benthic habitats exposed to entrained hydrocarbons would be expected to return to background conditions within weeks to months of contact.<br>Furthermore, due to the physical properties of the hydrocarbons and the well-mixed nature of the waters of the EMBA, coating of | Localized and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | benthic assemblages and prolonged exposure to hydrocarbons is considered unlikely. | | |
| **Invertebrates** | Marine invertebrates identified within the region, including commercially important species, could be impacted by in-water exposure of hydrocarbons within the upper 0–10 m of the water column.<br>The highest diversity of marine invertebrate species is generally found within water depths deeper than 10m. However, shallower inshore sediment sampling by Parry et al. (1990) also demonstrated high diversity, although patchy distribution, within shallow waters, with crustaceans, polychaetes and molluscs being the dominant species (Section 6.5.4). | Exposure in nearshore and intertidal areas is predicted to occur at low thresholds of dissolved and entrained, moderate thresholds of dissolved, with some sites predicted to be exposed to high thresholds of entrained for the worst-case scenario modelled.<br>No exposure at high thresholds was predicted for dissolved in-water hydrocarbons from either scenario (RPS, 2024).<br>Entrained and dissolved hydrocarbons can have negative impacts on marine invertebrates and associated larval forms. Impacts to some adult species (e.g. crustaceans) is reduced because of the presence of an exoskeleton, while others with no exoskeleton and larval forms may be more prone to impacts.<br>Localised impacts to larval stages may occur which could impact recruitment.<br>Water quality in benthic habitats exposed to entrained hydrocarbons would be expected to return to background conditions within weeks to months of contact. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |
| **Fish** | Several fish species may be present within the EMBA (LOWC) (Section 6.5.5).<br>BIAs identified within the EMBA are:<br>• Foraging BIA for the white shark | Any pelagic fish and shark species that occupy the water column, specifically within the upper 0–10 m of the water column the surface layers of the water column (where in-water hydrocarbon exposure is predicted), are more susceptible to entrained and dissolved hydrocarbons.<br>Since fish and sharks do not generally break the sea surface, the impacts of surface hydrocarbons to fish and shark species are unlikely to occur. Near the sea surface, fish are able to detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Volkman et al., 2004). | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |
| **Seabirds and shorebirds** | Several threatened, migratory and/or listed marine seabirds or shorebirds species may be present within the EMBA (LOWC) (Section 6.5.7).<br>Several foraging BIAs for several albatross, shearwater, petrel and gannet species were identified within EMBA:<br>• Antipodean albatross | Birds have the potential to be rafting, resting, diving and feeding within the area predicted to be contacted by surface hydrocarbons; diving or foraging within in-water hydrocarbons; and foraging and nesting within shoreline exposure.<br>The presence of birds within in-water hydrocarbons at moderate exposure levels is expected to be limited due to the transitory nature of foraging individuals limited extent of oil at levels which could have ecological effects.<br>Shoreline accumulation would be expected to concentrate along the high tide mark while the lower/upper parts are often untouched | Localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. | Level 3 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | • Wandering albatross<br>• Buller's albatross<br>• Indian yellow-nosed albatross<br>• Shy albatross<br>• Campbell albatross<br>• Black-browed albatross<br>• Common diving-petrel<br>• White-faced storm-petrel<br>• White-tailed shearwater<br>• Short-tailed shearwater<br>• Australasian gannet.<br>Breeding BIAs were also identified within the EMBA:<br>• Short-tailed shearwater. | (IPIECA, 1995). As breeding activities of shorebirds and seabirds generally occurs above the high tide mark, exposure of breeding and nesting birds to hydrocarbons is considered unlikely to occur. | | |
| **Marine reptiles** | There may be marine turtles in the area predicted to be exposed to hydrocarbons at relevant exposure levels. However, there are no BIAs or habitat critical to the survival of the species within this area.<br>Four of the five EPBC listed species which have the potential to be present within the area were identified to be present within the EMBA, these include: loggerhead, green, leather back and hawksbill turtle (Section 6.5.6).<br>Marine turtles may be exposed to hydrocarbon when transiting through the in-water hydrocarbons, surfacing to breathe within the surface slick. | Hydrocarbons can be ingested via the inhalation of toxic vapours at the surface waters which may cause harm to the internal organs of turtles. The area exposed by moderate levels of surface hydrocarbons from a LOWC event is limited to offshore open waters (15 km from release location) over a maximum period of 104 days at the worst-case scenario (RPS, 2024).<br>Oiling has the potential to cause mortality depending on the size of the individual and the extent of oiling (DWH Natural Resource Damage Assessment Trustees, 2016).<br>The number of marine turtles that may be exposed to hydrocarbons during a LOWC event is expected to be low due to the localised and temporary presence of hydrocarbons at moderate exposure levels, the low number of turtles moving through Bass Strait in general, 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 no population level impacts anticipated. | Localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. | Level 2 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Marine mammals - Pinnipeds** | There may be pinnipeds in the area predicted to affected by surface hydrocarbons at moderate exposure levels (Section 6.5.8).<br>Pinnipeds that are present within the EMBA (LOWC) have the potential to be impacted by surface hydrocarbons when surfacing to breathe, in-water hydrocarbons when transiting through the area, and shoreline accumulated hydrocarbons that occur at haul-out sites along the coastline.<br>No BIAs or habitat critical to survival of species for pinnipeds were identified within the EMBA (Section 6.5.8). | Exposure to surface hydrocarbons at, or above the moderate threshold can cause skin and eye irritations and disruptions to thermal regulation due to covering of insulating fur.<br>The area exposed by moderate levels of surface hydrocarbons from a LOWC event is limited to offshore open waters (~15 km from the release site) over a maximum period of 104 days.<br>Hydrocarbons within the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds.<br>Given condensate is considered a light hydrocarbon that rapidly evaporates, the absence of BIAs within the impacted area and the transient, highly mobile nature of the species, over typically extensive foraging grounds; impacts to pinnipeds at a population level are considered very unlikely. | Localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. | Level 3 |
| **Marine mammals - Cetaceans** | Several threatened, migratory and/or listed marine cetacean species have the potential to be migrating, resting or foraging within the EMBA (LOWC) (Section 6.5.8).<br>The following BIAs are within the area exposed to hydrocarbons at moderate exposure levels (EMBA):<br>• Pygmy blue whale known foraging and distribution BIA<br>• Southern right whale migration and reproduction BIAs.<br>. | Surface hydrocarbons are anticipated to extend for a maximum of ~75 km and 15 km at the low and moderate thresholds in the worst-case scenario modelled. No surface exposure at the high threshold was modelled for any scenario (RPS, 2024).<br>Inhalation of surface hydrocarbons could damage mucous membranes, damage airways, or even cause death. Furthermore, ingestion of contaminated prey could cause toxic impacts.<br>If whales are foraging 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 (<15 km from the release site).<br>In-water hydrocarbons are mostly predicted to occur at low thresholds of dissolved and entrained (100%), with low probabilities of moderate thresholds of dissolved, and a few sites with high thresholds of entrained for the worst-case scenario modelled.<br>No exposure at high) thresholds was predicted for dissolved in-water hydrocarbons from either scenario (RPS, 2024).<br>Cetaceans exposed to entrained hydrocarbons be physically coated, as well as inject oil (Geraci and St Aubin, 1988). Physical impacts from ingested hydrocarbon with subsequent lethal or sub-lethal impacts are possible with entrained oil. | Localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. | Level 3 |

| Receptor | Presence within EMBA | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | As highly mobile animals, in general it is very unlikely that cetaceans will be constantly exposed to concentrations of hydrocarbons in the water column for continuous durations (e.g., >96 hours) that would lead to chronic toxicity effects.<br>Low levels of surface hydrocarbons could occur within the southern right whale aggregation BIA from Port Fairy/Warrnambool. | | |

Summary

In the unlikely event of a LOWC, the volume of hydrocarbons released would result in a reduction in water quality with the potential to impact marine fauna. Marine fauna present in the area may be potentially impacted by a spill through exposure to surface and in-water (entrained and dissolved) hydrocarbons.

Impacts from a LOWC release would be greatest within several kilometres from the spill when the toxic aromatic components of the condensate will be at their highest concentration and when the hydrocarbon is at its thickest on the surface of the receiving waters. Upon release to the marine environment, the condensate will lose toxicity with time and will spread thinner at the surface as evaporation continues or will become entrained within the water column. The potential sensitive receptors in the surrounding areas of the spill will include plankton, invertebrates, benthic assemblages, fish, marine mammals, marine reptiles and seabirds at the sea surface (Table 9-35).

The worst-case consequence to marine fauna from an accidental release of condensate event is assessed as **Level 3** based on the potential for localised and medium-term impacts to species of recognised conservation value but not affecting local ecosystem functioning.

**Inherent Likelihood**

Blowout events during development drilling has been reported at a frequency for a gas well of 4.2 x $10^{-5}$ per drilled well (IOGP, 2019). This represents the frequency of the cause (i.e. a LOWC); additional environmental factors would be necessary for the worst-case consequences to marine fauna to eventuate.

Due to the nature of this activity, and based on previous occurrences, the impact is considered conceivable and could occur, however, it would require a rare combination of factors. Therefore, the inherent likelihood of an accidental release of condensate causing **Level 3** consequences to marine fauna is considered **Unlikely (D)**.

**Inherent Risk Severity**

The inherent risk severity of an accidental release of condensate causing a Level 3 impact to marine fauna is considered **Moderate**.

#### *9.6.5.5 Risk: Changes to the Functions, Interests, or Activities of Other Users*

**Inherent Consequence Evaluation**

The accidental release of condensate into the marine environment has the potential to affect the functions, interests, or activities of other users of the sea. Risk assessments often use the conservative low threshold levels of hydrocarbon exposure, specifically floating hydrocarbon threshold (1 g/m$^2$), shoreline accumulation threshold (10 g/m$^2$), and entrained/dissolved thresholds (10 ppm) to assess socio-economic impacts. These thresholds are considered the levels which could trigger temporary closures of areas (i.e., fishing grounds, shorelines) as a precautionary measure due to the visibility of the hydrocarbon on the sea surface or shoreline. These thresholds may also trigger the need for shoreline clean-up on beaches or man-made features/amenities (breakwaters, jetties, marinas, etc.) depending on the socio-economic value of the shoreline (French-McCay et al., 2005a; 2005b).

Functions, interests, or activities of other users that may be present within the extent of potential SEI include:

- Conservation values and sensitivities:
  - World and National Heritage Areas
  - Australian Marine Parks
  - Wetlands
  - State Parks and Reserves
  - Key Ecological Features

  - TECs.
- Socio-economic environment:
  - Coastal settlements
  - Commercial fisheries
  - Other offshore industry
  - Recreation and tourism.

Table 9-36 provides details on the presence of receptors within the extent of potential SEI, the potential impact and the resulting inherent consequence level for each type.

*Table 9-36: Inherent Consequence Levels – Accidental release of condensate – Changes to the functions, interests and activities of other users*

| Receptor | Presence within EMBA or extent of potential SEI | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| **Conservation values and sensitivities** | | | | |
| **World and National heritage areas** | Modelling predicted World and National heritage areas could be contacted by hydrocarbon exposure within the extent of potential SEI:<br>• Great Ocean and Scenic its Environs<br>• Point Nepean Defence Sites and Quarantine Station Area<br>• Commonwealth Heritage Places: HMAS Cerberus Marine and Coastal Area.<br>• Deen Maar - Tyrendarra Area, Yambuk, VIC, Australia. | The values identified of these World and National heritage areas have the potential to be exposed to shoreline hydrocarbons at, or above, the low threshold.<br>Visible shoreline hydrocarbons may have the potential to reduce the visual social and cultural amenity of the area temporarily.<br>Given the non-persistent nature of the hydrocarbon, waves and tidal action are anticipated to continue the weathering process if shoreline contact occurs.<br>Refer to potential impact to habitats (Section 9.6.5.2) and coastal settlements (below). | Localized and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |
| **AMPs** | Modelling predicted one AMP could be contacted by hydrocarbon exposure within the extent of potential SEI (LOWC):<br>• Apollo AMP (Multiple Use Zone (IUCN VI)).<br>The major conservation values for this AMP have been identified within Section 6.6.3 of the OPP and include foraging areas for some EPBC listed species of birds (e.g. petrels, shearwaters, albatross), and cetaceans (e.g. Pygmy Blue and Southern Right Whales).<br>Furthermore, this marine park is associated with unique seafloor features, which influence the formation of large eddies mixing warm waters with cool nutrient-rich waters increasing marine biodiversity (see Section 6.6.3). | The modelling did not predict contact by surface hydrocarbons for Apollo AMP, at or above the low threshold, in the event of a LOWC. However, values identified with the AMP may have the potential to be impacted by surface hydrocarbons at the relevant thresholds outside of the AMP.<br>Seabirds are a value which has been identified for this AMP that may be impacted by surface hydrocarbons by rafting, resting, diving or feeding within the surface slick. Impact to seabirds from direct or indirect exposure to surface hydrocarbons may cause a subsequent negative impact to the value of the AMP, however any impact is expected to be limited to a small number of individuals, with no impacts to regional populations.<br>The values identified within this AMP have the potential to be exposed to entrained hydrocarbons at, or above, the moderate threshold in the event of a LOWC (RPS, 2024).<br>However, the exposure of entrained hydrocarbons will be greatest within the upper 0-10 m of the water column and areas close to the spill source. The Apollo AMP is located within waters 80-120 m; therefore, conservation values within this AMP, such as ecosystems, habitats and sea-floor features are not predicted to be impacted.<br>The Apollo AMP includes important foraging areas for seabirds. There is a low probability that seabirds would forage only within the area exposed to hydrocarbons given their extensive foraging | Localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning. | Level 3 |

| Receptor | Presence within EMBA or extent of potential SEI | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | grounds. Therefore, there is a chance that foraging seabirds will experience sub-lethal impacts from consuming contaminated prey, however, impacts will be limited to individuals and are not expected to cause impacts at a population-level.<br>The Apollo AMP also overlaps areas where cetaceans could be moving through (i.e. humpback, blue, fin, and sei whales) (see Section 6.6.3). As cetaceans are highly mobile pelagic animals, they are unlikely to be within the exposure area 0-10 m of the water column for prolonged periods of time.<br>Refer to potential impact to marine fauna (Sections 9.6.5.3 and 9.6.5.4) and to habitats (Section 9.6.5.2). | | |
| **Wetlands** | Modelling predicted 5 internationally important Ramsar wetlands could be contacted by hydrocarbon exposure within the extent of potential SEI (LOWC), including:<br>• Port Phillip Bay (Western Shoreline) and Bellarine Peninsula<br>• Corner Inlet<br>• Western Port<br>• Glenelg Estuary and Discovery Bay Wetlands<br>• Lavinia.<br>Additional wetlands of national importance are also identified within the extent of potential SEI.<br>The major values for these wetlands have been identified within Section 6.6.4 of the EP.<br>Furthermore, a number of these wetlands are associated with First Nations cultural values (see Section 6.6.4). | Wetlands, including internationally important Ramsar wetlands, are saline marsh areas and estuarine environments that are a continuation from the marine environment. Therefore, depending on where the shoreline contact occurs there is a potential for shoreline oil to move into the estuary and wetlands, potentially impacting the aesthetic and ecological value of the wetland.<br>Wetlands have the potential to be exposed to shoreline hydrocarbons.<br>Shoreline hydrocarbon exposure at, or above, the low threshold may impact the key receptors of wetlands (e.g. waterbirds, fish and invertebrates) which may cause a subsequent negative impact to the value of the wetland, however, is expected to be limited to a small number of individuals, with no impacts to regional populations.<br>Refer to potential impact to marine fauna (Sections 9.6.5.3 and 9.6.5.4) and to habitats (Section 9.6.5.2) and First Nations heritage (Section 6.8.3.7). | Localised and medium-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 3 |
| **State parks and reserves** | The modelling identified 21 State Protected Areas present within the extent of potential SEI being exposed to, at or above, low thresholds of shoreline hydrocarbon accumulation, which include marine parks, marine sanctuaries, marine and coastal parks, marine reserves and national parks. | The values identified within the identified State Protected Areas that have the potential to be exposed to surface hydrocarbons at, or above, the low threshold.<br>Visible surface hydrocarbons (i.e. a rainbow sheen) may have the potential to reduce the visual amenity of the area, also impacting the value.<br>However, given the nature of the condensate, being light non-persistent hydrocarbon, it is expected to remain in waxy flake-like | Localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning. | Level 3 |

| Receptor | Presence within EMBA or extent of potential SEI | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | The Twelve Apostles Marine National Park, Marengo Reefs, Merri and The Arches Marine Sanctuary are the State Protected Areas identified to also be exposed to in-water (moderate threshold) and surface (low threshold) hydrocarbons as well as shoreline hydrocarbons within the extent of potential SEI.<br>Values associated with these State Protected Areas Park include habitats (i.e. reefs, limestone formation, and kelp beds) for a diverse range of invertebrates, fish, mammals and seabirds (see Section 6.6.5 for further details). | state; and in most cases surface oiling is not expected to the visible from shore.<br>The values identified within this marine park have the potential to be exposed to entrained hydrocarbons at, or above, the moderate threshold (RPS, 2024).<br>However, the exposure of entrained hydrocarbons will be greatest within the upper 0-10 m of the water column and areas close to the spill source. Therefore, conservation values within these AMPs, such as benthic and pelagic species, ecosystems, habitats and sea-floor features are not predicted to be impacted.<br>Visible shoreline hydrocarbons have the potential to reduce the visual amenity of the area for tourism and discourage recreational activities within the identified protected areas.<br>The modelling predicted rapid evaporation during the first 24 hours following the release of condensate, depending on the weather conditions (i.e. wind speeds). Given the non-persistent nature of the hydrocarbon, waves and tidal action are anticipated to continue the weathering process if shoreline contact occurs.<br>Majority of the coastlines that may be exposed to shoreline hydrocarbon accumulation are relatively unpopulated.<br>Therefore, given the nature of the hydrocarbon and action of weathering processes, impacts are not anticipated to be long-term.<br>Also refer to potential impact to marine fauna (Sections 9.6.5.3 and 9.6.5.4) and to habitats (Section 9.6.5.2). | | |
| **KEFs** | Modelling predicted exposure from in-water hydrocarbons at, or above low exposure levels, to overlap three KEFs within the extent of potential SEI:<br>• Bonney Coast Upwelling<br>• West Tasmania Canyons<br>• Shelf rocky reef.<br>These KEFs are all associated with unique sea-floor features of ecological significance (and habitat forming species, such as sponges, attached megafauna, and hard substrate formations and canyons which create a habitat for diverse species. | The values identified within these KEFs have the potential to be exposed to entrained hydrocarbons at, or above, the low threshold.<br>However, the exposure of entrained hydrocarbons will be greatest within the upper 0-10 m of the water column and areas close to the spill source. Therefore, the spill is unlikely to intersect with majority of the values of the KEFs which are concentrated within the water column >10 m deep or along the seafloor at varying water depths.<br>Hydrocarbon exposure to the key receptors of the KEFs (e.g. seabirds, pinnipeds and cetaceans) may cause a subsequent negative impact to the value of the KEFs, however is expected to be limited to a small number of individuals, with no impacts to regional populations.<br>The Bonney Coast Upwelling is also an area of high abundance of plankton, such as krill which acts as a food source to many seabirds, fish and cetacean species. Plankton populations may be | Localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning. | Level 3 |

| Receptor | Presence within EMBA or extent of potential SEI | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | The shelf rocky reefs KEF in particular supports a variety of benthic communities, such as coral, sponges and benthic communities, along the continental shelf within the temperate east marine region (see Section 6.6.6).<br>The Bonney Coast Upwelling is an area of high abundance of plankton, such as krill which acts as a food source to many seabirds, fish and cetacean species.<br>Both the Bonney Coast Upwelling and West Tasmanian Canyon KEFs are associated with high productivity and aggregations of cetaceans, pinnipeds, fish and sharks and seabirds<br>Furthermore, seasonal upwelling events which brings cold nutrient rich waters to the sea surface within these KEFs contribute to the high productivity and biodiversity associated within these areas. | impacted by hydrocarbon exposure, however, would be expected to be limited to a small proportion of the productivity driven by the Bonney upwelling, with no impacts to the overall system and productivity across the region.<br>The modelling predicted only a small portion in the south-east corner of the Bonney Coast Upwelling (approximately 10%) and an even smaller portion of the north-east corner of the West Tasmania Canyons KEF (approximately 5%) to be overlapped by the extent of potential SEI. Therefore, any impacts are anticipated to localised and not impact the overall value of the KEF.<br>Refer to potential impact to marine fauna (Sections 9.6.5.3 and 9.6.5.4) and to habitats (Section 9.6.5.2). | | |
| **TECs** | Modelling predicted exposure from shoreline hydrocarbons at, or above low exposure levels, to overlap 18 TECs within the extent of potential SEI, those with marine or shoreline features include:<br>• Giant Kelp Marine Forests of South East Australia<br>• Subtropical and Temperate Coastal Saltmarsh<br>• Littoral Rainforest and Coastal Vine Thickets of Eastern Australia<br>• Assemblages of Species Associated with Open-coast Salt-wedge Estuaries of western and central Victoria<br>• River-flat Eucalypt Forest on Coastal Floodplains of southern NSW and eastern Victoria.<br>Values associated with these TECs (see Section 6.6.7) are listed as critically | TECs have the potential to be exposed to shoreline hydrocarbons at, or above, the low threshold. Any hydrocarbon exposure to the key receptors of the TECs may cause a subsequent negative impact to the value of the TECs, However, potential impacts to socio-economic receptors (tourism, cultural and/or other social values associated with the TECs) are more likely to occur because of a reduction in the visual amenity, rather than ecological impacts of hydrocarbon exposure at low threshold.<br>Shoreline hydrocarbons can become concentrated as they strand ashore. However, most of the oil is concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA, 1995). The majority of the TECs are located above the high tide mark, therefore, impacts are not anticipated to occur.<br>Given the nature of the condensate, being light non-persistent hydrocarbon, any impacts to TECs are expected to be localised and short-term. | Localised and short-term impacts to species of recognized conservation value not affecting local ecosystem function. | Level 2 |

| Receptor | Presence within EMBA or extent of potential SEI | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | endangered, endangered or vulnerable, and can be sensitive to hydrocarbon exposure. | | | |
| **Socio-economic environment** | | | | |
| **Coastal settlements** | There are several local government areas identified as potentially being overlapped by the extent of potential SEI from shoreline hydrocarbon exposure at the low threshold; predominantly between Port Fairy and east of Cape Otway along the Victorian coastline, a shoreline accumulation at the low threshold along the west coast of King Island (RPS, 2024).<br>The scenarios modelled predicted shoreline exposure at the low threshold at 8 local government areas (Section 6.7.1). | Visible hydrocarbons along the shorelines can change the aesthetic value. Furthermore, closure of these shorelines could impact public use and public activities. However, given the nature of the condensate, being light non-persistent hydrocarbon, any impacts to coastal settlements are expected to be localised and short-term. The wave and tidal action, together with predicted weathering, indicates that hydrocarbons along shorelines will continually wash off the substrates, and be readily flushed into the water, with further weathering and dispersal. | Localised, short-term impacts. | Level 2 |
| **Commercial fisheries** | Several commercial fisheries operate in the extent of potential SEI (LOWC) and overlap the spatial extent of the water column hydrocarbon predictions (Section 6.7.2), these include:<br>• 6 Commercial Fisheries<br>• 9 Victorian State Fisheries<br>• 1 Tasmanian State Fisheries.<br>For the Tasmanian jurisdiction, the shoreline of King Island was predicted to be exposed to levels of shoreline hydrocarbons at relevant thresholds. No exposure to in-water hydrocarbons were predicted for this location or elsewhere in Tasmanian State waters (RPS, 2024). However, the shallow waters of King Island are where seaweed collectors harvest bull kelp. Therefore, this fishery has been considered within the assessment. | In-water hydrocarbon exposure may result in a reduction in commercially targeted marine species (i.e. fish and invertebrate species), subsequently resulting in impacts to commercial fishing productivity or the marketability of the catch. Contamination of target species can cause economic impacts to the industry.<br>Physical displacement of commercial fishers could occur due to the establishment of exclusion zones during the spill response. However, due to the nature of the condensate, being a light non-persistent hydrocarbon, with high anticipated evaporation and entrainment rates, exclusion zones are not expected to be long-term and are unlikely to result in extensive impacts.<br>Visible surface hydrocarbons (i.e. a rainbow sheen) may have the potential to cause impact public perception of the industry, potentially causing a negative economic impact.<br>Due to the sensitivity, a small number of juvenile fish, larvae, and planktonic organisms, may be impacted, however impacts are not expected to affect population viability or recruitment.<br>Hydrocarbon smothering has the potential to cause fouling and asphyxiation (Blumer, 1971; Cintron et al., 1981) and act as a physical barrier for the diffusion of $CO_2$ across cell walls of macroalgae (O'Brien and Dixon, 1976). Any impacts to commercially valuable seaweed has the potential to results in a negative economic impacts to the industry. Shoreline harvesters | Localised, short-term impacts. | Level 2 |

| Receptor | Presence within EMBA or extent of potential SEI | Potential impact | Description of consequence | Inherent consequence |
|---|---|---|---|---|
| | | could be affected by short-term closures but would be expected to recover relatively rapidly, with no long-term or irreversible damage.<br>Refer to potential impact to marine fauna (Sections 9.6.5.3 and 9.6.5.4) and potential impact to habitats (Sections 9.6.5.2). | | |
| **Other offshore industry** | Other offshore industry, such as shipping, petroleum exploration and production, other offshore infrastructure and defence activities, may occur within the extent of potential SEI (Section 6.7.3). | Physical displacement of other offshore industry may occur due to the establishment of exclusion zones during the spill response. This has the potential to cause negative economic impact.<br>However, due to the nature of the condensate, being a light non-persistent hydrocarbon, with high anticipated evaporation and entrainment rates, exclusion zones are not expected to be long-term and are unlikely to result in significant impacts. | Localised, short-term impacts. | Level 2 |
| **Recreation and tourism** | The Victorian coast and marine region provide a diverse range of land-based and near-shore tourism opportunities, including scuba diving, fishing, whale and wildlife watching, sailing, snorkelling and kayaking (Section 6.7.4).<br>Modelling predicted shoreline hydrocarbon exposure at, or above the low (10 g/m$^2$) threshold predominantly between Port Fairy and east of Cape Otway along the Victorian coastline, and shoreline accumulation at the low threshold along the West coast of King Island (RPS, 2024).<br>Floating hydrocarbon exposure at, or above the low threshold was only predicted for nearshore waters within Victorian State waters, along the Colac Otway to Warrnambool coast sections.<br>In general, recreational and tourism activities are restricted to shallower coastal waters and shorelines. | Visible surface hydrocarbons (i.e. a rainbow sheen) on the surface or stranded ashore have the potential to reduce the visual amenity of the area for tourism and discourage recreational activities.<br>Precautionary exclusion from shorelines may be implemented by local governments until water quality monitoring verifies the absence of residual hydrocarbons. This could cause disruption to some recreational and tourism activities within that area.<br>Furthermore, visible hydrocarbons along shorelines may impact the aesthetic value for tourism and discourage recreational activities that may be operating within the area.<br>Given the nature of the condensate, it is expected to evaporate, weather and disperse quickly. Wave and tidal action along shorelines, together with predicted weathering, would continually wash off the substrates, and be readily flushed into the water, with further weathering and dispersal.<br>Any impact to receptors that are depended on for nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism businesses in the locally affected area.<br>Refer to potential impact to marine fauna (Sections 9.6.5.3 and 9.6.5.4) | Localised, short-term impacts. | Level 2 |

**Summary**

The highest potential consequence to the functions, interests or activities of other users is assessed as **Level 3** based on the potential for localised and medium-term impacts to species of recognised conservation value but not affecting local ecosystem functioning. This was based on the worst-case consequence evaluated for AMPs, KEFs, wetlands and State parks and reserves.

**Inherent Likelihood**

Blowout events during development drilling has been reported at a frequency for a gas well of 4.2 x $10^{-5}$ per drilled well (IOGP, 2019). This represents the frequency of the cause (i.e. a LOWC); additional environmental factors would be necessary for the worst-case consequences (to conservation values and socioeconomic interests) to eventuate.

Due to the nature of this activity, and based on previous occurrences, the impact is considered conceivable and could occur, however, it would require a rare combination of factors. Therefore, the inherent likelihood of an accidental release of condensate causing **Level 3** consequences to other users is considered **Unlikely (D)**.

**Inherent Risk Severity**

The inherent risk severity of an accidental release of condensate causing impacts to receptors is considered **Moderate**.

### 9.6.6 Demonstration of Acceptability

To demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 9-37.

*Table 9-37: Accidental Release – LOWC Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Potential Impact: Change in water quality | Consequence: Level 2 |
| | Risk: Change in habitat | Risk: Moderate |
| | Risk: Change in fauna behaviour | Risk: Moderate |
| | Risk: Injury/mortality to fauna | Risk: Moderate |
| | Risk: Changes to the functions, interests, or activities of other users. | Risk: Moderate |
| **Principles of ESD** | A) 'Integration principle'<br>Consistent with Cooper Energy's risk management process (Section 7.3), the existing environment has been defined in Section 6, and relevant values and sensitivities have been included within this impact analysis (Section 9.6.4); with consideration for economic, environmental and social values.<br>There were no objections raised through consultation indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met.<br>By meeting relevant requirements and with implementing the control measures (refer below) the potential impact and risks from accidental release – LOWC are identified as:<br>• Level 2 consequence for change in water quality<br>• Moderate risk for change in habitat<br>• Moderate risk for change in fauna behaviour<br>• Moderate risk for injury/mortality to fauna | |

| | | | |
|---|---|---|---|
| | • Moderate risk for changes to the functions, interests or activities of other users.<br>The above predicted levels of impact and risk due to accidental release – LOWC from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). | | |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology.<br>• The consequence ranking for an accidental release from a LOWC was Level 3, and the highest inherent risk was evaluated as Moderate; therefore, an accidental release from a LOWC from the East Coast Project will not result in serious or irreversible environmental damage.<br>• The potential impacts and risks from an accidental release from a LOWC are well-understood, and management measures are well established and regulated in Australian waters.<br>• Any uncertainty surrounding the suitability of modelled oil spill scenarios and thresholds will be addressed by EPO20 which establishes a modelling review to ensure that scenarios and thresholds remain appropriate for activity specific environment plans. | | |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risks for an accidental release from a LOWC was evaluated as Moderate and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.6.7). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. | | |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant environmental values and sensitivities to an accidental release from a LOWC were evaluated in Section 9.6.5 and the highest inherent risk for an accidental release from a LOWC was evaluated as Moderate.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 9.6.7). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained. | | |
| | E) 'Valuation principle'<br>The East Coast Project is consistent with the principle of ESD (e) for this aspect by holding financial assurance under Section 571(2) of the *OPGGS Act* to ensure the project aligns with the 'polluter pays' principle. | | |
| **Legislative and Other Requirements** | **Requirement** | **Relevant Objective / Action** | **Demonstration of Requirement** |
| | OPPGS(E)R | An EP, including an OPEP and emergency response arrangements, must be place for any petroleum activity prior to activities | Adoption or the following control measures: |

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| | | commencing, and must be implemented. | CM1: Marine Assurance Process<br>All vessels contracted will meet survey, maintenance and certification of regulated Australian vessels as per AMSA MO 91 and MO 93.<br>CM12: Marine exclusion, caution and petroleum safety zones<br>Including:<br>• a temporary 3 km exclusion/cautionary zone around the MODU during the drilling program<br>• a temporary 500 m exclusion/caution zones to be established via Notice to Mariners around vessels undertaking petroleum activities<br>• PSZs may be gazetted around wells and other equipment where required for integrity management. Subsea infrastructure will be marked on navigational charts for awareness.<br>CM13: Ongoing Engagement<br>Further engagement will take place during the development and implementation of component EPs. This will include:<br>• details relating to notification of third-party stakeholders,<br>• engagement with other titleholders in the Otway with respect to each others ongoing activities and potential cumulative impacts.<br>Relevant information received will be included within the EPs as appropriate. |
| | *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* – Section 26F (implements MARPOL Annex I). | Several MOs are enacted under this Act relating to offshore petroleum activities, including:<br>MO Part 91: Marine Pollution Prevention – Oil<br>MO Part 93: Marine Pollution Prevention – Noxious Liquid Substances | |
| | Navigation Act 2012 – Chapter 4 (Prevention of Pollution). | Several Marine Orders (MO) are enacted under this Act which relate to offshore petroleum activities, including:<br>MO 21: Safety and emergency arrangements | |
| | AMSA Marine Orders 91 and 94 | In Commonwealth waters AMSA is the Statutory Agency for vessels and must be notified of all incidents involving a vessel. | |
| | Recovery plan for marine turtles in Australia 2017–2027 | 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.<br>Interim objective 3: Anthropogenic threats are demonstrably minimised.<br>No relevant management actions. | |
| | National Recovery Plan for Albatrosses and Petrels 2022 (DCCEEW, 2022e) | Recovery objective: To improve the conservation status of albatrosses and petrels so that these species are on a trajectory towards no longer being threatened in Australia's jurisdiction.<br>No relevant management actions. | |
| | Wildlife Conservation Plan for Seabirds (CoA, 2020) | Objective 2: Seabirds and their habitats are protected and managed in Australia.<br>Objective 3. The long-term survival of seabirds and their habitats is achieved through supporting priority research programs, coordinated monitoring, on-ground management and conservation.<br>No relevant management actions. | |
| | Wildlife Conservation Plan for Migratory Shorebirds – 2015 (CoA, 2015b) | Objective 3: Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.<br>No relevant management actions. | |
| | Blue Whale Conservation Management Plan 2015 - 2025 (2015) | Interim objective 4: Anthropogenic threats are demonstrably minimised.<br>Management action A.4.2: Ensure all vessel strike incidents are reported in the National Ship Strike Database (AMMC).<br>Management action A.4.3: Ensure the risk of vessel strikes on Blue | |

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| | | Whales is considered when assessing actions that increase vessel traffic in areas where Blue Whales occur and, if required, implement appropriate mitigation measures. | CM14: Facility Safety and Integrity Management Plans<br>Under Part 5 of the OPGGS (Resource Management and Administration) Regulations 2011, a NOPSEMA accepted WOMP (including Cooper Energy Well Management System) and a Safety Case is required before well activities can be undertaken.<br>The WOMP details the well barriers and the integrity testing that will be in place for the activity.<br>CM16: OSMP<br>Cooper Energy's OSMP details the arrangements and capability in place for:<br>• operational monitoring of a hydrocarbon spill to inform response activities<br>• scientific monitoring of environmental impacts of the spill and response activities.<br>CM17: OPEP<br>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 subsea LOWC, the OPEP will be implemented.<br>Cooper Energy acknowledges that any response will be implemented in accordance with the requirements described within the OPEP.<br>CM19: Source Control Emergency Response Plan<br>The Cooper Energy source control emergency response plan (SCERP) acknowledges |
| | National Recovery Plan for the Southern Right Whale (DCCEEW, 2024l) | Long term recovery objective is that the population has increased in size to a level that the conservation status has improved, and the species no longer qualifies for listing as threatened under any of the EPBC Act listing criteria.<br>Interim Objective 2: Anthropogenic threats are managed consistent with ecologically sustainable development principles to facilitate recovery of southern right whales. | |
| | 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.<br>No relevant management actions. | |
| | 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.<br>No relevant management actions. | |
| | Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (2013)<br>Conservation Advice for the *Neophoca cinerea* (Australian sea lion) | Overarching objective: 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:<br>Improving the population status leading to the future removal of the Australian sea lion from the threatened species list of the EPBC Act<br>Ensuring that anthropogenic activities do not hinder recovery in the near future or impact on the conservation status of the species in the future.<br>No relevant management actions. | |
| | Recovery Plan for the White Shark (*Carcharodon carcharias*) | 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.<br>No relevant management actions. | |
| | Conservation Advice for Subtropical and Temperate Coastal Saltmarsh (DSEWPAC, 2013) | No relevant objectives.<br>Management action: Identify Coastal Saltmarsh as important habitat in all oil spill contingency planning at national and State levels and monitor the application of protocols | |

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| | | on the management of spills involving saltmarshes. | legislative requirements and provides in detail the company's plans, equipment and personnel provisions to enable a source control response, commensurate to the risk at each stage of a wells life cycle from initial drilling to closing off the reservoir.<br>CM22: Modelling Review<br>Modelling studies used to inform the Activity Environment Plan will use scenarios that are representative of the activity, and current, published thresholds that are suitable for sensitive receptors. |
| | Approved Conservation Advice for *Botaurus poiciloptilus* (Australasian bittern) | provide guidance for actions that will expand the range and the number of Australasian Bitterns in Australia.<br>No relevant management actions. | |
| | Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) | Australian Objective:<br>Reduce disturbance at key roosting and feeding sites.<br>No relevant management actions. | |
| | Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) | Australian objectives:<br>Achieve a stable or increasing population.<br>Maintain and enhance important habitat.<br>Reduce disturbance at key roosting and feeding sites.<br>No relevant management actions. | |
| | National Recovery Plan for (*Sternula nereis nereis*) (Australian Fairy Tern)<br>Approved Conservation Advice for *Sternula nereis* (Australian Fairy Tern) | Long-term Vision:<br>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.<br>No relevant management actions. | |
| | Approved Conservation Advice for *Thinornis rubricollis* (Hooded Plover, Eastern) | Primary Conservation Objectives:<br>Achieve stable numbers of adults in the population, and maintain a stable number of occupied and active breeding territories<br>Maintain, enhance and restore habitat, and integrate the subspecies' needs into coastal planning.<br>No relevant management actions. | |
| | Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan | Specific recovery objective: To identify and manage the threats operating at sites where the subspecies occurs.<br>No relevant management actions. | |
| | National Recovery Plan for the *Lathamus discolour* (swift parrot)<br>Conservation Advice *Lathamus discolor* Swift Parrot | Overall objectives:<br>To prevent further decline of the Swift Parrot population.<br>To achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat to increase carrying capacity.<br>No relevant management actions. | |
| | National Recovery Plan for the Orange-bellied Parrot (*Neophema chrysogaster*) | Objective 1. To achieve a stable or increasing population in the wild within five years.<br>Objective 2. To increase the capacity of the captive population, both to support future releases of | |

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| | | captive-bred birds to the wild and to provide a secure long term insurance population.<br>Objective 3. To protect and enhance habitat to maintain, and support growth of, the wild population.<br>Objective 4. To ensure effective adaptive implementation of the plan.<br>No relevant management actions. | |
| | Commonwealth Conservation Advice on *Dermochelys coriacea* (2008) | These EPBC management plans identify habitat degradation/modification or pollution/contamination as a threat; but do not include any relevant objectives or relevant management actions. | |
| | Approved Conservation Advice for *Calidris canutus* (Red Knot) | | |
| | Approved Conservation Advice for *Charadrius leschenaultia* (Greater Sand Plover) | | |
| | Approved Conservation Advice for *Halobaena caerulea* (Blue Petrel) | | |
| | Approved Conservation Advice for *Limosa lapponica bauera* (Bar-tailed Godwit (western Alaskan) | | |
| | Approved Conservation Advice for *Pachyptila subantarctica* (Fairy Prion (southern)) | | |
| | Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) | | |
| | Approved Conservation Advice for *Thalassarche Chrysostoma*, Greyheaded Albatross) | | |
| | Conservation Advice *Thalassarche cauta* Shy Albatross | | |
| | Conservation Advice *Falco hypoleucos* Grey Falcon | | |
| | Conservation Advice *Hirundapus caudacutus* White-throated Needletail | | |
| | Conservation Advice for Dendronephthya australis Cauliflower Soft Coral (TSSC, 2020) | | |
| | Approved Conservation Advice for Giant Kelp Marine Forests of Southeast Australia | | |

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| | (TEC) (DSEWPAC, 2012)<br>Approved Conservation Advice for the Littoral Rainforest and Coastal Vine Thickets of Eastern Australia ecological community (DoE, 2015b) | | |
| **Internal Context** | Relevant management system processes adopted include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11)<br>• External Affairs & Stakeholder Management (MS05).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12). | | |
| **External Context** | Stakeholder feedback received.<br>GMTOAC has previously communicated values and sensitivities relevant to the risk. GMTOAC highlighted Gunditjmara's strong connection to Sea Country and responsibility for its care Cooper Energy briefed GMTOAC (February 2024) on the kinds of activities undertaken by Cooper Energy which carry a risk of spills, and the plans in place to prevent and respond to spills. During the briefing, members queried whether Cooper Energy had ever had a large hydrocarbon spill. Cooper Energy clarified that no hydrocarbon spills have occurred during Cooper Energy's time operating within the Otway. GMTOAC indicated Gunditjmara's responsibility for Country extended to a spill response along the coast and would expect to be contacted in the event of a spill which threatens Gunditjmara Country. GMTOAC are listed as a relevant person for the purposes of EP preparation which will enable their continued input into the management of activity specific impacts and risks. | | |
| **Predicted impact compared to Defined Acceptable Level** | The defined acceptable level of impacts relevant to an accidental release of condensate is AL3 identified in Table 9-38. This acceptable level is defined for change in water quality, change in habitat and injury / mortality to fauna, such that an accidental release of condensate event is unacceptable. Control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent an accidental release of condensate event from occurring, ensuring that AL3 is met and achieved.<br>This acceptable level defined for a change in water quality and habitat is detailed in Table 7-6.<br>The worst-case predicted impacts assessed in Section 9.6.5 are:<br>• Given the nature of the activity, implementation of control measures and based on previous occurrences, the inherent likelihood of an accidental release of condensate causing a change to water quality, habitat, injury/ mortality to fauna, change in fauna behaviour or change to the functions, interests and activities of other users is considered Unlikely (D).<br>• Highest consequence for change in habitat from accidental release of condensate is Level 3, for shorelines (rocky), saltmarsh and mangroves. These are localised medium-term impacts to habitats of recognized conservation value or to local ecosystem function.<br>• Highest consequence to marine fauna behaviour is Level 3 for pinnipeds. In the event of an accidental release of condensate pinnipeds may be displaced from haul-out sites, have movement affected, reduced mobility or sub lethal injury. The highest consequence is localised medium-term impacts, with population level impacts considered very unlikely.<br>• The highest consequence to injury/mortality to fauna is assessed as Level 3 for seabird and shorebirds, pinnipeds and cetaceans based on the potential for localised medium-term impacts to species or habitats of recognised conservation value, or to local ecosystem functioning.<br>• The highest consequence to the functions, interests or activities of other users is assessed as Level 3 for AMPs, wetlands, state parks and reserves and KEFs based on the potential for localised medium-term impacts to habitats or species of recognised conservation value or to local ecosystem functioning. | | |

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| | • The consequence ranking for an accidental release of condensate was Level 3, and the highest inherent risk was evaluated as Moderate.<br>Therefore, at its worst-case, the predicted impact from an accidental release of condensate would not:<br>• Lead to a substantial change in water quality which may adversely impact biodiversity and ecological integrity.<br>• Modify an important or substantial area of habitat which may adversely impact on biodiversity and ecological integrity.<br>• Disrupt the recovery of, or impact conservation status of EPBC Act listed threatened or migratory species.<br>• Lead to loss of habitat critical to the survival of species.<br>• Prevent maintenance of social and commercial amenity values of the Commonwealth marine area within the region consistent with the rights of all marine users.<br>• Lead to substantial adverse effects on the sustainability of commercial fisheries.<br>Therefore, the predicted level of impact resulting from an accidental release of condensate from the East Coast Project is at or below the defined acceptable levels. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to an accidental release from a LOWC are acceptable, based on:<br>• control measures that satisfy legislative and other requirements (as detailed in the row above) will be implemented to prevent an accidental release of condensate event from occurring.<br>• predicted levels of impact (evaluated in Section 9.6.5) are at or below the defined acceptable levels of impact (Table 7-6) for all receptors<br>• the planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• the activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• the proposed controls and impact and risk levels are not inconsistent with national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES<br>• feedback has been received from stakeholders that has informed the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures.<br>To manage impacts to receptors to or below the defined acceptable levels the following EPOs have been applied:<br>**EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment.<br>**EPO20:** For activity specific environment plans undertake review of modelling and impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. |

### 9.6.7 Environmental Performance

Table 9-38 lists the acceptable level and EPO defined for an accidental release of condensate and the adopted measures to achieve the outcome.

*Table 9-38: Environmental Performance Summary – Accidental release of condensate*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL3:** Unplanned loss of containment (hydrocarbons and chemicals) is unacceptable. | **EPO8:** No unplanned release of chemicals or hydrocarbons to the marine environment.<br>**EPO20:** For activity specific environment plans undertake review of modelling and | CM1: Marine Assurance Process |
| | | CM12: Marine Exclusion and Caution Zones |
| | | CM13: Ongoing Engagement |

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| | impact/ risk assessment to ensure modelled scenarios, applied thresholds, and impacts and risks to marine fauna provide valid and appropriate predictions, and demonstrate that the levels of impact will be acceptable. | CM14: Facility Safety and Integrity Management Plans |
| | | CM16: OSMP |
| | | CM17: OPEP |
| | | CM19: Source Control Emergency Response Plan |
| | | CM22: Modelling Review |

# 10 Risk and Impact Evaluation - First Nations Cultural Heritage Values and Sensitivities

This section evaluates the potential for the East Coast Project to affect cultural heritage and the continuation of cultural practices. In doing so, this section:

- Identifies the potential impacts to environment receptors that are, or are linked to, cultural features of the environment within the monitoring area that could be affected by East Coast Project aspects (Section 10.1).
- Summarises the outcomes of the impact and risk assessments (from Section 8 and 9) for environment receptors that are also cultural features, or are linked to cultural features of the environment, to characterise the relevant project aspects (Section 10.2).
- Evaluates to what degree the cultural features of the environment, and their value to first nations cultural practices and heritage, could be degraded considering the nature and scale of impacts / risk to relevant environment receptors (Section 10.3):

EPO have been developed for this project that are specific to First Nations Peoples cultural heritage. These EPOs are designed to be equal to or better than the acceptable levels of impact and risk:

- No impact to underwater cultural heritage

Further, there are measures evaluated and adopted following research, training and consultation, to ensure that the predicted environment impact can be managed at levels equal to or better than the defined acceptable level of impact or risk.

The section has been written with consideration to N-04750-GN1344 A339814; NOPSEMA, 2024 and APSC, 2022, First Nations people's Country Plans[25], Consultation with First Nations peoples, participation in cultural experiences and training led by Gunditjmara people on Gunditjmara Country.

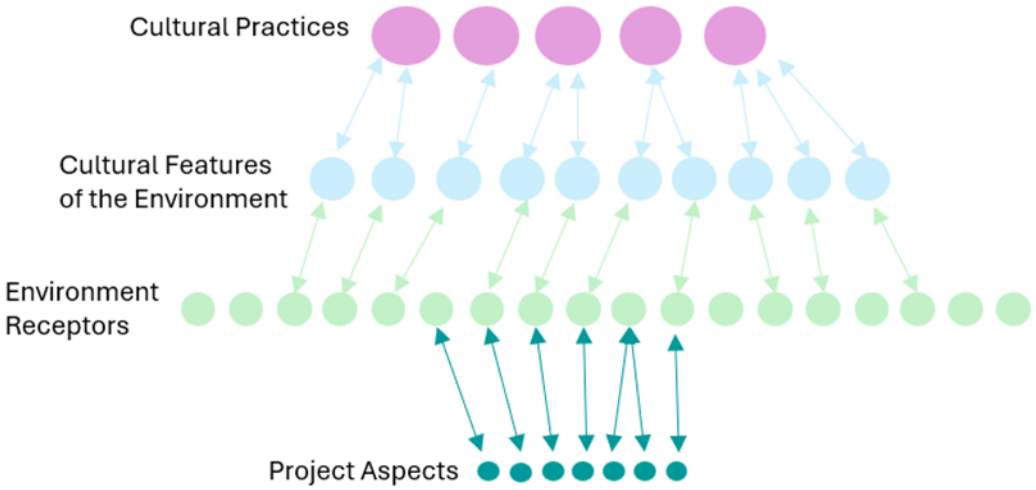



*Figure 10-1: Conceptual Illustration – Interaction between Project Aspects and Environment Receptors, and links to Cultural Features and Practices*

[25] *Sources:*
- *Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023*
- *Wadawurrung Traditional Owners Aboriginal Corporation, 2020*
- *Eastern Maar Aboriginal Corporation, 2014*
- *Gunaikurnai Land and Waters Aboriginal Corporation, 2015*

## 10.1 Summary of Potential Impacts to Cultural Features

Table 10-1 describes how relevant aspects of the project have the potential to affect the link between cultural features of the environment and First Nations people's heritage sites and values. Importantly, this is not a description of predicted impacts, but of the mechanisms by which a project aspect could affect a cultural feature and its value for First Nations People.

*Table 10-1: Potential to affect the link between cultural features of the environment and First Nations people's sites and values*

| First Nations people's heritage sites and values | Receptors relevant to the Activity | What Activity Aspects could interact with these receptors | Potential risk to intrinsic link to cultural features of the environment |
|---|---|---|---|
| **Tangible cultural heritage** | | | |
| Known coastal/island places and objects | • Deen Maar Island<br>• Convincing Ground<br>• Discovery Bay Coastal Park<br>• Wilsons Promontory and Associated Land Bridge | • Accidental Hydrocarbon Release<br>• Spill Response | Shoreline hydrocarbon exposure has the potential to change the cultural heritage value of the site (Section 9.6) if sites are not accessible to First Nations People to be able to practice culture, or if sites are perceived to have been degraded by tainting with hydrocarbons.<br>Table 10-2 identifies there is a moderate risk to known coastal/islands places and objects from hydrocarbon exposure in the event of unplanned discharge and accidental hydrocarbon release events.<br>Section 10.3.1.1 considers the level of impact and risk to environment receptors that are also, or that are linked to, cultural features and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| Known submerged sites | • Benthic habitats | • Multiple Aspects | Aspects resulting in seabed disturbance have the potential to change the cultural heritage value of submerged landscapes if that disturbance is widespread and within those landscapes that feature within cultural practices.<br>There are no potential impacts to the seabed from the activity which have more than a localised footprint (within the operational area), and therefore there will be no landscape scale impacts, or effects on the submerged elements such as the Tyrendarra lava flow which is >50 km from the operational area.<br>Table 10-2 identifies there is moderate risk of impact to known submerged sites from hydrocarbon exposure (in the event of unplanned discharge and accidental hydrocarbon release events).<br>Section 10.3.1.2 considers the level of impact and risk to environment receptors that are also, or that are linked to cultural features, and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| **Intangible cultural heritage** | | | |
| Sea Country | • State and Cwth Waters, including the Commonwealth Marine Environment, | • All Aspects | First Nations cultural heritage values associated with Sea Country including ecosystems and species are considered based on their ecological values, food sources, and/or culturally significant totemic values. The First Nations people's values associated with marine ecosystems and species |

| First Nations people's heritage sites and values | Receptors relevant to the Activity | What Activity Aspects could interact with these receptors | Potential risk to intrinsic link to cultural features of the environment |
|---|---|---|---|
| | and habitats and species therein. | | have the potential to be disrupted if there are impacts to ecosystem functioning and integrity or species population.<br>Table 10-2 summarises potential impacts and risks to Sea Country are mostly limited to localised and short-term impacts (Level 1 or 2 consequences), with no impacts at the population level. However the introduction, establishment and spread of IMS, and accidental hydrocarbon release is a risk of up to Moderate severity.<br>Section 10.3.2.1 considers the level of impact and risk to environment receptors that are also, or that are linked to cultural features, and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings | • Deen Maar Island<br>• Convincing Ground<br>• Discovery Bay Coastal Park<br>• Wilsons Promontory and Associated Land Bridge<br>• Tyrendarra lava flow (Julia reef) | • Accidental Hydrocarbon Release<br>• Spill Response | Impacts and risks to seabed habitats, The Convincing Ground, and Deen Maar has the potential to change First Nations cultural heritage values of Creation/Dreaming, Songlines, sacred sites and Ancestral Beings at these sites.<br>Shoreline hydrocarbon exposure (Section 9.6) to The Convincing Ground and Deen Maar has the potential to change the cultural heritage values (Creation/ Dreaming sites, sacred sites and Ancestral beings) of these sites.<br>Aspects resulting in seabed disturbance, if occurring at a widespread level has the potential to weaken, fragment or break of songlines associated with submerged landscapes.<br>Karntubul (whales) are Ancestors of Gunditj Mirring and have featured in Dreaming stories, ceremony, song and dance of Gunditjmara for thousands of years. Whale Dreaming stories connect Aboriginal people along the coastlines of Australia and strengthen the connection between neighbouring Aboriginal groups in Victoria. Protection of whales is essential to Gunditjmara spiritual and physical well-being.<br>Table 10-2 summarises potential impacts and risks to Creation/ Dreaming sites, songlines, sacred sites and Ancestral beings are mostly limited to localised, short-term and recoverable impacts (Level 1 or 2 consequences). The introduction, establishment and spread of IMS and accidental hydrocarbon release carries a risk of up to Moderate severity for some environmental receptors that are also cultural features, including culturally significant species and places (Deen Maar).<br>Section 10.3.2.2 considers the level of impact and risk to environment receptors that are also, or that are linked to, cultural features and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| | • Whales | • Multiple Aspects | |

| First Nations people's heritage sites and values | Receptors relevant to the Activity | What Activity Aspects could interact with these receptors | Potential risk to intrinsic link to cultural features of the environment |
|---|---|---|---|
| Connection to Country<br>Cultural obligations to care for Country<br>Knowledge Systems | • State and Cwth Waters, including the Commonwealth Marine Environment, and habitats and species therein. | • All Aspects | The potential disruption to the cultural obligations to care for Country is linked by potential impacts to the environment and the exclusion of First Nations people from Country or decision-making processes.<br>Potential change to knowledge on cultural heritage values will occur when the value is displaced, depleted or there is significant reduction in population of the value. If the value doesn't exist within the local area of Country, knowledge systems of that value will be disrupted or lost.<br>Limitation on access, for safety reasons, can also affect the ability of First Nations Peoples to practice their cultural obligations, foster knowledge systems, and maintain connection to particular elements of country.<br>Table 10-1 summarises potential impacts and risks to environment receptors that are linked to cultural features. These impacts and risks are mostly limited to localised and short-term impacts (Level 1 or 2 consequences), with no impacts at the population level. The introduction, establishment and spread of IMS and accidental hydrocarbon release carries a risk of up to Moderate severity for some environmental receptors that are also cultural features, including culturally significant species and places (Deen Maar).<br>Section 10.3.2.3 to 10.3.2.5 considers the level of impact and risk to environment receptors that are also, or that are linked to, cultural features and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| **Ecosystems and species** | | | |
| Culturally significant species | Food resources (current and historical):<br>• Fish, sharks, rays, eels (Kooyang), shellfish, crustaceans, whales, seals, Seabirds - collection from coastal and riverine environments.<br>• Plankton (basis of the food chain that provides for culturally significant species)<br><br>Connection to ancestors: | • Multiple Aspects | Food resources:<br>The potential change to food resources can occur when the resource is depleted (such as a reduction in population of a species) or displaced. The ability for First Nations people to continue to collect marine species (as a food resource) has the potential to change if impacts and risks to the resource species results in a reduction in population or change movements and distribution that lowers their occurrence within Sea Country of a group of First Nations Peoples.<br>Connection to Ancestors<br>Impacts to culturally significant species at a population level has the potential to erode the ability for First Nations people ability to care for culturally significant species, and to continue cultural practices that involve those species.<br>Table 10-2 summarises potential impacts and risks to environment receptors, that include culturally significant species linked to resources, and those linked to ancestors. The levels of impact are mostly limited to localised and short-term impacts (Level 1 or 2 consequences), with no impacts at the population level. The (unplanned) introduction, |

| First Nations people's heritage sites and values | Receptors relevant to the Activity | What Activity Aspects could interact with these receptors | Potential risk to intrinsic link to cultural features of the environment |
|---|---|---|---|
| | • Whales | | establishment and spread of IMS and accidental hydrocarbon release have a risk of up to Moderate severity (consequence Level 4 and 3 (respectively)).<br>Section 10.3.3 considers the level of impact and risk to environment receptors that are also, or that are linked to cultural features, and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| Key Ecological Feature - Bonney Coast Upwelling (productivity of) | • Bonney Upwelling (Key Ecological Feature) | • Multiple Aspects | In relation to the physical occurrence and characteristics of the Bonney Upwelling, Butler et al. (2004) identifies climate change as a possible influence on its strength or frequency, though was not of serious concern. The levels of impact are mostly limited to localised and short-term impacts to plankton (Level 1 or 2 consequences low or moderate inherent risk severity), with no impacts at the population level (Table 10-2).<br>Section 10.3.3.5 considers the level of impact and risk to environment receptors that are also, or that are linked to cultural features, and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| Water quality | • State and Cwth Waters, including the Commonwealth Marine Environment, and habitats and species therein. | • Multiple Aspects | Impacts to water quality from hydrocarbon exposure (Section 9.6), and discharges (Section 8.6 and 8.7) resulting in potential physical/tangible change to cultural heritage value of oceans and waterways.<br>Table 10-2 summarises potential impacts and risks to water quality are mostly limited to localised, short-term and recoverable impacts (Level 1 consequences or low inherent risk severity).<br>Section 10.3.3.6 considers the level of impact and risk to environment receptors that are also, or that are linked to, cultural features and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| Nearshore benthic habitats | • Seabed in State Waters, including the habitats and species therein. | • Accidental Hydrocarbon Release<br>• Introduction and establishment of IMS | Change to benthic habitats occurring at a widespread level, such as the introduction, establishment and spread of IMS (Section 9.4), has the potential to change the cultural heritage values of benthic ecosystems in coastal environment that provide habitat for culturally significant species, and resources for First Nations people.<br>Table 10-2 summarises potential impacts and risks to benthic habitats are mostly limited to localised and short-term impacts (Level 1 consequence). However the introduction, establishment and spread of IMS and accidental hydrocarbon release is a risk of up to Moderate severity.<br>Section 10.3.3.7 considers the level of impact and risk to environment receptors that are also, or that are linked to, cultural features and evaluates the potential for degradation of those cultural features, |

| First Nations people's heritage sites and values | Receptors relevant to the Activity | What Activity Aspects could interact with these receptors | Potential risk to intrinsic link to cultural features of the environment |
|---|---|---|---|
| | | | and to their value in relation to continuation of cultural practices.. |
| Intertidal communities and shorelines | • Victorian State waters and shorelines: Macroalgae, coastal saltmarsh, rocky and sandy shorelines. | • Accidental Hydrocarbon Release<br>• Introduction and establishment of IMS | Shoreline hydrocarbon exposure (Section 9.6) resulting in potential physical/tangible change to cultural heritage value of intertidal communities and shorelines.<br>Table 10-2 summarises potential impacts and risks to intertidal communities and shorelines are mostly limited to localised and short-term impacts (Level 1 consequence). However the introduction, establishment and spread of IMS and accidental hydrocarbon release is a risk of up to Moderate severity.<br>Section 10.3.3.7 considers the level of impact and risk to environment receptors that are also, or that are linked to, cultural features and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |
| Marine Park/ coastal reserves / wetlands | • Marengo Reef (State waters) | • Accidental Hydrocarbon Release | Hydrocarbon exposure (Section 9.6) resulting in potential physical/tangible change to cultural heritage value of Marine Parks, coastal reserves and wetland habitats that sustain culturally significant species.<br>Table 10-2 summarises potential impacts and risks to marine parks/coastal reserves/wetlands are mostly limited to localised and short-term impacts (Level 1 consequence). However the introduction, establishment and spread of IMS and accidental hydrocarbon release is a risk of up to Moderate severity.<br>Section 10.3.3.8 considers the level of impact and risk to environment receptors that are also, or that are linked to, cultural features and evaluates the potential for degradation of those cultural features, and to their value in relation to continuation of cultural practices. |

## 10.2 Project Aspect Potential Interactions with Cultural Heritage Values and Sensitivities

Offshore development within or adjacent to Sea Country has the potential to impact cultural features of the environment. Table 10-1 above identifies the potential interactions between the particular aspects of this project and relevant Cultural Features of the environment identified through consultation for this or comparable activities in the region, review of Country Plans, on Country Training, listening, and desktop research. Within Table 10-1, for each interaction the level of impact or risk is identified for the environment component that is intrinsically linked to, is part of, or is also a cultural feature.

The evaluation for each relevant environment component is detailed within Sections 8 and 9; the predicted impacts to these components are low-level, localised and / or generally short-term. There are risk events associated with the activity; consequences of these risk events could be more extensive, and longer term. The most severe risk events being a major loss of hydrocarbon containment, and establishment and spread of IMS; these events are Unlikely, or Remote, and there are established effective measures in place to prevent their occurrence.

Considering the level of impact or risk from activity aspects assists determining the spatial and temporal extent of the potential disturbance to, or degradation of, the associated cultural feature.

For further details on the intrinsic links between cultural features of the environment and First Nations people's heritage site and values refer to Section 6.8.3.

*Table 10-2: Identification of potential interactions between East Coast Project Aspects and First Nations cultural values*

| Cultural feature of the environment relating to First Nations People's heritage sites and values | Environmental receptor where the cultural feature may exist | Project planned and unplanned aspects: Emissions – light | Emissions – atmospheric | Interaction with Marine Fauna | Seabed disturbance | Planned Discharges - Drilling | GHG Emissions | Underwater sound emissions - Continuous | Underwater sound emissions - Impulsive | Planned Discharges – Operational | Loss of materials or waste overboard | Minor LOC | Accidental Release MDO | Accidental release - LOWC | Introduction, establishment and spread of IMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tangible Heritage Sites** | | | | | | | | | | | | | | | |
| **Known coastal/ island places and objects** | Heritage places:<br>• Victorian coastline<br>• The Convincing Ground<br>• Deen Maar<br>• Discovery Bay Coastal Park<br>• Wilsons Promontory<br>• Tyrendarra lava flow | | | | | | | | | | | | ✓<br>Moderate inherent risk severity to shoreline habitats<br>Section 9.5.5 | ✓<br>Moderate inherent risk severity to shoreline habitat 9.6.5 | |
| **Known submerged sites** | • Benthic habitats | | | | ✓<br>Consequence Level 2 –<br>localised and short-term impacts to benthic habitats and<br>Low inherent risk severity to cultural heritage<br>Section 8.8.1 | ✓<br>Consequence Level 2 –<br>localised and short-term impacts to benthic habitats<br>Section 8.6.4 | | | | | ✓<br>Low inherent risk severity to cultural heritage and benthic habitats<br>Section 9.1.4 | | ✓<br>Moderate inherent risk severity to benthic habitats<br>Section 9.5.5 | ✓<br>Moderate inherent risk severity to benthic habitats<br>Section 9.6.5 | ✓<br>Moderate inherent risk severity from IMS<br>Section 9.4.4 |
| **Intangible Cultural Heritage** | | | | | | | | | | | | | | | |
| **Sea Country** | • All physical and ecological receptors<br>• (Section 6.4 and 6.5) | ✓<br>Consequence Level 1 - temporary and localised change in marine fauna behaviour<br>Section 8.3.4 | ✓<br>Consequence Level 1 – temporary and localised change in air quality<br>Section 8.4.4 | ✓<br>Low inherent risk severity to marine fauna<br>Section 9.3.4 | ✓<br>Consequence Level 2 –<br>localised and short-term impacts to benthic habitats<br>Section 8.8.1 | ✓<br>Consequence Level 1 – localised and temporary change to water and sediment quality<br>Section 8.6.4 | ✓<br>Consequence Level 1 – minor contribution to the carbon budget<br>Section 8.5.4 | ✓<br>Consequence Level 2 –<br>localised and short-term impacts to cetaceans and Moderate inherent risk severity<br>Section 8.2.5 | ✓<br>Consequence Level 2 – localised and short-term impacts to cetaceans and Low inherent risk severity<br>Section 8.1.5 | ✓<br>Consequence Level 1 – localised and temporary change to water and sediment quality<br>Section 8.7.4 | ✓<br>Low inherent risk severity to benthic habitats<br>Section 9.1.4 | ✓<br>Low inherent risk severity to water quality<br>Section 9.2.4.1 | ✓<br>Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans<br>Section 9.5.5 | ✓<br>Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans<br>Section 9.6.5 | ✓<br>Moderate inherent risk severity from IMS<br>Section 9.4.4 |
| **Creation/ dreaming sites, Songlines, sacred sites and Ancestral beings** | • Culturally significant species<br>• The Convincing Ground<br>• Deen Maar | | | ✓<br>Low inherent risk severity to marine fauna<br>Section 9.3.4 | ✓<br>Consequence Level 2 –<br>localised and short-term impacts to benthic habitats<br>Section 8.8.1 | ✓<br>Consequence Level 1 – localised and temporary change to water and sediment quality | ✓<br>Consequence Level 1 – minor contribution to the carbon budget<br>Section 8.5.4 | ✓<br>Consequence Level 2 localised and short-term impacts to cetaceans and Moderate inherent risk severity<br>Section 8.2.5 | ✓<br>Consequence Level 2 – localised and short-term impacts to cetaceans and Low inherent risk severity<br>Section 8.1.5 | ✓<br>Consequence Level 1 – localised and temporary change to water and sediment quality<br>Section 8.7.4 | ✓<br>Low inherent risk to benthic habitats<br>Section 9.1.4 | ✓<br>Low inherent risk severity to water quality<br>Section 9.2.4.1 | ✓<br>Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans<br>Section 9.5.5 | ✓<br>Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans<br>Section 9.6.5 | ✓<br>Moderate inherent risk severity from IMS<br>Section 9.4.4 |

| Cultural feature of the environment relating to First Nations People's heritage sites and values | Environmental receptor where the cultural feature may exist | Project planned and unplanned aspects: Emissions – light | Emissions – atmospheric | Interaction with Marine Fauna | Seabed disturbance | Planned Discharges - Drilling | GHG Emissions | Underwater sound emissions - Continuous | Underwater sound emissions - Impulsive | Planned Discharges – Operational | Loss of materials or waste overboard | Minor LOC | Accidental Release MDO | Accidental release - LOWC | Introduction, establishment and spread of IMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cultural obligations to care for Country** | • All physical and ecological receptors<br>• (Section 6.4 and 6.5) | ✓ Consequence Level 1 - temporary and localised change in marine fauna behaviour Section 8.3.4 | ✓ Consequence Level 1 - temporary and localised change in air quality Section 8.4.4 | ✓ Low inherent risk severity to marine fauna Section 9.3.4 | ✓ Consequence Level 2 – localised and short-term impacts to benthic habitats Section 8.8.1 | ✓ Consequence Level 1 – localised and temporary change to water and sediment quality Section 8.6.4 | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | ✓ Consequence Level 2 localised and short-term impacts to cetaceans and Moderate inherent risk severity Section 8.2.5 | ✓ Consequence Level 2 – localised and short-term impacts to cetaceans and Low inherent risk severity Section 8.1.5 | ✓ Consequence Level 1 – localised and temporary change to water and sediment quality Section 8.7.4 | ✓ Low inherent risk to benthic habitats Section 9.1.4 | ✓ Low inherent risk severity to water quality Section 9.2.4.1 | ✓ Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans Section 9.5.5 | ✓ Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans Section 9.6.5 | ✓ Moderate inherent risk severity from IMS Section 9.4.4 |
| **Knowledge systems** | • Culturally significant species<br>• The Convincing Ground<br>• Deen Maar<br>• Discovery Bay Coastal Park<br>• Wilsons Promontory<br>• Tyrendarra lava flow. | | | ✓ Low inherent risk severity to marine fauna Section 9.3.4 | ✓ Consequence Level 2 – localised and short-term impacts to benthic habitats Section 8.8.1 | ✓ Consequence Level 1 – localised and temporary change to water and sediment quality Section 8.6.4 | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | ✓ Consequence Level 2 localised and short-term impacts to cetaceans and Moderate inherent risk severity Section 8.2.5 | ✓ Consequence Level 2 – localised and short-term impacts to cetaceans and Low inherent risk severity Section 8.1.5 | ✓ Consequence Level 1 – localised and temporary change to water and sediment quality Section 8.7.4 | ✓ Low inherent risk to benthic habitats Section 9.1.4 | ✓ Low inherent risk severity to water quality Section 9.2.4.1 | ✓ Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans Section 9.5.5 | ✓ Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans Section 9.6.5 | ✓ Moderate inherent risk severity from IMS Section 9.4.4 |
| **Connection to Country** | • All physical and ecological receptors<br>• (Section 6.4 and 6.5) | ✓ Consequence Level 1 - temporary and localised change in marine fauna behaviour Section 8.3.4 | ✓ Consequence Level 1 - temporary and localised change in air quality Section 8.4.4 | ✓ Low inherent risk severity to marine fauna Section 9.3.4 | ✓ Consequence Level 2 – localised and short-term impacts to benthic habitats Section 8.8.1 | ✓ Consequence Level 1 – localised and temporary change to water and sediment quality Section 8.6.4 | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | ✓ Consequence Level 2 localised and short-term impacts to cetaceans and Moderate inherent risk severity Section 8.2.5 | ✓ Consequence Level 2 – localised and short-term impacts to cetaceans and Low inherent risk severity Section 8.1.5 | ✓ Consequence Level 1 – localised and temporary change to water and sediment quality Section 8.7.4 | ✓ Low inherent risk to benthic habitats Section 9.1.4 | ✓ Low inherent risk severity to water quality Section 9.2.4.1 | ✓ Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans Section 9.5.5 | ✓ Moderate inherent risk to shoreline habitats, avifauna, pinnipeds and cetaceans Section 9.6.5 | ✓ Moderate inherent risk severity from IMS Section 9.4.4 |
| **Habitats and species** | | | | | | | | | | | | | | | |
| **Coastal reserves and wetlands** | | | | | | | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | | | | | | ✓ Moderate inherent risk severity to shoreline habitats Section 9.5.5 | ✓ Moderate inherent risk to shoreline habitat Section 9.6.5 | |
| **Culturally significant species and food resources:** | • Fish, sharks, rays, eels, shellfish and crustaceans | ✓ Consequence Level 1 - temporary and localised change in fish behaviour Section 8.3.4 | | | ✓ Moderate inherent risk severity to marine invertebrates and fish Section 8.8.1 | ✓ Low inherent risk severity to marine fauna Section 8.6.4 | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | ✓ Consequence Level 1 – minor impact on fish and Low inherent risk severity Section 8.2.5 | ✓ Consequence Level 1 – minor impact on fish and Low inherent risk severity Section 8.1.5 | ✓ Low inherent risk severity to marine fauna Section 8.7.4 | ✓ Low inherent risk severity to marine fauna Section 9.1.4 | | ✓ Low inherent risk severity to invertebrates, fish and sharks Section 9.5.5 | ✓ Moderate inherent risk severity to invertebrates, fish and sharks Section 9.6.5 | ✓ Moderate inherent risk severity from IMS Section 9.4.4 |

| Cultural feature of the environment relating to First Nations People's heritage sites and values | Environmental receptor where the cultural feature may exist | Project planned and unplanned aspects: Emissions – light | Emissions – atmospheric | Interaction with Marine Fauna | Seabed disturbance | Planned Discharges - Drilling | GHG Emissions | Underwater sound emissions - Continuous | Underwater sound emissions - Impulsive | Planned Discharges – Operational | Loss of materials or waste overboard | Minor LOC | Accidental Release MDO | Accidental release - LOWC | Introduction, establishment and spread of IMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Culturally significant species** | • Whales | | | ✓ Low inherent risk severity to marine fauna Section 9.3.4 | | ✓ Low inherent risk severity to marine fauna Section 8.6.4 | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | ✓ Consequence Level 2 – localised and short-term impacts to whales and Moderate inherent risk severity Section 8.2.5 | ✓ Consequence Level 2 – localised and short-term impacts to whales and Low inherent risk severity Section 8.1.5 | ✓ Low inherent risk severity to marine fauna Section 8.7.4 | ✓ Low inherent risk severity to marine fauna Section 9.1.4 | | ✓ Moderate inherent risk severity to cetaceans Section 9.5.5 | ✓ Moderate inherent risk severity to cetaceans Section 9.6.5 | |
| **Culturally significant species** | • Pinnipeds | | | ✓ Low inherent risk severity to marine fauna Section 9.3.4 | | ✓ Low inherent risk severity to marine fauna Section 8.6.4 | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | ✓ Consequence Level 1 – minor impact on pinnipeds and Low inherent risk severity Section 8.2.5 | | ✓ Low inherent risk severity to marine fauna Section 8.7.4 | ✓ Low inherent risk severity to marine fauna Section 9.1.4 | | ✓ Moderate inherent risk severity to pinnipeds Section 9.5.5 | ✓ Moderate inherent risk severity to pinnipeds Section 9.6.5 | ✓ Moderate inherent risk severity from IMS Section 9.4.4 |
| **Culturally significant species** | • Seabirds and shorebirds | ✓ Consequence Level 1 - temporary and localised change in avifauna behaviour Section 8.3.4 | | ✓ Low inherent risk severity to marine fauna Section 9.3.4 | | | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | | | | ✓ Low inherent risk severity to marine fauna Section 9.1.4 | | ✓ Moderate inherent risk severity to avifauna Section 9.5.5 | ✓ Moderate inherent risk severity to avifauna Section 9.6.5 | |
| **Key Ecological Feature** | • Bonney Coast Upwelling (productivity of) | | | | | ✓ Low inherent risk severity to plankton Section 8.6.4 | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | | | ✓ Low inherent risk severity to plankton Section 8.7.4 | | | ✓ Low inherent risk severity to plankton | ✓ Moderate inherent risk severity to plankton Section 9.6.5 | |
| **Water quality** | | | | | | ✓ Consequence Level 1 – localised and temporary change to water quality Section 8.6.4 | | | | ✓ Consequence Level 1 – localised and temporary change to water quality Section 8.7.4 | | ✓ Low inherent risk severity to water quality Section 9.2.4.1 | ✓ Low inherent risk severity to water quality Section 9.5.5 | ✓ Low inherent risk severity to water quality Section 9.6.5 | |
| **Nearshore benthic habitats** | • Benthic habitats | | | | ✓ Consequence Level 2 – localised and short-term impacts to benthic habitats Section 8.8.1 | ✓ Consequence Level 2 – localised and short-term impacts to benthic habitats Section 8.6.4 | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | | | | ✓ Low inherent risk severity to benthic habitats Section 9.1.4 | | ✓ Moderate inherent risk severity to benthic habitats Section 9.5.5 | ✓ Moderate inherent risk severity to benthic habitats Section 9.6.5 | ✓ Moderate inherent risk severity from IMS Section 9.4.4 |

| Cultural feature of the environment relating to First Nations People's heritage sites and values | Environmental receptor where the cultural feature may exist | Project planned and unplanned aspects | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Emissions – light | Emissions – atmospheric | Interaction with Marine Fauna | Seabed disturbance | Planned Discharges - Drilling | GHG Emissions | Underwater sound emissions - Continuous | Underwater sound emissions - Impulsive | Planned Discharges – Operational | Loss of materials or waste overboard | Minor LOC | Accidental Release MDO | Accidental release - LOWC | Introduction, establishment and spread of IMS |
| **Intertidal communities and shorelines** | • Mangroves, macroalgae, seagrass, coastal saltmarsh, rocky and sandy shorelines. | | | | | | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | | | | | | ✓ Moderate inherent risk severity to shoreline habitats Section 9.5.5 | ✓ Moderate inherent risk severity to shoreline habitat Section 9.6.5 | ✓ Moderate inherent risk severity from IMS Section 9.4.4 |
| **Marine Park, coastal reserve, and wetlands** | • Wilsons Promontory, Ninety Mile Beach, Marengo Reef | | | | | | ✓ Consequence Level 1 – minor contribution to the carbon budget Section 8.5.4 | | | | | | ✓ Moderate inherent risk severity to marine parks Section 9.5.5 | ✓ Moderate inherent risk severity to marine parks Section 9.6.5 | ✓ Moderate inherent risk severity from IMS Section 9.4.4 |

## 10.3 Evaluation

This section evaluates the potential disruption to the links between environment receptors and cultural features described in Section 10.1 and 10.2. In doing so, this section considers the nature and scale of the planned activities and impacts and risks to relevant environment receptors outlined in Table 10-1.

### 10.3.1 Tangible and Heritage Sites

#### *10.3.1.1 Known Coastal/Island Objects and Places*

Cultural heritage objects that may be found along the coast and islands within the monitoring area include shell middens, artefact scatters, and LDADs (the occurrence of stone artefacts at low densities) (Table 10-1). Shell middens and artefact scatters may be located close to the shoreline, whereas LDADs are typically found further inland (Biosis, 2023).

Cultural heritage places located within the monitoring area that are significantly mentioned within relevant Country Plans include:

- The Convincing Ground
- Deen Maar
- Discovery Bay Coastal Park
- Wilsons Promontory
- Tyrendarra lava flow.

**Potential disruption to Cultural Features**

Cultural heritage objects and places have the potential to be exposed to shoreline hydrocarbons in an unlikely accidental hydrocarbon release event. Hydrocarbon exposure of cultural heritage objects and places has the potential to disturb the intrinsic link between First Nations people values associated with cultural heritage objects and places.

Figure 6-1 shows stochastic modelling predicting shorelines with the potential to be exposed to shoreline hydrocarbon. Shoreline accumulation will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA, 1995). As a result, only known coastal/island objects and places along the high tide mark have the potential to be exposure exposed to shoreline hydrocarbons. Cultural heritage objects and places located above the high tide mark are not expected to be exposed, and therefore, not expected to be impacted by shoreline hydrocarbons. Cultural heritage objects and places located below to low tide mark may have some limited exposure to hydrocarbons entrained in the water column.

The exposure of cultural heritage objects and places from shoreline hydrocarbons at the high tide mark may occur. Deen Maar Island, being a place linked to the transition of spirits from the earth, could be exposed to hydrocarbons around its rocky shores. Deen Maar Island is not typically accessed, but is a constant visual and spiritual link for First Nations peoples on the Mainland; its cultural value in this respect would be unlikely to be disrupted by a spill of hydrocarbons of the nature and scale provided for within this plan. The topography of Deen Maar Island, and exposure to the ocean, provides a natural resilience against hydrocarbon spills; rocky shores lead into steep cliffs to the vegetated plateau high above the water. Due to the exposed location of Deen Maar Island, the highly volatile nature of the hydrocarbons associated with this activity (light non-persistent), in the unlikely event of hydrocarbons being release which then accumulate on shorelines in the region, and potentially around cultural heritage objects and places, are likely to be readily removed in the presence of tidal and/or wave action. Beaches and rocky shores on the mainland, facing Deen Maar Island, and which may hold a place in ceremony and knowledge transfer also have the potential to be exposed to hydrocarbons, though modelling indicates that these areas (~50 km from the operational area) may have the potential to be exposed to only Low concentrations of hydrocarbons; these levels of (light) hydrocarbons do not typically require intervention and are naturally dispersed over days and weeks. The potential exposure risk at Discovery Bay, Wilsons Promontory and Tyrendarra lava flow are the same or less than the coast facing Dean Maar Island.

The heritage value of cultural heritage objects and places temporarily exposed to shoreline hydrocarbons is not expected to change. The temporary exposure of cultural heritage objects and places to shoreline hydrocarbons may temporarily contaminate the objects or sites however, weathering of light non-persistent hydrocarbons will prevent long-term hydrocarbon exposure. This could disrupt cultural linkages to exposed components of the environment; this disruption would be temporary and recoverable. The risk severity is considered to be the same for the cultural feature as for the environment receptors that are the cultural feature, or form part of the cultural feature (Moderate).

Consultation with First Nations groups indicates that First Nations People would like to be engaged in the event of a spill, to be part of the recovery efforts (Consultation Day GMTOAC 17 February 2024, Ref: FN-GMTOAC-20240405-Email). The involvement of First Nations People would be expected to accelerate recovery of Country and avoid additional disruption to cultural heritage from response efforts.

Relevant First Nations groups will be engaged in the event an accidental hydrocarbon release will expose cultural heritage objects and places to hydrocarbons as specified in Section 10.3.1. Cooper Energy maintains a list of key First Nations persons who have expressed an interest in playing a key role in the protection of cultural heritage during such emergency events.

The intrinsic link between known coastal/island objects and associated Cultural Features is expected to be maintained given values of the objects and places is not expected to change and First Nations people will be central to the management of these objects and places in the event of an accidental hydrocarbon release.

#### *10.3.1.2 Known submerged sites*

Sea Country is considered to extend beyond formally defined RAP areas to include sea and submerged lands to the edge of the continental shelf. Planned activities and aspects with the potential to interact with the seabed are limited to within the operational area. Unplanned events and aspects that could affect known submerged sites are accidental release of hydrocarbons.

**Potential disruption to Cultural Features**

Known submerged sites have the potential to be impacted by the East Coast Project aspects that disturb the seabed. Disturbance to seabed within the operational area is expected to be localised and recoverable (Table 10-2). The area of impact is small compared to the extent and distribution of the substrate types within the operational area across the wider region (Sections 8 and 9). No underwater cultural heritage sites, including other cultural artefacts, have been identified within the operational area (Section 10.1).

Given the operational area, and associated seabed disturbance is located away (>50 km) from described landscape features of particular cultural significance (Tyrendarra Lava Flow), the expected absence of artifacts, and that disturbance to cultural heritage (if it were unexpectedly found) is regulated to avoid damage (CM9: Cooper Energy Cultural Heritage Disturbance Risk Management Measures), the intrinsic link to between known submerged sites and First Nations people is expected to be maintained.

An accidental release of hydrocarbons has the potential to impact on known submerged sites, via contact with hydrocarbons entrained within the water column. However, given the limited volumes, and low persistence of the hydrocarbons associated with this activity, any hydrocarbon contact would be brief and would not be expected to change the nature or integrity of submerged features.

The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Moderate).

### 10.3.2 Intangible Heritage Sites and Values

#### *10.3.2.1 Sea Country*

Sea Country is an intrinsic value to First Nations people. Sea Country may include parts of open ocean, beaches, land and freshwater on the coast, habitats and may encompass all living things, beliefs, values, creation spirits and cultural obligations connected to an area. The operational area

and monitoring area overlaps Sea Country as described by First Nations Groups respective Country Plans. Many coastal First Nations groups have a close connection with the sea and its resources which are central to culture, economy and survival of First Nations people. Caring for Sea Country is culturally significant to coastal First Nations groups of the Otway region. It is a place of abundant resources and habitat to culturally significant flora and fauna. First Nations people's wellbeing and confidence is reliant on the authority to access and practice on Country (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023; Eastern Maar Aboriginal Corporation, 2014).

**Potential disruption to Cultural Features**

Project impacts and risks to the biological and physical components of sea country are described in Sections 8 and 9. First Nations cultural heritage values associated with Sea Country including ecosystems and species are considered based on their ecological values, food sources or culturally significant totemic values. First Nations people's values of marine ecosystems and species has the potential to change if there are impacts to ecosystem functioning and integrity or species population.

As summarised in Table 10-2, potential impacts and risks to fish, marine mammals and seabirds and shorebirds, and water and sediment quality are mostly limited to localised and short-term impacts (Level 1 or 2 consequences), with no impacts at the population level, or which would manifest in disruption to a cultural feature. As an existing activity with limited nature and scale, potential disruption to Sea Country values is expected to be negligible; energy infrastructure has previously been installed on the seabed as well as onshore, and continues to coexist with first Nations Peoples values, memories and Songlines relating to Country (AMCI, 2010; Biosis, 2023).

The introduction, establishment and spread of IMS and accidental hydrocarbon release are a risk of up to Moderate severity, and could affect marine resources, including resources collected by First Nations peoples in coastal areas. With preventative and response controls in place, impacts and risks from these aspects are not expected eventuate, nor to result in widespread long-term impacts to Sea Country or impacts to ecosystem functioning and integrity or species populations. Links between environment receptors and cultural features could be disrupted in the unlikely event of a major hydrocarbon spill, or remote event of IMS introduction and spread, but are expected to be recoverable. The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Moderate).

#### *10.3.2.2 Creation/ Dreaming sites, Songlines, Sacred Sites and Ancestral Beings*

Creation/ Dreaming sites, Songlines, ceremonial sites link First Nations people to ancestors, culture, and Country. The Convincing Ground remains a place of ceremony for the Gunditjmara who gather at the site annually to reflect on the ongoing impacts of colonisation on their people (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023). Deen Maar is an important Dreaming site where Ancestors leave the earth. Karntubul (whales) are Ancestors of Gunditjmara and feature in Dreaming stories, ceremony, song and dance of Gunditjmara.

**Potential disruption to Cultural Features**

Project impacts to seabed are limited to the operational area, offshore and are not associated with landscapes of particular cultural significance such as the Tyrendarra Lava Flow. Project risks events have the potential to affect cultural features highlighted as of importance during consultation, including the Deen Maar, and whales. These project risks therefore have the potential to disrupt of the intrinsic link between First Nations peoples and Creation/Dreaming, Songlines, sacred sites and Ancestral beings. Energy infrastructure has previously been installed on the seabed as well as onshore, and continues to coexist with first Nations peoples values, memories and Songlines relating to Country (AMCI 2010; Biosis, 2023).

Shoreline hydrocarbon exposure to Deen Maar and the Convincing Ground has the potential to change the cultural heritage values (Creation/ Dreaming sites, sacred sites and Ancestral beings) of these sites. As evaluated in Section 10.3.1 the (risk) temporary exposure of Deen Maar and the Convincing Ground to shoreline hydrocarbons is not expected to change the heritage values of the sites. The temporary exposure to shoreline hydrocarbons may temporarily contaminate the sites however, weathering of light non-persistent hydrocarbons will prevent long-term hydrocarbon contamination. Relevant First Nations groups will be notified in the event an accidental hydrocarbon release will expose Deen Maar to hydrocarbons as specified in Section 9.5.6 and 9.6.6. The risk

severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Moderate).

Cooper Energy maintains a list of key First Nations persons who have expressed an interest in playing a key role in the protection of cultural heritage during such emergency events. The intrinsic links between First Nations people and cultural heritage values (Creation/ Dreaming sites, sacred sites and Ancestral beings) of Deen Maar and the Convincing Ground is expected to be maintained given First Nations people will be central to the management of these sites in the event of an accidental hydrocarbon release.

As summarised in Table 10-2, potential impacts to whales from Project aspects are mostly limited to localised and short-term impacts (Level 1 or 2 consequences), such as small, temporary changes to migratory or foraging behaviours (see Section 8.2.5), and which be managed to minimise behavioural disturbance to southern right whales and blue whales. The risk of vessels physically interacting with whales is Low and managed through the implementation of cautionary and no-approach zones around whales. These risks, though unlikely, if they were to eventuate, are not anticipated to impact population levels, distribution or local ecosystem function. With controls in place, impacts and risks to whales from Project aspects are not expected to impact the intrinsic link between First Nations people and whales that are valued as Ancestral beings, and will not affect populations or distributions of whales to the extent that Gunditjmara practice of 'calling in' whales would be disrupted. As such, the intrinsic links between First Nations people and Ancestral beings (whales) is expected to be maintained. The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Moderate).

Cooper Energy has established CM13: Ongoing Engagement to ensure First Nations people will be central to the management of First Nations people's heritage sites and values.

#### *10.3.2.3 Cultural Obligations to Care for Country*

First Nations people may be culturally obligated and inherently responsible to care, protect and heal Country for present and future generations. The roles held relating to taking care of Country and knowledge holding vary amongst individuals and within clans and family groups. Roles include taking care of culturally significant species or habitats of significant species known to be important food resources (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023). The obligation to care for Country is deep rooted in First Nations cultural laws and customs (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023). Caring for Country emphasises the protection and management of land, waters and plants and animals that reside in these areas and ensures they are preserved for future generations (Gunaikurnai Land and Waters Aboriginal Corporation, 2015).

**Potential disruption to Cultural Features**

By sharing of information through consultation, Country Plans, and on Country teachings, First Nations people have articulated the particular values and sensitivities that are important, and which will require particular consideration within the assessment of impacts and risks and their management. This is consistent with their inherent responsibility to care for Country. As evaluated in Section 10.3.2.1, Project aspects are not expected to result in widespread long-term impacts to Sea Country or impacts to ecosystem functioning and integrity or species populations. Table 10-2 summarises how potential impacts and risks to marine fauna and water and cultural heritage are mostly limited to localised and short-term impacts (Level 1 or 2 consequences). As an existing activity with limited nature and scale, potential disruption to sea country values is expected to be negligible; energy infrastructure has previously been installed on the seabed as well as onshore, and continues to coexist with first Nations Peoples values, memories and Songlines relating to Country (AMCI, 2010; Biosis, 2023).

The unplanned introduction, establishment and spread of IMS and accidental hydrocarbon release has the potential for moderate risk to environment receptors. With controls in place, impacts and risks to Sea Country are not expected to impact ecosystem functioning and integrity or species populations.

The exclusion of First Nations people from accessing Country or decision-making processes for Country may risk disrupting the intrinsic link between First Nations people and obligations to care for

Country. Scenarios where First Nations people are restricted in their access to Country could occur in the event of an accidental hydrocarbon release for safety reasons. To maintain and ensure First Nations people are central to the management of the Country, relevant First Nations groups will be notified in the event an accidental hydrocarbon release as specified in Section 9.5.6 and 9.6.6. The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Moderate).

Cooper Energy maintains a list of key First Nations persons who have expressed an interest in playing a key role in the protection of cultural heritage during such emergency events. First Nations people and obligations to care for Country is expected to be maintained given First Nations people will be central to the management of these sites in the event of an accidental hydrocarbon release which could impact them.

Cooper Energy has established CM13: Ongoing Engagement, to ensure First Nations people will be central to the management of First Nations people's heritage sites and values.

#### *10.3.2.4 Knowledge Systems*

First Nations peoples ecological, spiritual, traditional and cultural knowledge may be passed from generation to generation using cultural practices (Dreaming stories, ceremony, song and dance) where knowledge holders (Elders) are the custodians of knowledge. This knowledge includes culturally significant species, and landscape features that hold Dreaming and creation stories or are events and ceremonial places critical for intergenerational knowledge sharing and cultural practice.

Receptors relevant to First Nations people knowledge systems include:

- Culturally significant species including food resources, cetaceans, pinnipeds, seabirds and the Bonney Upwelling (refer to Sections 10.3.3.1 and 10.3.3.5)
- Cultural heritage places including benthic habitats, The Convincing Ground, Deen Maar, Discovery Bay Coastal Park, Wilson Promontory, and Tyrendarra lava flow (refer to Section 10.3.1.1 and Section 10.3.2.2).

**Potential disruption to Cultural Features**

Impacts and risks resulting in the exclusion of access to cultural heritage places or displacement/reduction in the population of culturally significant species have the potential to disrupt the intrinsic links between environment receptors and knowledge systems. Project aspects are not expected to result in widespread long-term impacts to environment receptors (including those that are part of knowledge systems). Table 10-2 summarises how potential impacts and risks to environment receptors are mostly limited to localised and short-term impacts (Level 1 or 2 consequences). As an existing activity with limited nature and scale, potential disruption to knowledge systems is expected to be negligible; energy infrastructure has previously been installed on the seabed as well as onshore, and continues to coexist with first Nations peoples values, memories and Songlines relating to Country (AMCI, 2010; Biosis, 2023).

The unplanned introduction, establishment and spread of IMS and accidental hydrocarbon release have the potential for moderate risk to environment receptors. If access to heritage places is restricted, knowledge systems of that value can potentially be disrupted or lost.

The potential to exclude First Nations people from accessing Country may risk disrupting the intrinsic links between First Nations people and knowledge systems. Scenarios where First Nations people are restricted access to Country may occur in the event of an accidental hydrocarbon release for safety reasons. The temporary exposure of cultural heritage places to shoreline hydrocarbons may temporarily result in restricted access to cultural heritage places. Due to the highly volatile nature of the hydrocarbons (MDO and Condensate) as a light non-persistent hydrocarbon (see Section 9.5.5 and 9.6.5), shoreline hydrocarbons at cultural heritage places, are likely to be easily washed off in the presence of tidal and/or wave action. As a result, access restrictions (if any) would be temporary and not long-term. Relevant First Nations groups will be engaged in the event an accidental hydrocarbon release will expose cultural heritage places to hydrocarbons as specified in Section 9.5.6 and 9.6.6. The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Moderate).

Cooper Energy maintains a list of key First Nations contacts who have expressed an interest in the protection of cultural heritage during such emergency events. The intrinsic links between environment receptors and First Nations Peoples knowledge systems is expected to be maintained given First Nations people will be central to the management of these sites in the event of an accidental hydrocarbon release.

As summarised in Table 10-2, potential impacts and risks to culturally significant species such as fish, marine mammals and seabirds and shorebirds are mostly limited to localised and short-term impacts (Level 1 or 2 consequences). The introduction, establishment and spread of IMS and accidental hydrocarbon release have the potential for moderate risk. With controls in place, impacts and risks from these aspects are not expected to result in impacts to species populations. As such, intrinsic link between environment receptors and First Nations peoples is expected to be maintained.

Cooper Energy has established CM13: Ongoing Engagement, to ensure First Nations people will be central to the management of First Nations people's heritage sites and values.

#### *10.3.2.5 Connection to Country*

First Nations people may hold strong connections to the south-east marine region, as occupation of coastal areas dates back over at least 40,000 years (DoE, 2015a). The Victorian coast is of significance with respect to First Nations cultural heritage. This includes areas where there may be no physical evidence of past cultural activities but includes places of spiritual or ceremonial significance, places where traditional plant or mineral resources occur or trade and travel routes (Aboriginal Victoria, 2008).

**Potential disruption to Cultural Features**

Impacts and risks that restrict access to Sea Country have the potential to disrupt the intrinsic links First Nations peoples connection to Country.

As evaluated in Section 10.3.2.1, impacts and risks from the East Coast Project aspects are not expected to result in widespread long-term impacts to Sea Country or impacts to ecosystem functioning and integrity or species populations. Table 10-2 summarises how potential impacts and risks to marine fauna, water and sediment quality, and cultural heritage are mostly limited to localised and short-term impacts (Level 1 or 2 consequences). As an existing activity with limited nature and scale, potential disruption of Connections to Country is expected to be negligible; energy infrastructure has previously been installed on the seabed as well as onshore, and continues to coexist with first Nations Peoples values, memories and Songlines relating to Country (AMCI, 2010; Biosis, 2023).

The introduction, establishment and spread of IMS and accidental hydrocarbon release have the potential for moderate risk. With controls in place, impacts and risks to Sea Country are not expected to impact ecosystem functioning and integrity or species populations. As such, the intrinsic links between environment receptors and First Nations Peoples connection to Country is expected to be maintained.

As evaluated in Section 10.3.2.4, restriction of access to Country may occur in the event of an accidental hydrocarbon release for safety reasons. The presence of shoreline hydrocarbons may temporarily enforce restricted access to Country. Due to the highly volatile nature of the MDO and condensate as a light non-persistent hydrocarbon, shoreline hydrocarbons are likely to be easily washed off in the presence of tidal and/or wave action. As a result, if restricted access to Country is enacted, it is expected to be temporary and not long-term. Relevant First Nations groups will be notified in the event an accidental hydrocarbon release will expose cultural heritage places to hydrocarbons as specified in Section 9.5.6 and 9.6.6. The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Moderate).

Cooper Energy maintains a list of key First Nations persons who have expressed an interest in playing a key role in the protection of cultural heritage during such emergency events. The intrinsic links between environment receptors and First Nations Peoples connection to Country is expected to be maintained given First Nations people will be central to the management of these sites in the event of an accidental hydrocarbon release.

### 10.3.3 Habitats and Species

#### *10.3.3.1 Culturally Significant Species and Food Resources - Eels*

Culturally significant food resources occur in the Otway. Highlighted during consultation and cultural training were short-finned eels (Kooyang). Kooyang migrate through the Otway Region including State waters and the Commonwealth Marine Area to/from freshwater systems in Gunditjmara Country to/from spawning grounds in the Coral Sea. Gunditjmara engineered aquaculture systems from volcanic formations associated with the Tyrendarra Lava flow (circa. 30,000 years old) to create Budj Bim. Eels were captured, fattened up, harvested, smoked and traded.

**Potential disruption to Cultural Features**

Eels (see Section 6.5.5) are an important resource for First Nations people as identified during consultation and review of relevant First Nations group Country Plans (Table 6-25). First Nations groups and specific individuals within the groups may have responsibility to care for eels and their habitats to ensure associated cultural practices, and ventures such as cultural education tourism, can continue for future generations (Table 6-24). Koster et al. (2024), and Church et al. (2021), identify conservation considerations for the short-finned eel; these include potential changes to river flows from climate change, and physical/anthropogenic habitat modification, both of which have the potential to affect the migratory success of populations, and therefore, affect the cultural practices associated with the eels migration.

As summarised in Table 10-2, potential impacts to eels from East Coast Project aspects are limited to Level 1 consequences of localised and short-term impacts to behaviour of individuals, but no population level impacts. There are no habitat modifications caused by the activity which would be expected to have an impact on migration to or from freshwater systems where they are harvested. This is because of the limited nature and scale of impacts to environment receptors, generally limited to the operational area and planned activity EMBAs, and the offshore location of the activity, away from freshwater habitats where the species migrates from and to, via a highly dispersed migration through the South East Marine Region.

Subsea noise generated by activity vessels and equipment has the potential to cause minor behavioural reactions in fish, including eels (i.e. possible brief changes to swimming speed / direction in the vicinity of project activities), which will not result in changes to eel migratory behaviour or success. The sources of noise, and potential effects on fish and eel is described in more detail in Section 8.1.5 and 8.2.5. There is negligible risk that planned aspects of the activity may either directly or indirectly impact on eel populations or migratory outcomes. As an existing activity with limited nature and scale, potential disruption to sea country values is expected to be negligible; energy infrastructure has previously been installed on the seabed as well as onshore, and continues to coexist with First Nations peoples values, memories and Songlines relating to Country (AMCI, 2010; Biosis, 2023).

The unplanned introduction, establishment and spread of IMS, and accidental hydrocarbon release from the activity carry moderate risk. With controls in place (described in Section 8 and 9), these unplanned events are not expected to occur, or result in long term impacts to species populations. As such, intrinsic links between environment receptors and First Nations peoples is expected to be maintained.

#### *10.3.3.2 Culturally Significant Species – Whales*

First Nations people around Australia have long had a strong connection to whales, which has significance as totemic ancestors to some groups. Karntubul (whales) in Sea Country hold deep cultural significance to the Gunditjmara and feature in Dreaming stories, ceremony, song and dance traditions.

Whales are culturally significant species for the First Nations peoples as identified during consultation and review of relevant First Nations group Country Plans (Table 6-25). First Nations people have a cultural responsibility to ensure cetaceans that reside within and migrate through Sea Country are cared for and healthy and their habitat is sustained. Whales feature in Dreaming stories, ceremony, song and dance of some First Nations groups along the coasts of Australia. The protection of Karntubul (whale) species is paramount to Gunditjmara spiritual, physical wellbeing and

it is the responsibility of Gunditjmara people to care for Sea Country and protect the species for present and future generations. Whales are also a source of food, and Gunditjmara people still gather resources from beached whales which has been done for thousands of years (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023).

EPBC threatened and migratory cetaceans are present within the operational area and monitoring area during seasonal migrations. Pygmy blue whale distribution and foraging BIAs and a southern right whale migration BIA overlaps the operational area. The monitoring area intersects foraging and distribution BIAs for the pygmy blue whale, migration and reproduction BIAs for the southern right whale and foraging BIAs for the humpback whale.

**Potential disruption to Cultural Features**

First Nations groups and specific individuals within the groups may have kinship and/or responsibility to care for culturally significant species and their habitats (see Table 6-25). It is considered that impacts to species at a population level may inhibit First Nations people's ability to perform their obligations to care for culturally significant species and their habitats.

There is potential that individual whales could be behaviourally affected or physically impacted by the presence/movement and noise of vessels which may occasionally be required for inspection and maintenance of the subsea facilities. Control measures have been established to minimise the risk of physical impact and behavioural disturbance. Therefore, the potential that overall whale occurrence nearby the coast, or the numbers of beached whales will be influenced by the activity is considered negligible.

As summarised in Table 10-2, potential impacts to cetaceans from the East Coast Project aspects are limited to Level 2 consequences of localised and short-term impacts to behaviour of individuals, but no population level impacts; these consequences are considered to be unlikely to occur, and the risk to whales is considered to be Low. The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Low). This is considered appropriate as cultural practices incorporate the movement of populations of whales into the region. Whilst there may be low level impacts to individuals, these impacts are not expected to result in changes to whale migratory outcomes, impact population levels or change population distributions.

An accidental hydrocarbon release carries moderate risks. With controls in place (described in Section 8 and 9), impacts and risks from these aspects are not expected occur, or to result in impacts to species populations. As such, intrinsic links between environment receptors and First Nations Peoples is expected to be maintained.

#### *10.3.3.3 Culturally Significant Species – Pinnipeds*

Pinnipeds such as seals and sealions may be of significant value to First Nations people. The First Nations people of the Otway region have a profound relationship with Sea Country and seals feature in cultural practices and Dreaming stories and have been hunted as a valuable food resource. Koorn Moorn (seals) feature in song and dance of the Gunditjmara people and are also a food resource. There is evidence of the collection of seals within the Tarragal cave site that date back to 10,000 years (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023).

Important colonies and breeding habitats are found within the monitoring area and are in within proximity of the operational area (Figure 6-53 and Figure 6-54).

**Potential disruption to Cultural Features**

First Nations groups and specific individuals within the groups may have kinship and/or responsibility to care for culturally significant species and their habitats (see Table 6-25). It is considered that impacts to species at a population level may inhibit First Nations people's ability to perform their obligations to care for culturally significant species and their habitats. If responsibilities have not been met it may reinforce a sense of powerlessness to members of First Nation groups responsible for the protection and care of these species (Holcombe, 2022).

As summarised in Table 10-2, potential impacts to pinnipeds from Project aspects are limited to Level 1 consequences of minor and local to behaviour and possible temporary changes to habitat in

the offshore environment, within or local to the operational area, and not within coastal environments where fauna are more likely to be encountered by people; no discernible disruption to cultural links would be expected. the risk severity is considered to be the same for the cultural feature as for the environment receptors that are the cultural feature, or form part of the cultural feature (Low).

Accidental hydrocarbon releases have the potential for moderate risk wider afield, including in coastal areas. As described in Section 9.5.5 and 9.6.5, hydrocarbon exposure, of the potential nature and scale associated with project risks, would not be expected to result in changes to pinniped foraging and breeding behaviours or impact population levels. With controls in place (described in Section 8 and 9), unplanned events of this nature are not expected to occur, or result in long term impacts to species populations. As such, intrinsic link between environment receptors and First Nations Peoples is expected to be maintained.

#### *10.3.3.4 Culturally Significant Species – Seabirds and Shorebirds*

Seabirds and shorebirds may play a vital role in some First Nations cultural stories and traditions and birds and eggs are a source of food to many First Nations groups. Different avian species hold deep connections to lore and represent spiritual emblems or totems. The arrival of migratory seabirds and shorebirds and breeding seasons of seabirds and shorebirds are important markers for the different seasons observed by First Nations groups (Eastern Maar Aboriginal Corporation, 2014). Magpie gees and Cape Barren geese were harvested for food from wetland habitats Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023). For the Gunaikurnai people of Gippsland, seabirds play a role in their cultural stories and traditions. One notable story involves Borun, the pelican, who is a significant figure in their creation story. Borun is considered the ancestor of the Gunaikurnai people, highlighting the importance of sea birds in their cultural heritage (Gunaikurnai Land and Waters Aboriginal Corporation, 2015).

Seabirds and shorebirds are of significant value to some First Nations people. Foraging BIAs for nine seabird species overlap the operational area. Breeding, migration and aggregation areas can be found within the monitoring area (BIAs are displayed in Figure 6-33 to Figure 6-40).

**Potential disruption to Cultural Features**

First Nations groups and specific individuals within the groups may have kinship and/or responsibility to care for culturally significant species and their habitats (see Table 6-25). It is considered that impacts to species at a population level may inhibit First Nations people's ability to perform their obligations to care for culturally significant species and their habitats. If responsibilities have not been met it may reinforce a sense of powerlessness to members of First Nation groups responsible for the protection and care of these species (Holcombe, 2022).

As summarised in Table 10-1, potential impacts could result from temporary changes to the physical environment, such as via the introduction of a source of artificial light. As described in Section 8.3.4, impacts from planned aspects such as light, are limited to Level 1 consequences of minor and local to behaviour, not resulting in population level impacts, or which change migratory outcomes, and which could then affect cultural practices and seasonal markers that are linked to the presence of birds. Accidental hydrocarbon release is considered a Low risk for seabirds. The risk severity is considered to be the same for the cultural feature as for the environment receptors that are the cultural feature, or form part of the cultural feature (Moderate). With controls in place, these impacts and risks from these aspects are not expected to impact culturally significant species at a population level, as such, the intrinsic link between environment receptors and First Nations Peoples cultural heritage values is expected to be maintained.

The unplanned introduction, establishment and spread of IMS, and accidental hydrocarbon release from the activity carry moderate risk. With controls in place (described in Section 8 and 9), these unplanned events are not expected to occur, or result in long term impacts to species populations. As such, intrinsic links between environment receptors and First Nations Peoples is expected to be maintained.

#### *10.3.3.5 Key Ecological Feature –Upwellings*

Some First Nations peoples recognise the significance of upwelling systems and the crucial role the Bonney Upwelling plays in the ecosystems of the Otway region. Plankton supports many culturally

significance species and is integral to the diets of species such as whales, seals, fish and seabirds. The Gunditj Mirring people recognise the significance of the Bonney Upwelling as a dominant feature in the Otway marine region which brings cool nutrient rich water to the surface which supports plankton production.

The Gunaikurnai people of Gippsland recognise that plankton is essential for maintaining the health of their coastal waters and serves as a primary food source for many marine species, which are important for Gunaikurnai traditional fishing practices and Gunaikurnai cultural heritage (Gunaikurnai Land and Waters Aboriginal Corporation, 2015). In this region the Upwelling East of Eden is a key ecological feature; it is a system if irregular / episodic eddies and upwellings moving south from the coast of southern NSW, and sometimes into the Gippsland region.

Phytoplankton and zooplankton are widespread throughout oceanic environments and is expected to occur within the operational area and monitoring area with a high level of diversity. Coastal krill sometimes swarms throughout the water column of continental shelf waters of the Otway primarily in summer and autumn (linked to the Bonney Upwelling), feeding on microalgae and providing an important link in the blue whale food chain. This is not always the case, as the Bonney Upwelling varies in its strength and timing (Huang and Wang, 2019). In February and March 2025 MMOs and ROV crews on a vessel inspecting the CHN subsea facilities observed low-to-no krill, and low numbers of travelling blue whales (2) over ~3-week period sea in the Otway (MMO daily reports for Amplitude Energy, March 2025).

**Potential disruption to Cultural Features**

First Nations groups and specific individuals within the groups may have kinship and/or responsibility to care for culturally significant species and their habitats (see Table 6-25). Changes in the frequency or intensity of the Bonney Upwelling impacts the abundance of plankton which can have impacts on culturally significant species in the region such as whales, seals, fish and sea birds (Gunditj Mirring Traditional Owners Aboriginal Corporation, 2023).

In relation to the physical occurrence and characteristics of the Bonney Upwelling, Butler et al. (2004) identify climate change as a possible influence on its strength or frequency, though was not of serious concern. As summarised in Table 10-1, potential impacts to physical oceanographic processes are limited; the activity contributes minor quantities of GHG emissions to Australia's carbon budget (Level 1 Consequence); there are no aspects of the activity which may have a discernible effect on the occurrence, extent or productivity of the Bonney Upwelling. With regards the plankton that are associated with upwelling events, project aspects may have localised and temporary impacts to negligible proportions of the plankton population (Table 10-1). These impacts will not result in changes to plankton local or regional diversity or productivity of plankton, or those fauna which rely on them as a food source. Therefore the intrinsic links between these environment receptors and First Nations Peoples cultural heritage values associated with the Bonney Upwelling is expected to be maintained irrespective of the project activities.

#### *10.3.3.6 Water Quality*

Water is of particular cultural significance to First Nations Peoples as an integral part Country, songs, ceremonies, hunting and collecting, and other activities that bind people to their Country and each other. Aboriginal communities in Victoria maintain strong connections to waters and culture and may have knowledge of particular water sources. Water sources on Country may be culturally significant or archaeologically prospective. Water may be an intrinsic value to First Nations people and may include parts of Sea Country, beaches, land and freshwater habitats on the coast.

**Potential disruption to Cultural Features**

Planned discharges and unplanned releases have the potential to change water quality of offshore and coastal waters. The change in water quality has the potential to impact culturally significant species and harm Country. Community concerns from the Wadawurrung people on changes in water quality from pollution from industry and development has been noted (Wadawurrung Traditional Owners Aboriginal Corporation, 2020).

As summarised in Table 10-1, potential impacts to water quality from planned Project aspects are limited to Level 1 consequences of minor, temporary, and localised changes in the offshore

environment. It is inferred that this level of impact in the offshore environment, would not cause disruption to the linkage between the environment receptor and First Nations Peoples cultural practices. However, an accidental hydrocarbon release has the potential for more widespread reduction in water quality in Sea Country, and which could cause concern as to actual or perceived impacts to water quality. Relevant First Nations groups will be engaged in the event of an accidental hydrocarbon release as specified in Section 9.5.6 and 9.6.6. Cooper Energy maintains a list of key First Nations persons who have expressed an interest in playing a key role in the protection of cultural heritage during such emergency events. With controls in place, the risks from an accidental hydrocarbon release are not expected to result in widespread long-term impacts to Sea Country or impacts to ecosystem functioning and integrity, or species populations. The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Low). As such, intrinsic links to between First Nations people and cultural heritage values associated with water quality is expected not expected to be disrupted long term and would be recoverable.

#### *10.3.3.7 Benthic Habitats, Intertidal Communities and Shorelines*

Benthic habitats may be of cultural significance to First Nations people for their ecological values to sustain culturally significant species. Benthic habitats within the Otway and broader Bass Strait include sponge-dominated reef and sandy substrates. Within the operational area, 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. 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. However, these reefs are in deeper waters (60-80 m) (DoE, 2015a).

Intertidal reefs and sandy shorelines may be valued by First Nations people for their role in supporting culturally significant species. Intertidal communities and shorelines provide habitat and shelter to both marine and terrestrial fauna, including infauna and epifaunal invertebrates, fish and birds. Sea Country for Wadawurrung people includes coastal habitats such as seagrass and saltmarsh (Wadawurrung Traditional Owners Aboriginal Corporation, 2020). The operational area does not include an intertidal environment. Intertidal communities and shorelines include mangroves, macroalgae, seagrass, coastal saltmarsh, rocky and sandy shorelines.

**Potential disruption to Cultural Features**

Impacts to benthic habitats at a widespread level poses a potential risk to the intrinsic links between First Nations people and cultural heritage values of benthic habitats. Widespread changes have the potential to impact population levels of culturally significant species.

As evaluated in Section 10.3.1.2, change in benthic habitat in the operational area is expected to be localised, short-term and recoverable (Table 10-1). The area of impact is small compared to the extent and distribution of the benthic habitats identified within the operational area and wider region (Sections 8 and 9, Table 10-1). Landscape scale impacts (widespread) were also not expected given the limited seabed footprints involved (pers comm Heritage Victoria, 2024). It is noted that oil and gas infrastructure on benthic habitats currently exists and operates in First Nations people's Country, and that values, memories and Songlines relating to Country are acknowledged and recognised (Biosis, 2023). Given the change in benthic habitat from the East Coast Project aspects are localised, short-term and recoverable, the intrinsic link between First Nations people and cultural heritage values of benthic habitats is expected to be maintained.

As evaluated in Section 10.3.1.2, change in benthic habitat in the operational area is expected to be localised, short-term and recoverable (Table 10-1). The area of impact is small compared to the extent and distribution of the benthic habitats identified within the operational area and wider region (Sections 8 and 9, Table 10-1). Planned activity aspects will not impact on coastal benthic habitats; there would be no change to the level or diversity of resources available to First Nations People.

Changes to ecosystem functioning and integrity of intertidal communities and shorelines poses a potential risk to the intrinsic link between First Nations people and the cultural heritage values of intertidal communities and shorelines.

As summarised in Table 10-2, the introduction, establishment and spread of IMS and accidental hydrocarbon release has the potential for moderate inherent risk of either directly or indirectly impacting intertidal communities and shoreline habitats. With controls in place, impacts and risks from these aspects are not expected to result in widespread long-term impacts to intertidal communities and shorelines including ecosystem functioning and integrity. As such, the intrinsic link to between First Nations people and cultural heritage values of intertidal communities and shorelines is expected to be maintained.

Relevant First Nations groups will be engaged in the event of an accidental hydrocarbon release as specified in Section 9.6.5. Cooper Energy maintains a list of key First Nations persons who have expressed an interest in playing a key role in the protection of cultural heritage during and the recovery of Sea Country in such emergency events. With controls in place, the risks from an accidental hydrocarbon release are not expected to result in widespread long-term impacts to Sea Country or impacts to ecosystem functioning and integrity, or species populations. As such, the intrinsic links between environment receptors and First Nations Peoples cultural heritage values is expected not expected to be disrupted long term and would be recoverable.

Cooper Energy has established CM13: Ongoing Engagement, to ensure First Nations people will be central to the management of First Nations people's heritage sites and values.

#### *10.3.3.8 Marine Parks, Coastal Reserves, and wetlands*

Marine Parks, coastal reserves, and wetlands are protected areas which are managed the primary purpose of conserving the biodiversity found in them, while also allowing for sustainable use of natural resources. First Nations people may have strong cultural associations with Sea Country and have cultural responsibilities of Country within Marine Parks and Reserves. Some First Nations groups including the Gunaikurnai people have joint management over the Marine Parks and reserves within Country. The Marine Parks and reserves around Wilsons Promontory and Ninety Mile Beach National Park were inhabited Gunaikurnai ancestors and are important for the Gunaikurnai peoples connection to Country (Gunaikurnai Land and Waters Aboriginal Corporation, 2015). The Marengo Reef Marine Park holds cultural significance for the Eastern Maar people and is a habitat for culturally significant marine species (Eastern Maar Aboriginal Corporation, 2014).

**Potential disruption to Cultural Features**

Changes to ecosystem functioning and integrity of Marine Parks, coastal reserves and wetlands poses a potential risk to the intrinsic links between First Nations people and the cultural heritage values of these places.

There is no overlap between the operational area and Marine Parks, Coastal Reserves and wetlands of International and National Importance, therefore, there is no risk to the intrinsic links between First Nations people and cultural heritage values associated with Marine Parks, coastal reserves, and wetlands for planned East Coast Project aspects.

As summarised in Table 10-1, the introduction, establishment and spread of IMS and accidental hydrocarbon release has the potential for moderate inherent risk of either directly or indirectly impacting Marine Park, coastal reserves, and wetlands.

The Marengo Reef Marine Park comprised of rocky substrate overlaps with the monitoring area; at >50 km from the operational area the Marine Park has the potential to be exposed to only low levels of hydrocarbons, below the threshold for ecological impacts. Relevant First Nations groups will be engaged in the event of an accidental hydrocarbon release as specified in Section 9.6.6. The risk severity is considered to be the same for the Cultural Feature as for the Environment Receptors that are the cultural feature, or form part of the cultural feature (Moderate).

Cooper Energy maintains a list of key First Nations persons who have expressed an interest in playing a role in the protection of cultural heritage during and the recovery of Sea Country in such emergency events. With controls in place to prevent and mitigate impacts if they were to occur, aspects are not expected to result in widespread long-term impacts to Marine Parks, Coastal Reserves, or to wetlands, when considering ecosystem functioning and integrity. As such, the intrinsic link between environment receptors and First Nations Peoples cultural heritage values is not expected to be disrupted long term and would be recoverable.

## 10.4 Demonstration of Acceptability

To demonstrate that the East Coast Project can be undertaken in such a way that the environmental impacts and risks will be managed to an acceptable level, Cooper Energy has evaluated all impacts and risks against the criteria described in Section 7.3. Predicted levels of environmental impact or risk have been compared to acceptable levels of impact defined in Table 7-6, and EPOs have been assigned to establish a level of environmental performance which enables management response to prevent the acceptable level of impact from being exceeded.

The demonstration of acceptability is presented in Table 10-3.

*Table 10-3: Interaction with First Nations Cultural Heritage Acceptability Assessment*

| Acceptability Criteria | Demonstration of Acceptability | |
|---|---|---|
| **Cooper Energy Risk Management Protocol** | Risk: Known coastal/Island places and objects | Risk: Moderate |
| | Risk: Known submerged sites | Risk: Moderate |
| | Risk: Sea Country | Risk: Moderate |
| | Risk: Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings | Risk: Moderate |
| | Risk: Cultural obligations to care for Country | Risk: Moderate |
| | Risk: Knowledge Systems | Risk: Moderate |
| | Risk: Connection to Country | Risk: Moderate |
| | Risk: Culturally significant species | Risk: Moderate |
| | Risk: Bonney Coast Upwelling (KEF) | Risk: Low |
| | Risk: Water quality | Risk: Low |
| | Risk: Nearshore benthic habitats | Risk: Moderate |
| | Risk: Intertidal communities and shorelines | Risk: Moderate |
| | Risk: Marine Parks, coastal reserves and wetlands | Risk: Moderate |
| **Principles of ESD** | A) 'Integration principle'<br>The Integration principle will be met through a combination of preliminary consultation in the initial preparation of the OPP for public comment, and importantly the opportunity provided through the public comment process. The objective of stage 1 consultation was to gain knowledge through consultation across key categories of stakeholder that may be affected by the proposed activities, and certain government agencies and authorities to which the activities may be relevant. Relevant feedback has been integrated in the OPP where appropriate.<br>The stage 2 public comment period provided the opportunity for broad public and stakeholder input, further to preliminary OPP consultation building further on insights shared with Cooper Energy during consultation for and the development of recent Environment Plans in proximity to the OPP. The stage 2 consultation period did not raise any objections relating to this aspect, indicating that short and long-term objectives are considered to be balanced by stakeholders demonstrating the integration principle is being met. Risks from First Nations cultural heritage values and sensitivities are identified as:<br>• Moderate risk for known coastal/island places and objects, known submerged sites and Sea Country<br>• Moderate risk for Creation/Dreaming sites, Songlines, sacred sites and Ancestral beings | |

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| | • Moderate risk for cultural obligations to care for Country,<br>• Moderate risk for knowledge systems, connection to Country and culturally significant species<br>• Low risk for Bonney Coast Upwelling (KEF) and water quality<br>• Moderate risk for benthic habitats, and intertidal communities and shorelines<br>• Moderate risk for marine parks, coastal reserves and wetlands.<br>The above predicted levels of risk due to First Nations cultural heritage values and sensitivities from the East Coast Project are equal to or better than the defined acceptable levels (Section 7.3). |
| | B) 'Precautionary principle'<br>If there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>The East Coast Project is consistent with the principle of ESD (b) for this aspect as:<br>• Evaluation of impacts and risks were conducted in accordance with Cooper Energy's risk assessment methodology and Cooper Energy's Cultural Heritage Disturbance Risk Management Measures.<br>• The highest inherent risk for interactions with First Nations cultural heritage values and sensitivities was evaluated as Moderate; therefore, interactions with First Nations cultural heritage values and sensitivities from the East Coast Project will not result in serious or irreversible environmental damage, or disruption to the intrinsic links to First Nations people's heritage sites and values. Although serious or irreversible environmental damage is not predicted to occur, Cooper Energy acknowledge there is some uncertainty with the identification of cultural features and heritage values within the Operational Area and EMBA.<br>• The proposed procedures, management measures and ongoing engagement with First Nations Peoples (see Table 10-4) has been developed to enable Cooper Energy to manage potential uncertainty on the impacts and risks to the interactions with First Nations cultural heritage values and sensitivities.<br>• Where ecosystem functions could be affected, and which could impact on resource distribution; these changes would be expected to be ultimately recoverable with involvement of First Nations Peoples in the response to incidents, and repair of components of the environment and associated cultural links.<br>• The potential impacts and risks to First Nations cultural heritage values and sensitivities (such as the introduction, establishment and spread of IMS and LOWC) are well-understood, and management measures are well established and regulated in Australian waters. |
| | C) 'Intergenerational principle'<br>The principle of inter-generational equity—is 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.<br>The East Coast Project is consistent with the principle of ESD (c) for this aspect as:<br>• The highest inherent risk from interactions with First Nations cultural heritage values and sensitivities was evaluated as Moderate and therefore will not forego the health, diversity and productivity of the environment for future generations.<br>• The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 10.5). The acceptable levels were developed to be consistent with the principles of ESD including the intergenerational principle, ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. |
| | D) 'Biodiversity principle'<br>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.<br>The East Coast Project is consistent with the principle of ESD (d) for this aspect as:<br>• The relevant cultural features to interactions with First Nations cultural heritage values and sensitivities were evaluated in Section 10.3 and the highest inherent risk from interactions with First Nations cultural heritage values and sensitivities was evaluated as Moderate. |

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| | • The predicted environmental impact can be managed at levels equal to or better than the defined acceptable level of impact or risk by the implementation of controls detailed below (Section 10.5). Acceptable levels were developed to be consistent with the principles of ESD, such that the conservation of biological diversity and ecological integrity is maintained. |

| Criteria | Demonstration of Acceptability |
|---|---|
| ***Underwater Cultural Heritage Act 2018***<br>Objective:<br>Protects the integrity of Australia's underwater cultural heritage sites in-situ and individual artefacts associated with those sites. | Adoption of the following control measures:<br>CM9: Underwater Cultural Heritage Disturbance Risk Management Measures<br>Cooper Energy Cultural Heritage Disturbance Risk Management Measures acknowledge legislative requirements and establishes the methods by which potential disturbance to cultural heritage is identified including via screening, consultation, and expert advice as required. The measures apply to the offshore project to ensure impacts and risks throughout the project remain within acceptable levels and are managed to ALARP.<br>Cooper Energy will ensure the activity is compliant with the *Underwater Cultural Heritage Act 2018* (Underwater Heritage Act) by:<br>• Ensuring seabed survey data is reviewed prior to well construction activities and used to inform equipment laydown locations to avoid impacts to underwater cultural heritage.<br>• Review of relevant seabed survey data will be conducted by a suitably qualified and experienced cultural heritage team.<br>• If cultural heritage is identified, it will be mapped, along with suitable exclusion zone and its location integrated into project inductions and procedures to ensure it is avoided during project.<br>• Implementing a process for reporting and managing unexpected finds during the activity. Any subsequent management advice (e.g. exclusion zones) will be provided to Heritage Victoria and accounted for within project installation procedures<br>CM13: Ongoing Engagement<br>Further opportunities to engage will be provided during the development and implementation of component EPs. Relevant information received will be included within the EPs as appropriate.<br>CM24: Seabed Survey<br>Seabed surveys (geophysical, geotechnical, visual and contaminant sampling) will be undertaken for the |
| **Gunditjmara Sea Country Plan 2023**<br>Objective:<br>Country is protected for present and future generations<br>Management actions:<br>M1 Gunditjmara lead the identification, planning and implementation of natural and cultural resource management programs.<br>Cooper Energy will seek to continue engagement **and** will seek opportunities to support involvement of First Nations Peoples in the management of Country.<br>Sections 8 and 9 of the OPP details how risks to values and sensitivities of Sea Country will be managed, such as avoiding injury to whales, and preventing loss of waste to sea which could cause harm to Country. | |
| **Gunditjmara Sea Country Plan 2023**<br>Objective:<br>Law/Lore/Learning: Nyamat Mirring (Sea Country) heals through practice change in response to knowledge and observations<br>Management actions:<br>L2. Increased understanding and appreciation of the cultural and archaeological values of Nyamat Mirring, including the current ocean floor.<br>Cooper Energy will seek to continue engagement and will seek opportunities to support involvement of First Nations Peoples in the management of Country.<br>Sections 8 and 9 of the OPP details how risks to values and sensitivities of Sea Country will be managed, such as avoiding injury to whales, and preventing loss of waste to sea which could cause harm to Country. | |
| **Eastern Maar Sea County Plan 2014**<br>Objective: Our Country is healthy and our natural resources are managed and used sustainably<br>Management actions:<br>Eastern Maar citizens are employed in the management of Country.<br>Cooper Energy will seek to continue engagement and will seek opportunities to support involvement of First Nations Peoples in the management of Country.<br>Sections 8 and 9 of the OPP details how risks to values and sensitivities of Sea Country will be managed, such as avoiding injury to whales, and preventing loss of waste to sea which could cause harm to Country. | |
| **Eastern Maar Sea County Plan 2014**<br>Objective: Our unique culture is getting stronger and we keep our Dreaming going<br>Management actions:<br>Our cultural heritage is protected, important places are managed and artefacts are returned | |

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| Section 9.6.6 details the adopted control measures against legislative requirements Cooper Energy are committed to demonstrate acceptability of the unlikely risk to Discovery Bay Coastal Park, Wilsons Promontory, and The Convincing Grounds from an accidental hydrocarbon spill. | | | purposes of collecting information to manage risks to the Shelf rocky reefs and hard substrates KEF values (high relief outcrops, reefs and sponge beds), sediment quality, underwater heritage, debris and hazards on the seafloor. These surveys will be undertaken prior to finalising MODU position, location of mooring equipment, and finalising well and subsea infrastructure locations. Details of relevant survey seabed findings (benthic environment, heritage, hazards) will be included in future EPs. |
| **Wadawurrung Country Plan 2020**<br>Objective: Coastal Country - By 2029, native vegetation extent remains or increases and cultural places are protected.<br>event.<br>Section 9.6.6 details the adopted control measures against legislative requirements Cooper Energy are committed to demonstrate acceptability of the unlikely risk to Discovery Bay Coastal Park, Wilsons Promontory, and The Convincing Grounds from an accidental hydrocarbon spill. | | | |
| **Gunaikurnai Country Plan 2015**<br>Objective: To heal our Country<br>Management action: Develop a 'mob intelligence network' to communicate on-ground information back to Gunaikurnai Land and Waters Aboriginal Corporation to inform future plans and programs for managing Country.<br>Cooper Energy will seek to continue engagement and will seek opportunities to support involvement of First Nations Peoples in the management of Country.<br>Sections 8 and 9 of the OPP detail how risks to values and sensitivities of Sea Country will be managed, such as avoiding injury to whales, and preventing loss of waste to sea which could cause harm to Country. | | | |
| **Internal Context** | Relevant management system processes adopted to implement and manage hazards include:<br>• Risk Management (MS03)<br>• Operations Management (MS07)<br>• Technical Management (MS08)<br>• Health Safety and Environment Management (MS09)<br>• Supply Chain and Procurement Management (MS11).<br>Activities will be undertaken in accordance with the Implementation Strategy (Section 12).<br>UCH assessments to date have not identified any specific cultural heritage constraints within the operational area that are not aligned with appropriate mitigations. | | |
| **External Context** | Feedback from stakeholders and published First Nations' Country Plans has informed the values and sensitivities /existing environment, impacts and risks, performance outcomes or mitigation measures of First Nations people cultural heritage. | | |
| **Predicted impact compared to Defined Acceptable Level** | Risk: Known coastal/Island places and objects | AL7 limits seabed disturbance to the operational area of the project. There is no overlap with known coastal/island places and objects.<br>AL18 addresses the potential risks to known coastal/island places and objects (as rights and interests of First Nations people within areas of Native Title) from the accidental release of MDO or a LOWC event, as outlined in Table 10-2.<br>By implementing control measures to prevent the accidental release of MDO (Section 9.5.6) and a LOWC event (Section 9.6.6), the risk to the cultural heritage value of known coastal/island places and objects will be prevented. By preventing the risk, AL15 is met and achieved. | |
| | Risk: Known submerged sites | AL16 and 18 addresses the potential risks to known submerged sites from seabed disturbance and planned discharges - drilling, as outlined in Table 10-2. By implementing CM9: Cooper Energy Cultural Heritage Disturbance Risk Management Measures, the risk to the cultural heritage value of known submerged sites will | |

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| | | be prevented. By preventing the risk, AL13 and 15 are met and achieved.<br>AL16 and 18 also addresses the potential risks to known submerged sites from accidental release – MDO and accidental release - LOWC, as outlined in Table 10-2. By implementing control measures to prevent the accidental release of MDO (Section 9.5.6) and a LOWC event (Section 9.6.6), the risk to the cultural heritage value of known submerged sites will be prevented. By preventing these risks, AL13 and 15 are met and achieved. |
| | Risk: Sea Country | Sea Country encompasses the entirety of the existing environment. As a result, all the potential impacts and risks as evaluated in Sections 8 and 9 are considered potential risks to Sea Country cultural heritage values. As outlined in Table 10-2 all aspects of the project have the potential to interact with intangible cultural heritage values of Sea Country.<br>Given the all-encompassing nature of Sea Country, all acceptable levels as described in Table 7- are considered relevant and address the potential risks to Sea Country cultural heritage values. By achieving the EPOs and meeting the acceptable levels as defined in Table 7- and through the application of controls listed in Sections 8 and 9, potential risks to Sea Country cultural heritage values will be prevented.<br>AL15 ensures evaluations of potential risks to intangible and tangible cultural heritage values from activities defined in this OPP remains current and accurately reflected. By undertaking ongoing engagement with relevant First Nations groups, the identified cultural heritage values of Sea Country and potential risks to those values have a mechanism to remain current and accurately reflected. |
| | Risk: Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings | Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings are interconnected to all aspects of the existing environment. As a result, all the potential impacts and risks as evaluated in Sections 8 and 9 are considered potential risks to Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings. As outlined in Table 10-2 all aspects of the project have the potential to interact with these cultural heritage values with the exception of light and atmospheric emissions.<br>Given that Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings are interconnected to all aspects of the existing environment, all acceptable levels as described in Table 7- are considered relevant and address the potential risks to these cultural heritage values. By achieving the EPOs and meeting the acceptable levels as defined in Table 7- and through the application of controls listed in Sections 8 and 9, potential risks to Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings (which are interconnected to all aspects of the existing environment) will be prevented.<br>AL15 ensures evaluations of potential risks to intangible and tangible cultural heritage values from activities defined in this OPP remain current and accurately reflected. By undertaking ongoing engagement with relevant First Nations groups, the identified values associated with Creation/ Dreaming sites, Songlines, sacred sites and Ancestral beings and potential risks to those values have a mechanism to remain current and be accurately reflected. |
| | Risk: Cultural obligations to care for Country | Cultural obligations to care for Country includes responsibility for the entirety of the existing environment. As a result, all the potential impacts and risks as evaluated in Sections 8 and 9 are considered potential risks to cultural obligations to care for Country. As outlined in Table 10-2 all aspects of the project have the potential to interact with cultural obligations to care for Country. |

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| | | Given the all-encompassing nature of Country including responsibility to care for Country, all acceptable levels as described in Table 7- are considered relevant and address the potential risks to cultural obligations to care for Country. By achieving the EPOs and meeting the acceptable levels as defined in Table 7- and through the application of controls listed in Sections 8 and 9, potential risks to cultural obligations to care for Country will be prevented.<br>AL15 ensures evaluations of potential risks to intangible and tangible cultural heritage values from activities defined in this OPP remain current and accurately reflected. By undertaking ongoing engagement with relevant First Nations groups, the identified cultural heritage values of Sea Country and potential risks to cultural obligations to care for Country have a mechanism to remain current and be accurately reflected. |
| | Risk: Knowledge Systems | Knowledge systems of cultural heritage values associated with Country is interconnected with the entirety of the existing environment. As a result, all the potential impacts and risks as evaluated in Sections 8 and 9 are considered potential risks to knowledge systems. As outlined in Table 10-2 all aspects of the project have the potential to interact with knowledge systems, with the exception of light and air emissions,<br>Given the all-encompassing nature of Country including knowledge systems associated with Country, all acceptable levels as described in Table 7- are considered relevant and address the potential risks to knowledge systems of cultural heritage values. By achieving the EPOs and meeting the acceptable levels as defined in Table 7- and through the application of controls listed in Sections 8 and 9, potential risks the cultural heritage value of knowledge systems will be prevented.<br>AL15 ensures evaluations of potential risks to intangible and tangible cultural heritage values from activities defined in this OPP remains current and accurately reflected. By undertaking ongoing engagement with relevant First Nations groups, the identified cultural heritage values of Sea Country and potential risks to knowledge systems associated with Country have a mechanism to remain current and be accurately reflected. |
| | Risk: Connection to Country | Sea Country encompasses the entirety of the existing environment. As a result, all the potential impacts and risks as evaluated in Sections 8 and 9 are considered potential risks to cultural heritage values associated with connection to Country. As outlined in Table 10-2 all aspects of the project have the potential to interact with intangible cultural heritage values of Sea Country.<br>Given the all-encompassing nature of Sea Country, all acceptable levels as described in Table 7- are considered relevant and addresses the potential risks to connection to Country cultural heritage values. By achieving the EPOs and meeting the acceptable levels as defined in Table 7- and through the application of controls listed in Sections 8 and 9, potential risks to connection to Country cultural heritage values will be prevented.<br>AL15 ensures evaluations of potential risks to intangible and tangible cultural heritage values from activities defined in this OPP remains current and accurately reflected. By undertaking ongoing engagement with relevant First Nations groups, the identified cultural heritage values of connection to Country and potential risks to those values have a mechanism to remain current and accurately reflected. |
| | Risk: Culturally significant species | AL18 addresses the potential risks to culturally significant species (as rights of First Nations people within areas of Native Title) from light emissions, seabed disturbance, interaction with marine fauna, planned discharges – drilling, GHG emissions, |

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| | | underwater sound – continuous, underwater sound – impulsive, planned operational discharges, loss of materials or waste overboard, accidental release of MDO or a LoWC event and the introduction of IMS, as outline in Table 10-2.<br>By implementing control measures to prevent light emissions (Section 8.3.5), seabed disturbance (Section 8.8.5), the interaction with marine fauna (Section 9.3.5), planned drilling discharges (Section 8.6.5), GHG emissions (Section 8.5.5), underwater sound – continuous (Section 8.2.6), underwater sound – impulsive (Section 8.1.6), planned discharges – operational (Section 8.7.5), loss of materials or waste overboard (Section 9.1.5), accidental release of MDO (Section 9.5.6) and a LOWC event (Section 9.6.6), and the introduction of IMS (Section 9.4.5) the risk to culturally significant species will be prevented. By preventing the risk, AL18 is met and achieved. |
| | Risk: Bonney Coast Upwelling (KEF) | AL18 addresses the potential risk to Bonney Coast Upwelling (KEF) (as rights and interests of the First Nations people within areas of Native Title) from the minor GHG contribution to the carbon budget, accidental release of MDO or a LoWC event and the introduction of IMS, as outline in Table 10-2.<br>By implementing control measures to prevent the minor contribution to the carbon budget (Section 8.5.5), accidental release of MDO (Section 9.5.6) and a LOWC event (Section 9.6.6), and the introduction of IMS (Section 9.4.5), the risk to the cultural heritage value of the Bonney Coast Upwelling (KEF) will be prevented. By preventing the risk, AL18 is met and achieved. |
| | Risk: Water quality | AL15, AL2 and AL3 addresses the potential risk to water quality (AL15 in terms of rights and interests of the First Nations people within areas of Native Title) from the planned drilling and operational discharges, minor LOC, accidental release of MDO or a LoWC event, as outlined in Table 10-2.<br>By implementing control measures to prevent the LOC (Section 9.2.5), accidental release of MDO (Section 9.5.6) and a LOWC event (Section 9.6.6), and by achieving EPOs 2, 3, 4, 5, 6, and 7 the risk to the cultural heritage value of the Bonney Coast Upwelling (KEF) will be prevented. By preventing the risk, AL18, AL2 and AL3 are met and achieved. |
| | Risk: Nearshore benthic habitats | AL18 addresses the potential risk to nearshore benthic habitats (as rights and interests of the First Nations people within areas of Native Title) from the minor GHG contribution to the carbon budget, accidental release of MDO or a LoWC event and the introduction of IMS, as outline in Table 10-2.<br>By implementing control measures to prevent the minor contribution to the carbon budget (Section 8.5.5), accidental release of MDO (Section 9.5.6) and a LOWC event (Section 9.6.6), and the introduction of IMS (Section 9.4.5), the risk to the cultural heritage value of nearshore benthic habitats will be prevented. By preventing the risk, AL18 is met and achieved. |
| | Risk: Intertidal communities and shorelines | Risk: Moderate<br>AL18 addresses the potential risk to intertidal communities and shorelines (as rights and interests of the First Nations people within areas of Native Title) from the minor GHG contribution to the carbon budget, accidental release of MDO or a LoWC event and the introduction of IMS, as outline in Table 10-2.<br>By implementing control measures to prevent the minor contribution to the carbon budget (Section 8.5.5), accidental release of MDO (Section 9.5.6) and a LOWC event (Section 9.6.6), and the introduction of IMS (Section 9.4.5), the risk of the cultural heritage value of the intertidal communities and shorelines will be prevented. By preventing the risk, AL18 is met and achieved. |

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| | Risk: Marine Parks, coastal reserves and wetlands | Risk: Moderate<br>AL18 addresses the potential risk to marine parks, coastal reserves, and wetlands (as rights and interests of the First Nations people within areas of Native Title) from the minor GHG contribution to the carbon budget, accidental release of MDO or a LoWC event and the introduction of IMS, as outline in Table 10-2.<br>By implementing control measures to prevent the minor contribution to the carbon budget (Section 8.5.5), accidental release of MDO (Section 9.5.6) and a LOWC event (Section 9.6.6), and the introduction of IMS (Section 9.4.5), the risk of the cultural heritage value of marine parks, coastal reserves, and wetlands will be prevented. By preventing the risk, AL18 is met and achieved. |
| **Acceptability Outcome** | Cooper Energy has determined that impacts and risks related to First Nations people cultural heritage are acceptable, based on:<br>• Predicted levels of impact (evaluated in Section 10.3) are at or below the defined acceptable levels of impact (Table 10-2 and Table 7-) for all receptors;<br>• The planned management of impacts and risks integrates Cooper Energy internal requirements, including relevant management system processes<br>• The activities will be managed in a way that is not inconsistent with the relevant principles of ESD<br>• The proposed controls and impact and risk levels are not inconsistent with relevant First Nations groups Country plans, national and international standards, laws, and policies including applicable plans for management and conservation advices, and significant impact guidelines for MNES<br>• Feedback has been received from stakeholders that has informed the values and sensitivities /existing environment, impacts and risks, performance outcomes and / or mitigation measures.<br>To manage impacts to receptors at or below the defined acceptable levels the following EPO have been applied:<br>**EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the *Underwater Cultural Heritage Act 2018*.<br>**EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts, including potential changes to seabed quality.<br>**EPO12:** Seabed disturbance limited to the planned disturbance areas defined in this OPP and limited to within the Operational Area.<br>**EPO24**: No impact to underwater cultural heritage<br>**EPO25:** Undertake Ongoing Engagement with relevant First Nations groups to ensure identified tangible and intangible cultural heritage and potential risks to cultural heritage values remains current and its protection is provided for within EPs for the activity*.<br>*The ongoing engagement to be undertaken as part of OPGSSA Environment Regulations during the preparation of the activity specific Environment Plans provides opportunity for First Nations groups to engage with Cooper Energy and identify tangible and intangible cultural heritage values that the proposed activities described in the environment plan may impact, so that these can be managed and AL14 is met.<br>The decision of Munkara v Santos NA Barossa Pty Ltd. (No.3) sets clearer standards on the evidentiary burden to establish risks to tangible and intangible cultural heritage posed by a project. The decision clarifies the evidential burden to prove intangible cultural heritage and makes clear that evidence must show 'a sufficient cogent or coherent belief' that holds normative content for the relevant Traditional Owner group for the belief to amount to a cultural feature of an environment. A singular perspective will not suffice, regardless of the individual's cultural authority. Rather, for beliefs to form a cultural feature, those beliefs must be shown to be 'held by the relevant people as a people.' | |

## 10.5 Environmental Performance

Table 10-4 lists the acceptable level and EPO defined for the interaction with First Nations Cultural Heritage and the adopted control measures to achieve the outcome.

*Table 10-4: Environmental Performance Summary – First Nations cultural heritage*

| Defined Acceptable Level | Environmental Performance Outcomes | Adopted Control Measures |
|---|---|---|
| **AL7:** Seabed disturbance will not occur outside the Operational Area<br>**AL15**: Evaluations of potential risks to intangible and tangible cultural heritage values from activities defined in this OPP remains current and accurately reflected.<br>**AL16**: Impacts and risks from activities defined in this OPP will not prevent the protection and conservation of underwater cultural heritage as defined under the *Underwater Cultural Heritage Act 2018.*<br>**AL17**: Impacts and risks from activities defined in this OPP will not lead to injury or desecration of objects or areas declared for protection under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984.*<br>**AL18**: Impacts and risks from activities defined in this OPP will not interfere with native title rights or interests as defined under Section 233 of the *Native Title Act 1993* (Cth), to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the Titleholder. | **EPO10:** The selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts will:<br>• avoid areas of high relief outcrops, reefs, and sponge beds, where practicable<br>• not disturb underwater heritage as defined under the *Underwater Cultural Heritage Act 2018*.<br>**EPO11:** Undertake Seabed Surveys to inform the selection of the location for wells, flowline paths, mooring and other infrastructure and associated planned impacts including potential changes to seabed quality.<br>**EPO12:** Seabed disturbance limited to the planned disturbance areas defined in this OPP and limited to within the Operational Area.<br>**EPO24**: No impact to underwater cultural heritage<br>**EPO25:** Undertake Ongoing Engagement with relevant First Nations groups to ensure identified tangible and intangible cultural heritage and potential risks to cultural heritage values remains current and its protection is provided for within EPs for the activity. | CM9: Underwater Cultural Heritage Disturbance Risk Management Measures<br>CM13: Ongoing Engagement<br>CM24: Seabed Survey |

# 11 Cumulative Impact Assessment

In the context of offshore petroleum activities cumulative environmental impacts are defined by the regulator, NOPSEMA, as successive, additive, or synergistic impacts of collectively significant activities or projects with material impacts on the environment that have the potential to accumulate over temporal and spatial scales (NOPSEMA Environment Plan Decision Making Guideline, N-04750-GL1721 A524696, Jan 2024).

The effects of past project activities, and currently operating activities, are captured when describing the existing condition of and any pressure or threats affecting the environment (refer to Section 6 Description of the Environment). This baseline condition and understanding of the capacity of the receiving environment and receptors to accommodate changes, considering existing pressures and threats, informs the environmental impact assessments conducted in Section 8 of this OPP.

The focus of this cumulative impact assessment is to build on these assessments by considering the potential impacts from the planned components of the proposed activity on key matters in conjunction with the potential impacts from other reasonably foreseeable future projects and activities. Impacts and risks from unplanned aspects have not been considered in the cumulative impact assessment. It is not reasonable to consider unplanned aspects for cumulative environmental effects, because of the low likelihood relating to unplanned events for the East Coast Project and other foreseeable future projects and activities.

The types of activities and projects typically considered in cumulative impact assessment (CIA) are large in scale and are of relevance in terms of potentially contributing to or compounding material impacts in the relevant project area. While an environmental value is at the centre of the CIA this doesn't mean that every potential impact of regional concern to that value needs to be addressed. For example, while loss of habitat to a threatened species may be of regional concern, there may be no reason to incorporate those potential impacts into a project-initiated CIA if the project under assessment does not contribute to long term habitat reduction (Minerals Council of Australia 2015). The scoping assessment is used to identify where the East Coast Project contributes to cumulative impacts which may be material.

## 11.1 Methodology

Operators (titleholders) in the Otway have a history of supporting marine research and the respective operators continue to collaborate and share learnings on best practice from each other's operations. This includes implementing an approach to cumulative impact assessment which considers relevant regional and cumulative guidelines; for this OPP, this includes:

- Guidance from the United Kingdom (UK) Nationally Significant Infrastructure Projects - Advice Note Seventeen: Cumulative effect assessment relevant to nationally significant infrastructure projects (Planning Inspectorate, 2019).
- NSW Cumulative Impact Assessment Guidelines for State Significant Projects (NSW, 2022).

Both the UK and NSW guidelines are intended to apply to large-scale national and state significant projects, respectively, with greater potential for cumulative impacts into the long-term. Consequently, the assessment process applied here has been adapted to the nature and scale of the activities associated with the proposed East Coast Project.

## 11.2 Scoping the Cumulative Impact Assessment

To determine if impacts from the East Coast Project could result in cumulative impacts to receptors, a scoping assessment was undertaken to define the following factors:

- **Other reasonably foreseeable future projects** to be considered in the cumulative impact assessment based on currently operating projects, approved projects, and projects under assessment (including those under public comment); and if these projects and their associated activities are reasonably foreseeable within the spatial and temporal extent of the assessment.

- **Key environmental matters** are features of the environment (ecological, socio-economic, and cultural values and sensitivities) that are valued because of their rarity or importance, including the critical role they play in supporting systems which are essential for the environment, people and / or the economy (NSW, 2022). For example, commercial fisheries and threatened species undertaking biologically important behaviours. For the East Coast Project, key environmental matters are the receptors listed as MNES or have social or cultural significance predicted to be impacted by planned aspects (Sections 8 and 10).
- **Spatial extent** is the study area for the cumulative impact assessment, depending on the key environmental matters' range and distribution within the bioregion; and environment that may be affected by the planned aspects. Note where multiple spatial extents (or EMBAs) have been identified for an aspect (e.g. light emissions), the worst-case has been adopted to be conservative.
- **Temporal extent** is the period of the cumulative impact assessment, depending on the duration of the planned aspects or characteristics of the key environmental matters.
- **Material cumulative impacts** resulting from the East Coast Project and other reasonably foreseeable future projects that have the potential to be above the defined acceptable levels, for example, threats of wide-scale, serious or irreversible damage due to cumulative impacts.
- **Successive impacts** - those that occur one after the other.
- **Additive impacts** - those where the combined impact is the sum of the separate impacts.
- **Synergistic impacts** - those where the combined impact is greater than the sum of the separate impacts.
- **Cumulative impact assessment approach** based on standard assessment of material cumulative impacts, identify which cumulative impacts require further comprehensive assessment through either issue-specific cumulative impact assessment or combined cumulative impact assessment.

To identify the above factors, the scoping assessment is undertaken in two parts.

- Part 1: Identify reasonably foreseeable future projects and activities (Section 11.2.1).
- Part 2: Identify relevant key environmental matters (Section 11.2.2).

The scoping assessment identifies potential cause-effect pathways which could result in material cumulative impacts. A detailed assessment of these cumulative impacts is then provided in Section 11.3.

### 11.2.1 Part 1: Identify reasonably foreseeable future projects and activities

To identify reasonably foreseeable future projects and activities, spatial and temporal extents for cumulative impacts have been based on the maximum spatial and temporal influence of the East Coast Project. The spatial extent of impacts from the East Coast Project varies depending on the source of aspect. The spatial extent of impacts from planned activities associated with the East Coast Project is limited to the Otway Marine Bioregion. These are often only temporary activities, the nature and scale of which changes depending on the phase of the project. The maximum temporal extent of the East Coast Project is based on the indicative project life where activities are expected to begin in 2025 and end in 2049 (Section 4.1.2).

The scoping steps of Part 1 are as follows:

- Step 1: Review NOPSEMA and DEECA (Vic) Environment Plan websites to identify projects and activities that overlap the spatial (Otway Marine Bioregion) and temporal (2025 to 2049) extents.
- Step 2: Confirm potential overlap with other Otway Basin petroleum titleholders.

Reasonably foreseeable future projects and activities identified to date, within the life of the East Coast Project (from 2025 to 2049) and located in the Otway Marine Bioregion, are detailed in Table

11-1. Projects and activities that are not reasonably foreseeable have been excluded from the assessment scope to maintain practicality and relevance in decision-making processes.

Given the location of the Otway region, a number of titleholders will likely be utilising the same MODUs for their exploration drilling and P&A campaigns. These activities are therefore expected to occur consecutively rather than concurrently. Consecutive drilling would result in aspects from these activities affecting the region, and ecosystem components, for longer periods. Some non-drilling aspects of the activity (such as seabed disturbance) would occur by operators at the same time, these disturbances will be localised and are not expected to occur at a level that would affect biodiversity and ecological integrity either at the activity level, or cumulatively. Other aspects associated with non-drilling activities (such as subsea noise and artificial light) would only occur for the duration of the activity, with areas expected to return to ambient conditions once the activity is complete, and before the next activity commences in a different area. The resulting impact footprint of these aspects remains short-term and relatively local to the activity at the time.

At the time of preparing this OPP, DCCEEW have identified 6 priority areas for offshore wind around Australia, 3 of which have been declared. The Southern Ocean area was declared in March 2024 and is the closest to the East Coast Project, located ~5 km from the operational area (DCCEEW, 2024k). Early project feasibility planning is underway for the Spinifex Offshore Wind Farm (OWF) in waters adjacent to Warrnambool and Port Fairy in Victoria (Figure 6-105). The Spinifex OWF licence area is ~24 km from the East Coast Project Operational Area. It is the only licence area within the Southern Ocean declared area considered within the CIA due its proximity to the East Coast Project. Other declared areas are outside of the Otway Marine Bioregion and are therefore not considered within the CIA. Prospective windfarms have not been included within the CIA due to insufficient information available to reasonably predict overlap of impacts and will be considered in future activity-specific Environment Plans.

There are no subsea cables which overlap with the East Coast Project activity EMBAs; therefore they have not been considered further.

Information on projects and activities is typically accessible once consultation commences, and relevant technical supporting information is submitted for public comment or assessment. Information relevant to this assessment has been shared during engagements with Otway Basin Petroleum Titleholders. Where project/activity-specific data is not yet available, data from similar projects has been used as a proxy prior to technical information being made available. Given the similarity of impacts, there is a high level of certainty in the prediction of cumulative impacts in most cases.

Assumptions around specific timings for projects or activities have been made as there is some level of uncertainty in schedule and timing of approvals to support activities. Consequently, a conservative approach has been adopted whereby credible worst-case scenarios (e.g. concurrent activities with overlapping activity EMBAs) are assessed.

*Table 11-1: Part 1 - Reasonably foreseeable future projects or activities in the offshore Otway Basin*

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| **Petroleum Activities** | | | | | |
| Cooper Energy | Operations of the existing CHN facilities to the Athena Gas Plant since 2006 (CHN operations) (Cooper Energy, 2024).<br><br>Includes regular vessel-based inspections, maintenance and repair; and well workovers using a MODU. | Existing | Ongoing<br><br>End of field life ~2050 | Yes – potential temporal overlap of CHN operations IMR campaigns schedule with timing of East Coast Project activities, though generally offshore works would be expected to be scheduled sequentially. | Yes – the East Coast Project will tie into the existing CHN facilities, and will ultimately become part of the operating facilities, so the operational areas of both projects overlap.<br>**Light EMBA**<br>A 'localised (small radius of light glow around vessels)' assessed for Cooper's CHN activities (Cooper Energy, 2024a), could be entirely overlapped by the East Coast Project's precautionary 49 km flaring EMBA. The CHN EMBA overlaps:<br>• foraging BIAs for multiple bird species, including albatross and gannets.<br><br>**Sound EMBA**<br>Noise EMBAs (5.97 km marine mammal behaviour criteria during resupply) resulting from CHN Operation vessels overlap with those of this OPP (Appendix 4 – Noise Modelling).<br>THE CHN EMBA overlaps:<br>• foraging BIAs for pygmy blue whale, including the annual high use area<br>• migration BIA and reproduction BIA for southern right whale<br>• distribution BIA for white shark (Cooper Energy, 2024a)* |
| Beach Energy Limited | Operations of Halladale, Speculant, Geographe, Thylacine gas fields to the Otway Gas Plant (Otway operations) (Beach, 2024).<br><br>Includes regular vessel-based inspections, maintenance and repair. And well workovers using a MODU. | Existing | Ongoing<br><br>End of field life ~2037 | Yes – potential temporal overlap of IMR campaigns schedule with timing of East Coast Project activities, though there is also potential for activities to occur sequentially. | Yes – potential overlapping of Beach Otway operations underwater sound and light emissions EMBAs with East Coast Project underwater sound and light emissions EMBAs.<br>The East Coast Project operational area is located ~31 km from Geographe-1 and 45 km from Thylacine operational areas.<br><br>**Light EMBA**<br>A precautionary 20 km light EMBA was applied by Beach (Beach, 2024), which could overlap a relatively large portion of the East Coast Project's precautionary 49 km flaring EMBA. The Beach light EMBA overlaps<br>• foraging BIAs for multiple bird species, such as albatross, petrels, and shearwater species,<br>• breeding BIAs for the wedge-tailed shearwater, and<br>• roosting BIAs for little curlew, pin-tailed snipe, and swinhoe's snipe |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | | | **Sound EMBA**<br>Modelling predicted the furthest sound contour distance for Beach IMR activities as 7.5 km to reach the noise effect criteria for behavioural effects in marine mammals (Beach, 2024) and overlap with those of this OPP (Appendix 4 – Noise Modelling).<br>The Beach noise EMBAs overlaps:<br>• the migration BIA for the southern right whale,<br>• the foraging BIAs for the pygmy blue whale, including the annual high use area (Beach, 2024). |
| Cooper Energy | Exploration Drilling | Proposed | 2025-2029 (~60 days per well, max 3 wells) | Yes – potential overlap with exploration drilling activities and timings of East Coast Project activities (surveys, installation and commissioning and operation phases) though generally offshore works would be expected to be scheduled sequentially.<br><br>East Coast Project drilling activities are unlikely to occur concurrently with exploration drilling activities, however may occur sequentially. | Yes – the operational area is located within the East Coast Project operational area.<br><br>**Light EMBA**<br>A precautionary 49 km flaring associated light EMBA applied by Cooper Energy (Cooper Energy, 2024c) could overlap with a portion of the East Coast Project precautionary 20 km routine light EMBA. There will be no concurrent overlap of flaring EMBAs between the projects. Flaring for the drilling activity will be short term (maximum of 60 hours per well) and temporary (Cooper Energy flaring EMBA overlaps:<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species<br>• one breeding BIA for the wedge-tailed shearwater<br>• orange-bellied parrot was identified as known to occur (Cooper Energy, 2024c).<br><br>**Sound EMBA**<br>Modelling for Cooper Energy activities predicted the furthest sound contour distance for exploration drilling activities within the operational area was 23 km to reach the noise criteria threshold for behavioural effects in marine mammals (Cooper Energy, 2024c) and overlap those of this OPP (Appendix 4 – Noise Modelling).<br>Exploration activities noise EMBAs overlap:<br>• foraging BIA for the pygmy blue whale<br>• migration BIA and reproduction BIA for the southern right whale<br>• distribution BIA for the white shark (Cooper Energy, 2024c)* |
| ConocoPhillips | Exploration Drilling | Accepted | 2025-2028 (typically, 30-40 days per well, max 6 wells) | Yes – potential overlap of ConocoPhillips drilling activities and timings of East Coast Project | Yes – potential overlap of underwater sound and light emissions EMBAs between ConocoPhillips exploration drilling activities and East Coast Project activities. |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | | activities (surveys, installation and commissioning and operation phases)<br><br>East Coast Project drilling activities will not occur concurrently with exploration drilling activities, however may occur sequentially. | The ConocoPhillips exploration drilling operational area (VICP/79 portion) is located within hundreds of metres of the East Coast Project operational area.<br><br>**Light EMBA**<br>A precautionary 49 km flaring associated light EMBA applied by ConocoPhillips (ConocoPhillips, 2024a) could overlap with a portion of the East Coast Project precautionary 20 km routine light EMBA. There will be no concurrent overlap of flaring EMBAs between the projects. Flaring for the drilling activity will be short-term (maximum of 100 hours), temporary and only required for 4 of the 6 proposed wells (ConocoPhillips, 2024a). ConocoPhillips flaring EMBA overlaps:<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species<br>• breeding BIAs for petrel, shearwater, penguin and cormorant species<br>• migration route for the orange-bellied parrot (ConocoPhillips, 2024a).<br><br>**Sound EMBA**<br>Modelling for ConocoPhillips activities predicted the furthest sound contour distance for exploration drilling activities within the operational area was 12.6 / 22.8 km non-shelf / on shelf edge locations to reach the noise criteria threshold for behavioural effects in marine mammals (ConocoPhillips, 2024a). The OPP only overlaps shelf areas (Appendix 4 – Noise Modelling). ConocoPhillips noise EMBAs overlaps:<br>• foraging BIA for the pygmy blue whale<br>• migration BIA for the southern right whale<br>distribution BIA for the white shark (ConocoPhillips, 2024a).* |
| Woodside Energy | Minerva Decommissioning and Field Management | Accepted | 2024-2025<br><br>Approximate duration is 90-120 days (Woodside, 2024). | Yes – potential overlap of planned impact EMBAs associated with Woodside decommissioning activities and timings of East Coast Project activities (surveys, well construction, installation and commissioning and operation phases) depending on operational progress. | Yes – potential overlap of underwater sound and light emission EMBAs between Minerva decommissioning activities and East Coast Project activities.<br>The Minerva decommissioning operational area is located ~7 km from the East Coast Project operational area.<br><br>**Light EMBA**<br>Woodside do not define a light EMBA outside of their operational area (Woodside, 2024). However, overlap associated with the light EMBAs for each project may occur due to the proximity of Minerva decommissioning operational area to the East Coast Project. The East Coast Projects precautionary 20 km routine light EMBA and/or the 49 km flaring EMBA |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | | | may overlap with the vessel activities within the Minerva decommissioning operational area. Woodside's operational area overlaps:<br>• migratory route for the orange-bellied parrot<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species (Woodside, 2024).<br><br>**Sound EMBA**<br>Modelling for Woodside activities predicted the furthest sound contour distance for decommissioning activities within the operational area was 2.4 km (during equipment removal) to reach the noise criteria threshold for behavioural effects in marine mammals (Woodside, 2024). Noise EMBAs of this OPP (Appendix 4 – Noise Modelling) will not overlap those of the Minerva Decommissioning and Field Management activities.<br>Woodsides noise EMBAs overlaps:<br>• foraging BIA for the pygmy blue whale<br>• migration BIA for the southern right whale (Woodside, 2024). |
| Woodside Energy | Minerva Plug and Abandonment | Accepted | 2025<br><br>Approximate duration 40 – 160 days (Woodside, 2024) | Yes – As per the NOPSEMA website, activities commenced March 2, 2025 (NOPSEMA, 2025).<br><br>There is potential for temporal overlap of planned impact EMBAs associated with Minerva P&A activities and survey activities associated with the East Coast Project. Project MODU activities timing would not overlap as the same MODU and support vessels would be used across the activities for respective titleholders. | Yes – potential overlap of underwater sound and light emissions EMBAs between Minerva P&A activities and East Coast Project survey activities. The Minerva P&A operational area is located ~6 km from the East Coast Project operational area.<br><br>**Light EMBA**<br>A precautionary 49 km flaring associated light EMBA applied by Woodside (Woodside, 2024a) could overlap with a portion of the East Coast Project precautionary 20 km routine light EMBA. There will be no concurrent overlap of flaring EMBAs between the projects. Flaring for the P&A activity will be of a short duration, is likely to only occur for a few minutes and will only be required for 2 of the wells (Woodside, 2024a). Therefore, concurrent overlap of the routine light EMBAs (20 km) is considered the main source for potential cumulative impact. Woodside's light EMBA overlaps:<br>• migratory route for the orange-bellied parrot<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species (Woodside, 2024a).<br><br>**Sound EMBA**<br>Modelling for Woodside activities predicted the furthest sound contour distance for P&A activities within the operational area was 10.2 km (during anchor tensioning) to reach the noise criteria threshold for behavioural |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | | | effects in marine mammals (Woodside, 2024a) and overlap those of this OPP (Appendix 4 – Noise Modelling).<br>Woodsides noise EMBAs overlaps:<br>• foraging BIA for the pygmy blue whale<br>• migration and reproduction BIA for the southern right whale<br>• distribution BIA for the white shark (Woodside, 2024a).* |
| Beach Energy Limited | Offshore Gas Victoria Drilling and P&A Activities | Proposed | 2025-2028<br><br>Drilling: 30-40 days per well, max 5 wells<br><br>P&A: 15-20 days per well, max 5 wells | Yes – potential overlap of planned impact EMBAs associated with Beach drilling and P&A activities and timings of East Coast Project activities (surveys, installation and commissioning and operation phases).<br><br>East Coast Project drilling activities will not occur concurrently with Beach Energy drilling and P&A activities, as the same MODU and vessels would be expected to be used for the respective activities of each Titleholder. However, the activities may occur in sequence. | Yes – potential overlap of underwater sound and light emissions EMBAs between Beach drilling and P&A activities and East Coast Project activities. The Beach drilling and P&A operational area overlaps with the East Coast Project operational area; however, no wells are planned to be drilled within the overlap.<br><br>**Light EMBA**<br>A precautionary 20 km light EMBA applied by Beach (Beach, 2024a) could overlap with a portion of the East Coast Project precautionary 20 km routine light EMBA. There is no flaring allowed for under the Offshore Gas Victoria Drilling and P&A Activities EP (Beach, 2024a). Therefore, there will be no concurrent or consecutive overlap of flaring EMBAs between the projects. Therefore, concurrent overlap of the routine light EMBAs (20 km) is considered the main source for potential cumulative impact. Beach's light EMBA overlaps:<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species<br>• likely migration route for the orange-bellied parrot<br>• foraging BIA for the white shark (Beach, 2024a).*<br><br>**Sound EMBA**<br>Modelling for Beach activities predicted the furthest sound contour distance for exploration drilling activities within the operational area was 19.6 km to reach the noise criteria threshold for behavioural effects in marine mammals (Beach, 2024a) and overlap those of this OPP (Appendix 4 – Noise Modelling).<br>Beach noise EMBAs overlaps:<br>• foraging BIA for pygmy blue whale<br>• migration BIA for southern right whale<br>• distribution BIA for white shark (Beach, 2024a).* |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| Beach Energy Limited | Geophysical/Geotechnical Survey | Proposed | 2024-2028 | Yes – potential temporal overlap of planned impact EMBAs during geophysical survey and timings of East Coast Project activities.<br>~ 40 days overlap may occur between the East Coast Project activities and the geophysical surveys within the Otway operational area (Beach, 2024). There is also potential for activities to occur sequentially. | Yes – potential overlapping of Beach Geophysical/Geotechnical surveys underwater sound and light emissions EMBAs with East Coast Project underwater sound and light emissions EMBAs.<br>The Beach Otway operational area is located ~4 km from the East Coast Project operational area.<br><br>**Light EMBA**<br>A precautionary 20 km light EMBA applied by Beach (Beach, 2024) could overlap a large portion of the East Coast Project's precautionary 49 km flaring EMBA. Beach's light EMBA overlaps:<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species<br>• breeding BIAs for the little penguin, white bellied sea eagle, and short-tailed shearwater, and<br>• roosting BIAs for little curlew, pin-tailed snipe, and swinhoe's snipe (Beach, 2024).<br><br>**Sound EMBA**<br>Modelling for Beach activities area predicted the furthest sound contour distance for geophysical surveys within the Otway operational area was 145 m to reach the noise criteria threshold for behavioural effects in marine mammals (Beach, 2023) and overlap those of this OPP (Appendix 4 – Noise Modelling). Beach's noise EMBAs overlaps:<br>• migration BIA for the southern right whale, and<br>• foraging BIAs for the pygmy blue whale, including the annual high use area (Beach, 2024). |
| CGG - Regia | Seismic Survey | Proposed | 2024-2028<br>• 60 days acquisition<br>• 90 days in field<br>• One survey between November – May) or<br>• Two separate surveys April – June, and or | Yes – potential temporal overlap of planned impact EMBAs associated during seismic acquisition timeframe and timings of East Coast Project activities.<br>~ 90 days of overlap between the East Coast Project activities and the CGG-Regia survey. There is also potential for activities to occur sequentially. | Yes – potential overlapping of CGG-Regia underwater sound and light emissions EMBAs with East Coast Project underwater sound and light emissions EMBAs.<br>The Regia Seismic Survey operational area overlaps the East Coast Project operational area.<br><br>**Light EMBA**<br>The East Coast Project's 49 km flaring associated light EMBA will overlap the precautionary 20 km light EMBA applied by CGG. CGG's light EMBA overlaps<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species (CGG, 2024).<br><br>**Sound EMBA**<br>Modelling for CGG activities predicted the sound contour distance to reach the noise criteria threshold for behavioural effects up to 44 km and overlap |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | September – November. | | those of this OPP (Appendix 4 – Noise Modelling). Results predicted a maximum distance of ~23 km for pygmy blue whale, and ~15 km for southern right whale. CGG's noise EMBA overlaps:<br>• the migration BIA for the southern right whale,<br>• the distribution and foraging BIA (annual high use area) for the pygmy blue whale, and<br>• the foraging BIA for the Australian Fur-seal. |
| Beach Energy | Development of Artisan and La Bella gas fields (Beach, 2021). | Proposed | 2024-ongoing<br>• Seabed assessments : up to 30 days<br>• Drilling activities for production wells: 70 to 90 days per well<br>• Plugging wells: 30 days per well<br>• Inspections and modifications to existing seabed infrastructure : 30 - 120 days per field. | Yes – potential temporal overlap during the development of Artisan and La Bella gas fields with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – potential overlapping of Artisan and La Bella development activities' underwater sound and light emissions EMBAs with East Coast Project underwater sound and light emissions EMBAs.<br>The East Coast Project operational area is located approximately 20 km from La Bella and 45 km from Artisan gas fields areas.<br><br>**Light EMBA**<br>The precautionary 20 km light EMBAs applied by Beach will therefore be overlapped entirely by the East Coast Project's 49 km flaring EMBA during flaring. During non-flaring activities, only the light EMBA from La Bella may be overlapped. Beach's light EMBA overlaps:<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species (Beach, 2023).<br><br>**Sound EMBA**<br>Preliminary modelling for Beach predicted the furthest sound contour distance to reach the noise criteria threshold as <3-7 km for development activities (Beach, 2023). and overlap those of this OPP (Appendix 4 – Noise Modelling).<br>Beach's sound EMBA overlaps:<br>• foraging BIAs for pygmy blue whale, including annual high use area,<br>• migration BIAs for southern right whale |
| **Offshore Wind** | | | | | |
| Alinta Energy and JERA Nex (Spinifex Offshore Wind) | Construction, operation, decommissioning and associated surveys and monitoring for multiple offshore wind farms. | Feasibility licence | The licence was awarded in March 25.<br>The project is in the pre-planning phase and as such no specific details are | Yes – potential temporal overlap of the Spinifex Offshore Wind installation with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – The Spinifex Offshore Wind installation is located ~24 km from the East Coast Project operational area. There is potential spatial overlap of underwater sound and light EMBAs associated with The Spinifex Offshore Wind installation and the East Coast Project.<br><br>**Light EMBA**<br>Due to the early phase of development, no modelling has been completed to identify the light EMBA for The Spinifex Offshore Wind installation, |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | The licence area is ~285 km$^2$ in size and expected to be a 1GW+ development in size. It is located ~24 km from the East Coast Project operational area. | | currently publicly available for this installation. Suggested dates are: Surveys – ~2025 – 2028; Turbine Installation – ~2031; Typical operation period of 25 years (DCCEEW 2025). | | however, the East Coast Project predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3), therefore an overlap of at least 15-44 km could occur using a proxy 20 km EMBA. This proxy light EMBA for the licence area will overlap:<br>• foraging BIAs for multiple bird species, such as several albatross, petrel, and shearwater species<br><br>**Sound EMBA**<br>Due to the early phase of development, there is no publicly available modelling to identify the sound EMBA for The Spinifex Offshore Wind installation. However, proxy modelling from comparative offshore windfarm designs (Norro et al., 2013) of ~20 km marine mammal behavioural threshold overlaps modelling for this OPP.<br>The Spinifex licence area overlaps:<br>• foraging BIAs for pygmy blue whale, including annual high use area,<br>• migration BIAs for southern right whale<br><br>Given the nature and scale of the East Coast Project, and the control measures in place (designed with consideration to relevant species recovery plans), the additive effect of the East Coast project activities are expected to be negligible. |
| **Commercial Fisheries** | | | | | |
| Bass Strait Central Zone Scallop Fishery | Towed dredge fishing method with managed seasonal / area closures and total allowable catch controls. | Active | July to 31 December each year. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | No – The East Coast Project operational area overlaps with the fishery management area, however based on current fishing activity presence of fishing vessels in the operational area is unlikely. Potential overlap of underwater sound and light emissions EMBAs between fishing vessels and the East Coast Project is not expected.<br>Refer to Table 6-19 for further information on commercial fisheries. |
| Eastern Tuna and Billfish Fishery | Fishing conducted using pelagic longline, minor line (such as handline, troll, rod and reel) method. | Active | Season goes all year, commencing on 1 January each year. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | No – The East Coast Project operational area overlaps with the fishery management area, however based on current fishing activity presence of fishing vessels in the operational area is unlikely. Potential overlap of underwater sound and light emissions EMBAs between fishing vessels and the East Coast Project is not expected.<br>Refer to Table 6-19 for further information on commercial fisheries. |
| Small Pelagic Fishery | Midwater trawl, purse seine and jigging and mine line methods | Active | 12-month fishing season commences 1st May each year | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project | No – The East Coast Project operational area overlaps with the fishery management area, however based on current fishing activity presence of fishing vessels in the operational area is unlikely. Potential overlap of |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | are permitted for fishing. | | | activities. There is also potential for activities to occur sequentially. | underwater sound and light emissions EMBAs between fishing vessels and the East Coast Project is not expected.<br>Refer to Table 6-19 for further information on commercial fisheries. |
| Southern and Eastern Scalefish and Shark Fishery – Commonwealth Gillnet and Shark Hook Sector | Fishing conducted using demersal gillnet, demersal longline and auto-longline methods. | Active | 12-month fishing season commences 1st May each year. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – There is a potential that fishing vessels associated with this fishery may be actively fishing within or in proximity to the East Coast Project operational area and therefore there is potential overlap of underwater sound and light emissions EMBAs.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around fishing vessels may be overlapped by the East Coast Project if fishing occurs within the light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The fishery may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species.<br><br>**Sound EMBA**<br>The localised sound EMBA around the fishing vessel may be overlapped by the East Coast Project if fishing occurs within the sound EMBA (Appendix 4).<br>The fishery may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>However, given the spatial area of the fishery (Figure 6-72), the overlap from the light and sound EMBAs will be relatively small compared to the area of available fishing grounds.<br>Refer to Table 6-19 for further information on commercial fisheries. |
| Southern and Eastern Scalefish and Shark Fishery – Commonwealth Scalefish Hook Sector | Multi-gear fishery. | Active | 12-month fishing season commences 1st May each year. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – There is a potential that fishing vessels associated with this fishery may be actively fishing within or in proximity to the East Coast Project operational area and therefore there is potential overlap of underwater sound and light emissions EMBAs.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around fishing vessels may be overlapped by the East Coast Project if fishing occurs within the light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The fishery may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species.<br><br>**Sound EMBA**<br>The localised sound EMBA around the fishing vessel may be overlapped |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | | | by the East Coast Project if fishing occurs within the sound EMBA (Appendix 4).<br>The fishery may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>Given the spatial area of the fishery (Figure 6-74), the overlap from the light and sound EMBAs will be relatively small compared to the area of available fishing grounds.<br>Refer to Table 6-19 for further information on commercial fisheries. |
| Southern and Eastern Scalefish and Shark Fishery – Commonwealth Trawl Sector | Multi-gear fishery. | Active | 12-month fishing season commences 1st May each year. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – There is a potential that fishing vessels associated with this fishery may be actively fishing within or in proximity to the East Coast Project operational area and therefore there is potential overlap of underwater sound and light emissions EMBAs.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around fishing vessels may be overlapped by the East Coast Project if fishing occurs within the light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The fishery may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species.<br><br>**Sound EMBA**<br>The localised sound EMBA around the fishing vessel may be overlapped by the East Coast Project if fishing occurs within the sound EMBA (Appendix 4).<br>The fishery may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>Given the spatial area of the fishery (Figure 6-75), the overlap from the light and sound EMBAs will be relatively small compared to the area of available fishing grounds. Refer to Table 6-19 for further information on commercial fisheries. |
| Southern Blue Fin Tuna Fishery | Pelagic longline and purse seine fishing gear is used in this fishery. | Active | 12-month fishing seasons commences 1st December each year. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities | No – The East Coast Project operational area overlaps with the fishery management area, however based on current fishing activity presence of fishing vessels in the operational area is unlikely. Potential overlap of underwater sound and light emissions EMBAs between fishing vessels and the East Coast Project is not expected<br>Refer to Table 6-19 for further information on commercial fisheries. |
| Southern Squid Jig Fishery | Single method of jigging. | Active | 12-month fishing seasons commences 1st | Yes – potential temporal overlap of fishing vessel activities with timings of | Yes – There is a potential that fishing vessels associated with this fishery may be actively fishing within or in proximity to the East Coast Project |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | December each year. | East Coast Project activities. There is also potential for activities to occur sequentially. | operational area and therefore there is potential overlap of underwater sound and light emissions EMBAs.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around fishing vessels may be overlapped by the East Coast Project if fishing occurs within the light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The fishery may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species.<br><br>**Sound EMBA**<br>The localised sound EMBA around the fishing vessel may be overlapped by the East Coast Project if fishing occurs within the sound EMBA (Appendix 4).<br>The fishery may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>Given the spatial area of the fishery (Figure 6-69), the overlap from the light and sound EMBAs will be relatively small compared to the area of available fishing grounds.<br>Refer to Table 6-19 for further information on commercial fisheries. |
| Victorian Abalone Fishery | Hand collected by divers. | Active | 12-month fishing season commences 1st April each year. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | No – The East Coast Project operational area overlaps with the fishery management area, however based on current fishing activity presence of fishing vessels in the operational area is unlikely. Potential overlap of underwater sound and light emissions EMBAs between fishing vessel and the East Coast Project is not expected.<br>Refer to Table 6-20 for further information on commercial fisheries in Victorian state waters. |
| Victorian Rock Lobster Fishery | Baited pot collection method.<br><br>Season is split into male and female open seasons. | Active | Female open season: Nov 16-May 31.<br><br>Male open season: Nov 16 – 16 Sept | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – There is a potential that fishing vessels associated with this fishery may be actively fishing within or in proximity to the East Coast Project operational area and therefore there is potential overlap of underwater sound and light emissions EMBAs.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around fishing vessels may be overlapped by the East Coast Project if fishing occurs within the light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The fishery may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species. |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | | | **Sound EMBA**<br>The localised sound EMBA around the fishing vessel may be overlapped by the East Coast Project if fishing occurs within the sound EMBA (Appendix 4).<br>The fishery may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>Given the spatial area of the fishery (Figure 6-79), the overlap from the light and sound EMBAs will be relatively small compared to the area of available fishing grounds. Refer to Table 6-20 for further information on commercial fisheries in Victorian state waters. |
| Victorian Giant Crab Fishery | Baited pot collection method with only one entrance and one chamber.<br><br>Season is split into male and female open seasons. | Active | Female open season: Nov 16-May 29<br><br>Male open season: Nov 16 – 16 Sept | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – There is a potential that fishing vessels associated with this fishery may be actively fishing within or in proximity to the East Coast Project operational area and therefore there is potential overlap of underwater sound and light emissions EMBAs.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around fishing vessels may be overlapped by the East Coast Project if fishing occurs within the light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The fishery may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species.<br><br>**Sound EMBA**<br>The localised sound EMBA around the fishing vessel may be overlapped by the East Coast Project if fishing occurs within the sound EMBA (Appendix 4).<br>The fishery may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>Given the spatial area of the fishery (Figure 6-80 the overlap from the light and sound EMBAs will be relatively small compared to the area of available fishing grounds.<br>Refer to Table 6-20 for further information on commercial fisheries in Victorian state waters. |
| Victorian Scallop Fishery | Using scallop dredge. | Active | 12-month fishing season commencing 1st April. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also | No – The East Coast Project operational area overlaps with the fishery management area, however based on current fishing activity presence of fishing vessels in the operational area is unlikely. Potential overlap of underwater sound and light emissions EMBAs between fishing vessels and the East Coast Project is not expected. |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | | potential for activities to occur sequentially. | Refer to Table 6-20 for further information on commercial fisheries in Victorian state waters. |
| Victorian Octopus Fishery | Baited pots collection method. | Active | Year-round season | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – There is a potential that fishing vessels associated with this fishery may be actively fishing within or in proximity to the East Coast Project operational area and therefore there is potential overlap of underwater sound and light emissions EMBAs.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around fishing vessels may be overlapped by the East Coast Project if fishing occurs within the light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The fishery may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species.<br><br>**Sound EMBA**<br>The localised sound EMBA around the fishing vessel may be overlapped by the East Coast Project if fishing occurs within the sound EMBA (Appendix 4).<br>The fishery may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>Given the spatial area of the fishery (Figure 6-82) the overlap from the light and sound EMBAs will be relatively small compared to the area of available fishing grounds.<br>Refer to Table 6-20 for further information on commercial fisheries in Victorian state waters. |
| Victorian Sea Urchin Fishery | Hand collection. | Active | 12-month fishing season commencing 1st July each year. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | No – The East Coast Project operational area overlaps with the fishery management area, however based on current fishing activity presence of fishing vessels in the operational area is unlikely. Potential overlap of underwater sound and light emissions EMBAs between fishing vessels and the East Coast Project is not expected.<br>Refer to Table 6-20 for further information on commercial fisheries in Victorian state waters. |
| Victorian Wrasse Fishery | Hook and line collection. | Active | Year-round season. | Yes – potential temporal overlap of fishing vessel activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – There is a potential that fishing vessels associated with this fishery may be actively fishing within or in proximity to the East Coast Project operational area and therefore there is potential overlap of underwater sound and light emissions EMBAs.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around fishing vessels may be overlapped by the East Coast Project if fishing occurs within the |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| | | | | | light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The fishery may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species.<br><br>**Sound EMBA**<br>The localised sound EMBA around the fishing vessel may be overlapped by the East Coast Project if fishing occurs within the sound EMBA (Appendix 4).<br>The fishery may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>Given the spatial area of the fishery (Figure 6-85) the overlap from the light and sound EMBAs will be relatively small compared to the area of available fishing grounds. Refer to Table 6-20 for further information on commercial fisheries in Victorian state waters. |
| **Commercial Shipping** | | | | | |
| Numerous shipping channels throughout the Otway Basin | 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.<br>The main shipping channel for vessels (e.g., cargo tankers) travelling between major Australian and foreign ports is located south of the Otway Development, about 75 km (40 nm) south of Warrnambool. | Active | All year round, about 3-4 vessels per day. | Yes – potential temporal overlap of shipping activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | Yes – potential overlapping with underwater sound and light emissions.<br><br>**Light EMBA**<br>The localised (small radius of light glow) expected around shipping vessels may be overlapped by the East Coast Project if shipping comes within the light EMBA. Modelling predicted the light EMBAs to range from 20 - 49 km, depending on flaring (see Section 8.3). The Shipping activity throughout the Otway Basin may overlap:<br>• foraging and breeding BIAs for multiple bird species, such as several albatross, petrel, and shearwater species.<br><br>**Sound EMBA**<br>The localised sound EMBA around the shipping vessel may be overlapped by the East Coast Project if shipping comes within the sound EMBA (Appendix 4). The Shipping activity throughout the Otway Basin may overlap:<br>• foraging, distribution and migrations BIAs for marine fauna, including cetaceans, pinnipeds, and sharks.<br>Given the spatial area of the shipping areas (Figure 6-102) the overlap from the light and sound EMBAs will be relatively small compared to the available shipping channels throughout the Otway Basin. |
| **Defence** | | | | | |

| Titleholder / Operator / Proponent | Activity Type | Status | Timing | Potential for Temporal Overlap | Potential for Spatial Overlap |
|---|---|---|---|---|---|
| King Island UXO | The King Island UXO was used during 1954 as an Air-to-Air Firing Range. This area is classed as slight potential. | Existing | Ongoing | N/A | No – the East Coast Project does not intersect any UXO sites. The King Island UXO is located ~32 km from the operational area. |
| Bass Strait Sea Dumping UXO | The Bass Strait Sea Dumping UXO area was used for the dumping of ordnance and other items in 1998-1999. | Existing | Ongoing | N/A | No – the East Coast Project does not intersect any UXO sites. The Bass Strait Sea Dumping UXO is located ~28 km from the operational area. |
| Swan Island Defence Precinct | The Swan Island training area is located in the eastern side of Swan Island, near to Queenscliff in Victoria. It is a join training facility operated by the Australian Secret Intelligence Services. | Existing | Ongoing | Yes – potential temporal overlap of Swan Island Defence Precinct activities with timings of East Coast Project activities. There is also potential for activities to occur sequentially. | No – The Swan Island Defence Precinct is located ~170 km away from the operational area. The large distance between the two areas prevents potential spatial overlap of underwater sound EMBAs. |

*DCCEEW has removed distribution BIAs for white shark within the south-east marine region

### 11.2.2 Part 2: Scoping assessment to identify relevant key environmental matters

The scoping steps of Part 2 are detailed as follows:

- **Step 1:** Review Sections 8 and 10 to identify the planned project aspects of the East Coast Project, relevant key environmental matters, and the acceptable levels of impact for each key environmental matter.
- **Step 2:** Based on the Otway Marine Bioregion spatial extent, identify potential pathways for cumulative impacts from the East Coast Project and other reasonably foreseeable future projects and activities for each key environmental matter (i.e. multiple planned aspects that have spatial overlap with areas of significance for key environmental matters such as BIAs, critical habitat, active fishing cells, petroleum titles).
- **Step 3:** Based on the indicative East Coast Project life (2025 to 2049), identify potential pathways for cumulative impacts from the East Coast Project and other reasonably foreseeable future projects and activities for each key environmental matter (i.e. multiple planned aspects that have temporal overlap with the presence of key environmental matters present in the Otway Marine Bioregion).
- **Step 4:** From the identified spatial and temporal pathways for cumulative impacts, confirm if there is potential for material cumulative cause-effect pathways and the resulting cumulative impacts.
- **Step 5:** Identify the level of certainty of the scoping assessment data used to define the above factors.
- **Step 6:** Review the potential of material cumulative impacts and level of certainty for each key environmental matter:
  - If there is potential for material cumulative impacts, the key environmental matter is required to have a detailed cumulative impact assessment (Section 11.3).
  - If the certainty of the scoping assessment data does not meet the following points below, the key environmental matter is required to have a detailed cumulative impact assessment (Section 11.3):
    - Impacts are well understood,
    - Impacts are relatively easy to predict using standard methods,
    - Impacts are capable of being mitigated to comply with relevant standards and to meet the acceptable level.

Table 11-2 details the results of Part 2 scoping assessment. As described in Section 6.6, there is no overlap between the East Coast Project operational area and AMPs in the south-east marine region. The shelf rocky reef / hard substrate KEF is known to be a common feature throughout the Otway Bioregion, including within the operational area of the East Coast Project. 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. Potential cumulative impacts to these values and sensitivities have been considered in the table below.

The cumulative impact assessment to First Nations values and sensitivities has been described in Section 10, considering the interconnectedness of key environmental matters and values. For this, Section 10 draws on elements of both Sections 8 and 10.

*Table 11-2: Part 2 - Identification of relevant key environmental matters and detailed cumulative impact assessment scoping*

| Environmental Component | Key Environmental Matter | East Coast Project Aspects | | | | | | | | | Acceptable Level for key environmental matters | Cumulative Impact Scoping: Based on Planned Aspects from the East Coast Project and Reasonably Foreseeable Future Projects | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Underwater sound emissions - Impulsive | Underwater sound emissions - continuous | Light emissions | Atmospheric emissions | GHG emissions | Planned discharges – Drilling | Planned discharges – Operational | Seabed disturbance | Displacement of marine users | | Potential for cumulative impact - Spatial | Potential for cumulative impact - Temporal | Material cumulative cause-effect pathway | Level of Certainty of Scoping Assessment | Does the material cumulative impact require detailed assessment? |
| Physical Environment | Water quality | | | | | | ✓ | ✓ | | | AL2: Water quality beyond 1000 m of the discharge location is within the range for water typical of the wider Otway offshore marine environment, with any difference from regional baseline being temporary[11]. Planned drilling discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure. | No<br>Spatial interference is incidental | No<br>Temporal interference is incidental | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause temporary and localised change to water quality. OPP activities that could cause a change to water quality have been assessed in Section 8.6 (Planned Discharges - Drilling) and Section 8.7 (Planned Discharges – Operational). Impacts were found to be local and temporary with a consequence rating of Level 1.<br>Based on the spatial and temporal overlap of the East Coast Project with other reasonably foreseeable projects and activities and the localised scale of potential impacts, no material successive, additive or synergistic cumulative cause-effect pathways are identified. | Impacts are well understood. | No.<br>No material cumulative impacts anticipated. |
| | Sediment quality | | | | | | ✓ | ✓ | | | AL4: Sediment quality beyond 1000 m of the discharge location is within the range for sediments typical of the wider Otway offshore marine environment.<br>Planned drilling discharges will only contain chemicals selected in accordance with the Cooper Energy Offshore Chemical Procedure | No<br>Spatial interference is incidental | No<br>Temporal interference is incidental | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause temporary and localised change to sediment quality. Non-routine seabed discharges during the East Coast Project are related to activities that are intermittent, brief and likely result in localised changes to sediment quality. OPP activities that could cause a change to sediment quality have been assessed in Section 8.6 (Planned Discharges - Drilling) and Section 8.7 (Planned Discharges – Operational). Impacts were found to be local and temporary with a consequence rating of Level 1.<br>Based on the spatial and temporal overlap of the East Coast Project with other reasonably foreseeable projects and activities and the localised scale of potential impacts, no material successive, additive or synergistic cumulative cause-effect pathways are identified. | Impacts are well understood. | No.<br>No material cumulative impacts anticipated. |
| | Ambient light | | | ✓ | | | | | | | AL5: Artificial light from project activities defined in this OPP will not exceed lighting levels required for navigation and safe operation, with any change in ambient light levels being temporary[12]. Lighting management measures will be applied during offshore campaigns, and will be informed by the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k), to ensure biologically important behaviours of | No<br>Spatial interference is incidental | No<br>Temporal interference is incidental | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause temporary and localised change to ambient light. Light emission sources of the East Coast Project are related to activities that are intermittent, of a short-term duration and relatively localised. Following the completion of phase activities, light emissions will return to ambient levels with no remedial or recovery work required. OPP activities that could cause a change to ambient light have been assessed in Section 8.3 (Light Emissions). Impacts were found to be local and temporary with a consequence rating of Level 1.<br>Based on the spatial and temporal overlap of the East Coast Project with other reasonably foreseeable projects and activities and the localised scale of potential impacts, no material successive, additive or synergistic cumulative cause-effect pathways are identified. | Impacts are well understood. | No.<br>No material cumulative impacts anticipated. |

| Environmental Component | Key Environmental Matter | East Coast Project Aspects | | | | | | | | | Acceptable Level for key environmental matters | Cumulative Impact Scoping: Based on Planned Aspects from the East Coast Project and Reasonably Foreseeable Future Projects | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Underwater sound emissions - Impulsive | Underwater sound emissions - continuous | Light emissions | Atmospheric emissions | GHG emissions | Planned discharges – Drilling | Planned discharges – Operational | Seabed disturbance | Displacement of marine users | | Potential for cumulative impact - Spatial | Potential for cumulative impact - Temporal | Material cumulative cause-effect pathway | Level of Certainty of Scoping Assessment | Does the material cumulative impact require detailed assessment? |
| | | | | | | | | | | | light sensitive species can continue. | | | | | |
| | Underwater noise | ✓ | ✓ | | | | | | | | AL11: Changes to ambient underwater sound from project activities will be characterised through modelling and/or monitoring, and impacts and risks will not be inconsistent with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. | No<br>Spatial interference is incidental | No<br>Temporal interference is incidental | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause temporary and localised change to ambient sound. The extent and duration of underwater sound generated by the East Coast Project is related to activities that are intermittent, of a short-term duration and relatively localised. Following the completion phase of activities, underwater sound will return to ambient levels with no remedial or recovery work required. OPP activities that could cause a change to ambient sound have been assessed in Section 8.1 (Underwater Sound Emissions – Impulsive) and Section 8.2 (Underwater Sound Emissions – Continuous). Impacts were found to be local and temporary with a consequence rating of Level 1.<br>Based on the spatial and temporal overlap of the East Coast Project with other reasonably foreseeable projects and activities and the localised scale of potential impacts, no material successive, additive or synergistic cumulative cause-effect pathways are identified. | Impacts are well understood. | No.<br>No material cumulative impacts anticipated. |
| | Climate | | | | | ✓ | | | | | AL10: GHG Emissions from activities defined in this OPP will not interfere with Australia's greenhouse gas commitments under the Paris Agreement, enacted in the Climate Change Act 2022 and managed by the safeguard mechanism. | No<br>Low levels of contribution to Australian and Victorian carbon budgets | No (not outside the framework of the national and domestic emissions reduction targets) | The East Coast Project and other reasonably foreseeable projects and activities will require fuels and energy that will result in greenhouse gases being released into the atmosphere. The cumulative emissions are anticipated to be relatively small in the context of Australian carbon budgets. Direct and / or indirect low levels of GHG emissions from the East Coast Project in addition to other reasonably foreseeable projects and activities will not result in material successive, additive or synergistic cumulative impacts to climate systems.<br>The detailed impact assessment on GHG emissions includes an assessment of cumulative impacts (Section 8.5). | Impacts are capable of being mitigated to comply with relevant standards and to meet the acceptable level. | No.<br>No material cumulative impacts anticipated. |
| **Ecological Environment** | Benthic assemblages | | | | | | ✓ | | ✓ | | AL6: No unrecoverable impacts to seabed including shelf rocky reef and hard substrate KEF values[13].<br>AL7: Seabed disturbance will not occur outside the Operational Area | No<br>No critical habitat overlaps | No<br>No seasonal presence overlap | There are no threatened or critical habitats (spatial defined Key Ecological Features, AMP or threatened ecological communities) in the East Coast Project operational area. Hard substrates along the continental shelf are considered values associated with the shelf rocky reefs KEF, supporting increased productivity and diversity of benthic assemblages. The East Coast Project and other reasonably foreseeable projects and activities have the potential to result in incidental and localised seabed disturbance. This incidental seabed disturbance does not have potential to result in serious or irreversible damage to benthic assemblage's characteristic of the region, as seen by the recovery of seabed communities around existing infrastructure in the Otway region. The sand or gravelly / rubble and hard platform substrates are highly represented in the wider Otway Basin Bioregion. Seabed disturbance is minimised through utilisation of existing infrastructure where practicable and the planning and design of the new infrastructure to minimise its footprint. OPP activities that could cause a disturbance to benthic assemblages have been assessed in Section 8.6 (Planned Discharges – Drilling) and Section 8.8 (Seabed Disturbance). Impacts were found to be local with consequence ratings of Level 1 and 2. | Impacts are well understood. | No.<br>Seabed disturbance is a localised and incidental consequence of the East Coast Project<br>Localised and recoverable loss of benthic assemblages that are not threatened listed ecological communities is considered an acceptable impact. |

| Environmental Component | Key Environmental Matter | East Coast Project Aspects | | | | | | | | | Acceptable Level for key environmental matters | Cumulative Impact Scoping: Based on Planned Aspects from the East Coast Project and Reasonably Foreseeable Future Projects | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Underwater sound emissions - Impulsive | Underwater sound emissions - continuous | Light emissions | Atmospheric emissions | GHG emissions | Planned discharges – Drilling | Planned discharges – Operational | Seabed disturbance | Displacement of marine users | | Potential for cumulative impact - Spatial | Potential for cumulative impact - Temporal | Material cumulative cause-effect pathway | Level of Certainty of Scoping Assessment | Does the material cumulative impact require detailed assessment? |
| | | | | | | | | | | | | | | Based on the spatial and temporal overlap of the East Coast Project with other reasonably foreseeable projects and activities and the localised scale of potential impacts, no material successive, additive or synergistic cumulative cause-effect pathways are identified. | | |
| | Plankton | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | AL11: Changes to ambient underwater sound from project activities will be characterised through modelling and/or monitoring, and impacts and risks will not be inconsistent with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. | No<br>No BIA or critical habitat overlap | No<br>No seasonal presence overlap | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause incidental and indiscernible levels of disturbance to fish eggs and larvae (plankton). Fish eggs and larvae are subject to a diverse array of predators, resulting in frequent predator avoidance behaviours and loss of eggs and larvae from consumption (Reebs, 2008). OPP activities that could cause a change to sediment quality have been assessed in Section 8.6 (Planned Discharges - Drilling) and Section 8.7 (Planned Discharges – Operational). Impacts were found to be local and temporary with the risk of injury or mortality assessed as low.<br>Based on the spatial and temporal overlap of the East Coast Project and other reasonably foreseeable projects and activities, additional temporary impacts to fish eggs and larvae will not result in material successive, additive or synergistic cumulative impacts. | Impacts are well understood. | No.<br>Incidental localised and temporary disturbance to fish eggs and larvae is considered an acceptable impact. |
| | Invertebrates | | | ✓ | | | | | ✓ | | | No<br>No critical habitat overlaps | No<br>No seasonal presence overlap | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause temporary behavioural change and incidental injury/mortality to sessile benthic invertebrates from disturbance to the seabed.<br>This incidental seabed disturbance does not have potential to result in serious or irreversible damage to invertebrates characteristic of the region, as seen by the recovery of seabed communities around existing infrastructure in the Otway region. The sand or gravelly / rubble and hard platform substrates are highly represented in the wider Otway Basin Bioregion. Seabed disturbance is minimised through utilisation of existing infrastructure where practicable and the planning and design of the new infrastructure to minimise its footprint. OPP activities that could impact invertebrate species have been assessed in Section 8.3 (Light Emissions), Section 8.5 (GHG Emissions), Section 8.6 (Planned Discharges – Drilling), Section 8.7 (Planned Discharges – Operational) and Section 8.8 (Seabed Disturbance). Impacts were found to be local with the risk of behavioral change, injury or mortality assessed as either low or moderate for Seabed Disturbance.<br>Additional impacts from the East Coast Project and other reasonably foreseeable projects and activities are not expected to result in material successive, additive or synergistic cumulative impacts. | Impacts are well understood. | No.<br>Temporary incidental loss of sessile marine invertebrates that are well represented in the region and is not defined as a critical habitat, is considered an acceptable impact. |
| | Fish | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | No<br>No BIA or critical habitat overlap | No<br>No seasonal presence overlap | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause temporary behavioural change to fish. OPP activities that could impact fish species have been assessed in Section 8.1 (Underwater Sound Emissions – Impulsive), Section 8.2 (Underwater Sound Emissions – Continuous). Section 8.3 (Light Emissions), Section 8.5 (GHG Emissions), Section 8.6 (Planned Discharges – Drilling), Section 8.7 (Planned Discharges – Operational) and Section 8.8 (Seabed Disturbance). Impacts were found to be local with the risk of | Impacts are well understood. | No.<br>Incidental, localised and temporary disturbance fish is considered an acceptable impact. |

| Environmental Component | Key Environmental Matter | East Coast Project Aspects | | | | | | | | | Acceptable Level for key environmental matters | Cumulative Impact Scoping: Based on Planned Aspects from the East Coast Project and Reasonably Foreseeable Future Projects | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Underwater sound emissions - Impulsive | Underwater sound emissions - continuous | Light emissions | Atmospheric emissions | GHG emissions | Planned discharges – Drilling | Planned discharges – Operational | Seabed disturbance | Displacement of marine users | | Potential for cumulative impact - Spatial | Potential for cumulative impact - Temporal | Material cumulative cause-effect pathway | Level of Certainty of Scoping Assessment | Does the material cumulative impact require detailed assessment? |
| | | | | | | | | | | | | | | behavioral change, injury or mortality assessed as N/A, low or moderate for Seabed Disturbance.<br>Based on the spatial and temporal overlap of the East Coast Project and other reasonably foreseeable projects and activities, additional temporary impacts to fish will not result in material successive, additive or synergistic cumulative impacts. | | |
| | Marine reptiles | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | No<br>No BIA or critical habitat overlap | No<br>No seasonal presence overlap | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause behavioural change to occasional individual marine reptiles. OPP activities that could impact turtle species have been assessed in Section 8.1 (Underwater Sound Emissions – Impulsive), Section 8.2 (Underwater Sound Emissions – Continuous). Section 8.5 (GHG Emissions), Section 8.6 (Planned Discharges – Drilling) and Section 8.7 (Planned Discharges – Operational). Impacts were found to be local with the risk of behavioral change, injury or mortality assessed as low.<br>Behavioural change to occasional individual marine reptiles will not result in material successive, additive or synergistic cumulative impacts to marine reptiles. | Impacts are well understood. | No.<br>Temporary and localised behavior change to occasional individual marine reptiles not in habitat critical to survival is considered an acceptable impact. |
| | Seabirds and shorebirds | | | ✓ | | | | | | | | Yes<br>BIAs for sensitive species overlapped by light EMBAs. | Yes<br>Impact during seasonal presence | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause temporary behavioural change to seabirds and shorebirds undertaking biologically important behaviours. Light emissions are the cause-effect pathway. Light emissions as a result of OPP activities have been assessed as having a low risk of a change in behaviour, injury or mortality to birds (Section 8.3). Collectively, light emissions from the East Coast Project and other reasonably foreseeable project and activities have the potential to cause either cumulative impacts to seabirds and shorebirds by disturbing them whilst they are undertaking biologically important behaviours. These impacts from other reasonably foreseeable projects, together with these same types of impact from the East Cost Project will sometimes be additive, and sometimes successive. The flaring light EMBA for the East Coast Project overlaps 9 known or likely foraging BIAs of albatross, petrel and shearwater species which are carried forward for further assessment (Table 11-5). The flaring light EMBA for the East Coast Project also overlaps the migration route for the orange-bellied parrot and is also carried forward for further assessment (Table 11-5). | Impacts are capable of being mitigated to comply with relevant standards and to meet the acceptable level. | Yes.<br>Detailed assessment required to determine if l cumulative impacts are acceptable. |
| | Marine mammals | ✓ | ✓ | | | | ✓ | ✓ | | | | Yes<br>Multiple impacts overlap BIAs | Yes<br>Multiple impacts during seasonal presence | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause behavioural change to marine mammals undertaking biologically important behaviours. Cause-effect pathways include underwater sound emissions. Collectively these projects have the potential to cause cumulative impacts to marine mammals by disturbing them whilst they are undertaking important behaviours. These impacts from other reasonably foreseeable projects, together with these same types of impact from the East Cost Project will sometimes be additive, and sometimes successive.<br>Marine mammal species considered for further assessment are the: | Impacts are capable of being mitigated to comply with relevant standards and to meet the acceptable level. | Yes.<br>Detailed assessment required to determine if cumulative impacts are acceptable for Endangered species of marine mammals (i.e., blue whale and southern right whale with BIAs and biological important behaviour overlapped by multiple offshore activities. |

| Environmental Component | Key Environmental Matter | East Coast Project Aspects | | | | | | | | | Acceptable Level for key environmental matters | Cumulative Impact Scoping: Based on Planned Aspects from the East Coast Project and Reasonably Foreseeable Future Projects | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Underwater sound emissions - Impulsive | Underwater sound emissions - continuous | Light emissions | Atmospheric emissions | GHG emissions | Planned discharges – Drilling | Planned discharges – Operational | Seabed disturbance | Displacement of marine users | | Potential for cumulative impact - Spatial | Potential for cumulative impact - Temporal | Material cumulative cause-effect pathway | Level of Certainty of Scoping Assessment | Does the material cumulative impact require detailed assessment? |
| | | | | | | | | | | | | | | • blue whale - listed as Endangered under the EPBC Act with foraging, feeding or related behaviour known to occur within the noise EMBA (Appendix 4) with anthropogenic noise interference listed as a threat.<br>• southern right whale - listed as Endangered under the EPBC Act with breeding known to occur within the noise EMBA (Appendix 4) and noted as a species of cultural significance with noise interference listed as a threat.<br>Considering other significant activities or projects over temporal and spatial scales, the assessment outcomes found there was limited potential for successive, additive or synergistic impacts to other marine mammal species from noise emissions as no BIAs or biologically important behaviour were identified within the noise EMBA (Appendix 4) and as detailed within in Section 8.1 (Underwater Sound Emissions – Impulsive) and Section 8.2 (Underwater Sound Emissions – Continuous). | | |
| Socio-economic Environment | Commercial fisheries | | | | | | | | | ✓ | AL14: No interference with other marine users to a greater extent than is necessary for the reasonable exercise of the rights and performance of duties as conferred by the titles granted to Cooper Energy. | Yes<br>Fishing area overlap | Yes<br>Impact during seasonal presence | The East Coast Project and other reasonably foreseeable oil and gas projects and activities have the potential to cause temporary and localised change in commercial fishing activities. OPP activities that could cause a temporary and localised change in fishing activities have been assessed in Section 8.9 (Interaction with Other Marine Users). Impacts were found to be local and temporary with a consequence rating of Level 1.<br>Temporary and localised change in fishing activities to avoid the East Coast Project will not cause material change or result in material successive, additive or synergistic cumulative impacts to commercial fisheries. Large renewable infrastructure projects have the potential to obstruct some fisheries long term; however, the East Coast project facilities are all located at seabed and outside of trawl grounds and would not be expected to have a discernable additive impact to fishing when considered alongside reasonably foreseeable future renewable projects. | Impacts are well understood. | No.<br>No material cumulative impacts anticipated. |
| | Other offshore industry - Shipping | | | | | | | | | ✓ | AL14: No interference with other marine users to a greater extent than is necessary for the reasonable exercise of the rights and performance of duties as conferred by the titles granted to Cooper Energy. | No<br>Spatial interference is incidental | No<br>Temporal interference is incidental | The East Coast Project and other reasonably foreseeable projects and activities have the potential to cause temporary and localised change in shipping movements. OPP activities that could cause a temporary and localised change in shipping activities have been assessed in Section 8.9 (Interaction with Other Marine Users). Impacts were assessed as having a consequence rating of Level 1.<br>Temporary and localised change in shipping routes to avoid the East Coast Project and other reasonably foreseeable project and activities will not result in material successive, additive or synergistic cumulative impacts to the shipping industry. | Impacts are well understood. | No.<br>Temporary and localised change to shipping movements outside of major shipping routes is considered an acceptable impact (Section 8.9.4.1). |
| | Other offshore industry - Petroleum exploration and production | | | | | | | | | ✓ | | No<br>No overlap with other petroleum titles | No<br>Temporal overlap results in no interference | Operations of the East Coast Project and other reasonably foreseeable projects and activities will not overlap as activities will be limited to within each operator's title or otherwise arranged through defined processes and Title agreements and have been assessed in Section 8.9 (Interaction with Other Marine Users). Impacts were assessed as having a consequence rating of Level 1.<br>No material successive, additive or synergistic cumulative cause-effect pathways identified. | Impacts are well understood. | No.<br>No material cumulative impacts anticipated. |

| Environmental Component | Key Environmental Matter | East Coast Project Aspects | | | | | | | | | Acceptable Level for key environmental matters | Cumulative Impact Scoping: Based on Planned Aspects from the East Coast Project and Reasonably Foreseeable Future Projects | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Underwater sound emissions - Impulsive | Underwater sound emissions - continuous | Light emissions | Atmospheric emissions | GHG emissions | Planned discharges – Drilling | Planned discharges – Operational | Seabed disturbance | Displacement of marine users | | Potential for cumulative impact - Spatial | Potential for cumulative impact - Temporal | Material cumulative cause-effect pathway | Level of Certainty of Scoping Assessment | Does the material cumulative impact require detailed assessment? |
| | Other offshore infrastructure – Offshore renewable energies | | | | | | | | | ✓ | | No<br>No overlap with other offshore infrastructure | Yes<br>IMR activities may overlap with wind farm installation (expected 2031). | Operations of the East Coast Project and other reasonably foreseeable projects and activities will not overlap declared offshore wind areas as activities will be limited to within each operator's title. OPP activities that have been assessed in Section 8.9 (Interaction with Other Marine Users). Impacts were assessed as having a consequence rating of Level 1.<br>No material successive, additive or synergistic cumulative cause-effect pathways identified. | Impacts are well understood. | No.<br>No material cumulative impacts anticipated. |
| | Recreation and tourism | | | | | | | | | ✓ | | No<br>No spatial overlap | No<br>Temporal interference is inconsequential | Operations of the East Coast Project and other reasonably foreseeable projects and activities will not overlap recreation and tourism activities that are generally land-based or near-shore. Large renewable infrastructure projects have the potential to obstruct some recreational and charter fishing long term; however, the East Coast Project facilities are all located at seabed have very limited exclusion zones and would not be expected to have a discernable additive impact to recreational or charter fishing when considered alongside reasonably foreseeable future renewable projects.<br>OPP activities that could impact recreation and tourism activities have been assessed in Section 8.9 (Interaction with Other Marine Users). Impacts were assessed as having a consequence rating of Level 1.<br>No material successive, additive or synergistic cumulative cause-effect pathways identified. | Impacts are well understood. | No.<br>No material cumulative impacts anticipated. |

## 11.3 Detailed cumulative impact assessment

For those receptors and aspects where a potential cumulative cause-effect pathway and material impact was identified in the Part 2: scoping assessment (Table 11-2), a detailed Cumulative Impact Assessment (CIA) was applied in general alignment with the project-specific methodology described in Section 5.

The CIA process applied to each aspect and component of the environment was:

- Identification of:
  - receptor conservation values or values relevant to CIA e.g. EPBC Listed Threatened Species, MNES, commercial or cultural significance
  - legislative or other requirements relevant to the assessment
  - relevant threatening processes.
  - relevant spatial extent such as BIAs, and temporal extent when receptor present including any biologically important features such as behaviours or critical life-cycle stages or, timings.
  - relevant actions from legislative or other requirements.
- Detail the baseline existing environment including pressures and condition.
- Define the cumulative impact acceptable level.
- Identification of other reasonably foreseeable future projects where the aspect overlaps the identified relevant spatial and temporal extents.
- Assessment of potential for cumulative impacts:
  - Description of potential cumulative impact
  - Detail the level of certainty of the assessment
  - Detail Cooper Energy's existing control measures
  - Detailing any additional control measures
  - Assess aspect specific cumulative impact consequence level
  - If applicable, assess combined cumulative impact consequence level.

The following tables in the subsections below provide detailed cumulative impact assessments for the identified key environmental matters identified in the Part 2: scoping assessment:

- Table 11-3 – Blue whales
- Table 11-4 – Southern right whales
- Table 11-5 – Seabirds and shorebirds.

### 11.3.1 Marine Mammals

*Table 11-3: Detailed cumulative impact assessment: blue whale*

| Key Environmental Matter | Marine Mammals – Blue Whale | |
|---|---|---|
| Conservation (or other) Value and Status | EPBC Act listed: Endangered, Cetacean, Migratory. | |
| Legislative or Other Requirements | Guidance on key terms within the Blue Whale Conservation Management Plan (DAWE 2021a)<br>Conservation Management Plan for the Blue Whale (DoE 2015a):<br>• Action A.2: Blue whales can continue to utilise the area without injury and [are] not displaced from a foraging area (or as revised under relevant statutory conservation listing advice and plans).<br>Identified anthropogenic threats within the Conservation Management Plan for the Blue Whale relevant to the East Coast Project:<br>• Noise interference | |
| Spatial and Temporal Extent of Key Environmental Matter | Typically, blue whales migrate between breeding grounds (low latitudes) where mating and calving take place in the winter, to feeding grounds (high latitudes) where foraging occurs in the summer. Australia has 2 known seasonal feeding aggregations of blue whales; one occurs adjacent to the Bonney Upwelling system off South Australia and Victoria.<br>The blue whale is known to aggregate each year during the summer (January to April) off southern Australia due to seasonal upwellings that result in high concentrations of prey (DoE, 2023). The abundance of whales in the area varies within and between seasons and is closely in-sync with the strength of the Bonney Upwelling (DoE, 2015a., Gill et al., 2011, McCauley et al., 2018). Blue whales migrate through the southern waters of the Indian Ocean and south of Australia, including Otway Basin, between January and June.<br>BIAs for the blue whales are detailed in Figure 6-44. | |
| Acceptable Level | Artificial underwater sound emissions will be managed so that:<br>**AL11:** Changes to ambient underwater sound from project activities will be characterised through modelling and/or monitoring, and impacts and risks will not be inconsistent with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. | |
| **Planned Project Aspects Relevant to Identified Threats** | **Underwater Sound Emissions - Impulsive** | **Underwater Sound Emissions - Continuous** |
| Relevant Spatial and Temporal Extent of Identified Threats | Multiple localised and short-term impulsive underwater sound EMBAs (Appendix 4) overlap foraging and distribution BIAs in the Otway Basin from the East Coast Project and other reasonably foreseeable future projects and activities (Table 11-1). This includes the potential localised and short-term impulsive underwater sound EMBAs from sequential drilling activities.<br>Underwater sound EMBA (Appendix 4) for the East Coast Project overlap the combined foraging BIAs for the blue whale <1 %, (presence is between November to June, peaking in February and March). | Multiple localised and short-term continuous underwater sound EMBAs overlap foraging and distribution BIAs in the Otway Basin from the East Coast Project and other reasonably foreseeable future projects and activities. There is also potential for localised continuous underwater sound EMBAs from sequential drilling activities.<br>Underwater sound EMBA (Appendix 4) for the East Coast Project overlap the combined foraging BIAs for the blue whale <1 %, (presence is between November to June, peaking in February and March). |

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| Baseline Environmental Condition | The foraging and distribution BIAs are overlapped by area of high commercial fishing effort, shipping and existing oil and gas activity. These activities may temporarily use impulsive sources.<br>Ambient noise within the existing environment is detailed within Section 6.4.9<br>Listed species identified may also be impacted by noise sources from:<br>• existing shipping (Section 6.7.3.1) including current commercial fishing effort (Section 6.7.2).<br>• existing oil and gas activities (Section 6.7.3.2**Error! Reference source not found.**)<br>On average ~225 vessels operate within the blue whale combined foraging and foraging (annual high use area) (Otway region) BIAs per day with associated continuous noise emissions. | The foraging and distribution BIAs are overlapped by area of high commercial fishing effort, shipping and existing oil and gas activity. These activities may temporarily use impulsive sources.<br>Ambient noise within the existing environment is detailed within Section 6.4.9<br>Listed species identified may also be impacted by noise sources from:<br>• existing shipping (Section 6.7.3.1) including current commercial fishing effort (Section 6.7.2).<br>• existing oil and gas activities (Section 6.7.3.2)<br>On average ~225 vessels operate within the blue whale combined foraging and foraging (annual high use area) (Otway region) BIAs per day with associated continuous noise emissions. |
| Other Reasonably Foreseeable Projects/ Activities Relevant to Aspect | Together the following projects that occur between Cape Otway and Robe during the biologically important period (January to June) will generate multiple sources of impulsive sound:<br>• Commercial fishing<br>• CHN operations – Cooper Energy<br>• Otway Operations – Beach Energy<br>• Minerva decommissioning – Woodside Energy<br>• Drilling – Beach Energy<br>• Decommissioning – Beach Energy<br>• Geophysical/geotechnical survey – Beach Energy<br>• Drilling – ConocoPhillips<br>• Seismic survey – CGG-Regia. | Together the following projects that occur between Cape Otway and Robe during the biologically important period (January to June) will generate multiple sources of continuous sound:<br>• Commercial shipping<br>• Commercial fishing<br>• CHN operations – Cooper Energy<br>• Otway Operations – Beach Energy<br>• Minerva decommissioning – Woodside Energy<br>• Drilling – Beach Energy<br>• Decommissioning – Beach Energy<br>• Drilling – ConocoPhillips.<br>Drilling activities are expected to occur consecutively, therefore instead of multiple sound sources occurring at one time, one drilling sound source in the Otway Basin is expected to occur over a long period of time. |
| Description of Cumulative Impact | The potential risks from impulsive underwater sound to blue whales from East Coast Project OPP activities are assessed as being Low for Change in fauna behaviour and N/A for TTS or PTS (Section 8.1).<br><br>**Successive and Additive Impacts:**<br>As described in Section 8.1, behavioural EMBA for low-frequency cetaceans from the East Coast Project impulsive sound sources is 130 m around the operational area. This is assumed representative of impulsive sound sources from other reasonably foreseeable projects, aside from seismic surveys which have a larger footprint (e.g. 8.09 km to behavioural thresholds from CGG-Regia Seismic survey). However, as a single MODU | The potential risks from continuous underwater sound to blue whales from East Coast Project OPP activities are assessed as being moderate for Change in fauna behaviour of marine mammals and N/A for TTS or PTS (Section 8.2).<br><br>**Successive and Additive Impacts:**<br>As a single MODU will be used within the Otway region by multiple titleholders, therefore concurrent drilling activities are unlikely to occur. Therefore, additive cumulative impacts by concurrent drilling operations are also unlikely. Additive impacts are only possible between a single drilling operation, other support or IMR operations, seismic surveys or general shipping activity. However, these will be limited due to the relatively short time drilling and support activities take |

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| | will be used within the Otway region by multiple titleholders, concurrent impulsive activities associated with drilling programs are unlikely to occur.<br>Successive impacts are possible throughout the life of the East Coast Project OPP (Section 4). However, drilling and support activities are conducted over relatively short durations compared with the life of the East Coast Project OPP and other reasonably foreseeable projects (Table 11-1). In addition, the presence of all vessels connected to East Coast Project OPP and other reasonably foreseeable activities will be temporary (Section 4).<br>The locations of East Coast Project OPP and other reasonably foreseeable activities are isolated and separated. Whilst foraging or migrating blue whales may exert more energy to avoid localised impulsive sound sources from the East Coast Project and other reasonably foreseeable projects, areas of behavioural impact would not form barriers to the migration of whale species or other biological important behaviours.<br>Based on this, it is not credible to consider that successive or additive cumulative behavioural impacts to blue whale will occur as a result of the East Coast Project in combination with other oil and gas projects of a similar nature and scale. Vessels / activities would never be within 130 m of each other due to safety and navigation risk, therefore overlap in behaviour EMBAs is not predicted. Even if several similar activities were being undertaken at once or sequentially within the foraging BIA, the overall footprint of impulsive sound impacts would still be very small, and displacement of blue whale is not predicted.<br>Potential behavioural disturbance to blue whale is predicted within 8.09 km of the Regia MSS, however CGG plans to implement an activity limitation where the sound source will only be operated in the pygmy blue whale foraging BIA during April, May & June or September, October & November when low numbers of pygmy blue whales and other foraging whales are in the BIA. This activity limitation is designed to meet the action from the Conservation Management Plan for Blue Whale (DoE 2015) and reduce impacts to ALARP and acceptable levels.<br>Minor avoidance behaviours of blue whales within the foraging BIA from multiple highly temporary impulsive sources is not expected to result in the displacement of blue whales from a foraging area, including stopping or preventing a blue whale from foraging, causing a blue whale to move on when foraging or stopping or preventing a blue whale from entering a foraging area (DAWE 2021a).<br>The Bonney Coast Upwelling KEF (Section 6.6.6) is an area where blue whales are known to feed in relatively high numbers. However, this BIA is situated ~50 km from the East Coast Project operational area and impulsive underwater noise EMBA. Behavioural underwater noise EMBAs from ConocoPhillips exploration drilling activities may overlap this KEF but | compared with the life of the East Coast Project OPP (Section 4) and other reasonably foreseeable projects (Table 11-1).<br>Successive impacts are possible throughout the life of the East Coast Project OPP. However, drilling and support activities are conducted over relatively short durations compared with the life of the East Coast Project OPP (Section 4) and other reasonably foreseeable projects (Table 11-1). In addition, the presence of all vessels connected to East Coast Project OPP and other reasonably foreseeable activities will be temporary (Section 4). The locations of East Coast Project OPP and other reasonably foreseeable activities are isolated and separated. Whilst foraging or migrating blue whales may exert more energy to avoid localised continuous sound sources from the East Coast Project and other reasonably foreseeable projects, areas of behavioural impact would not form barriers to the migration of whale species or other biological important behaviours.<br>As described in Section 8.2, behavioural EMBA for low-frequency cetaceans from the East Coast Project continuous sound sources is 0.44 km from a single source and ~25 km from concurrent sources (up to 4). This is assumed representative of continuous sound sources from other reasonably foreseeable projects and activities.<br>Based on what is known about other reasonably foreseeable projects and activities in the region, it is likely that most activities will involve a single vessel operating, therefore the 0.44 km EMBA for continuous sound sources is most relevant for this assessment. Based on this EMBA, the likelihood of successive or additive cumulative impacts occurring is low. Vessels / activities would rarely be within 0.44 km of each other due to safety and navigation risk, therefore overlap in behaviour EMBAs is not expected. Even if several similar activities were being undertaken at once or sequentially within the foraging BIA, the overall footprint of continuous sound impacts would still be very small.<br>Minor avoidance behaviours of blue whales within the foraging BIA from multiple continuous sources is not expected to result in the displacement of blue whales from a foraging area, including stopping or preventing a blue whale from foraging, causing a blue whale to move on when foraging or stopping or preventing a blue whale from entering a foraging area (DAWE 2021a).<br>The Bonney Coast Upwelling KEF (Section 6.6.6) is an area where blue whales are known to feed in relatively high numbers. However, this BIA is situated ~50 km from the East Coast Project operational area and ~30 km from the continuous underwater noise EMBA. Behavioural underwater noise EMBAs from ConocoPhillips exploration drilling activities may overlap this KEF but as previously stated, concurrent drilling operation will not occur with successive activities also not expected to cause a cumulative impact. Whilst CGG's Regia MSS underwater noise emissions will overlap the KEF, seasonal controls are proposed to avoid behavioural disturbance to blue whales. |

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| | as previously stated, concurrent drilling operation will not occur with successive activities also not expected to cause a cumulative impact. Whilst CGG's Regia MSS underwater noise emissions will overlap the KEF, seasonal controls are proposed to avoid behavioural disturbance to blue whales.<br><br>**Synergistic Impacts** – none identified with the presence of a MODU and additional vessels. | **Synergistic Impacts** – none identified with the presence of a MODU and additional vessels. |
| Certainty of Assessment | There is a high level of predictability and certainty in the limited potential for impacts, given the underwater noise modelling data available for the East Coast Project OPP and other reasonably foreseeable projects. In addition, OPP activities and all other reasonably foreseeable projects, as listed in Table 11-1, have controls in place* for each activity to prevent / limit impacts.<br>*These control measures are detailed in published Environment Plans; where these plans are not available for a particular activity, it is considered reasonable to expect that a similar level of control measures would be implemented given the environment protection framework that applies to activities in the marine environment, and additional regulatory requirements that apply to large offshore petroleum and infrastructure projects. | |
| Existing Control Measures | CM1: Marine Assurance Process<br>CM2: Offshore Operational Procedures<br>CM3: Cooper Energy Offshore Victoria Whale Disturbance Risk Management Process | |
| Additional Control Measures / Environmental Performance Standards | Cooper Energy will communicate work programs with other the Otway Basin Petroleum Titleholders with the aim of minimising the potential for cumulative impacts associated with underwater sound, should activity timings potentially result in concurrent activities and overlap biologically important period (January to June) for blue whales.<br>**Additional Controls:**<br>Observation, incidents, and opportunities for improvement regarding the interaction with other users will be reported to other petroleum titleholders.<br>Additional commitments will be included within:<br>CM13: Ongoing Engagement<br>CM20: Campaign Risk Review<br>CM27: Each future EP resulting from the East Coast Project OPP will undertake a review for additional or significantly revised reasonably foreseeable projects. Additional or significantly revised projects will be assessed as per CIA methodology (Section 11.1). Any cumulative impacts from new, significantly revised or currently unknown activities that results in an unacceptable level of impact to receptors, will be subject to new or revised control measures within the appropriate EP to reduce cumulative impacts to ALARP. | |
| Aspect Specific Cumulative Consequence | Level 2 | Level 2 |
| Combined Cumulative Consequence | Level 2<br>The combination of multiple highly temporary and localised sources of potential behavioural disturbance to blue whales, including long-term and localised sources from sequential drilling activities, in the Otway, could result in minor impacts to species of recognised conservation value across multiple seasonal biologically important periods.<br>With sufficient management measures in place appropriate to the nature and scale of each project, potential impacts are not expected to result in the displacement of blue whales from a foraging area, including stopping or preventing a blue whale from foraging, causing a blue whale to move on when | |

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| | foraging or stopping or preventing a blue whale from entering a foraging area. If appropriate management is not implemented then the risk of displacement increases; the Blue Whale CMP assess the potential impacts of anthropogenic noise from shipping and industry, which is present across multiple seasonal biologically important periods, as Minor; having the potential to affect individuals but with no effect at the population level (DoE, 2015). |
| Acceptable Level Achieved | Yes – the consequence of combined cumulative impacts of Level 2 is considered acceptable because potential cumulative impacts can be managed such that they are not inconsistent with the Conservation Management Plan for the Blue Whale such that blue whales can continue to utilise the area without injury and [are] not displaced from a foraging area. |

*Table 11-4: Detailed cumulative impact assessment: southern right whale*

| Key Environmental Matter | Marine Mammals – Southern Right Whale |
|---|---|
| Conservation (or other) Value and Status | EPBC Act listed: Endangered, Cetacean, Migratory. |
| Legislative or Other Requirements | National Recovery Plan for the Southern Right Whale (DCCEEW, 2024l):<br>Action A.5;<br>• Improve baseline understanding of southern right whale acoustic communication to better inform potential impacts from anthropogenic underwater noise.<br>• Actions within and adjacent to southern right whale BIAs and habitat critical to survival should demonstrate that:<br>  • it does not prevent any southern right whale from utilising the area or cause auditory impairment, and<br>  • the risk of behavioural disturbance is minimised.<br>• Ensure environmental assessments associated with underwater noise generating activities include consideration of national policy and guidelines related to managing anthropogenic underwater noise and implement appropriate mitigation measures to reduce risks to southern right whales to the lowest possible level.<br>• Quantify risks of anthropogenic underwater noise to southern right whales, including studies aimed to measure physiological effects, behavioural disturbance, and changes to acoustic communication (e.g., masking of vocalisations) to whales.<br>• Prioritise government/industry funding opportunities to support research to identify short and long-term responses of southern right whales to underwater noise.<br>• Improve understanding and characterisation of marine soundscapes, including the application of new technologies for data processing, within southern right whale BIAs to facilitate quantification of anthropogenic noise in the marine soundscape.<br>Identified anthropogenic threats within the National Recovery Plan for the Southern Right Whale relevant to the East Coast Project:<br>• Anthropogenic underwater noise |
| Spatial and Temporal Extent of Key Environmental Matter | There is the potential for southern right whales to be transiting through the area offshore Victoria during May-June and September-October as they move to and from coastal reproduction areas. Occasionally entry to coastal waters happens as early as April and exit as late as November (DCCEEW, 2024l). The Victorian coastline has been identified as a reproduction BIA and is located within the monitoring area (Figure 6-47). |
| Acceptable Level | Artificial underwater sound emissions will be managed so that:<br>**AL11:** Changes to ambient underwater sound from project activities will be characterised through modelling and/or monitoring, and impacts and risks will not be inconsistent with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. |

| Planned Project Aspects Relevant to Identified Threats | Underwater Sound Emissions - Impulsive | Underwater Sound Emissions - Continuous |
|---|---|---|
| Relevant Spatial and Temporal Extent of Identified Threats | Multiple localised and short-term impulsive underwater sound EMBAs overlapping the migration BIA in the Otway Basin from the East Coast Project (Appendix 4) and other reasonably foreseeable future projects and activities (Table 11-1). This includes the potential localised and short-term impulsive underwater sound EMBAs from sequential drilling activities. | Multiple localised and short-term continuous underwater sound EMBAs overlapping the migration and reproductive BIA in the Otway Basin from the East Coast Project (Appendix 4) and other reasonably foreseeable future projects and activities (Table 11-1). There is also potential for localised continuous underwater sound EMBAs from sequential drilling activities. |
| Baseline Environmental Condition | The migration and reproductive BIAs are overlapped by area of high commercial fishing effort, shipping and existing oil and gas activity. These activities may temporarily use impulsive sources.<br>Ambient noise within the existing environment is detailed within Section 6.4.9<br>Listed species identified may also be impacted by impulsive noise sources from:<br>• existing shipping (Section 6.7.3.1) including current commercial fishing effort (Section 6.7.2).<br>• existing oil and gas activities (Section 6.7.3.2)<br>On average ~1663 vessels operate within the southern right whale migration BIA per day with possible associated impulsive noise emissions. | The migration and reproductive BIAs are overlapped by area of high commercial fishing effort, shipping and existing oil and gas activity. These activities use continuous sources.<br>Ambient noise within the existing environment is detailed within Section 6.4.9<br>Listed species identified may also be impacted by noise sources from:<br>• existing shipping (Section 6.7.3.1) including current commercial fishing effort (Section 6.7.2).<br>• existing oil and gas activities (Section 6.7.3.2)<br>On average ~1663 vessels operate within the southern right whale migration BIA per day with associated continuous noise emissions.<br>On average ~1250 vessels operate within the southern right whale reproductive BIA per day with associated continuous noise emissions. |
| Other Reasonably Foreseeable Projects/ Activities Relevant to Aspect | Together the following projects that occur between Cape Otway and Robe during the biologically important period (April to November) will generate multiple sources of impulsive sound:<br>• Commercial fishing<br>• CHN operations – Cooper Energy<br>• Otway Operations – Beach Energy<br>• Minerva decommissioning – Woodside Energy<br>• Drilling – Beach Energy<br>• Decommissioning – Beach Energy<br>• Geophysical/geotechnical survey – Beach Energy<br>• Drilling – ConocoPhillips<br>• Seismic survey – CGG-Regia. | Together the following projects that occur between Cape Otway and Robe during the biologically important period (April to November) will generate multiple sources of continuous sound:<br>• Commercial shipping<br>• Commercial fishing<br>• CHN operations – Cooper Energy<br>• Otway Operations – Beach Energy<br>• Minerva decommissioning – Woodside Energy<br>• Drilling – Beach Energy<br>• Decommissioning – Beach Energy<br>• Drilling – ConocoPhillips.<br>Drilling activities are expected to occur consecutively, therefore instead of multiple sound sources occurring at one time, one drilling sound source in the Otway Basin is expected to occur over a long period of time. |

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| Description of Cumulative Impact | The potential risks from impulsive underwater sound to southern right whales from East Coast Project OPP activities are assessed as being Low for Change in fauna behaviour and N/A for TTS or PTS (Section 8.1).<br><br>**Successive and Additive Impacts:**<br>As described in Section 8.1, behavioural EMBA for low-frequency cetaceans from the East Coast Project impulsive sound sources is 130 m around the operational area. This is assumed representative of impulsive sound sources from other reasonably foreseeable projects, aside from seismic surveys which have a larger footprint (e.g. 8.17 km to behavioural thresholds from CGG-Regia Seismic survey). However, as a single MODU will be used within the Otway region by multiple titleholders, concurrent impulsive activities associated with drilling programs are unlikely to occur.<br>Successive impacts are possible throughout the life of the East Coast Project OPP (Section 4). However, drilling and support activities are conducted over relatively short durations compared with the life of the East Coast Project OPP and other reasonably foreseeable projects (Table 11-1). In addition, the presence of all vessels connected to East Coast Project OPP and other reasonably foreseeable activities will be temporary (Section 4).<br>The locations of East Coast Project OPP and other reasonably foreseeable activities are isolated and separated. Whilst migrating southern right whales may exert more energy to avoid localised impulsive sound sources from the East Coast Project and other reasonably foreseeable projects, areas of behavioural impact would not form barriers to the migration of whale species or other biological important behaviours.<br>Based on this, it is not credible to consider that cumulative behavioural impacts to southern right whale will occur as a result of the East Coast Project in combination with other reasonably foreseeable activities of a similar nature and scale. Vessels / activities would never be within 130 m of each other due to safety and navigation risk, therefore overlap in behaviour EMBAs is not predicted. Even if several similar activities were being undertaken at once or sequentially within the migration BIA, the overall footprint of impulsive sound impacts would still be very small, and displacement of southern right whale is not predicted.<br>Potential behavioural disturbance to southern right whale is predicted within 8.17 km of the Regia MSS, however a suite of control measures is proposed to reduce potential impacts to | The potential risks from continuous underwater sound to blue whales from East Coast Project OPP activities are assessed as being moderate for Change in fauna behaviour of marine mammals and N/A for TTS or PTS (Section 8.2).<br><br>**Successive and Additive Impacts:**<br>As a single MODU will be used within the Otway region by multiple titleholders, therefore concurrent drilling activities will not occur. Therefore, additive cumulative impacts by concurrent drilling operations are not possible. Additive impacts are only possible between a single drilling operation, other support or IMR operations, seismic surveys or general shipping activity. However, these will be limited due to the relatively short time drilling and support activities take compared with the life of the East Coast Project OPP (Section 4) and other reasonably foreseeable projects (Table 11-1).<br>Successive impacts are possible throughout the life of the East Coast Project OPP (Section 4). However, drilling and support activities are conducted over relatively short durations compared with the life of the East Coast Project OPP and other reasonably foreseeable projects (Table 11-1). In addition, the presence of all vessels connected to East Coast Project OPP and other reasonably foreseeable activities will be temporary (Section 4).<br>The locations of East Coast Project OPP and other reasonably foreseeable activities are isolated and separated. Whilst migrating southern right whales may exert more energy to avoid localised continuous sound sources from the East Coast Project and other reasonably foreseeable projects, areas of behavioural impact would not form barriers to the migration of whale species or other biological important behaviours.<br>As described in Section 8.2, behavioural EMBA for low-frequency cetaceans from the East Coast Project continuous sound sources is 0.44 km from a single source and ~25 km from concurrent sources (up to 4). This is assumed representative of continuous sound sources from other reasonably foreseeable projects and activities.<br>Based on what is known about other reasonably foreseeable projects and activities in the region, it is likely that most activities will involve a single vessel operating, therefore the 0.44 km EMBA for continuous sound sources is most relevant for this assessment. Based on this EMBA, the likelihood of cumulative impacts occurring is low. Vessels / activities would rarely be within 0.44 km of each other due to safety and navigation risk, therefore overlap in behaviour EMBAs is not expected. Even if several similar activities were being undertaken at once or sequentially within the migration BIA, the overall footprint of continuous sound impacts would still be very small.<br>Assessment of the underwater sound modelling report (Appendix 4) determined that the ensonified areas produced from Scenarios 2, 5, and 10 at Annie-2 have the potential to overlap the reproduction BIA for the southern right whale with these activities presented as worst-case scenarios. However, further review of the reproduction BIA overlap found the preferred reproduction habitat (within the shallow waters of <10m and within <1 km from shore) is not overlapped. |

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| | marine mammals (including southern right whale) to ALARP and acceptable levels, ensuring that the activity meets the actions of the National Recovery Plan for the Southern Right Whale (DCCEEW 2024l).<br>Minor avoidance behaviours of migrating southern right whales from multiple highly temporary impulsive sources is not expected to result in the disruption of migratory behaviours of southern right whales.<br>**Synergistic Impacts** – none identified with the presence of a MODU and additional vessels. | Much of the Australian coastline, particularly within the south-east marine region, has been identified as a reproduction BIA for southern right whale which is also identified as a habitat critical to the survival of the southern right whale (DCCEEW 2024l). Assuming activities were centred around the closest point in the operational area to this important reproductive area, the behavioural EMBA would not be sufficiently large enough to restrict movement into or out of the reproductive area, and continuous underwater sound emissions from the East Coast Project are not expected to present a barrier to movement for southern right whale into the reproduction BIA. As no underwater sound EMBAs are predicted to overlap the southern right whale preferred reproduction habitat when the SRW are present, successive or additive cumulative impacts to SRW reproductive activity are not predicted to occur<br>Minor avoidance behaviours of southern right whale within the migration BIA from multiple highly temporary continuous sources is not expected to result in the disruption of migratory behaviours of southern right whales. Barriers to movement of southern right whale into / out of the reproduction BIA is not predicted.<br>**Synergistic Impacts** – none identified with the presence of a MODU and additional vessels. |
| Certainty of Assessment | There is a high level of predictability and certainty in the limited potential for impacts, given the underwater noise modelling data available for this OPP and other reasonably foreseeable projects. In addition, OPP activities and all other reasonably foreseeable projects, as listed in Table 11-1, have controls in place* for each activity to prevent / limit impacts.<br>*These control measures are detailed in published Environment Plans; where these plans are not available for a particular activity, it is considered reasonable to expect that a similar level of control measures would be implemented given the environment protection framework that applies to activities in the marine environment, and additional regulatory requirements that apply to large offshore petroleum and infrastructure projects. | |
| Existing Control Measures | CM1: Marine Assurance Process<br>CM2: Offshore Operational Procedures<br>CM20: Campaign Risk Review | |
| Additional Control Measures / Environmental Performance Standards | Cooper Energy will communicate work programs with other the Otway Basin Petroleum Titleholders with the aim of minimising the potential for cumulative impacts associated with underwater sound, should activity timings potentially result in concurrent activities and overlap biologically important period (January to June) for blue whales.<br>**Additional Controls:**<br>Observation, incidents, and opportunities for improvement regarding the interaction with other users will be reported to other petroleum titleholders.<br>Additional commitments will be included within:<br>CM13: Ongoing Engagement<br>CM20: Campaign Risk Review<br>CM27: Each future EP resulting from the East Coast Project OPP will undertake a review for additional or significantly revised reasonably foreseeable projects. Additional or significantly revised projects will be assessed as per CIA methodology (Section 11.1). Any cumulative impacts from new, significantly revised or currently unknown activities that results in an unacceptable level of impact to receptors, will be subject to new or revised control measures within the appropriate EP to reduce cumulative impacts to ALARP. | |

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| Aspect Specific Cumulative Consequence | Level 2 | Level 2 |
| Combined Cumulative Consequence | Level 2<br>The combination of multiple highly temporary and localised sources of potential behavioural disturbance to southern right whales, including long-term and localised sources from sequential drilling activities, in the Otway could result in minor impacts to species of recognised conservation value across multiple seasonal biologically important periods.<br>With sufficient management measures in place appropriate to the nature and scale of each project, potential impacts are not expected to result in the disturbance and subsequent displacement of southern right whales from habitat critical to the survival of the species. If appropriate management is not implemented, then the risk of disturbance and displacement increases; the National Recovery Plan for the southern right whale assesses the potential impacts to the eastern population from anthropogenic noise from shipping and industry, which is present across multiple seasonal biologically important periods, as Minor (individuals are effected but no effect at the population level). | |
| Acceptable Level | Yes – the consequence of combined cumulative impacts of Level 2 is considered acceptable because potential cumulative impacts can be managed to ensure outcomes are not inconsistent with the National Recovery Plan for the southern right whale (DCCEEW 2024l). The activities are not expected to prevent southern right whales utilising the migration or reproductive BIAs, nor to cause injury (TTS and PTS), or significant behavioural changes within habitat critical to the survival of the species. | |

### 11.3.2 Birds

*Table 11-5: Detailed cumulative impact assessment: Seabirds and Shorebirds*

| Key Environmental Matter | Seabirds and shorebirds |
|---|---|
| Conservation (or other) Value and Status | The flaring light EMBA for the East Coast Project overlaps 9 known or likely foraging BIAs for the following albatross and petrel species:<br>• Short-tailed shearwater<br>• Wandering albatross<br>• Antipodean albatross<br>• Common diving-petrel<br>• Bullers albatross<br>• Shy albatross<br>• Indian yellow-nosed albatross<br>• Black-browed albatross<br>• Campbell albatross.<br><br>The flaring light EMBA for the East Coast Project also overlaps the migration route known to occur within area for: |

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| | • Orange-bellied parrot. The National recovery plan for the Orange-bellied Parrot does not identify light as a major threat to migration, but as a potential barrier that could modify the behaviour of individuals (DELWP, 2016).<br>EPBC Act listed:<br>• Threatened species (Critically Endangered)<br>• Marine. |
| Legislative or Other Requirements | Wildlife Conservation Plan for Seabirds (CoA, 2020) has objectives to protect and manage habitats from anthropogenic disturbances.<br>National Light Pollution Guidelines for Wildlife (DCCEEW, 2023k) includes information relevant to assessment and management of artificial light. |
| Spatial and Temporal Extent of Key Environmental Matter | Shearwaters forage in areas offshore Victoria during late-August/early-September to May as they move to and from breeding islands (DoE, 2023).<br>Albatrosses forage in areas offshore Victoria between September and April as they move to and from breeding islands (ACAP, 2023).<br>The common diving-petrel is present year-round to forage in areas offshore Victoria, however, are not listed as threatened species under the EPBC Act (DCCEEW, 2023). The common diving-petrel is known to forage at night.<br>BIAs for albatross species are detailed in Section 6.5.7.1.<br>BIAs for the common diving-petrel species are detailed in Section 6.5.7.1<br>BIAs for shearwater species are detailed in Section 6.5.7.1<br>Distribution and migration routes of the orange-bellied parrot are detailed in Section 6.5.7.1 |
| Acceptable Level | Artificial light will be managed so that:<br>**AL11:** Changes to ambient underwater sound from project activities will be characterised through modelling and/or monitoring, and impacts and risks will not be inconsistent with conservation advice, recovery plans and threat abatement plans for EPBC Act listed threatened, migratory or cetacean species. |
| **Planned Project Aspects Relevant to Identified Threats** | **Light Emissions** |
| Relevant Spatial and Temporal Extent of Identified Threats | Multiple localised and short-term artificial light emissions (from vessels hired for offshore activities) overlapping the foraging BIAs in the Otway Basin from the East Coast Project and other reasonably foreseeable future projects and activities. This includes the potential localised and short-term artificial light emissions from sequential drilling activities. |
| Baseline Environmental Condition | The foraging BIAs of seabirds and shorebird migration routes are overlapped by an existing shipping channel, area of high commercial fishing effort, and existing and proposed oil and gas activities. These activities temporarily use and result in artificial light during operations, including flaring.<br>Ambient light within the Project Area is detailed within Section 6.4.8.<br>Bird species may also be impacted by light sources from:<br>• current commercial fishing effort (Section 6.7.2).<br>• existing shipping (Section 6.7.3.1)<br>• existing oil and gas activities (Section 6.7.3.2)<br>Cooper expects that seabirds within the foraging area are highly habituated to light emissions from continuous and long-term exposure to shipping vessels and existing oil and gas activities as per other species (Dunlop and Rippey 2001). Additional anthropogenic light sources within the vicinity of coastal areas include streetlights, building lights, façade lights, vehicular.<br>An average of ~635 individual vessels pass through the combined shearwater foraging BIAs per day. |

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| | On average >500 individual vessels pass through the combined albatross BIAs (as listed above) per day.<br>An average of ~430 individual vessels pass through the common-diving petrel foraging BIA per day.<br>An average ~120 individual vessels pass through the orange-bellied parrot probable migration route area per day. |
| Other Reasonably Foreseeable Projects/ Activities Relevant to Aspect | Together the following projects operate within seabird foraging BIAs during known foraging periods (August to May), and shorebird migration routes, and will generate multiple sources of artificial light:<br>• Commercial shipping<br>• Commercial fishing<br>• CHN operations – Cooper Energy<br>• Otway Operations – Beach Energy<br>• Minerva decommissioning – Woodside Energy<br>• Drilling – Beach Energy<br>• Decommissioning – Beach Energy<br>• Geophysical/geotechnical survey – Beach Energy<br>• Drilling – ConocoPhillips<br>• Seismic survey – CGG-Regia. |
| Description of Cumulative Impact | Impact assessment of light emissions (Section 8.3) found that the risk of injury or mortality to seabirds from East Coast Project OPP activities was considered low and will not result in significant behavioural changes to foraging or migrating of seabirds.<br>**Successive and Additive impacts:**<br>Potential impacts to albatross species and the short-tailed shearwaters are expected to be limited to foraging individuals. These species are not known to forage at night therefore the impact from light emissions form East Coast Project operations and other reasonably foreseeable projects is considered negligible with no successive or additive cumulative impacts identified. There are no planned permanent light fixtures associated with the East Coast Project offshore to which birds could habituate and modify behaviours in the longer-term.<br>Light EMBAs for the East Coast Project OPP have limited overlap with the total area of the common diving-petrel foraging BIA (Flaring EMBA ~2%; Light EMBA <1 %). Light EMBAs for all other reasonably foreseeable projects (Table 11-1) also have limited overlap therefore, the area of influence, will be negligible considering the nature and scale of the foraging area.<br>Any vessel present will form the East Coast Project or other reasonably foreseeable project will not bisect any of the detailed BIAs and therefore restrict critical behaviour. Successive or additive cumulative impacts to foraging activities of the detailed seabirds are considered highly unlikely.<br>As outlined in the National Recovery Plan for the orange-bellied parrot (DELWP 2016), anecdotal evidence suggests illuminated structures and boats may act as behavioural barriers for individuals of this species, particularly along migration routes (Holdsworth 2006). A MODU (acting as a barrier) will only be present in the orange bellied parrot probably migration route for activities under Woodside's approved Minerva Decommissioning and Field Management Environment Plan (Woodside 2025). Other activities associated with the approved Woodside Minerva decommissioning activities (Woodside 2025) also overlap the probable migration route. Neither EP identifies any change to long-term population viability to the OBP related to the respective project activities, or impacts resulting from cumulative impacts. The East Coast Project OPP operational area overlaps the <0.001 % of the OBP probable migration route. Therefore, localised and short-term artificial light emissions from the East Coast Project (as detailed in Section 8.3) and other reasonably foreseeable future projects and activities will not impact a large extent of the migration route to effectively form a barrier that will result in population impacts to the orange-bellied parrot. In addition, migrating orange-bellied parrots are anticipated to be adapted to pre-existing artificial light sources from commercial vessels and oil and gas activities.<br>**Synergistic Impacts** – none identified with the presence of a MODU and additional vessels. |

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| Certainty of Assessment | High certainty in the limited potential for cumulative impacts, based on the limited overlap of sensitive areas, the temporary nature of the artificial light associated with the project in addition to other activities, and the application of control measures to prevent impacts*. .<br>Whilst there is no published information available on the sensitivity of the orange-bellied parrot to light, only anecdotal evidence regarding the impact of barriers to migration exists (Holdsworth 2006). However, impacts on other bird species is well understood (Section 8.3.4).<br>**These control measures are detailed in published Environment Plans; where these plans are not available for a particular activity, it is considered reasonable to expect that a similar level of control measures would be implemented given the environment protection framework that applies to activities in the marine environment, and additional regulatory requirements that apply to large offshore petroleum and infrastructure projects.* |
| Existing Control Measures | CM1: Marine Assurance Process<br>CM2: Offshore Operational Procedures<br>CM4: Light Management Measures |
| Additional Control Measures / Environmental Performance Standards | Cooper Energy will communicate work programs with other the Otway Basin Petroleum Titleholders with the aim of minimising the potential for cumulative impacts associated with light emissions, should activity timings potentially result in concurrent activities and overlap biologically important period (August to May) for shearwaters and albatrosses.<br>**Additional Controls:**<br>Observation, incidents, and opportunities for improvement regarding the interaction with other users will be reported to other petroleum titleholders.<br>Additional commitments will be included within:<br>CM13: Ongoing Engagement<br>CM27: Each future EP resulting from the East Coast Project OPP will undertake a review for additional or significantly revised reasonably foreseeable projects. Additional or significantly revised projects will be assessed as per CIA methodology (Section 11.1). Any cumulative impacts from new, significantly revised or currently unknown activities that results in an unacceptable level of impact to receptors, will be subject to new or revised control measures within the appropriate EP to reduce cumulative impacts to ALARP. |
| Aspect Specific Cumulative Consequence | Level 1<br>The combination of multiple and sequential minor local behavioural impacts to seabirds in the Otway will result in minor local impacts to species of recognized conservation value. Minor local attraction or avoidance behaviours to foraging seabirds is not expected to affect population levels. |
| Acceptable Level Achieved | Yes – the Level 1 consequence for a cumulative impact is considered acceptable because potential cumulative impacts are not inconsistent with the defined acceptable levels, consistent with the EPBC Act Significant impact guidelines. |

# 12 Implementation Strategy

Cooper Energy retains full and ultimate responsibility as the proponent of the East Coast Project and is responsible for ensuring that the Development and associated activities are implemented in accordance with the performance outcomes outlined in this OPP.

The Implementation Strategy described in this section provides a summary of the Cooper Energy Management System (CEMS), which will help achieve the EPOs (detailed in Section 8 and 9), as per the requirements of Section 7 of the OPGGS(E)R. This will be described in more detail in future activity-specific EPs.

## 12.1 Cooper Energy Management System

The Cooper Energy Management System (CEMS) is Cooper Energy's integrated system which consolidates all of Cooper Energy's business processes into one system of management. It incorporates HSEC, Operations, Well Construction, Engineering and Finance in accordance with a set of core concepts (Table 12-1).

The CEMS document hierarchy is shown in Table 12-1: with Cooper Energy's Health, Safety, Environment and Community (HSEC) Policy shown in Figure 12-2 and the CEMS standards list in Table 12-2.

*Table 12-1: Cooper Energy's Management System Core Concepts*

| Core Concepts | |
|---|---|
| **People** | How we organise (line and function)<br>Which roles we need<br>Which skills we need<br>How we build and sustain capability |
| **Culture** | Why we exist<br>What we value<br>How we work together<br>How we communicate |
| **Process** | What we do<br>How we do it<br>How we learn<br>How we continuously improve |
| **Technology** | Which tools we use<br>How we use them<br>How we support people to perform their role |
| **Governance** | How we manage risk<br>How we make decisions<br>How we ensure safety, quality and technical integrity |

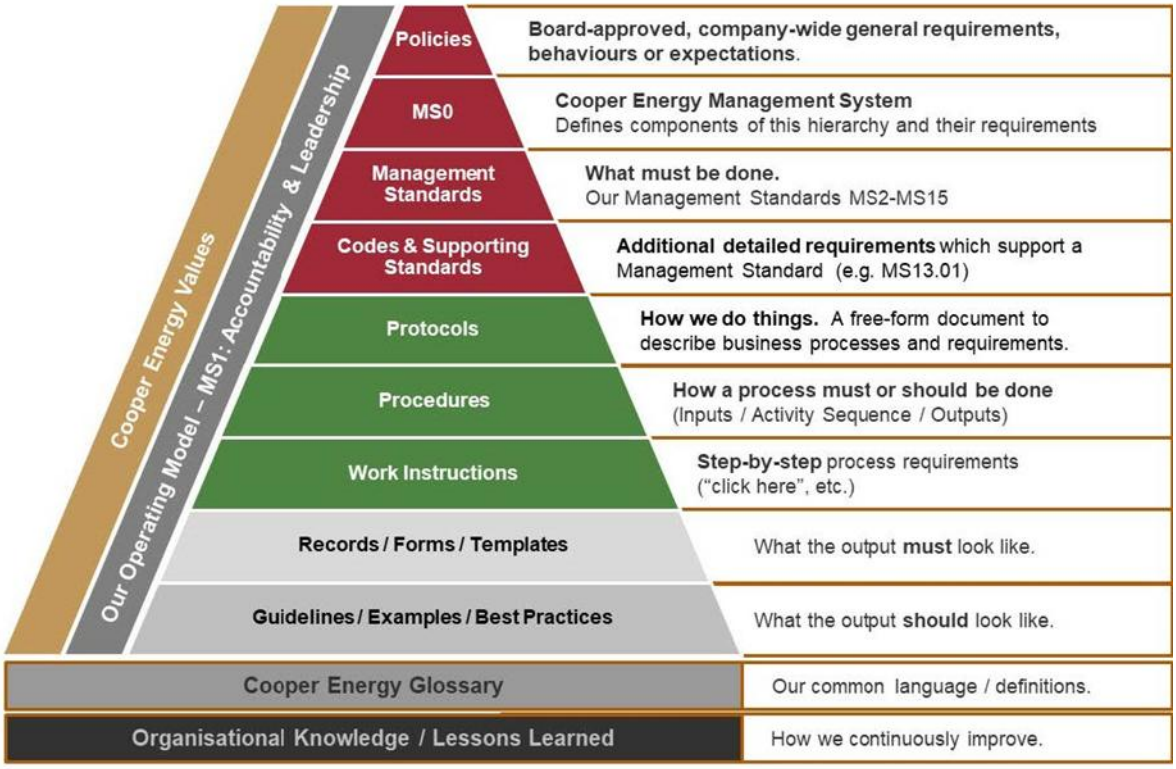



*Figure 12-1: CEMS Document Hierarchy*

*Table 12-2: 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

AEMS | Health & Safety | Policy

**This policy describes our approach to managing Health, Safety and Environmental risks at Amplitude Energy**

### Our Commitment

Amplitude Energy is committed to taking all reasonably practicable steps to protect the health and safety of our workers, contractors, partners, and the communities in the areas where we operate.

In addition, we will ensure our business is conducted in an environmentally responsible manner.

### Our Actions

We will:

- **Integrate** health, safety and environmental requirements into our daily work, our business planning and our decision making
- **Comply** with all relevant health, safety and environmental laws and regulations
- **Provide** resources and systems to enable delivery of our health, safety and environmental objectives
- **Identify, control and monitor** risks that have the potential to harm people and the environment to as low as reasonably practical
- **Empower** our people, regardless of position, to "Stop the Job" if they consider it necessary to prevent harm to themselves, others or the environment
- **Consult, communicate and promote participation** of our workforce to build and maintain a strong health, safety and environment culture
- **Ensure** all employees and contractors are trained, competent and suitably supervised so that works are undertaken in a safe and environmentally responsible manner
- **Collaborate** proactively with our stakeholders and the communities where we operate
- **Investigate and learn** from our incidents and from those in our industry
- **Set, measure and monitor** health, safety and environmental targets to drive continuous improvement in our performance
- **Report** publicly and transparently on our health, safety and environmental performance

### Governance

The HSE Improvement Forum 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 our HSE 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 to keep it current.

### Policy authorised by

**Jane Norman**
**Managing Director & CEO**
Date: 11 February 2025 Review Date: 13 July 2026

*Figure 12-2: Amplitude Energy Health, Safety and Environment Policy*

## 12.2 Asset Integrity Management

The integrity of all Cooper Energy Assets is managed in line with MS08: Technical Management.

An accepted Well Operations Management Plan (WOMP) is required before drilling can commence, which 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.

Cooper Energy manage the integrity of the existing CHN facilities through an Offshore Integrity Management Plan. This plan would be expanded to include provision for the future tie-ins. The overall strategy of the integrity management plan 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 several 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.

## 12.3 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 12-3). Each phase is subject to assurance processes and a gate review, the outcomes of which include continue, stop, hold, or recycle.

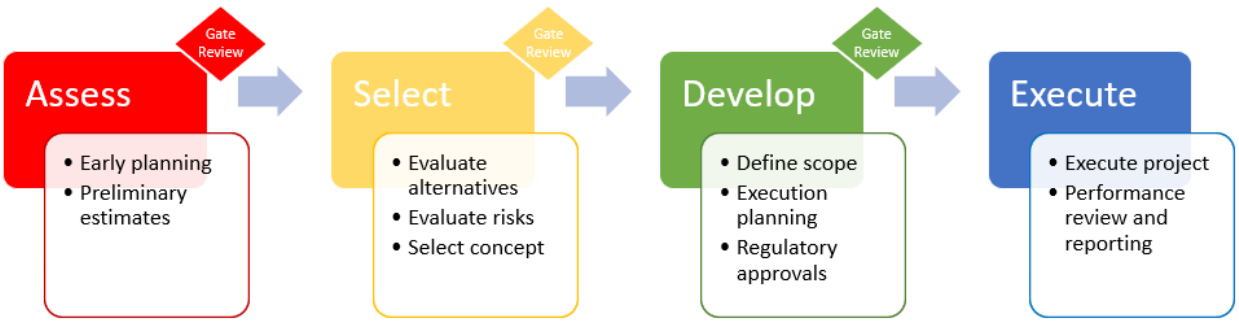



*Figure 12-3: Project Workflow*

### 12.3.1 Decommissioning Planning

Decommissioning an asset involves permanently sealing wells, deconstruction and removal (base case) of infrastructure, processing of 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, responsibilities, and 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 the regulator accepts an alternative end-state.

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.

## 12.4 Contractor Management

The Supply Chain and Procurement Management Standard 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.

This standard 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 the 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 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.

Before activities commence in the Operational Area, Cooper Energy will ensure contractors have a HSE Management System in place that meets the requirements of future EPs, and ensure that contractors are aware of, and comply with, EP requirements.

## 12.5 Emergency Response

Cooper Energy manages emergencies from offshore Victoria activities in accordance with its Incident Management Plan (IMP). 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 of the IMT members.

Any future EPs for the East Coast Project are required to have an accepted OPEP/Emergency Response Plan (ERP) as per Section 22(8) of the OPGGS(E)R. Section 22(9) provides a framework for the control measures and arrangements for responding to and monitoring oil pollution.

Roles and responsibilities for maintaining oil spill response capability and preparedness, testing and review arrangements and oil spill response competency and training requirements would be detailed in the activity specific OPEP/ERP.

## 12.6 Chemical Assessment and Selection

Cooper Energy's Offshore Chemical Assessment Procedure 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 before use. This process guides selection of the lowest toxicity, most biodegradable and least bioaccumulative chemicals that meet the technical requirements are selected.

The evaluation process uses a series of steps to assess chemicals by first screening chemicals against public databases. Where necessitated by the screening, such as where public data shows a chemical to have toxicity, bioaccumulation or biodegradation outside of defined thresholds, an ALARP justification is completed. This ALARP justification includes consideration of alternatives, and a detailed technical justification is required to approve the chemical. The ALARP Justification must be approved by the Project Manager. Where technical justification for the chemical cannot be provided, the chemical is not accepted for use.

## 12.7 Marine Assurance Process

Cooper Energy's Marine Assurance Process requires that vessels, MODUs and equipment to be used offshore for a project or operations, have been assessed as compliant with applicable International MARPOL, SOLAS requirements, Australian legislation, and Cooper Energy MS requirements. This process ensures vessels and equipment are fit for purpose, maintained in good order, and that the crew and offshore project team are suitable for the scope of work, prior to the commencement of work in the Operational Area.

## 12.8 Invasive Marine Species Risk Assessment

Cooper Energy's Invasive Marine Species Risk Management Process 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 OPP for the activity). The procedure incorporates key considerations from IMO (2011) and Australian Government (2009) biofouling guidelines and supports compliance with the Biosecurity Amendment (Biofouling Management) Regulations 2021. The current the inputs, decision points and general flow of the IMS risk management actions are shown in Figure 12-4.

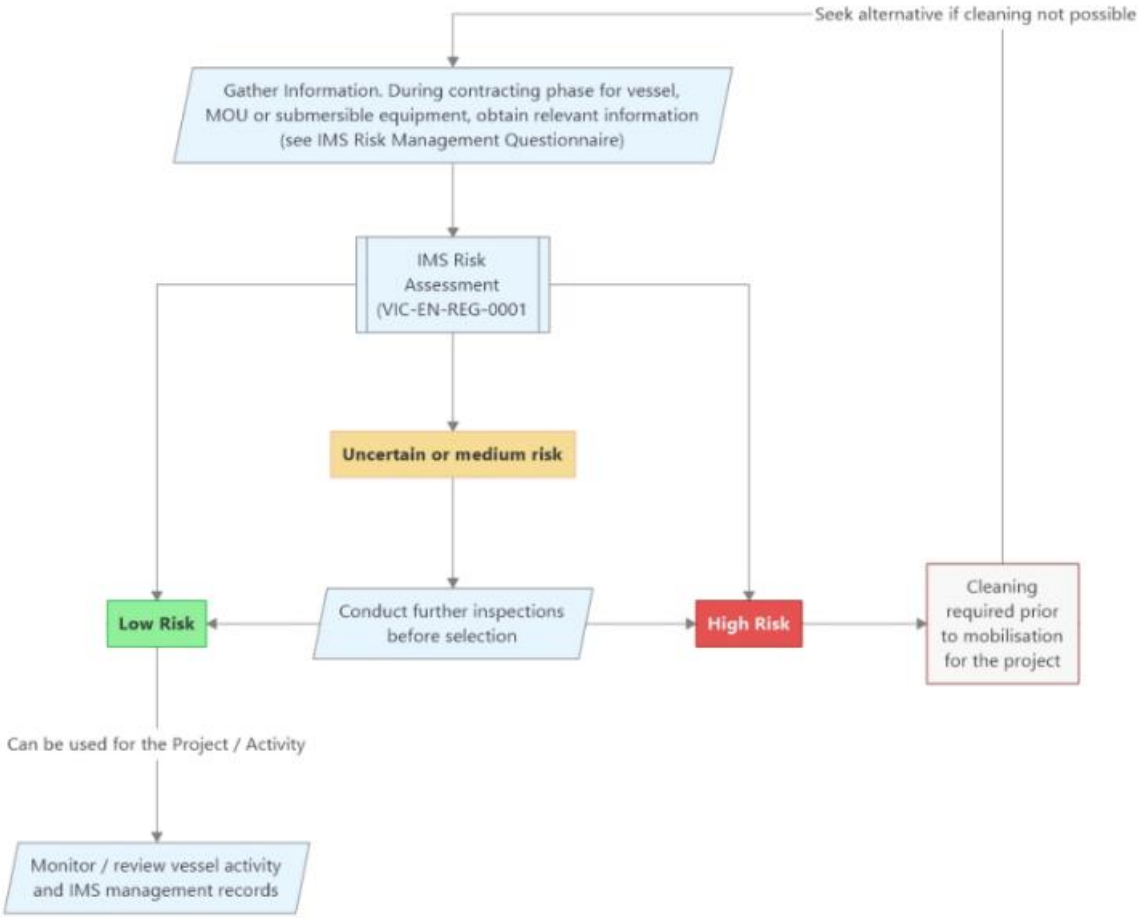



*Figure 12-4: Cooper Energy IMS Risk Management Flow*

## 12.9 Marine Mammal Risk Review and Management

Cooper Energy implements risk reviews before undertaking offshore campaigns.

The Cooper Energy Whale Disturbance Risk Management Process is designed to ensure alignment with government guidelines and is adjusted according to operational needs and new information such as additional baseline, new scientific information regarding disturbance thresholds, and new detection and mitigation technologies.

Figure 12-5 illustrates the overall planning process and describes the key components and considerations of the pre-activity risk review which ensures that the impacts and risks for a particular activity within the East Coast Project, do not exceed acceptable levels, are continually reduced to ALARP, and EPOs can continue to be met.

Figure 12-6 illustrates the kind of monitoring and mitigation that will apply to an offshore MODU / vessel campaign. Annotations are included that describe how this kind of monitoring and mitigation program is built for a campaign.

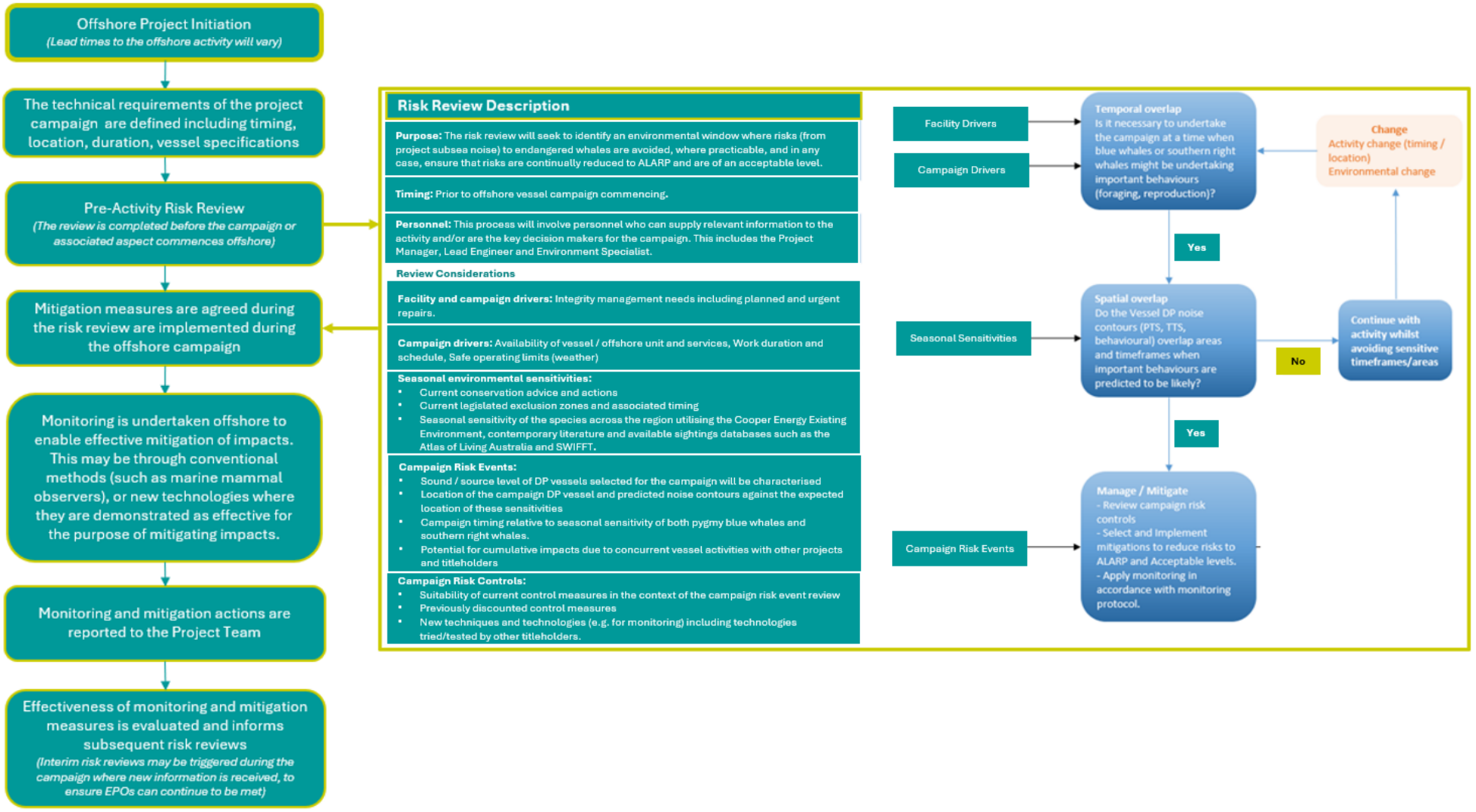



*Figure 12-5: Whale Disturbance Risk Management – key steps when planning an offshore campaign*

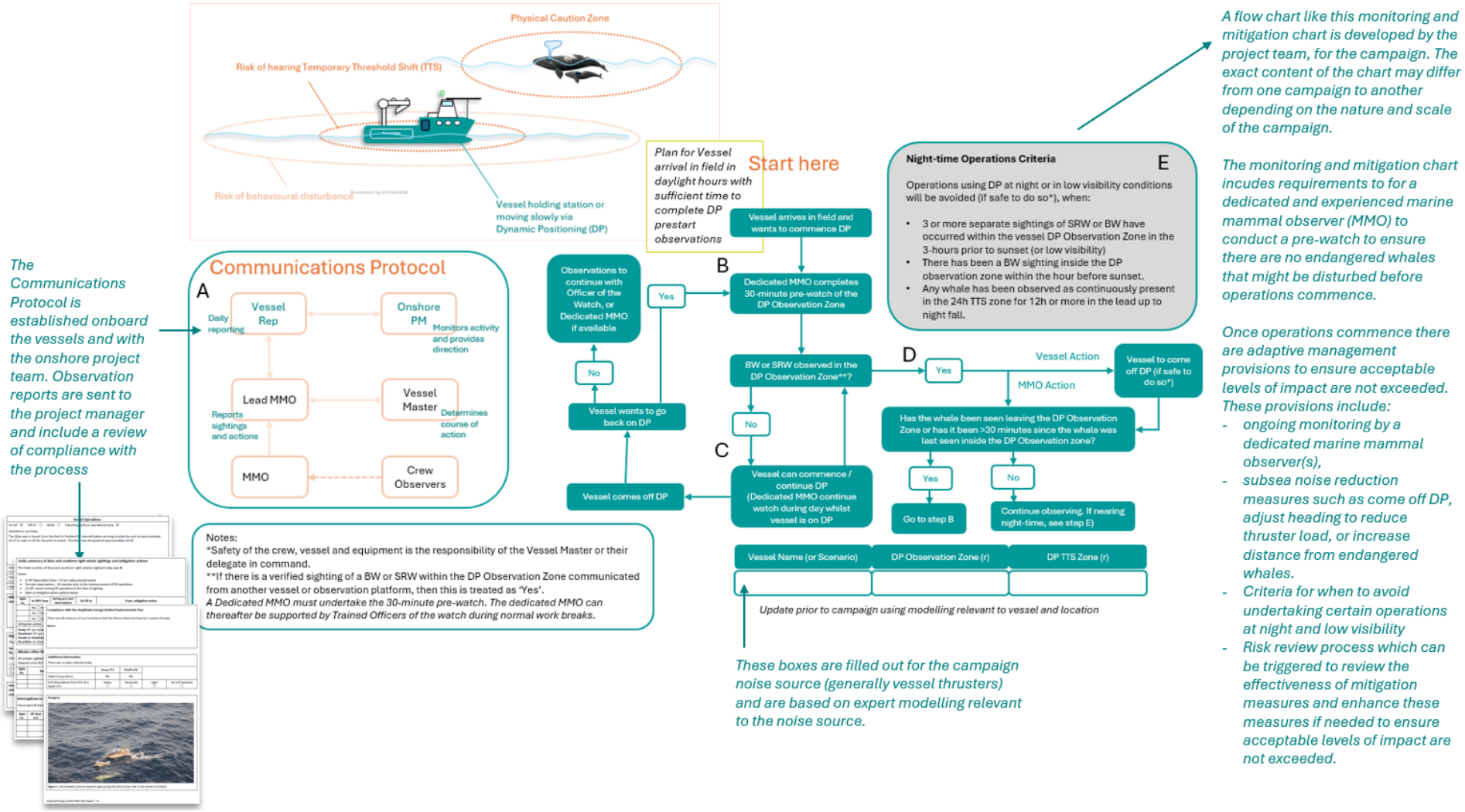



*Figure 12-6: Whale Disturbance Risk Management – example of monitoring and mitigation during an offshore campaign*

## 12.10 Inventory Management

Following the completion of well construction activities, residual bulks (barite, bentonite and cement) will be managed in accordance with Figure 12-7. Cooper Energy's preference will be to transfer unused bulk products to the next client utilising the MODU, however if this is not possible a residual bulks management process (Figure 12-7) has been developed to allow for consideration of management options.

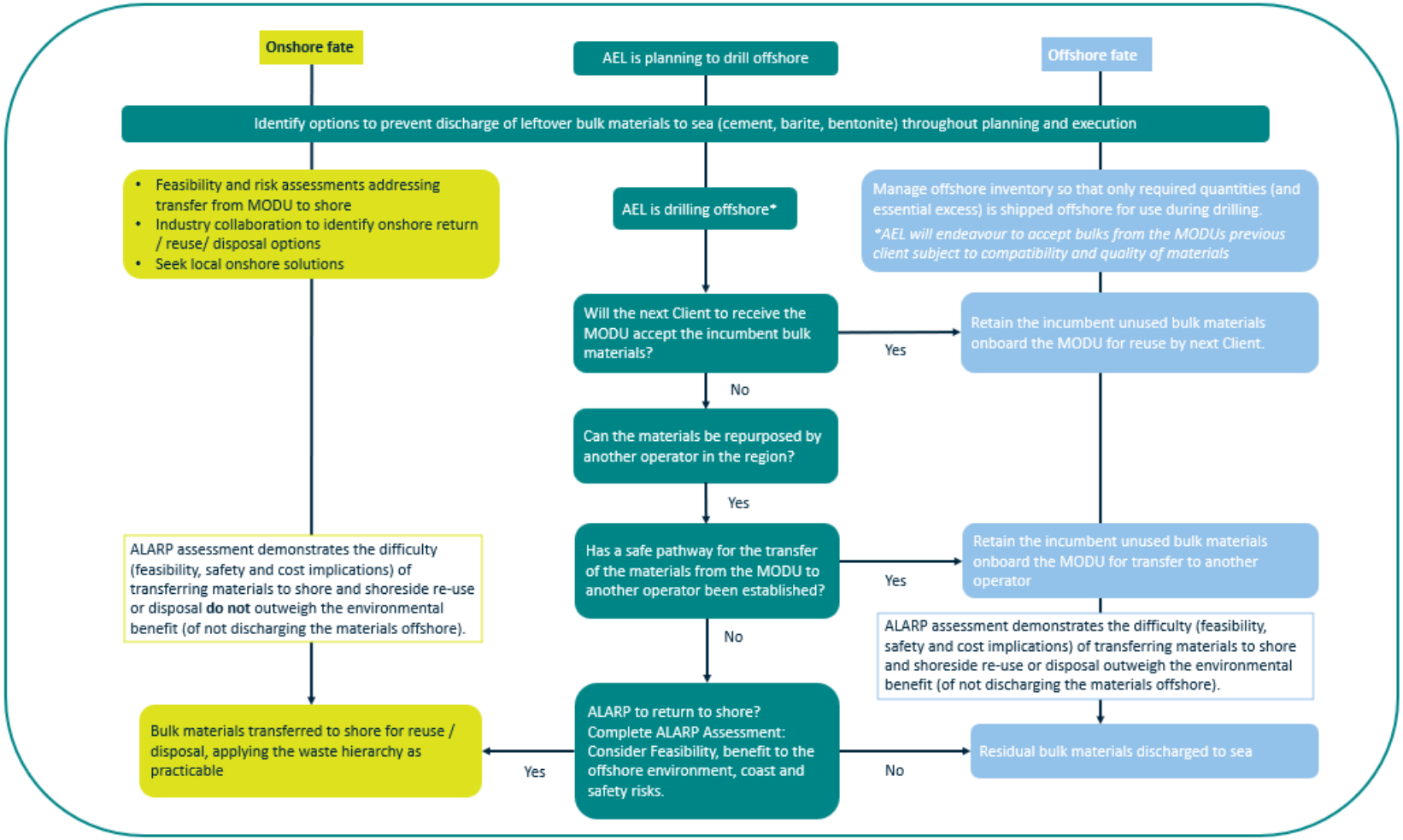



*Figure 12-7: Process for management of residual bulk materials*

## 12.11 Management of Change

MS08 Technical Management and Management of Change (MoC) General Protocol describes the requirements for dealing with change management. The objective of the MoC process is to eliminate, or reduce so far as is reasonably practicable, the potential hazards and risks associated with changes. 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.

These changes will be addressed to determine if there is potential for any new or increased environmental impact or risk not already provided for in this OPP. In the EP phase, the trigger for resubmission of an EP will be evaluated against the requirements of Section 38 and 39 of the OPGGS(E)R.

## 12.12 Assurance

The CEMS manages compliance assurance to ensure that identified controls are effective and any non-compliances are resolved.

The environmental performance of offshore operations and activities will be audited and reviewed in several ways to ensure that:

- applicable legal and CEMS requirements are being met
- EPOs are being met
- potential non-compliances and opportunities for continuous improvement are identified, and
- environmental monitoring requirements are being met.

A record of all assurance activities undertaken, and the outcomes, are maintained and actions are tracked until completed.

## 12.13 Incident Reporting and Recording

Cooper Energy's Incident and Crisis Management Protocol and Incident Investigation and Reporting Protocol 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 will be provided in future EPs.

As defined under Section 48 of the OPGGS(E)R incidents are required to be reported for future EPs related to this OPP.

As defined in the legislation, a recordable incident which arises from the activity is one that is:

*'a breach of an environmental performance outcome or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident'*

Recordable incidents must be reported to NOPSEMA no later than 15 days after the end of the calendar month and include breaches to the environmental performance outcomes set within future activity specific EPs related to EPOs listed in this OPP (Section 8 and 9).

As defined in the legislation, a reportable incident which arises from the activity is one that:

*'has caused, or has the potential to cause, moderate to significant environmental damage'*

All reportable incidents will be notified to NOPSEMA, as per the requirements of Sections 47, 48 and 49 of the OPGGS(E)R.

## 12.14 Implementing Requirements of the OPP in Future EPs

NOPSEMA's Offshore Project Proposal Content Requirements (NOPSEMA, 2019) state that an OPP must include:

*'appropriate environmental performance outcomes that are consistent with the principles of ecologically sustainable development; and demonstrate that the environmental impacts and risks of the project will be managed to an acceptable level.'*

EPOs are supported by adopted control measures which provide additional context on how the EPO will be achieved. Control measures are developed as the result of the impact assessment process and are a content requirement of future activity specific EPs related to the activity assessed within this OPP.

Setting environmental performance standards (EPSs) is not a component of the OPP phase but is a requirement of future activity specific EPs. These EPs must also include appropriate measurement criteria to monitor the performance of control measures and determine whether the EPOs and EPSs have been met.

The implementation strategy described within this OPP will be presented in greater detail in future EPs. The strategy will ensure control measures are effective in reducing the environmental impacts and risks of the specific activity to ALARP and acceptable levels, and that EPOs and EPSs are continually met.

## 12.15 Environmental Performance Monitoring and Reporting

Cooper Energy will undertake monitoring to ensure that the EPOs provided in this OPP are demonstrated within future EPs. This includes:

- environmental impacts and risks of the activity continue to be identified and will be reduced to a level that is ALARP
- control measures detailed in future activity specific EPs 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 activity specific EPs are being met
- emissions and discharges are monitored.

Routine reporting will be undertaken as per Section 51 of the OPGGS(E)R, which requires environmental performance reporting for activities described in future EPs, including recordable incidents.

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## 13.2 Guidance

| Document Number | Document Name |
|---|---|
| **NOPSEMA Guidance** | |
| **N-04790-GN1663 A473026** | Offshore Project Proposal Content Requirements Guidance Note (NOPSEMA, 2020a) |
| **N-04790-GL1816 A630598** | Offshore project proposal decision making guideline (NOPSEMA, 2024a) |
| **N-04790-GN1663 A473026** | Offshore Project proposal Content Requirements Guidance Note (NOPSEMA, 2024b) |
| **N-00500-PL1903 A720369** | Maintenance and removal of property Policy (Section 572) (NOPSEMA, 2020b) |
| **N-04750-IP1765 A625748** | Acoustic impact evaluation and management (NOPSEMA, 2020c) |
| **N-00500-PL1959 A800981** | Consent to surrender Title (Section 270) (NOPSEMA, 2022) |
| **N-04750-GL1721 A524696** | Environment Plan Decision Making Guideline (NOPSEMA, 2024) |
| **N-04750-IP1899** | Reducing marine pest biosecurity risks through good practice biofouling management (NOPSMEA, 2020d) |
| **N-00500-IP2002** | Planning for proactive decommissioning Information Paper (NOPSEMA, 2021) |
| **No ID** | NOPSEMA Decommissioning Compliance Strategy 2024 – 2029 Referenced in OPP RFFWI #2. NOPSEMA ID: 7895 A1139619 |

| Document Number | Document Name |
|---|---|
| **Other Guidance** | |
| **ANZG** | Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 |
| **CoA** | National Biofouling Management Guidance for the Petroleum Production and Exploration Industry |
| **DAFF** | Antifouling and In-water Cleaning Guidelines |
| **CoA** | National biofouling management guidelines for commercial vessels |
| **DCCEEW** | National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds (2023) |
| **CoA** | National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna |
| **DAFF** | Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (2017) |
| **EPA Victoria** | Guideline for minimizing greenhouse gas emissions (2022) |
| **DISER** | Offshore Petroleum Decommissioning Guideline (2022) |
| **UK Government** | Nationally Significant Infrastructure Projects - Advice Note 17: Cumulative effects assessment relative to nationally significant infrastructure projects (2019) |
| **State of NSW** | Cumulative Impact Assessment Guideline for State Significant Projects (2022) |
| **DEWHA** | EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales |

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# Appendix 1. EPBC Database Protected Matters Search Tool Results

Australian Government

Department of Climate Change, Energy, the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

East Coast Project Ecological EMBA PMST Report

Report created: 07-May-2025




*Ecological EMBA*


Summary

Details

Matters of NES

Other Matters Protected by the EPBC Act

Extra Information

Caveat

Acknowledgements

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | 1 |
| Wetlands of International Importance (Ramsar | 1 |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | 2 |
| Listed Threatened Ecological Communities: | 9 |
| Listed Threatened Species: | 124 |
| Listed Migratory Species: | 70 |

## Other Matters Protected by the EPBC Act

| | |
|---|---|
| State and Territory Reserves: | 32 |
| Regional Forest Agreements: | 3 |
| Nationally Important Wetlands: | 3 |
| EPBC Act Referrals: | 99 |
| Key Ecological Features (Marine): | 3 |
| Biologically Important Areas: | 20 |

| | |
|---|---|
| Bioregional Assessments: | 1 |
| Geological and Bioregional Assessments: | None |

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

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

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

| | |
|---|---|
| Commonwealth Lands: | 5 |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 118 |
| Whales and Other Cetaceans: | 30 |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | 4 |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

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

# Details

## Matters of National Environmental Significance

### National Heritage Places [ Resource Information ]

| Name | State | Legal Status |
|---|---|---|
| Historic | | |
| Great Ocean Road and Scenic Environs | VIC | Listed place |

### Wetlands of International Importance (Ramsar Wetlands) [ Resource Information ]

| Ramsar Site Name | Proximity |
|---|---|
| Port phillip bay (western shoreline) and bellarine peninsula | Within 10km of Ramsar site |

### Commonwealth Marine Area [ Resource Information ]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

| Feature Name |
|---|

Commonwealth Marine Areas (EPBC Act)

Commonwealth Marine Areas (EPBC Act)

## Listed Threatened Ecological Communities [ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

| Community Name | Threatened Category | Presence Text |
|---|---|---|
| Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community | Endangered | Community likely to occur within area |
| Giant Kelp Marine Forests of South East Australia | Endangered | Community may occur within area |
| Grassy Eucalypt Woodland of the Victorian Volcanic Plain | Critically Endangered | Community known to occur within area |
| Natural Damp Grassland of the Victorian Coastal Plains | Critically Endangered | Community may occur within area |
| Natural Temperate Grassland of the Victorian Volcanic Plain | Critically Endangered | Community likely to occur within area |
| River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria | Critically Endangered | Community may occur within area |
| Community Name | Threatened Category | Presence Text |
| Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains | Critically Endangered | Community likely to occur within area |
| Subtropical and Temperate Coastal Saltmarsh | Vulnerable | Community likely to occur within area |
| White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | Critically Endangered | Community likely to occur within area |

## Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| BIRD | | |
| Anthochaera phrygia | | |

| | | |
|---|---|---|
| Regent Honeyeater [82338] | Critically Endangered | Foraging, feeding or related behaviour likely to occur within area |
| [Aphelocephala leucopsis](#)<br>Southern Whiteface [529] | Vulnerable | Species or species habitat may occur within area |
| [Ardenna grisea](#)<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat likely to occur within area |
| [Arenaria interpres](#)<br>Ruddy Turnstone [872] | Vulnerable | Roosting known to occur within area |
| [Botaurus poiciloptilus](#)<br>Australasian Bittern [1001] | Endangered | Species or species habitat known to occur within area |
| [Calidris acuminata](#)<br>Sharp-tailed Sandpiper [874] | Vulnerable | Roosting known to occur within area |
| [Calidris canutus](#)<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat known to occur within area |
| [Calidris ferruginea](#)<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| [Callocephalon fimbriatum](#)<br>Gang-gang Cockatoo [768] | Endangered | Species or species habitat known to occur within area |
| [Calyptorhynchus lathami lathami](#)<br>South-eastern Glossy Black-Cockatoo [67036] | Vulnerable | Species or species habitat may occur within area |
| [Charadrius leschenaultii](#)<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area |
| [Charadrius mongolus](#)<br>Lesser Sand Plover, Mongolian Plover [879] | Endangered | Roosting known to occur within area |
| [Climacteris picumnus victoriae](#)<br>Brown Treecreeper (south-eastern) [67062] | Vulnerable | Species or species habitat may occur within area |
| [Dasyornis brachypterus](#)<br>Eastern Bristlebird [533] | Endangered | Species or species habitat known to occur within area |
| [Diomedea antipodensis](#)<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea antipodensis gibsoni](#)<br>Gibson's Albatross [82270] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea epomophora](#)<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea exulans](#)<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea sanfordi](#) | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Falco hypoleucos<br>Grey Falcon [929] | Vulnerable | Species or species habitat likely to occur within area |
| Fregetta grallaria grallaria<br>White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438] | Vulnerable | Species or species habitat likely to occur within area |
| Gallinago hardwickii<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area |
| Grantiella picta<br>Painted Honeyeater [470] | Vulnerable | Species or species habitat known to occur within area |
| Halobaena caerulea<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area |
| Hirundapus caudacutus<br>White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area |
| Lathamus discolor<br>Swift Parrot [744] | Critically Endangered | Species or species habitat known to occur within area |
| Limosa lapponica baueri<br>Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380] | Endangered | Species or species habitat known to occur within area |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Macronectes halli<br>Northern Giant Petrel [1061] | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | Endangered<br>Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Melanodryas cucullata cucullata<br>South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093] | | Species or species habitat may occur within area |
| Neophema chrysogaster<br>Orange-bellied Parrot [747] | Critically Endangered | Species or species habitat known to occur within area |
| Neophema chrysostoma<br>Blue-winged Parrot [726] | Vulnerable | Species or species habitat known to occur within area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| Pachyptila turtur subantarctica<br>Fairy Prion (southern) [64445] | Vulnerable | Species or species habitat known to occur within area |
| Pedionomus torquatus<br>Plains-wanderer [906] | Critically Endangered | Species or species habitat may occur within area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| Pterodroma leucoptera leucoptera<br>Gould's Petrel, Australian Gould's Petrel [26033] | Endangered | Species or species habitat may occur within area |
| Pterodroma mollis<br>Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| [Pycnoptilus floccosus](#)<br>Pilotbird [525] | Endangered<br>Vulnerable | Species or species habitat known to occur within area |
| [Rostratula australis](#)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Stagonopleura guttata<br>Diamond Firetail [59398] | Vulnerable | Species or species habitat known to occur within area |
| Sternula albifrons<br>Little Tern [82849] | Vulnerable | Breeding known to occur within area |
| Sternula nereis nereis<br>Australian Fairy Tern [82950] | Vulnerable | Species or species habitat known to occur within area |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche bulleri platei<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| Thalassarche eremita<br>Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Thinornis cucullatus cucullatus<br>Eastern Hooded Plover, Eastern Hooded Plover [90381] | Vulnerable | Species or species habitat known to occur within area |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat known to occur within area |
| CRUSTACEAN | | |
| Euastacus bidawalus<br>Bidhawal Crayfish, Bidawal Crayfish, East Gippsland Spiny Crayfish [83136] | Endangered | Species or species habitat may occur within area |
| Euastacus bispinosus<br>Glenelg Spiny Freshwater Crayfish, Pricklyback [81552] | Endangered | Species or species habitat likely to occur within area |
| FISH | | |

Galaxiella pusilla

| | | |
|---|---|---|
| Eastern Dwarf Galaxias, Dwarf Galaxias [56790] | Endangered | Species or species habitat may occur within area |
| Hoplostethus atlanticus<br>Orange Roughy, Deep-sea Perch, Red Roughy [68455] | Conservation Dependent | Species or species habitat likely to occur within area |
| Nannoperca obscura<br>Yarra Pygmy Perch [26177] | Endangered | Species or species habitat known to occur within area |
| Scientific Name | Threatened Category | Presence Text |

| | | |
|---|---|---|
| [Prototroctes maraena](#)<br>Australian Grayling [26179] | Vulnerable | Species or species habitat known to occur within area |
| [Seriolella brama](#)<br>Blue Warehou [69374] | Conservation Dependent | Species or species habitat known to occur within area |
| **FROG** | | |
| [Heleioporus australiacus flavopunctatus](#)<br>Southern Owl Frog, Southern Giant Burrowing Frog [92014] | Endangered | Species or species habitat may occur within area |
| [Litoria aurea](#)<br>Green and Golden Bell Frog [1870] | Vulnerable | Species or species habitat likely to occur within area |
| [Litoria raniformis](#)<br>Southern Bell Frog, Growling Grass Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828] | Vulnerable | Species or species habitat known to occur within area |
| [Uperoleia martini](#)<br>Martin's Toadlet [1873] | Endangered | Species or species habitat known to occur within area |
| **INSECT** | | |
| [Synemon plana](#)<br>Golden Sun Moth [25234] | Vulnerable | Species or species habitat may occur within area |
| **MAMMAL** | | |
| [Antechinus minimus maritimus](#)<br>Swamp Antechinus (mainland) [83086] | Vulnerable | Species or species habitat known to occur within area |
| [Balaenoptera borealis](#)<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| [Balaenoptera musculus](#) | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Blue Whale [36]<br>Balaenoptera physalus | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Dasyurus maculatus maculatus (SE mainland population)<br>Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184] | Endangered | Species or species habitat known to occur within area |
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |
| Isoodon obesulus obesulus<br>Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (southeastern) [68050] | Endangered | Species or species habitat known to occur within area |
| Mastacomys fuscus mordicus<br>Broad-toothed Rat (mainland), Tooarrana [87617] | Endangered | Species or species habitat known to occur within area |
| Miniopterus orianae bassanii<br>Southern Bent-wing Bat [87645] | Critically Endangered | Breeding known to occur within area |
| Neophoca cinerea<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area |
| Petauroides volans<br>Greater Glider (southern and central) [254] | Endangered | Species or species habitat may occur within area |
| Petaurus australis australis<br>Yellow-bellied Glider (south-eastern) [87600] | Vulnerable | Species or species habitat known to occur within area |

| | | |
|---|---|---|
| [Potorous tridactylus trisulcatus](#)<br>Long-nosed Potoroo (southern mainland) [86367] | Vulnerable | Species or species habitat known to occur within area |
| [Pseudomys fumeus](#)<br>Smoky Mouse, Konoom [88] | Endangered | Species or species habitat may occur within area |
| Scientific Name | Threatened Category | Presence Text |
| [Pseudomys novaehollandiae](#)<br>New Holland Mouse, Pookila [96] | Vulnerable | Species or species habitat likely to occur within area |
| [Pseudomys shortridgei](#)<br>Heath Mouse, Dayang, Heath Rat [77] | Endangered | Species or species habitat known to occur within area |
| [Pteropus poliocephalus](#)<br>Grey-headed Flying-fox [186] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| PLANT | | |
| [Amphibromus fluitans](#)<br>River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215] | Vulnerable | Species or species habitat likely to occur within area |
| [Caladenia concolor](#)<br>Crimson Spider-orchid, Maroon Spiderorchid [5505] | Vulnerable | Species or species habitat may occur within area |
| [Caladenia hastata](#)<br>Melblom's Spider-orchid [16118] | Endangered | Species or species habitat likely to occur within area |
| [Caladenia orientalis](#)<br>Eastern Spider Orchid [83410] | Endangered | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Caladenia tessellata<br>Thick-lipped Spider-orchid, Daddy Longlegs [2119] | Vulnerable | Species or species habitat likely to occur within area |
| Cryptostylis hunteriana<br>Leafless Tongue-orchid [19533] | Vulnerable | Species or species habitat likely to occur within area |
| Dodonaea procumbens<br>Trailing Hop-bush [12149] | Vulnerable | Species or species habitat may occur within area |
| Eucalyptus strzeleckii<br>Strzelecki Gum [55400] | Vulnerable | Species or species habitat known to occur within area |
| Glycine latrobeana<br>Clover Glycine, Purple Clover [13910] | Vulnerable | Species or species habitat known to occur within area |
| Grevillea infecunda<br>Anglesea Grevillea [22026] | Vulnerable | Species or species habitat likely to occur within area |
| Haloragis exalata subsp. exalata<br>Wingless Raspwort, Square Raspwort [24636] | Vulnerable | Species or species habitat known to occur within area |
| Ixodia achillaeoides subsp. arenicola<br>Sand Ixodia, Ixodia [21474] | Vulnerable | Species or species habitat known to occur within area |
| Lachnagrostis adamsonii<br>Adamson's Blown-grass, Adamson's Blowngrass [76211] | Endangered | Species or species habitat may occur within area |
| Leiocarpa gatesii<br>Wrinkled Buttons [76212] | Vulnerable | Species or species habitat may occur within area |
| Lepidium aschersonii<br>Spiny Peppercress [10976] | Vulnerable | Species or species habitat known to occur within area |

| | | |
|---|---|---|
| [Lepidium hyssopifolium](#)<br>Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542] | Endangered | Species or species habitat known to occur within area |
| [Pimelea spinescens subsp. spinescens](#)<br>Plains Rice-flower, Spiny Rice-flower, Prickly Pimelea [21980] | Critically Endangered | Species or species habitat likely to occur within area |
| [Prasophyllum frenchii](#)<br>Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704] | Endangered | Species or species habitat likely to occur within area |
| [Prasophyllum litorale listed as Prasophyllum littorale](#)<br>Coastal Leek Orchid [55234] | Critically Endangered | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Prasophyllum spicatum](#)<br>Dense Leek-orchid [55146] | Vulnerable | Species or species habitat known to occur within area |
| [Prasophyllum suaveolens](#)<br>Fragrant Leek-orchid [64956] | Endangered | Species or species habitat may occur within area |
| [Pterostylis chlorogramma](#)<br>Green-striped Greenhood [56510] | Vulnerable | Species or species habitat likely to occur within area |
| [Pterostylis cucullata](#)<br>Leafy Greenhood [15459] | Vulnerable | Species or species habitat likely to occur within area |
| [Pterostylis tenuissima](#)<br>Swamp Greenhood, Dainty Swamp Orchid [13139] | Vulnerable | Species or species habitat known to occur within area |
| [Senecio macrocarpus](#)<br>Large-fruit Fireweed, Large-fruit Groundsel [16333] | Vulnerable | Species or species habitat likely to occur within area |

| | | |
|---|---|---|
| Senecio psilocarpus<br>Swamp Fireweed, Smooth-fruited Groundsel [64976] | Vulnerable | Species or species habitat known to occur within area |
| Thelymitra epipactoides<br>Metallic Sun-orchid [11896] | Endangered | Species or species habitat known to occur within area |
| Thelymitra matthewsii<br>Spiral Sun-orchid [4168] | Endangered | Species or species habitat known to occur within area |
| Thelymitra orientalis<br>Hoary Sun-orchid [88011] | Critically Endangered | Species or species habitat may occur within area |
| Xerochrysum palustre<br>Swamp Everlasting, Swamp Paper Daisy [76215] | Vulnerable | Species or species habitat likely to occur within area |

| REPTILE | | |
|---|---|---|
| Scientific Name | Threatened Category | Presence Text |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Species or species habitat known to occur within area |
| Delma impar<br>Striped Legless Lizard, Striped Snakelizard [1649] | Vulnerable | Species or species habitat likely to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth | Endangered | Foraging, feeding or related behaviour known to occur within area |

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|---|---|---|
| [Eretmochelys imbricata](#)<br>Hawksbill Turtle [1766] | Vulnerable | Breeding likely to occur within area |
| [Lissolepis coventryi](#)<br>Swamp Skink, Eastern Mourning Skink | Endangered [84053] | Species or species habitat known to occur within area |

SHARK

| | | |
|---|---|---|
| [Carcharodon carcharias](#)<br>White Shark, Great White Shark [64470] | Vulnerable | |

Listed Migratory Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Migratory Marine Birds | | |
| | | Foraging, feeding or related behaviour known to occur within area |
| Centrophorus uyato<br>Little Gulper Shark [68446] | Conservation Dependent | Species or species habitat likely to occur within area |
| Galeorhinus galeus<br>School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453] | Conservation Dependent | Species or species habitat likely to occur within area |
| Rhincodon typus<br>Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |
| Anous stolidus<br>Common Noddy [825] | | Species or species habitat likely to occur within area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area |
| Ardenna carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Species or species habitat known to occur within area |
| Ardenna grisea<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat likely to occur within area |
| Ardenna tenuirostris<br>Short-tailed Shearwater [82652] | | Breeding known to occur within area |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| [Diomedea epomophora](#)<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea exulans](#)<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea sanfordi](#)<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| [Macronectes giganteus](#)<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| Sternula albifrons<br>Little Tern [82849] | Vulnerable | Breeding known to occur within area |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| Thalassarche eremita<br>Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Migratory Marine Species | | |
| Balaenoptera bonaerensis<br>Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely to occur within area |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera edeni<br>Bryde's Whale [35] | | Species or species habitat may occur within area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Caperea marginata<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour likely to occur within area |
| Carcharhinus longimanus<br>Oceanic Whitetip Shark [84108] | | Species or species habitat may occur within area |
| Carcharias taurus | | |

| | | |
|---|---|---|
| Grey Nurse Shark [64469] | | Species or species habitat may occur within area |
| [Carcharodon carcharias](#)<br>White Shark, Great White Shark [64470] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| [Caretta caretta](#)<br>Loggerhead Turtle [1763] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| [Chelonia mydas](#)<br>Green Turtle [1765] | Vulnerable | Species or species habitat known to occur within area |
| [Dermochelys coriacea](#)<br>Leatherback Turtle, Leathery Turtle, Luth Endangered [1768] | | Foraging, feeding or related behaviour known to occur within area |
| [Eretmochelys imbricata](#)<br>Hawksbill Turtle [1766] | Vulnerable | Breeding likely to occur within area |
| [Eubalaena australis as Balaena glacialis australis](#)<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |
| [Isurus oxyrinchus](#)<br>Shortfin Mako, Mako Shark [79073] | | Species or species habitat likely to occur within area |
| [Lagenorhynchus obscurus](#)<br>Dusky Dolphin [43] | | Species or species habitat likely to occur within area |
| [Lamna nasus](#)<br>Porbeagle, Mackerel Shark [83288] | | Species or species habitat likely to occur within area |
| [Megaptera novaeangliae](#)<br>Humpback Whale [38] | | Species or species habitat known to occur within area |
| [Orcinus orca](#) | | |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Killer Whale, Orca [46] | | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Physeter macrocephalus<br>Sperm Whale [59] | | Species or species habitat may occur within area |
| Rhincodon typus<br>Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |
| **Migratory Terrestrial Species** | | |
| Hirundapus caudacutus<br>White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area |
| Motacilla flava<br>Yellow Wagtail [644] | | Species or species habitat may occur within area |
| **Migratory Wetlands Species** | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat known to occur within area |
| Arenaria interpres<br>Ruddy Turnstone [872] | Vulnerable | Roosting known to occur within area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Roosting known to occur within area |
| Calidris alba<br>Sanderling [875] | | Roosting known to occur within area |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat known to occur within area |

| | | |
|---|---|---|
| [Calidris ferruginea](#)<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area |
| [Calidris melanotos](#)<br>Pectoral Sandpiper [858] | | Species or species habitat known to occur within area |
| [Calidris ruficollis](#)<br>Red-necked Stint [860] | | Roosting known to occur within area |
| [Charadrius bicinctus](#)<br>Double-banded Plover [895] | | Roosting known to occur within area |
| [Charadrius leschenaultii](#)<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area |
| [Charadrius mongolus](#)<br>Lesser Sand Plover, Mongolian Plover [879] | Endangered | Roosting known to occur within area |
| [Gallinago hardwickii](#)<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area |
| [Gallinago megala](#)<br>Swinhoe's Snipe [864] | | Roosting likely to occur within area |
| [Gallinago stenura](#)<br>Pin-tailed Snipe [841] | | Roosting likely to occur within area |
| [Limosa lapponica](#)<br>Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| [Numenius madagascariensis](#)<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| [Numenius minutus](#)<br>Little Curlew, Little Whimbrel [848] | | Roosting likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Numenius phaeopus<br>Whimbrel [849] | | Roosting known to occur within area |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area |
| Pluvialis fulva<br>Pacific Golden Plover [25545] | | Roosting known to occur within area |
| Thalasseus bergii<br>Greater Crested Tern [83000] | | Breeding known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Tringa brevipes<br>Grey-tailed Tattler [851] | | Roosting known to occur within area |
| Tringa glareola<br>Wood Sandpiper [829] | | Roosting known to occur within area |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat known to occur within area |
| Tringa stagnatilis<br>Marsh Sandpiper, Little Greenshank [833] | | Roosting known to occur within area |

## Other Matters Protected by the EPBC Act

### Commonwealth Lands [ Resource Information ]

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

| Commonwealth Land Name | State |
|---|---|
| **Defence** | |
| Defence - WARRNAMBOOL TRAINING DEPOT [21111] | VIC |
| **Unknown** | |
| Commonwealth Land - [21583] | VIC |

| | | |
|---|---|---|
| Commonwealth Land - [21498] | | VIC |
| Commonwealth Land - [21492] | | VIC |
| Commonwealth Land - [21497] | | VIC |

## Listed Marine Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| **Bird** | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat known to occur within area |
| Anous stolidus<br>Common Noddy [825] | | Species or species habitat likely to occur within area |
| Anseranas semipalmata<br>Magpie Goose [978] | | Species or species habitat may occur within area overfly marine area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area |
| Ardenna carneipes as Puffinus carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Species or species habitat known to occur within area |
| Ardenna grisea as Puffinus griseus<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat likely to occur within area |
| Ardenna tenuirostris as Puffinus tenuirostris<br>Short-tailed Shearwater [82652] | | Breeding known to occur within area |
| Arenaria interpres<br>Ruddy Turnstone [872] | Vulnerable | Roosting known to occur within area |
| Bubulcus ibis as Ardea ibis | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Roosting known to occur within area |
| Calidris alba<br>Sanderling [875] | | Roosting known to occur within area |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat known to occur within area overfly marine area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area overfly marine area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| [Calidris melanotos](#)<br>Pectoral Sandpiper [858] | | Species or species habitat known to occur within area overfly marine area |
| [Calidris ruficollis](#)<br>Red-necked Stint [860] | | Roosting known to occur within area overfly marine area |
| [Chalcites osculans as Chrysococcyx osculans](#)<br>Black-eared Cuckoo [83425] | | Species or species habitat known to occur within area overfly marine area |
| [Charadrius bicinctus](#)<br>Double-banded Plover [895] | | Roosting known to occur within area overfly marine area |
| [Charadrius leschenaultii](#)<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area |
| [Charadrius mongolus](#)<br>Lesser Sand Plover, Mongolian Plover [879] | Endangered | Roosting known to occur within area |
| [Charadrius ruficapillus](#)<br>Red-capped Plover [881] | | Roosting known to occur within area overfly marine area |
| [Chroicocephalus novaehollandiae as Larus novaehollandiae](#)<br>Silver Gull [82326] | | Breeding known to occur within area |
| [Diomedea antipodensis](#)<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea antipodensis gibsoni as Diomedea gibsoni](#)<br>Gibson's Albatross [82270] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea epomophora](#) | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea exulans](#)<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea sanfordi](#)<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| [Eudyptula minor](#)<br>Little Penguin [1085] | | Breeding known to occur within area |
| [Gallinago hardwickii](#)<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area<br>overfly marine area |
| [Gallinago megala](#)<br>Swinhoe's Snipe [864] | | Roosting likely to occur within area<br>overfly marine area |
| [Gallinago stenura](#)<br>Pin-tailed Snipe [841] | | Roosting likely to occur within area<br>overfly marine area |
| [Haliaeetus leucogaster](#)<br>White-bellied Sea-Eagle [943] | | Breeding known to occur within area |
| [Halobaena caerulea](#)<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area |
| [Himantopus himantopus](#)<br>Pied Stilt, Black-winged Stilt [870] | | Roosting known to occur within area<br>overfly marine area |
| [Hirundapus caudacutus](#) | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area overfly marine area |
| Larus pacificus<br>Pacific Gull [811] | | Breeding known to occur within area |
| Lathamus discolor<br>Swift Parrot [744] | Critically Endangered | habitat known to occur within area overfly marine area |
| Limosa lapponica<br>Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Merops ornatus<br>Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area |
| Monarcha melanopsis<br>Black-faced Monarch [609] | | Species or species habitat likely to occur within area overfly marine area |
| Morus capensis<br>Cape Gannet [59569] | | Breeding known to occur within area |
| Morus serrator<br>Australasian Gannet [1020] | | Breeding known to occur within area |
| Motacilla flava<br>Yellow Wagtail [644] | | Species or species |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | | habitat may occur within area overfly marine area |
| Myiagra cyanoleuca<br>Satin Flycatcher [612] | | Breeding known to occur within area overfly marine area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Neophema chrysogaster<br>Orange-bellied Parrot [747] | Critically Endangered | Species or species habitat known to occur within area overfly marine area |
| Neophema chrysostoma<br>Blue-winged Parrot [726] | Vulnerable | Species or species habitat known to occur within area overfly marine area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| Numenius minutus<br>Little Curlew, Little Whimbrel [848] | | Roosting likely to occur within area overfly marine area |
| Numenius phaeopus<br>Whimbrel [849] | | Roosting known to occur within area |
| Pachyptila turtur<br>Fairy Prion [1066] | | Species or species habitat known to occur within area |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area |
| Pelecanoides urinatrix<br>Common Diving-Petrel [1018] | | Breeding known to occur within area |
| Phalacrocorax fuscescens<br>Black-faced Cormorant [59660] | | Breeding known to occur within area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| Pluvialis fulva<br>Pacific Golden Plover [25545] | | Roosting known to occur within area |
| Pterodroma cervicalis | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| White-necked Petrel [59642] | | Species or species habitat may occur within area |
| [Pterodroma mollis](#)<br>Soft-plumaged Petrel [1036] | Vulnerable | habitat may occur within area |
| [Recurvirostra novaehollandiae](#)<br>Red-necked Avocet [871] | | Roosting known to occur within area<br>overfly marine area |
| [Rhipidura rufifrons](#)<br>Rufous Fantail [592] | | Species or species habitat known to occur within area<br>overfly marine area |
| [Rostratula australis as Rostratula benghalensis (sensu lato)](#)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat known to occur within area<br>overfly marine area |
| [Stercorarius antarcticus as Catharacta skua](#)<br>Brown Skua [85039] | | Species or species habitat may occur within area |
| [Sterna striata](#)<br>White-fronted Tern [799] | | Foraging, feeding or related behaviour likely to occur within area |
| [Sternula albifrons as Sterna albifrons](#)<br>Little Tern [82849] | Vulnerable | Breeding known to occur within area |
| [Thalassarche bulleri](#)<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche bulleri platei as Thalassarche sp. nov.](#)<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche carteri](#)<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| [Thalassarche cauta](#)<br>Shy Albatross [89224] | Endangered | Species or species habitat likely to occur within area<br>Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche chrysostoma](#)<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| [Thalassarche eremita](#)<br>Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |
| [Thalassarche impavida](#)<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche melanophris](#)<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche salvini](#)<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche steadi](#)<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| [Thalasseus bergii as Sterna bergii](#)<br>Greater Crested Tern [83000] | | Breeding known to occur within area |
| [Thinornis cucullatus as Thinornis rubricollis](#)<br>Hooded Plover, Hooded Dotterel [87735] | | Species or species habitat known to occur within area<br>overfly marine area |
| [Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis](#)<br>Eastern Hooded Plover, Eastern Hooded Plover [90381] | Vulnerable | Species or species habitat known to |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | | occur within area<br>overfly marine area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Tringa brevipes as Heteroscelus brevipes<br>Grey-tailed Tattler [851] | | Roosting known to occur within area |
| Tringa glareola<br>Wood Sandpiper [829] | | Roosting known to occur within area<br>overfly marine area |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat known to occur within area<br>overfly marine area |
| Tringa stagnatilis<br>Marsh Sandpiper, Little Greenshank [833] | | Roosting known to occur within area<br>overfly marine area |
| Fish | | |
| Heraldia nocturna<br>Upside-down Pipefish, Eastern Upsidedown Pipefish, Eastern Upside-down Pipefish [66227] | | Species or species habitat may occur within area |
| Hippocampus abdominalis<br>Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233] | | Species or species habitat may occur within area |
| Hippocampus breviceps<br>Short-head Seahorse, Short-snouted Seahorse [66235] | | Species or species habitat may occur within area |
| Hippocampus minotaur<br>Bullneck Seahorse [66705] | | Species or species habitat may occur within area |
| Histiogamphelus briggsii<br>Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242] | | Species or species habitat may occur within area |
| Histiogamphelus cristatus | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243] | | Species or species habitat may occur within area |
| Hypselognathus rostratus<br>Knifesnout Pipefish, Knife-snouted Pipefish [66245] | | Species or species habitat may occur within area |
| Kaupus costatus<br>Deepbody Pipefish, Deep-bodied Pipefish [66246] | | Species or species habitat may occur within area |
| Kimblaeus bassensis<br>Trawl Pipefish, Bass Strait Pipefish [66247] | | Species or species habitat may occur within area |
| Leptoichthys fistularius<br>Brushtail Pipefish [66248] | | Species or species habitat may occur within area |
| Lissocampus caudalis<br>Australian Smooth Pipefish, Smooth Pipefish [66249] | | Species or species habitat may occur within area |
| Lissocampus runa<br>Javelin Pipefish [66251] | | Species or species habitat may occur within area |
| Maroubra perserrata<br>Sawtooth Pipefish [66252] | | Species or species habitat may occur within area |
| Mitotichthys mollisoni<br>Mollison's Pipefish [66260] | | Species or species habitat may occur within area |
| Mitotichthys semistriatus<br>Halfbanded Pipefish [66261] | | Species or species habitat may occur within area |
| Mitotichthys tuckeri | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Tucker's Pipefish [66262]<br>Notiocampus ruber | | Species or species habitat may occur within area |
| Red Pipefish [66265]<br>Phycodurus eques | | Species or species habitat may occur within area |
| Leafy Seadragon [66267]<br>Phyllopteryx taeniolatus | | Species or species habitat may occur within area |
| Common Seadragon, Weedy Seadragon [66268]<br>Pugnaso curtirostris | | Species or species habitat may occur within area |
| Pugnose Pipefish, Pug-nosed Pipefish [66269]<br>Solegnathus robustus | | Species or species habitat may occur within area |
| Robust Pipehorse, Robust Spiny Pipehorse [66274]<br>Solegnathus spinosissimus | | Species or species habitat may occur within area |
| Spiny Pipehorse, Australian Spiny Pipehorse [66275]<br>Stigmatopora argus | | Species or species habitat may occur within area |
| Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]<br>Stigmatopora nigra | | Species or species habitat may occur within area |
| Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]<br>Stipecampus cristatus | | Species or species habitat may occur within area |
| Ringback Pipefish, Ring-backed Pipefish [66278]<br>Syngnathoides biaculeatus | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279] | | Species or species habitat may occur within area |
| Urocampus carinirostris<br>Hairy Pipefish [66282] | | Species or species habitat may occur within area |
| Vanacampus margaritifer<br>Mother-of-pearl Pipefish [66283] | | Species or species habitat may occur within area |
| Vanacampus phillipi<br>Port Phillip Pipefish [66284] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Vanacampus poecilolaemus<br>Longsnout Pipefish, Australian Longsnout Pipefish, Long-snouted Pipefish [66285] | | Species or species habitat may occur within area |
| **Mammal** | | |
| Arctocephalus forsteri<br>Long-nosed Fur-seal, New Zealand Furseal [20] | | Species or species habitat may occur within area |
| Arctocephalus pusillus<br>Australian Fur-seal, Australo-African Fur-seal [21] | | Breeding known to occur within area |
| Neophoca cinerea<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area |
| **Reptile** | | |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Species or species habitat known to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth Endangered [1768] | | Foraging, feeding or related behaviour known to occur within area |
| Eretmochelys imbricata<br>Hawksbill Turtle [1766] | Vulnerable | Breeding likely to occur within area |

| Whales and Other Cetaceans | | [ Resource Information ] |
| --- | --- | --- |
| Current Scientific Name | Status | Type of Presence |
| **Mammal** | | |
| Balaenoptera acutorostrata<br>Minke Whale [33] | | Species or species habitat may occur within area |
| Balaenoptera bonaerensis | | |

| | | |
|---|---|---|
| Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely to occur within area |
| Current Scientific Name | Status | Type of Presence |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera edeni<br>Bryde's Whale [35] | | Species or species habitat may occur within area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Berardius arnuxii<br>Arnoux's Beaked Whale [70] | | Species or species habitat may occur within area |
| Caperea marginata<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour likely to occur within area |
| Delphinus delphis<br>Common Dolphin, Short-beaked Common Dolphin [60] | | Species or species habitat may occur within area |
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |
| Globicephala macrorhynchus<br>Short-finned Pilot Whale [62] | | Species or species habitat may occur within area |
| Globicephala melas | | |

| | | |
|---|---|---|
| Long-finned Pilot Whale [59282] | | Species or species habitat may occur within area |
| [Grampus griseus](#)<br>Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area |
| Current Scientific Name | Status | Type of Presence |
| [Kogia breviceps](#)<br>Pygmy Sperm Whale [57] | | Species or species habitat may occur within area |
| [Kogia sima](#)<br>Dwarf Sperm Whale [85043] | | Species or species habitat may occur within area |
| [Lagenorhynchus obscurus](#)<br>Dusky Dolphin [43] | | Species or species habitat likely to occur within area |
| [Lissodelphis peronii](#)<br>Southern Right Whale Dolphin [44] | | Species or species habitat may occur within area |
| [Megaptera novaeangliae](#)<br>Humpback Whale [38] | | Species or species habitat known to occur within area |
| [Mesoplodon bowdoini](#)<br>Andrew's Beaked Whale [73] | | Species or species habitat may occur within area |
| [Mesoplodon densirostris](#)<br>Blainville's Beaked Whale, Densebeaked Whale [74] | | Species or species habitat may occur within area |
| [Mesoplodon grayi](#)<br>Gray's Beaked Whale, Scamperdown Whale [75] | | Species or species habitat may occur within area |
| [Mesoplodon hectori](#)<br>Hector's Beaked Whale [76] | | Species or species habitat may occur within area |
| [Mesoplodon layardii](#) | | |

| | | |
|---|---|---|
| Strap-toothed Beaked Whale, Straptoothed Whale, Layard's Beaked Whale [25556]<br><br>Mesoplodon mirus | | Species or species habitat may occur within area |
| True's Beaked Whale [54] | | Species or species habitat may occur within area |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area |
| Physeter macrocephalus<br>Sperm Whale [59] | | Species or species habitat may occur within area |
| Pseudorca crassidens<br>False Killer Whale [48] | | Species or species habitat likely to occur within area |
| Tursiops aduncus<br>Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | | Species or species habitat likely to occur within area |
| Tursiops truncatus s. str.<br>Bottlenose Dolphin [68417] | | Species or species habitat may occur within area |
| Ziphius cavirostris<br>Cuvier's Beaked Whale, Goose-beaked Whale [56] | | Species or species habitat may occur within area |

| Australian Marine Parks | [ Resource Information ] |
|---|---|
| Park Name | Zone & IUCN Categories |
| Apollo | Multiple Use Zone (IUCN VI) |
| Zeehan | Multiple Use Zone (IUCN VI) |
| Zeehan | National Park Zone (IUCN II) |

| | |
|---|---|
| Zeehan | Special Purpose Zone (IUCN VI) |

## Extra Information

| State and Territory Reserves | | [ Resource Information ] |
|---|---|---|
| Protected Area Name | Reserve Type | State |
| Aire River | Heritage River | VIC |
| Aire River W.R. | Natural Features Reserve | VIC |
| Anglesea B.R. | Natural Features Reserve | VIC |
| Anser Island | Reference Area | VIC |
| Bay of Islands Coastal Park | Conservation Park | VIC |
| Breamlea F.F.R. | Nature Conservation Reserve | VIC |
| Cape Nelson | State Park | VIC |
| Croajingolong | National Park | VIC |
| Discovery Bay Coastal Park | Conservation Park | VIC |
| Edna Bowman N.C.R. | Natural Features Reserve | VIC |
| Great Otway | National Park | VIC |
| Johanna Falls S.R. | Natural Features Reserve | VIC |
| Lady Julia Percy Island W.R. | Nature Conservation Reserve | VIC |
| Lake Gillear W.R | Natural Features Reserve | VIC |
| Lawrence Rocks W.R. | Nature Conservation Reserve | VIC |
| Marengo N.C.R. | Nature Conservation Reserve | VIC |
| Marengo Reefs | Marine Sanctuary | VIC |

| | | |
|---|---|---|
| Merri | Marine Sanctuary | VIC |
| Point Addis | Marine National Park | VIC |
| Point Hicks | Marine National Park | VIC |
| Port Campbell | National Park | VIC |
| Princetown W.R | Natural Features Reserve | VIC |
| Southern Wilsons Promontory | Remote and Natural Area - Schedule 6, National Parks Act | VIC |
| Stony Creek (Otways) | Reference Area | VIC |
| The Arches | Marine Sanctuary | VIC |
| Twelve Apostles | Marine National Park | VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Unnamed P0176 | Private Nature Reserve | VIC |
| Wild Dog Creek SS.R. | Natural Features Reserve | VIC |
| Wilsons Promontory | National Park | VIC |
| Wilsons Promontory | Marine National Park | VIC |
| Wilsons Promontory Islands | Remote and Natural Area - Schedule 6, National Parks Act | VIC |
| Yambuk F.F.R. | Nature Conservation Reserve | VIC |

## Regional Forest Agreements

[ Resource Information ]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

| RFA Name | State |
|---|---|
| East Gippsland RFA | Victoria |
| Gippsland RFA | Victoria |
| West Victoria RFA | Victoria |

## Nationally Important Wetlands [ Resource Information ]

| Wetland Name | State |
|---|---|
| Lower Aire River Wetlands | VIC |
| Lower Merri River Wetlands | VIC |
| Princetown Wetlands | VIC |

## EPBC Act Referrals [ Resource Information ]

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Apollo Bay to Skenes Creek Coastal Trail | 2022/09274 | | Assessment |
| Cape Winds Offshore Windfarm Geophysical, Geotechnical and Marine Studies | 2023/09629 | | Completed |
| Decommissioning of the Minerva Pipeline in Victorian state waters | 2024/09879 | | Completed |
| Decommissioning of the Minerva Pipeline in Victorian state waters ? May 2025 | 2025/10138 | | Referral Decision |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Geographe-A gas exploration well | 2000/82 | | Completed |
| Great Ocean Road Coastal Trail (GORCT) ? Fairhaven to Grey River | 2024/10073 | | Completed |
| Hydrocarbon exploration wells | 2003/1062 | | Completed |
| Marine Route Survey for Subsea Fibre Optic Data Cable System Australia East | 2024/09795 | | Completed |
| Normanville Energy Park | 2024/10070 | | Assessment |
| Otway Astrolabe 3D Marine Seismic Survey, Otway Basin | 2012/6421 | | Completed |
| Portland Energy Park | 2024/09947 | | Assessment |

| | | | |
|---|---|---|---|
| SMAP telecommunications submarine cable installation | 2024/09989 | | Completed |
| Southern Winds Offshore Wind Project | 2022/09435 | | Completed |
| Southern Winds Offshore Wind Project Initial Marine Field Investigations | 2022/09436 | | Completed |
| Spinifex Offshore Surveys | 2022/09359 | | Completed |
| Spinifex Offshore Wind Farm Offshore Investigations | 2024/09918 | | Referral Decision |
| Strike Oil NL Seismic Surveys | 2000/107 | | Completed |
| Thylacine-A Exploration Well | 2000/81 | | Completed |
| Vic-P51 and Vic-P52 3D seismic survey | 2002/799 | | Completed |

| Controlled action | | | |
|---|---|---|---|
| Alston-1 petroleum exploration well, permit VIC/P44 | 2003/1315 | Controlled Action | Post-Approval |
| Casino Gas Field Development | 2003/1295 | Controlled Action | Post-Approval |
| Establishment of plantation for use of effluent water | 2003/1063 | Controlled Action | Completed |
| Mosquito Control | 2005/2132 | Controlled Action | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Controlled action | | | |
| Otway Development | 2002/621 | Controlled Action | Post-Approval |
| Pacific Hydro (Portland) Wind Farm SW Victoria | 2000/18 | Controlled Action | Post-Approval |
| Residential Subdivision & Infrastructure Parish of Belfast | 2005/1954 | Controlled Action | Completed |
| Schomberg 3D Marine Seismic Survey | 2007/3754 | Controlled Action | Completed |

| | | | |
|---|---|---|---|
| Strike Oil Gas Exploration Well, Otway Basin (VIC/P44) | 2000/97 | Controlled Action | Completed |
| Twelve Apostles Saddle Lookout | 2019/8571 | Controlled Action | Post-Approval |
| VIC Offshore Windfarm | 2021/8966 | Controlled Action | Assessment Approach |
| VICP61 2D Marine Seismic Survey | 2008/4075 | Controlled Action | Completed |
| Not controlled action | | | |
| Amrit-1 exploration well | 2004/1572 | Not Controlled Action | Completed |
| Biodiversity Impacts Audit | 2011/6191 | Not Controlled Action | Completed |
| Communications tower extension | 2003/1099 | Not Controlled Action | Completed |
| Construction and operation of Barwon Water biosolids treatment facility | 2008/4345 | Not Controlled Action | Completed |
| Construction of Barwon Heads Bridge | 2005/2375 | Not Controlled Action | Completed |
| construction of pump station for pump diversion from the Barham River | 2003/1242 | Not Controlled Action | Completed |
| Construction of the Edgars Road Extension, from Childs Road, Lalor to Cooper Street, Epping | 2003/1135 | Not Controlled Action | Completed |
| Drilling of Callister-1 exploration well in VIC/P51 | 2004/1633 | Not Controlled Action | Completed |
| Enterprise 1 Exploration Drilling Program, near Port Campbell, Vic | 2019/8438 | Not Controlled Action | Completed |
| Exploration drilling for liquid/gaseous hydrocarbons | 2004/1681 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| Gas Field Development | 2006/2635 | Not Controlled Action | Completed |
| Gas Fields Development | 2011/5879 | Not Controlled Action | Completed |

| | | | |
|---|---|---|---|
| Golflinks Road Residential Development & Water Storage Facility at Barwon Heads | 2004/1793 | Not Controlled Action | Completed |
| Grevillea infecunda tip cuttings and soil samples | 2005/1979 | Not Controlled Action | Completed |
| Halladale and Speculant Gas Pipeline Project, North of Port Campbell, Vic | 2015/7551 | Not Controlled Action | Completed |
| Henry-1 Exploration Well, Petroleum Permit Area VIC/P44 | 2005/2147 | Not Controlled Action | Completed |
| Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia | 2015/7522 | Not Controlled Action | Completed |
| INDIGO Central Submarine Telecommunications Cable | 2017/8127 | Not Controlled Action | Completed |
| Installation of a 35 metre telecommunications facility at Jirrahlinga Animal San | 2003/1151 | Not Controlled Action | Completed |
| Kelly Swamp Boardwalk Construction | 2010/5371 | Not Controlled Action | Completed |
| Maintenance of Access Track and Weed Removal | 2009/4973 | Not Controlled Action | Completed |
| Nirranda South Wind Farm Pty Ltd | 2002/763 | Not Controlled Action | Completed |
| Offshore exploration drilling within permit area VIC/P 37(v) | 2004/1466 | Not Controlled Action | Completed |
| Port Campbell Headland Walking Trail Realignment | 2012/6676 | Not Controlled Action | Completed |
| Redevelopment Project to Upgrade and Extend the Portland Trawler Wharf | 2008/4317 | Not Controlled Action | Completed |
| Residential/Resort/Golf Course development | 2002/907 | Not Controlled Action | Completed |
| Stage 1 residential subdivision, Anna Catherine Drive | 2005/1992 | Not Controlled Action | Completed |
| Torquay Sewerage Strategy - pipe replacement between Torquay and | 2004/1704 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |

| | | | |
|---|---|---|---|
| the Black Rock | | | |
| Track construction - Great Ocean Walk | 2002/793 | Not Controlled Action | Completed |
| VIC-P44 Stage 2 Gas Field Development | 2007/3767 | Not Controlled Action | Completed |
| Victorian Generator Project | 2005/1984 | Not Controlled Action | Completed |
| Wind Farm Construction and Operation | 2001/471 | Not Controlled Action | Completed |

| Not controlled action (particular manner) | | | |
|---|---|---|---|
| 'Moonlight Head' 3D seismic survey, VIC/P38(V), VIC/P43 and VIC/RL8 | 2005/2236 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Marine Seismic Survey | 2005/2295 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic Survey | 2003/1214 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic Survey in VIC/P50 and VIC/P46 | 2004/1810 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D seismic survey VIC/P50 | 2005/2313 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D marine seismic survey near King Island | 2004/1461 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D Marine Seismic Survey within Torquay Sub-basin off sthn Victoria | 2012/6256 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D seismic program VIC/P38(v), VIC/P43 and VIC/RL8 | 2003/1137 | Not Controlled Action (Particular Manner) | Post-Approval |

| | | | |
|---|---|---|---|
| Astrolabe 3D Marine Seismic Survey | 2011/6048 | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| BHPBilliton Otway 3D Seismic Survey | 2007/3443 | Not Controlled Action (Particular Manner) | Post-Approval |
| Deepwater Sorell Basin 2001 NonExclusive 2D Seismic Survey | 2001/156 | Not Controlled Action (Particular Manner) | Post-Approval |
| Drill and Profile Exploration Well Somerset 1, License Area T34P | 2009/5037 | Not Controlled Action (Particular Manner) | Post-Approval |
| Enterprise Three-dimensional Transition Zone Seismic Survey, Victoria | 2016/7800 | Not Controlled Action (Particular Manner) | Post-Approval |
| Fuelbreak construction | 2009/4915 | Not Controlled Action (Particular Manner) | Post-Approval |
| Geelong Bypass Section 3 | 2005/2099 | Not Controlled Action (Particular Manner) | Post-Approval |
| INDIGO Marine Cable Route Survey (INDIGO) | 2017/7996 | Not Controlled Action (Particular Manner) | Post-Approval |
| La Bella 3D Marine Seismic Survey, Otway Basin, VIC | 2012/6683 | Not Controlled Action (Particular Manner) | Post-Approval |
| OTE10 2D Marine Seismic Survey | 2009/5223 | Not Controlled Action (Particular Manner) | Post-Approval |
| Otway Basin Exploration Drilling Campaign, Vic | 2011/6125 | Not Controlled Action (Particular Manner) | Post-Approval |

| | | | |
|---|---|---|---|
| [Santos 2D Seismic Survey VIC/P44 & VIC/P51] | 2003/1213 | Not Controlled Action (Particular Manner) | Post-Approval |
| Title of referral | Reference | Referral Outcome | Assessment Status |
| Not controlled action (particular manner) | | | |
| [Santos Otway 3d Seismic VIC/P44] | 2007/3367 | Not Controlled Action (Particular Manner) | Post-Approval |
| [Schomberg 3D Marine Seismic survey] | 2007/3868 | Not Controlled Action (Particular Manner) | Post-Approval |
| [Southern Margins T/35P and T/36P 3D Seismic Surveys] | 2007/3817 | Not Controlled Action (Particular Manner) | Post-Approval |
| [Speculant 3D Transition Zone Seismic Survey] | 2010/5558 | Not Controlled Action (Particular Manner) | Post-Approval |
| [Surface Geochemical Exploration Program, TAS] | 2010/5780 | Not Controlled Action (Particular Manner) | Post-Approval |
| [The Enterprise 3D Seismic Acquisition Survey, Otway Basin, Vic] | 2012/6565 | Not Controlled Action (Particular Manner) | Post-Approval |
| [Torquay Sub-basin (VIC/P62) OTE12-3D Seismic Survey] | 2012/6655 | Not Controlled Action (Particular Manner) | Post-Approval |
| [Undertake a three dimensional marine seismic survey] | 2010/5700 | Not Controlled Action (Particular Manner) | Post-Approval |
| [Vic/P37(v) and Vic/P44 3D marine seismic survey] | 2003/1102 | Not Controlled Action (Particular Manner) | Post-Approval |
| [VIC P44 Gas Exploration Wells] | 2002/662 | Not Controlled Action (Particular Manner) | Post-Approval |

| | | | |
|---|---|---|---|
| Vic-P51 and Vic-P52 2D seismic survey | 2002/811 | Not Controlled Action (Particular Manner) | Post-Approval |

| Referral decision | | | |
|---|---|---|---|
| 3D Marine Seismic Survey | 2011/6156 | Referral Decision | Completed |
| Title of referral | Reference | Referral Outcome | Assessment Status |
| Referral decision | | | |
| All actions taken in response to the current severe bushfires in Victoria. | 2009/4787 | Referral Decision | Completed |
| Portland Wave Energy Project | 2008/3946 | Referral Decision | Completed |
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, VIC | 2012/6545 | Referral Decision | Completed |
| VICP61 2D Marine Seismic Survey | 2008/3975 | Referral Decision | Completed |

## Key Ecological Features [ Resource Information ]

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

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

## Biologically Important Areas [ Resource Information ]

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Seabirds | | |
| Ardenna pacifica | | |
| Wedge-tailed Shearwater [84292] | Foraging | Likely to occur |
| Ardenna tenuirostris | | |
| Short-tailed Shearwater [84292] | Breeding | Known to occur |
| Ardenna tenuirostris | | |
| Short-tailed Shearwater [82652] | Breeding | Known to occur |
| Ardenna tenuirostris | | |

| | | | |
|---|---|---|---|
| Short-tailed Shearwater [82652] | Foraging | Known to occur | to |
| Diomedea exulans (sensu lato)<br>Wandering Albatross [1073] | Foraging | Known to occur | to |
| Diomedea exulans antipodensis<br>Antipodean Albatross [82269] | Foraging | Known to occur | to |
| Scientific Name | Behaviour | Presence | |
| Morus serrator<br>Australasian Gannet [1020] | Aggregation | Known to occur | |
| Morus serrator<br>Australasian Gannet [1020] | Foraging | Known to occur | |
| Pelagodroma marina<br>White-faced Storm-petrel [1016] | Foraging | Known to occur | |
| Pelecanoides urinatrix<br>Common Diving-petrel [1018] | Breeding | Known to occur | |
| Pelecanoides urinatrix<br>Common Diving-petrel [1018] | Foraging | Known to occur | |
| Thalassarche bulleri<br>Bullers Albatross [64460] | Foraging | Known to occur | |
| Thalassarche cauta cauta<br>Shy Albatross [82345] | Foraging likely | Likely to occur | |
| Thalassarche chlororhynchos bassi<br>Indian Yellow-nosed Albatross [85249] | Foraging | Known to occur | |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Foraging | Known to occur | |
| Thalassarche melanophris impavida<br>Campbell Albatross [82449] | Foraging | Known to occur | |
| Sharks | | | |

| | | |
|---|---|---|
| Carcharodon carcharias<br>White Shark [64470] | Foraging | Known to occur |

| Whales | | |
|---|---|---|
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Foraging | Likely to be present |
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Foraging (annual high use area) | Known to occur |
| Scientific Name | Behaviour | Presence |
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Known Foraging Area | Known to occur |

| Bioregional Assessments | | [ Resource Information ] |
|---|---|---|
| SubRegion | BioRegion | Website |
| Gippsland | Gippsland Basin | BA website |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania

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

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

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

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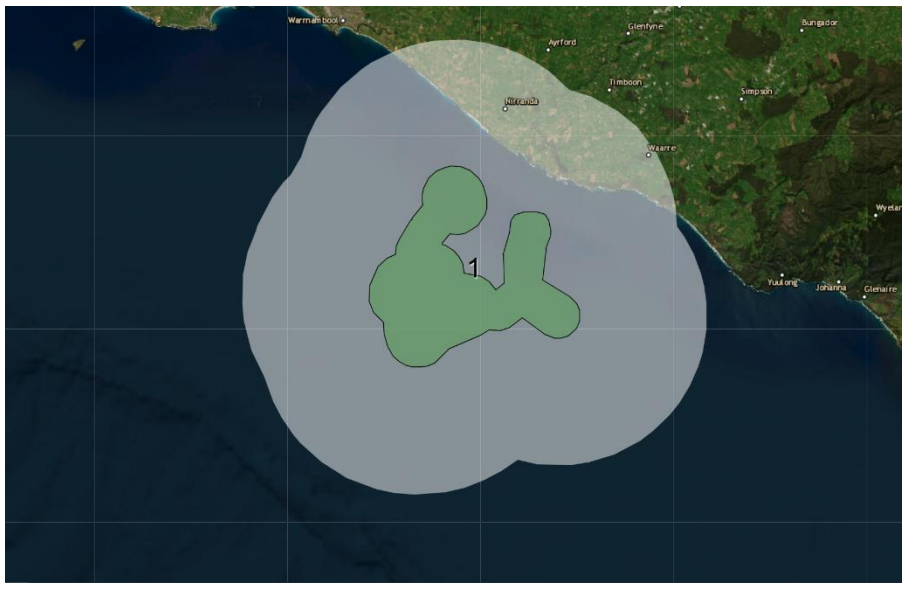
Department of Climate Change, Energy, the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

East Coast Project 20 km Light EMBA PMST Report

Report created: 07-May-2025




*20km Light EMBA*


Summary

Details

Matters of NES

Other Matters Protected by the EPBC Act

Extra Information

Caveat

Acknowledgements

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | 1 |
| Wetlands of International Importance (Ramsar | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | 2 |
| Listed Threatened Ecological Communities: | 5 |
| Listed Threatened Species: | 87 |
| Listed Migratory Species: | 53 |

## Other Matters Protected by the EPBC Act

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

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

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

| | |
|---|---|
| Commonwealth Lands: | None |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 90 |
| Whales and Other Cetaceans: | 28 |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | None |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

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

| | |
|---|---|
| State and Territory Reserves: | 7 |
| Regional Forest Agreements: | 1 |
| Nationally Important Wetlands: | None |

| | |
|---|---|
| EPBC Act Referrals: | 55 |
| Key Ecological Features (Marine): | 1 |
| Biologically Important Areas: | 13 |
| Bioregional Assessments: | None |
| Geological and Bioregional Assessments: | None |

# Details

## Matters of National Environmental Significance

### National Heritage Places [ Resource Information ]

| Name | State | Legal Status | Buffer Status |
|---|---|---|---|
| Historic | | | |
| Great Ocean Road and Scenic Environs | VIC | Listed place | In buffer area only |

### Commonwealth Marine Area [ Resource Information ]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

| Feature Name | Buffer Status |
|---|---|
| Commonwealth Marine Areas (EPBC Act) | In feature area |
| Commonwealth Marine Areas (EPBC Act) | In feature area |

### Listed Threatened Ecological Communities [ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| BIRD | | | |
| Community Name | Threatened Category | Presence Text | Buffer Status |

| | | |
|---|---|---|
| Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community | Endangered | Community likely to occur within area<br>In buffer area only |
| Giant Kelp Marine Forests of South East Australia | Endangered | Community may occur within area<br>In buffer area only |
| Grassy Eucalypt Woodland of the Victorian Volcanic Plain | Critically Endangered | Community may occur within area<br>In buffer area only |
| Natural Temperate Grassland of the Victorian Volcanic Plain | Critically Endangered | Community may occur within area<br>In buffer area only |
| Subtropical and Temperate Coastal Saltmarsh | Vulnerable | Community likely to occur within area<br>In buffer area only |

## Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Anthochaera phrygia<br>Regent Honeyeater [82338] | Critically Endangered | Species or species habitat may occur within area | In buffer area only |
| Ardenna grisea<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Botaurus poiciloptilus<br>Australasian Bittern [1001] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| Callocephalon fimbriatum<br>Gang-gang Cockatoo [768] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| Climacteris picumnus victoriae<br>Brown Treecreeper (south-eastern) [67062] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Diomedea epomophora | | | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Diomedea sanfordi<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Falco hypoleucos<br>Grey Falcon [929] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| Gallinago hardwickii<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Grantiella picta<br>Painted Honeyeater [470] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| Halobaena caerulea<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Hirundapus caudacutus<br>White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Lathamus discolor<br>Swift Parrot [744] | Critically Endangered | Species or species habitat may occur within area | In buffer area only |
| Limosa lapponica baueri<br>Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380] | Endangered | Species or species habitat known to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Macronectes giganteus](#)<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area | In feature area<br>In feature area |
| [Macronectes halli](#)<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Neophema chrysogaster](#)<br>Orange-bellied Parrot [747] | Critically Endangered | Species or species habitat known to occur within area | |
| [Neophema chrysostoma](#)<br>Blue-winged Parrot [726] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Numenius madagascariensis](#)<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| [Pachyptila turtur subantarctica](#)<br>Fairy Prion (southern) [64445] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| [Phoebetria fusca](#)<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| [Pterodroma leucoptera leucoptera](#)<br>Gould's Petrel, Australian Gould's Petrel [26033] | Endangered | Species or species habitat may occur within area | In feature area |
| [Pterodroma mollis](#)<br>Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat may occur within area | In feature area |
| [Rostratula australis](#)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat likely to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Stagonopleura guttata<br>Diamond Firetail [59398] | Vulnerable | | In feature area |
| Sternula albifrons<br>Little Tern [82849] | Vulnerable | Species or species habitat known to occur within area<br>Species or species habitat may occur within area | In buffer area only<br>In buffer area only |
| Sternula nereis nereis<br>Australian Fairy Tern [82950] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | |
| Thalassarche bulleri platei<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area | In feature area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| --- | --- | --- | --- |
| [Thalassarche salvini](#)<br>Salvin's Albatross [64463] | Vulnerable | | In feature area<br>In feature area |
| [Thalassarche steadi](#)<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area<br>Foraging, feeding or related behaviour known to occur within area | In feature area |
| [Thinornis cucullatus cucullatus](#)<br>Eastern Hooded Plover, Eastern Hooded Plover [90381] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat likely to occur within area | In buffer area only |
| FISH | | | |
| Gadopsis sp. SWV<br>Western Victorian Blackfish [90722] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Hoplostethus atlanticus<br>Orange Roughy, Deep-sea Perch, Red Roughy [68455] | Conservation Dependent | Species or species habitat likely to occur within area | In buffer area only |
| Nannoperca obscura<br>Yarra Pygmy Perch [26177] | Endangered | Species or species habitat likely to occur within area | In buffer area only |
| Prototroctes maraena<br>Australian Grayling [26179] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| Seriolella brama<br>Blue Warehou [69374] | Conservation Dependent | Species or species habitat known to occur within area | In feature area |
| FROG | | | |
| Litoria raniformis<br>Southern Bell Frog, Growling Grass Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| MAMMAL | | | |

| | | | |
|---|---|---|---|
| [Antechinus minimus maritimus](#)<br>Swamp Antechinus (mainland) [83086] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Balaenoptera borealis](#)<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Balaenoptera musculus](#)<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Scientific Name | Threatened Category | Presence Text | Buffer Status |

| | | | |
|---|---|---|---|
| [Balaenoptera physalus](#)<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Dasyurus maculatus maculatus (SE mainla](#)[)]<br>[population](#)<br>Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184] | Endangered | Species or species habitat may occur within area | In buffer area only |
| [Eubalaena australis](#)<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area | In feature area |
| [Isoodon obesulus obesulus](#)<br>Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (southeastern) [68050] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| [Mastacomys fuscus mordicus](#)<br>Broad-toothed Rat (mainland), Tooarrana [87617] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| [Miniopterus orianae bassanii](#)<br>Southern Bent-wing Bat [87645] | Critically Endangered | Breeding known to occur within area | In buffer area only |
| [Neophoca cinerea](#)<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area | In feature area |
| [Petaurus australis australis](#)<br>Yellow-bellied Glider (south-eastern) [87600] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Potorous tridactylus trisulcatus](#)<br>Long-nosed Potoroo (southern mainland) [86367] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| [Pseudomys novaehollandiae](#)<br>New Holland Mouse, Pookila [96] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Pteropus poliocephalus](#)<br>Grey-headed Flying-fox [186] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In buffer area only |
| PLANT | | | |
| [Amphibromus fluitans](#)<br>River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215] | Vulnerable | Species or species habitat may occur within area | |
| [Glycine latrobeana](#)<br>Clover Glycine, Purple Clover [13910] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Haloragis exalata subsp. exalata](#)<br>Wingless Raspwort, Square Raspwort [24636] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Lepidium aschersonii](#)<br>Spiny Peppercress [10976] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| [Lepidium hyssopifolium](#)<br>Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542] | Endangered | Species or species habitat likely to occur within area | In buffer area only |
| [Prasophyllum spicatum](#)<br>Dense Leek-orchid [55146] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Prasophyllum suaveolens](#)<br>Fragrant Leek-orchid [64956] | Endangered | Species or species habitat may occur within area | In buffer area only |
| [Pterostylis chlorogramma](#)<br>Green-striped Greenhood [56510] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| [Pterostylis cucullata](#)<br>Leafy Greenhood [15459] | Vulnerable | Species or species | In buffer area only |

| | | | |
|---|---|---|---|
| | | habitat likely to occur within area | |
| Pterostylis tenuissima<br>Swamp Greenhood, Dainty Swamp Orchid [13139] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Senecio psilocarpus<br>Swamp Fireweed, Smooth-fruited Groundsel [64976] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Thelymitra epipactoides<br>Metallic Sun-orchid [11896] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Thelymitra matthewsii<br>Spiral Sun-orchid [4168] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Thelymitra orientalis<br>Hoary Sun-orchid [88011] | Critically Endangered | Species or species habitat may occur within area | In buffer area only |
| Xerochrysum palustre<br>Swamp Everlasting, Swamp Paper Daisy [76215] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| REPTILE | | | |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Breeding likely to occur within area | In feature area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Delma impar<br>Striped Legless Lizard, Striped Snakelizard [1649] | Vulnerable | Species or species habitat may occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Dermochelys coriacea](#)<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area | In feature area |
| [Lissolepis coventryi](#)<br>Swamp Skink, Eastern Mourning Skink [84053] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| SHARK | | | |
| [Carcharodon carcharias](#)<br>White Shark, Great White Shark [64470] | Vulnerable | Migration route known to occur within area | In feature area |
| [Centrophorus uyato](#)<br>Little Gulper Shark [68446] | Conservation Dependent | Species or species habitat likely to occur within area | In buffer area only |
| [Galeorhinus galeus](#)<br>School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453] | Conservation Dependent | Species or species habitat may occur within area | In feature area |

## Listed Migratory Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Migratory Marine Birds | | | |
| [Apus pacificus](#)<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area | In feature area |
| [Ardenna carneipes](#)<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Ardenna grisea](#)<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area | In feature area |
| [Ardenna tenuirostris](#)<br>Short-tailed Shearwater [82652] | | Breeding known to occur within area | In buffer area only |
| [Diomedea antipodensis](#)<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |
| Diomedea sanfordi<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area | In feature area |
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | | |
| | | Species or species habitat likely to occur within area | In feature area |
| Sternula albifrons<br>Little Tern [82849] | Vulnerable | | |
| | | Species or species habitat may occur within area | In buffer area only |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | | |
| | | Species or species habitat likely to occur within area | In feature area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |

| | | | |
|---|---|---|---|
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | | In feature area |
| | | Species or species habitat may occur within area | |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area | In feature area |
| **Migratory Marine Species** | | | |
| Balaenoptera bonaerensis<br>Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely to occur within area | In buffer area only |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| | | | |
|---|---|---|---|
| Caperea marginata<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour may occur within area | In feature area |
| Carcharias taurus<br>Grey Nurse Shark [64469] | | Species or species habitat may occur within area | In feature area |
| Carcharodon carcharias<br>White Shark, Great White Shark [64470] | Vulnerable | Migration route known to occur within area | In feature area |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Breeding likely to occur within area | In feature area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area | In feature area |
| Eubalaena australis as Balaena glacialis australi<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area | In feature area |
| Isurus oxyrinchus<br>Shortfin Mako, Mako Shark [79073] | | Species or species habitat likely to occur within area | In feature area |
| Lagenorhynchus obscurus<br>Dusky Dolphin [43] | | Species or species habitat likely to occur within area | In feature area |
| Lamna nasus<br>Porbeagle, Mackerel Shark [83288] | | Species or species habitat likely to occur within area | In feature area |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area | In feature area |

| | | | |
|---|---|---|---|
| [Orcinus orca](#)<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area | In feature area |
| [Physeter macrocephalus](#)<br>Sperm Whale [59] | | Species or species habitat may occur within area | In buffer area only |
| **Migratory Terrestrial Species** | | | |
| [Hirundapus caudacutus](#)<br>White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Motacilla flava](#)<br>Yellow Wagtail [644] | | Species or species habitat may occur within area | In buffer area only |
| **Migratory Wetlands Species** | | | |
| [Actitis hypoleucos](#)<br>Common Sandpiper [59309] | | Species or species habitat known to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Calidris acuminata](#) Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| [Calidris canutus](#) Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area | In feature area |
| [Calidris ferruginea](#) Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| [Calidris melanotos](#) Pectoral Sandpiper [858] | | Species or species habitat may occur within area | In feature area |
| [Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| [Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Gallinago megala](#) Swinhoe's Snipe [864] | | Roosting likely to occur within area | In buffer area only |
| [Gallinago stenura](#) Pin-tailed Snipe [841] | | Roosting likely to occur within area | In buffer area only |
| [Limosa lapponica](#) Bar-tailed Godwit [844] | | Species or species habitat known to occur within area | In buffer area only |
| [Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| [Numenius minutus](#) | | | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Little Curlew, Little Whimbrel [848] | | Roosting likely to occur within area | In buffer area only<br>In buffer area only |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area | |
| Common Greenshank, Greenshank [832] | Endangered | Species or species habitat likely to occur within area | In buffer area only Tringa nebularia |

## Other Matters Protected by the EPBC Act

| Listed Marine Species | | | [ Resource Information ] |
|---|---|---|---|
| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| Bird | | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat known to occur within area | In feature area |
| Anseranas semipalmata<br>Magpie Goose [978] | | Species or species habitat may occur within area overfly marine area | In buffer area only |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Ardenna carneipes as Puffinus carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Ardenna grisea as Puffinus griseus<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| Ardenna tenuirostris as Puffinus tenuirostris<br>Short-tailed Shearwater [82652] | | Breeding known to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status | S |
|---|---|---|---|---|
| Bubulcus ibis as Ardea ibis<br>Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area | In buffer area only | |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | habitat known to occur within area | In feature area | |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area overfly marine area | In feature area | |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area overfly marine area | In feature area | |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area | In feature area | |
| Chalcites osculans as Chrysococcyx osculans<br>Black-eared Cuckoo [83425] | | Species or species habitat likely to occur within area overfly marine area | In buffer area only | |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only | |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area | |
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Diomedea sanfordi<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Eudyptula minor<br>Little Penguin [1085] | | Breeding known to occur within area | |
| Gallinago hardwickii<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area<br>overfly marine area | In buffer area only |
| Gallinago megala<br>Swinhoe's Snipe [864] | | Roosting likely to occur within area<br>overfly marine area | In buffer area only |
| Gallinago stenura<br>Pin-tailed Snipe [841] | | Roosting likely to occur within area<br>overfly marine area | In buffer area only |
| Haliaeetus leucogaster<br>White-bellied Sea-Eagle [943] | | Breeding known to occur within area | In buffer area only |
| Halobaena caerulea<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Hirundapus caudacutus<br>White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area<br>overfly marine area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| --- | --- | --- | --- |
| | | | Species or s |
| [Lathamus discolor](#)<br>Swift Parrot [744] | Critically Endangered | | In buffer area only |
| | | Species or species habitat may occur within area overfly marine area | |
| [Limosa lapponica](#)<br>Bar-tailed Godwit [844] | | | In buffer area only |
| | | Species or species habitat known to occur within area | |
| [Macronectes giganteus](#)<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | | In feature area |
| | | Species or species habitat may occur within area | |
| [Macronectes halli](#)<br>Northern Giant Petrel [1061] | Vulnerable | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| --- | --- | --- | --- |
| [Merops ornatus](#)<br>Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area | In buffer area only |
| [Monarcha melanopsis](#)<br>Black-faced Monarch [609] | | Species or species habitat known to occur within area | In buffer area only |
| [Pandion haliaetus](#)<br>Osprey [952] | | Species or species habitat known to occur within area | [Motacilla flava](#)<br>Yellow Wagtail [644] |
| In buffer area only [Phalacrocorax fuscescens](#) | | | [Myiagra cyanoleuca](#)<br>Satin Flycatcher [612] |
| | | | [Neophema chrysogaste](#)<br>Orange-bellied Parrot [7 |
| | | | [Neophema chrysostoma](#)<br>Blue-winged Parrot [726 |
| | | | [Numenius madagascari](#)<br>Eastern Curlew, Far Eas [847] |
| | | | [Numenius minutus](#)<br>Little Curlew, Little Whir |
| | | | [Pachyptila turtur](#)<br>Fairy Prion [1066] |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Black-faced Cormorant [59660] | | Species or species Breeding known to occur within area | In feature area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | | |
| Pterodroma mollis<br>Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Rhipidura rufifrons<br>Rufous Fantail [592] | | Species or species habitat may occur within area | In feature area |
| Rostratula australis as Rostratula benghalensis (sensu lato)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat known to occur within area overfly marine area | In buffer area only |
| Stercorarius antarcticus as Catharacta skua<br>Brown Skua [85039] | | Species or species habitat likely to occur within area overfly marine area | In buffer area only<br>In feature area |
| Sterna striata<br>White-fronted Tern [799] | | Species or species habitat may occur within area | In feature area |
| Sternula albifrons as Sterna albifrons<br>Little Tern [82849] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area<br>Species or species habitat may occur within area | In buffer area only |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche bulleri platei as Thalassarche sp. nov.<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche carteri | | | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status | In |
|---|---|---|---|---|
| Indian Yellow-nosed Albatross [64464] | Vulnerable | habitat likely to occur within area | | |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | | In feature area | |
| | | Foraging, feeding or related behaviour likely to occur within area | | |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | | In feature area | |
| | | Species or species habitat may occur within area | | |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | | In feature area | |
| | | Foraging, feeding or related behaviour likely to occur within area | | |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | | In feature area | |
| | | Foraging, feeding or related behaviour likely to occur within area | | |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | | In feature area | |
| | | Foraging, feeding or related behaviour likely to occur within area | | |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | | | |
| | | Foraging, feeding or related behaviour known to occur within area | In feature area | |
| Thinornis cucullatus as Thinornis rubricollis<br>Hooded Plover, Hooded Dotterel [87735] | | | | |
| | | Species or species habitat known to occur within area overfly marine area | In buffer area only | |
| Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis<br>Eastern Hooded Plover, Eastern Hooded Plover [90381] | Vulnerable | | | |
| | | Species or species habitat known to occur within area overfly marine area | In buffer area only | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| --- | --- | --- | --- |
| [Tringa nebularia](#)<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat likely to occur within area overfly marine area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Fish | | | |
| [Heraldia nocturna](#)<br>Upside-down Pipefish, Eastern Upsidedown Pipefish, Eastern Upside-down Pipefish [66227] | | Species or species habitat may occur within area | In feature area |
| [Hippocampus abdominalis](#)<br>Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233] | | Species or species habitat may occur within area | In feature area |
| [Hippocampus breviceps](#)<br>Short-head Seahorse, Short-snouted Seahorse [66235] | | Species or species habitat may occur within area | In feature area |
| [Histiogamphelus briggsii](#)<br>Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242] | | Species or species habitat may occur within area | In feature area |
| [Histiogamphelus cristatus](#)<br>Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243] | | Species or species habitat may occur within area | In feature area |
| [Hypselognathus rostratus](#)<br>Knifesnout Pipefish, Knife-snouted Pipefish [66245] | | Species or species habitat may occur within area | In feature area |
| [Kaupus costatus](#)<br>Deepbody Pipefish, Deep-bodied Pipefish [66246] | | Species or species habitat may occur within area | In feature area |
| [Leptoichthys fistularius](#)<br>Brushtail Pipefish [66248] | | Species or species habitat may occur within area | In feature area |
| [Lissocampus caudalis](#)<br>Australian Smooth Pipefish, Smooth Pipefish [66249] | | Species or species habitat may occur within area | In feature area |
| [Lissocampus runa](#)<br>Javelin Pipefish [66251] | | Species or species habitat may occur within area | In feature area |
| [Maroubra perserrata](#)<br>Sawtooth Pipefish [66252] | | Species or species habitat may occur within area | In feature area |

| | | | Buffer Status |
|---|---|---|---|
| Scientific Name | Threatened Category | Presence Text | In feature area |
| Mitotichthys semistriatus<br>Halfbanded Pipefish [66261] | | Species or species habitat may occur within area | |
| Mitotichthys tuckeri<br>Tucker's Pipefish [66262] | | Species or species habitat may occur within area | In feature area |
| Notiocampus ruber<br>Red Pipefish [66265] | | Species or species habitat may occur within area | In feature area |
| Phycodurus eques<br>Leafy Seadragon [66267] | | Species or species habitat may occur within area | In feature area |
| Phyllopteryx taeniolatus<br>Common Seadragon, Weedy Seadragon [66268] | | Species or species habitat may occur within area | In feature area |
| Pugnaso curtirostris<br>Pugnose Pipefish, Pug-nosed Pipefish [66269] | | Species or species habitat may occur within area | In feature area |
| Solegnathus robustus<br>Robust Pipehorse, Robust Spiny Pipehorse [66274] | | Species or species habitat may occur within area | In feature area |
| Solegnathus spinosissimus<br>Spiny Pipehorse, Australian Spiny Pipehorse [66275] | | Species or species habitat may occur within area | In feature area |
| Stigmatopora argus<br>Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276] | | Species or species habitat may occur within area | In feature area |
| Stigmatopora nigra<br>Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277] | | Species or species habitat may occur within area | In feature area |

| | | | |
|---|---|---|---|
| [Stipecampus cristatus](#)<br>Ringback Pipefish, Ring-backed Pipefish [66278] | | Species or species habitat may occur within area | In feature area |
| **Scientific Name** | **Threatened Category** | **Presence Text** | **Buffer Status** |
| [Urocampus carinirostris](#)<br>Hairy Pipefish [66282] | | Species or species habitat may occur within area | In feature area |
| [Vanacampus margaritifer](#)<br>Mother-of-pearl Pipefish [66283] | | Species or species habitat may occur within area | In feature area |
| [Vanacampus phillipi](#)<br>Port Phillip Pipefish [66284] | | Species or species habitat may occur within area | In feature area |
| [Vanacampus poecilolaemus](#)<br>Longsnout Pipefish, Australian Longsnout Pipefish, Long-snouted Pipefish [66285] | | Species or species habitat may occur within area | In feature area |
| **Mammal** | | | |
| [Arctocephalus forsteri](#)<br>Long-nosed Fur-seal, New Zealand Furseal [20] | | Species or species habitat may occur within area | In feature area |
| [Arctocephalus pusillus](#)<br>Australian Fur-seal, Australo-African Fur-seal [21] | | Species or species habitat may occur within area | In feature area |
| [Neophoca cinerea](#)<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area | In feature area |
| **Reptile** | | | |
| [Caretta caretta](#)<br>Loggerhead Turtle [1763] | Endangered | Breeding likely to occur within area | In feature area |
| [Chelonia mydas](#)<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area | In feature area |

| | | | |
|---|---|---|---|
| | | | Buffer Status |
| | | | In feature area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area | In feature area |

## Whales and Other Cetaceans [ Resource Information ]

| Current Scientific Name | Status | Type of Presence | Buffer Status |
|---|---|---|---|
| **Mammal** | | | |
| Current Scientific Name | Status | Type of Presence | |
| Balaenoptera acutorostrata<br>Minke Whale [33] | | Species or species habitat may occur within area | |
| Balaenoptera bonaerensis<br>Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely to occur within area | In buffer area only |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Berardius arnuxii<br>Arnoux's Beaked Whale [70] | | Species or species habitat may occur within area | In buffer area only |
| Caperea marginata<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour may occur within area | In feature area |
| Delphinus delphis<br>Common Dolphin, Short-beaked Common Dolphin [60] | | Species or species habitat may occur within area | In feature area |

| | | | |
|---|---|---|---|
| [Eubalaena australis](#)<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area | In feature area |
| [Globicephala macrorhynchus](#)<br>Short-finned Pilot Whale [62] | | | In buffer area only |
| | | Species or species habitat may occur within area | |
| [Globicephala melas](#)<br>Long-finned Pilot Whale [59282] | | Species or species habitat may occur within area | In buffer area only |
| [Grampus griseus](#)<br>Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area | In feature area |
| [Kogia breviceps](#)<br>Pygmy Sperm Whale [57] | | | |
| | | Species or species habitat may occur within area | In buffer area only |
| [Kogia sima](#)<br>Dwarf Sperm Whale [85043] | | | |
| | | Species or species habitat may occur within area | In buffer area only |
| [Lagenorhynchus obscurus](#)<br>Dusky Dolphin [43] | | | |
| | | Species or species habitat likely to occur within area | In feature area |
| [Lissodelphis peronii](#)<br>Southern Right Whale Dolphin [44] | | | |
| | | Species or species habitat may occur within area | In buffer area only |
| [Megaptera novaeangliae](#)<br>Humpback Whale [38] | | Species or species habitat likely to occur within area | In feature area |
| [Mesoplodon bowdoini](#)<br>Andrew's Beaked Whale [73] | | | In buffer area only |
| | | Species or species habitat may occur within area | |
| [Mesoplodon densirostris](#)<br>Blainville's Beaked Whale, Densebeaked Whale [74] | | | In buffer area only |
| | | Species or species habitat may occur within area | |

| Current Scientific Name | Status | Type of Presence | Buffer Status |
| --- | --- | --- | --- |
| | | | Buffer Status |
| [Mesoplodon hectori](#)<br>Hector's Beaked Whale [76] | | Species or species habitat may occur within area | In feature area<br>In buffer area only |
| [Mesoplodon layardii](#)<br>Strap-toothed Beaked Whale, Straptoothed Whale, Layard's Beaked Whale [25556] | | Species or species habitat may occur within area | In buffer area only |
| [Mesoplodon mirus](#)<br>True's Beaked Whale [54] | | Species or species habitat may occur within area | In buffer area only |

| Current Scientific Name | Status | Type of Presence | Buffer Status |
|---|---|---|---|
| Orcinus orca<br>Killer Whale, Orca [46] | | | |
| | | Species or species habitat likely to occur within area | In feature area |
| Physeter macrocephalus<br>Sperm Whale [59] | | | |
| | | Species or species habitat may occur within area | In buffer area only |
| Pseudorca crassidens<br>False Killer Whale [48] | | | |
| | | Species or species habitat likely to occur within area | In feature area |
| Tursiops aduncus<br>Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | | | |
| | | Species or species habitat likely to occur within area | In feature area |
| Tursiops truncatus s. str.<br>Bottlenose Dolphin [68417] | | | |
| | | Species or species habitat may occur within area | In feature area |
| Ziphius cavirostris<br>Cuvier's Beaked Whale, Goose-beaked Whale [56] | | | |
| | | Species or species habitat may occur within area | In buffer area only |

## Extra Information

| State and Territory Reserves | | | [ Resource Information ] |
|---|---|---|---|
| Protected Area Name | Reserve Type | State | Buffer Status |
| Bay of Islands Coastal Park | Conservation Park | VIC | In buffer area only |
| Curdie Vale N.C.R. | Natural Features Reserve | VIC | In buffer area only |
| Lake Gillear W.R | Natural Features Reserve | VIC | In buffer area only |
| Nullawarre F.R. | Nature Conservation Reserve | VIC | In buffer area only |
| Port Campbell | National Park | VIC | In buffer area only |
| The Arches | Marine Sanctuary | VIC | In buffer area only |

| | | | |
|---|---|---|---|
| Twelve Apostles | Marine National Park | VIC | In buffer area only |

## Regional Forest Agreements [ Resource Information ]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

| RFA Name | State | Buffer Status |
|---|---|---|
| West Victoria RFA | Victoria | In buffer area only |

## EPBC Act Referrals [ Resource Information ]

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Decommissioning of the Minerva Pipeline in Victorian state waters | 2024/09879 | | Completed | In buffer area only |
| Decommissioning of the Minerva Pipeline in Victorian state waters ? May 2025 | 2025/10138 | | Referral Decision | In buffer area only |
| Geographe-A gas exploration well | 2000/82 | | Completed | In buffer area only |
| Marine Route Survey for Subsea Fibre Optic Data Cable System Australia East | 2024/09795 | | Completed | In buffer area only |
| Otway Astrolabe 3D Marine Seismic Survey, Otway Basin | 2012/6421 | | Completed | In buffer area only |
| SEA Gas Project transmission pipeline | 2001/513 | | Completed | In buffer area only |
| Strike Oil NL Seismic Surveys | 2000/107 | | Completed | In feature area |
| Thylacine-A Exploration Well | 2000/81 | | Completed | In buffer area only |
| **Controlled action** | | | | |
| Alston-1 petroleum exploration well, permit VIC/P44 | 2003/1315 | Controlled Action | Post-Approval | In buffer area only |
| Casino Gas Field Development | 2003/1295 | Controlled Action | Post-Approval | In feature area |
| Otway Development | 2002/621 | Controlled Action | Post-Approval | In feature area |
| Schomberg 3D Marine Seismic Survey | 2007/3754 | Controlled Action | Completed | In feature area |
| Strike Oil Gas Exploration Well, Otway Basin (VIC/P44) | 2000/97 | Controlled Action | Completed | In feature area |

| | | | | |
|---|---|---|---|---|
| VICP61 2D Marine Seismic Survey | 2008/4075 | Controlled Action | Completed | In feature area |

| Not controlled action | | | | |
|---|---|---|---|---|
| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
| Not controlled action | | | | |
| CO2 geosequestration - Otway Basin Pilot Project | 2006/2699 | Not Controlled Action | Completed | In buffer area only |
| Enterprise 1 Exploration Drilling Program, near Port Campbell, Vic | 2019/8438 | Not Controlled Action | Completed | In buffer area only |
| Exploration drilling for liquid/gaseous hydrocarbons | 2004/1681 | Not Controlled Action | Completed | In feature area |
| Gas Field Development | 2006/2635 | Not Controlled Action | Completed | In feature area |
| Gas Fields Development | 2011/5879 | Not Controlled Action | Completed | In buffer area only |
| Halladale and Speculant Gas Pipeline Project, North of Port Campbell, Vic | 2015/7551 | Not Controlled Action | Completed | In buffer area only |
| Henry-1 Exploration Well, Petroleum Permit Area VIC/P44 | 2005/2147 | Not Controlled Action | Completed | In feature area |
| Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia | 2015/7522 | Not Controlled Action | Completed | In buffer area only |
| INDIGO Central Submarine Telecommunications Cable | 2017/8127 | Not Controlled Action | Completed | In feature area |
| Minerva Cut Back Project, Vic | 2017/8036 | Not Controlled Action | Completed | In buffer area only |
| Newfield wind farm | 2007/3226 | Not Controlled Action | Completed | In buffer area only |
| Nirranda South Wind Farm Pty Ltd | 2002/763 | Not Controlled Action | Completed | In buffer area only |
| Offshore exploration drilling within permit area VIC/P 37(v) | 2004/1466 | Not Controlled Action | Completed | In feature area |
| Port Campbell Headland Walking Trail Realignment | 2012/6676 | Not Controlled Action | Completed | In buffer area only |

| | | | | |
|---|---|---|---|---|
| Track construction - Great Ocean Walk | 2002/793 | Not Controlled Action | Completed | In buffer area only |
| VIC-P44 Stage 2 Gas Field Development | 2007/3767 | Not Controlled Action | Completed | In feature area |
| Victorian Generator Project | 2005/1984 | Not Controlled Action | Completed | In buffer area only |
| Wind Farm Construction and Operation | 2001/471 | Not Controlled Action | Completed | In buffer area only |

| Not controlled action (particular manner) | | | | |
|---|---|---|---|---|
| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
| 'Moonlight Head' 3D seismic survey, VIC/P38(V), VIC/P43 and VIC/RL8 | 2005/2236 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| 3D marine seismic survey near King Island | 2004/1461 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| 3D seismic program VIC/P38(v), VIC/P43 and VIC/RL8 | 2003/1137 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Astrolabe 3D Marine Seismic Survey | 2011/6048 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| BHPBilliton Otway 3D Seismic Survey | 2007/3443 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Deepwater Sorell Basin 2001 NonExclusive 2D Seismic Survey | 2001/156 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Drill and Profile Exploration Well Somerset 1, License Area T34P | 2009/5037 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |

| | | | | |
|---|---|---|---|---|
| Enterprise Three-dimensional Transition Zone Seismic Survey, Victoria | 2016/7800 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| INDIGO Marine Cable Route Survey (INDIGO) | 2017/7996 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| La Bella 3D Marine Seismic Survey, Otway Basin, VIC | 2012/6683 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Otway Basin Exploration Drilling Campaign, Vic | 2011/6125 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Santos Otway 3d Seismic VIC/P44 | 2007/3367 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Schomberg 3D Marine Seismic survey | 2007/3868 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Shaw River Power Station construct gas pipeline and associated infrastructure | 2009/5089 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Southern Gas Pipeline Project | 2002/619 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Speculant 3D Transition Zone Seismic Survey | 2010/5558 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, Vic | 2012/6565 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Not controlled action (particular manner) | | | | |

| | | | | |
|---|---|---|---|---|
| Undertake a three dimensional marine seismic survey | 2010/5700 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Vic/P37(v) and Vic/P44 3D marine seismic survey | 2003/1102 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| VIC P44 Gas Exploration Wells | 2002/662 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Vic-P51 and Vic-P52 2D seismic survey | 2002/811 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |

| Referral decision | | | | |
|---|---|---|---|---|
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, VIC | 2012/6545 | Referral Decision | Completed | In feature area |
| VICP61 2D Marine Seismic Survey | 2008/3975 | Referral Decision | Completed | In feature area |

## Key Ecological Features [ Resource Information ]

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

| Name | Region | Buffer Status |
|---|---|---|
| West Tasmania Canyons | South-east | In buffer area only |

## Biologically Important Areas [ Resource Information ]

| Scientific Name | Behaviour | Presence | Buffer Status |
|---|---|---|---|
| Seabirds | | | |
| Ardenna pacifica<br>Wedge-tailed Shearwater [84292] | Foraging | Likely to occur | In feature area |
| Ardenna tenuirostris<br>Short-tailed Shearwater [84292] | Breeding | Known to occur | In buffer area only |
| Ardenna tenuirostris<br>Short-tailed Shearwater [82652] | Foraging | Known to occur | In buffer area only |
| Diomedea exulans (sensu lato)<br>Wandering Albatross [1073] | Foraging | Known to occur | In feature area |

| | | | |
|---|---|---|---|
| Diomedea exulans antipodensis<br>Antipodean Albatross [82269] | Foraging | Known to occur | In feature area |
| Pelecanoides urinatrix<br>Common Diving-petrel [1018] | Foraging | Known to occur | In feature area |
| Thalassarche bulleri<br>Bullers Albatross [64460] | Foraging | Known to occur | In feature area |
| Thalassarche cauta cauta<br>Shy Albatross [82345] | Foraging likely | Likely to occur | In feature area |
| Thalassarche chlororhynchos bassi<br>Indian Yellow-nosed Albatross [85249] | Foraging | Known to occur | In feature area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Foraging | Known to occur | In feature area |
| Thalassarche melanophris impavida<br>Campbell Albatross [82449] | Foraging | Known to occur | In feature area |

| Whales | | | |
|---|---|---|---|
| Scientific Name | Behaviour | Presence | Buffer Status |
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Foraging | Likely to be present | In buffer area only |
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Foraging (annual high use area) | Known to occur | In feature area |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales

-Department of Environment and Primary Industries, Victoria

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

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

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

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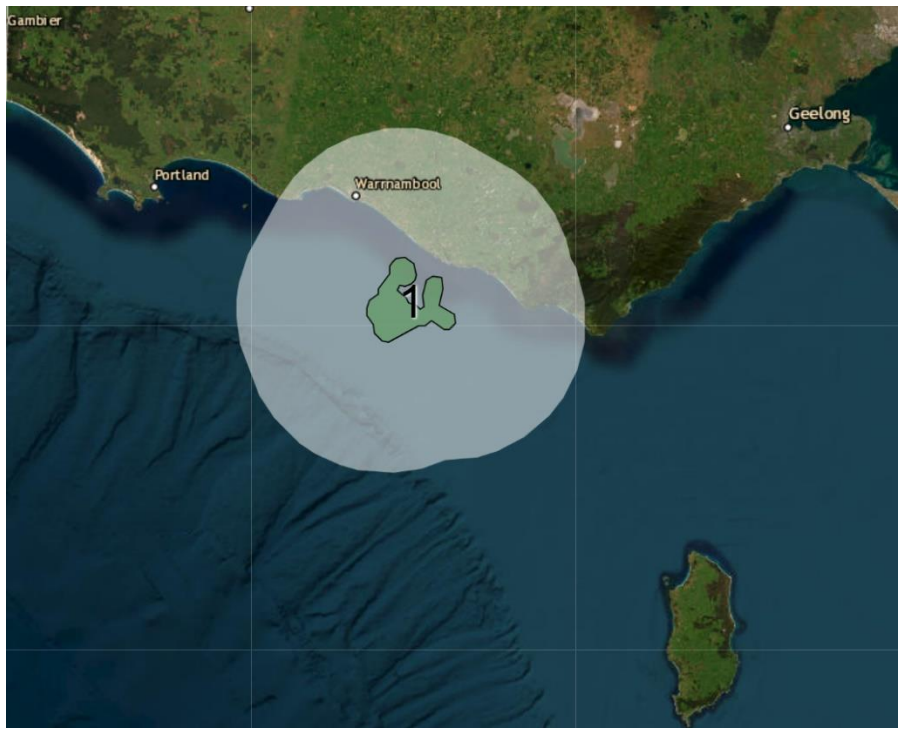
# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

East Coast Project 49 km Light EMBA PMST Report

Report created: 07-May-2025

Summary
Details
Matters of NES
Other Matters Protected by the EPBC Act
Extra Information
Caveat
Acknowledgements




*49km Light EMBA*

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | 1 |
| Wetlands of International Importance (Ramsar | 1 |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | 2 |
| Listed Threatened Ecological Communities: | 8 |
| Listed Threatened Species: | 106 |
| Listed Migratory Species: | 64 |

## Other Matters Protected by the EPBC Act

| | |
|---|---|
| State and Territory Reserves: | 30 |
| Regional Forest Agreements: | 1 |
| Nationally Important Wetlands: | 4 |
| EPBC Act Referrals: | 87 |
| Key Ecological Features (Marine): | 2 |
| Biologically Important Areas: | 15 |

| | |
|---|---|
| Bioregional Assessments: | None |
| Geological and Bioregional Assessments: | None |

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

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

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

| | |
|---|---|
| Commonwealth Lands: | 1 |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 105 |
| Whales and Other Cetaceans: | 29 |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | None |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

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

# Details

## Matters of National Environmental Significance

### National Heritage Places [ Resource Information ]

| Name | State | Legal Status | Buffer Status |
|---|---|---|---|
| Historic | | | |
| Great Ocean Road and Scenic Environs | VIC | Listed place | In buffer area only |

### Wetlands of International Importance (Ramsar Wetlands) [ Resource Information ]

| Ramsar Site Name | Proximity | Buffer Status |
|---|---|---|
| Western district lakes | Within 10km of Ramsar site | In buffer area only |

### Commonwealth Marine Area [ Resource Information ]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

| Feature Name | Buffer Status |
|---|---|
| Commonwealth Marine Areas (EPBC Act) | In feature area |

| Commonwealth Marine Areas (EPBC Act) | In feature area |
|---|---|

## Listed Threatened Ecological Communities [ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

| Community Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community | Endangered | Community likely to occur within area | In buffer area only |
| Giant Kelp Marine Forests of South East Australia | Endangered | Community may occur within area | In buffer area only |
| Grassy Eucalypt Woodland of the Victorian Volcanic Plain | Critically Endangered | Community known to occur within area | In buffer area only |
| Natural Damp Grassland of the Victorian Coastal Plains | Critically Endangered | Community may occur within area | In buffer area only |
| Natural Temperate Grassland of the Victorian Volcanic Plain | Critically Endangered | Community likely to occur within area | In buffer area only |
| Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains | Critically Endangered | Community likely to occur within area | In buffer area only |
| Community Name | Threatened Category | Presence Text | Buffer Status |
| Subtropical and Temperate Coastal Saltmarsh | Vulnerable | Community likely to occur within area | In buffer area only |
| White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | Critically Endangered | Community may occur within area | In buffer area only |

## Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| BIRD | | | |
| Anthochaera phrygia | | | |
| Regent Honeyeater [82338] | Critically Endangered | Foraging, feeding or related behaviour may occur within area | In buffer area only |

| | | | |
|---|---|---|---|
| [Aphelocephala leucopsis](#)<br>Southern Whiteface [529] | Vulnerable | | In buffer area only |
| [Ardenna grisea](#)<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area | In feature area |
| [Arenaria interpres](#)<br>Ruddy Turnstone [872] | Vulnerable | Species or species habitat may occur within area<br>Roosting known to occur within area | In buffer area only |
| [Botaurus poiciloptilus](#)<br>Australasian Bittern [1001] | Endangered | | In buffer area only |
| [Calidris acuminata](#)<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat known to occur within area<br>Roosting known to occur within area | In feature area |
| [Calidris canutus](#)<br>Red Knot, Knot [855] | Vulnerable | | In feature area |
| [Calidris ferruginea](#)<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area<br>Species or species habitat known to occur within area | In feature area |
| [Callocephalon fimbriatum](#)<br>Gang-gang Cockatoo [768] | Endangered | Species or species habitat known to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| [Charadrius mongolus](#) Lesser Sand Plover, Mongolian Plover [879] | Endangered | Roosting known to occur within area | In buffer area only |
| [Climacteris picumnus victoriae](#) Brown Treecreeper (south-eastern) [67062] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| [Diomedea antipodensis](#) Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Diomedea epomophora](#) Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Diomedea exulans](#) Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Diomedea sanfordi](#) Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Falco hypoleucos](#) Grey Falcon [929] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| [Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Grantiella picta](#) Painted Honeyeater [470] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| [Halobaena caerulea](#) | | | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Blue Petrel [1059] | Vulnerable<br>Vulnerable | Species or species habitat may occur within area | In feature area |
| Hirundapus caudacutus<br>White-throated Needletail [682] | | habitat known to occur within area | In buffer area only |
| Lathamus discolor<br>Swift Parrot [744] | Critically Endangered | Species or species habitat known to occur within area | In buffer area only |
| Limosa lapponica baueri<br>Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area | In feature area |
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Melanodryas cucullata cucullata<br>South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Neophema chrysogaster<br>Orange-bellied Parrot [747] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| Neophema chrysostoma<br>Blue-winged Parrot [726] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Pachyptila turtur subantarctica](#)<br>Fairy Prion (southern) [64445] | Vulnerable<br>Vulnerable | Species or species<br>Species or species habitat known to occur within area | In feature area |
| [Pedionomus torquatus](#)<br>Plains-wanderer [906] | Critically Endangered | Species or species habitat may occur within area | In buffer area only |
| [Phoebetria fusca](#)<br>Sooty Albatross [1075] | | habitat likely to occur within area | In feature area |
| [Pterodroma leucoptera leucoptera](#)<br>Gould's Petrel, Australian Gould's Petrel [26033] | Endangered | Species or species habitat may occur within area | In feature area |
| [Pterodroma mollis](#)<br>Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat may occur within area | In feature area |
| [Rostratula australis](#)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| [Stagonopleura guttata](#)<br>Diamond Firetail [59398] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Sternula albifrons](#)<br>Little Tern [82849] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| [Sternula nereis nereis](#)<br>Australian Fairy Tern [82950] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| [Thalassarche bulleri](#)<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| --- | --- | --- | --- |
| | Vulnerable | Species or species | |
| Thalassarche bulleri platei<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area | In feature area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Thinornis cucullatus cucullatus<br>Eastern Hooded Plover, Eastern Hooded Plover [90381] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| CRUSTACEAN | | | |
| Euastacus bispinosus<br>Glenelg Spiny Freshwater Crayfish, Pricklyback [81552] | Endangered | Species or species habitat likely to occur within area | In buffer area only |
| FISH | | | |
| Gadopsis sp. SWV<br>Western Victorian Blackfish [90722] | Endangered | Species or species | In buffer area only |

| | | | |
|---|---|---|---|
| [Hoplostethus atlanticus](#)<br>Orange Roughy, Deep-sea Perch, Red Roughy [68455] | Conservation Dependent Species or species buffer area only | In | habitat known to occur within area<br>habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Nannoperca obscura<br>Yarra Pygmy Perch [26177] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Prototroctes maraena<br>Australian Grayling [26179] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| Seriolella brama<br>Blue Warehou [69374] | Conservation Dependent | Species or species habitat known to occur within area | In feature area |
| FROG | | | |
| Litoria raniformis<br>Southern Bell Frog, Growling Grass Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| INSECT | | | |
| Synemon plana<br>Golden Sun Moth [25234] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| MAMMAL | | | |
| Antechinus minimus maritimus<br>Swamp Antechinus (mainland) [83086] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Dasyurus maculatus maculatus (SE mainland population) | | | |

| | | | |
|---|---|---|---|
| Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184] | Endangered | Species or species habitat likely to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area | In feature area |
| Isoodon obesulus obesulus<br>Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (southeastern) [68050] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Mastacomys fuscus mordicus<br>Broad-toothed Rat (mainland), Tooarrana [87617] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Miniopterus orianae bassanii<br>Southern Bent-wing Bat [87645] | Critically Endangered | Breeding known to occur within area | In buffer area only |
| Neophoca cinerea<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area | In feature area |
| Petauroides volans<br>Greater Glider (southern and central) [254] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Petaurus australis australis<br>Yellow-bellied Glider (south-eastern) [87600] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Potorous tridactylus trisulcatus<br>Long-nosed Potoroo (southern mainland) [86367] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Pseudomys fumeus<br>Smoky Mouse, Konoom [88] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Pseudomys novaehollandiae<br>New Holland Mouse, Pookila [96] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Pteropus poliocephalus](#)<br>Grey-headed Flying-fox [186] | Vulnerable | | |
| | | Roosting known to occur within area | In buffer area only |
| PLANT | | | |
| [Amphibromus fluitans](#)<br>River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| [Caladenia concolor](#)<br>Crimson Spider-orchid, Maroon Spiderorchid [5505] | [Pimelea spinescens subsp. spinescens](#)<br>Plains Rice-flower, Spiny Rice-flower, Prickly Pimelea [21980] | | |
| [Dianella amoena](#)<br>Matted Flax-lily [64886] | [Poa sallacustris](#)<br>Salt-lake Tussock-grass [24424] | Vulnerable | |
| | | Species or species habitat may occur within area | |
| [Dodonaea procumbens](#)<br>Trailing Hop-bush [12149] | | | |
| | Endangered | Species or species habitat known to occur within area | |
| [Eucalyptus strzeleckii](#)<br>Strzelecki Gum [55400] | | | |
| | Vulnerable | Species or species habitat may occur within area | |
| [Glycine latrobeana](#)<br>Clover Glycine, Purple Clover [13910] | | | |
| | Vulnerable | Species or species habitat known to occur within area | |
| [Haloragis exalata subsp. exalata](#)<br>Wingless Raspwort, Square Raspwort [24636] | | | Endangered |
| | Vulnerable | Species or species habitat known to occur within area | Species or species |
| [Lachnagrostis adamsonii](#)<br>Adamson's Blown-grass, Adamson's Blowngrass [76211] | | | |
| | Vulnerable | Species or species habitat known to occur within area | |
| [Lepidium aschersonii](#)<br>Spiny Peppercress [10976] | | | |
| | Endangered | Species or species habitat may occur within area | |
| [Lepidium hyssopifolium](#)<br>Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542] | | | |
| | Vulnerable | Species or species | |

| | | | |
|---|---|---|---|
| | ccur within area | In buffer area only | In buffer area only |
| Critically Endangered species | Species or habitat may occur within area | In buffer area only | In buffer area only |
| | | In buffer area only | In buffer area only |
| Vulnerable | Species or species | In buffer area only | |
| | | In buffer area only | In buffer area only |
| In buffer area only | | | |
| | | In buffer area only | |
| | | habitat likely to occur within area | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Prasophyllum spicatum<br>Dense Leek-orchid [55146] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Prasophyllum suaveolens<br>Fragrant Leek-orchid [64956] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Pterostylis chlorogramma<br>Green-striped Greenhood [56510] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| Pterostylis cucullata<br>Leafy Greenhood [15459] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| Pterostylis tenuissima<br>Swamp Greenhood, Dainty Swamp Orchid [13139] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Rutidosis leptorhynchoides<br>Button Wrinklewort [67251] | Endangered | Species or species habitat likely to occur within area | In buffer area only |
| Senecio macrocarpus<br>Large-fruit Fireweed, Large-fruit Groundsel [16333] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| Senecio psilocarpus<br>Swamp Fireweed, Smooth-fruited Groundsel [64976] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Thelymitra epipactoides<br>Metallic Sun-orchid [11896] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Thelymitra matthewsii | | | |

| | | | |
|---|---|---|---|
| Spiral Sun-orchid [4168] | Endangered | Species or species habitat may occur within area | In buffer area only |
| [Thelymitra orientalis](#)<br>Hoary Sun-orchid [88011] | Critically Endangered | Species or species habitat may occur within area | In buffer area only |
| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| [Xerochrysum palustre](#)<br>Swamp Everlasting, Swamp Paper Daisy [76215] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| REPTILE | | | |
| [Caretta caretta](#)<br>Loggerhead Turtle [1763] | Endangered | Breeding likely to occur within area | In feature area |
| [Chelonia mydas](#)<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area | In feature area |
| [Delma impar](#)<br>Striped Legless Lizard, Striped Snakelizard [1649] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Dermochelys coriacea](#)<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area | In feature area |
| [Eulamprus tympanum marnieae](#)<br>Corangamite Water Skink, Dreeite Water Skink [64487] | Endangered | Species or species habitat may occur within area | In buffer area only |
| [Lissolepis coventryi](#)<br>Swamp Skink, Eastern Mourning Skink [84053] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| SHARK | | | |
| [Carcharodon carcharias](#) | | | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status | |
|---|---|---|---|---|
| White Shark, Great White Shark [64470] | Vulnerable | Species or species School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453] | | Con Dep |
| Centrophorus uyato | | Foraging, feeding or related behaviour known to occur within area | In feature area | |

## Listed Migratory Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| **Migratory Marine Birds** | | | |
| Little Gulper Shark [68446] | Conservation Dependent | Species or species habitat likely to occur within area | In buffer area only |
| Galeorhinus galeus | | Species or species habitat may occur within area | In feature area |
| Apus pacificus<br>Fork-tailed Swift [678] | | habitat likely to occur within area | In feature area |
| Ardenna carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Ardenna grisea<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Ardenna tenuirostris<br>Short-tailed Shearwater [82652] | | Breeding known to occur within area | In buffer area only |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| | | | |
|---|---|---|---|
| [Diomedea exulans](#)<br>Wandering Albatross [89223] | Vulnerable | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |
| [Diomedea sanfordi](#)<br>Northern Royal Albatross [64456] | Endangered | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |
| [Macronectes giganteus](#)<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area | In feature area |
| [Macronectes halli](#)<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Phoebetria fusca](#)<br>Sooty Albatross [1075] | Vulnerable | | |
| | | Species or species habitat likely to occur within area | In feature area |
| [Sternula albifrons](#)<br>Little Tern [82849] | Vulnerable | | |
| | | Species or species habitat may occur within area | In buffer area only |
| [Thalassarche bulleri](#)<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | | |
| | | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Thalassarche carteri](#)<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | | |
| | | Species or species habitat likely to occur within area | In feature area |
| [Thalassarche cauta](#)<br>Shy Albatross [89224] | Endangered | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| **Species or species habitat may occur within area** | | | |
| [Thalassarche chrysostoma](#)<br>Grey-headed Albatross [66491] | Endangered | | In feature area |
| [Thalassarche impavida](#)<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | | In feature area |
| [Thalassarche melanophris](#)<br>Black-browed Albatross [66472] | Vulnerable | | In feature area |
| [Thalassarche salvini](#)<br>Salvin's Albatross [64463] | Vulnerable | | In feature area |
| [Thalassarche steadi](#)<br>White-capped Albatross [64462] | Vulnerable | | In feature area |
| **Migratory Marine Species** | | | |
| [Balaenoptera bonaerensis](#) | | | |

Species or species habitat may occur within area

Foraging, feeding or related behaviour likely to occur within area

Foraging, feeding or related behaviour likely to occur within area

Foraging, feeding or related behaviour likely to occur within area

Foraging, feeding or related behaviour known to occur within area

| | | | |
|---|---|---|---|
| Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | | In buffer area only |
| | | habitat likely to occur within area | |
| [Balaenoptera borealis](#) Sei Whale [34] | Vulnerable | | |
| | | Foraging, feeding or related behaviour known to occur within area | In feature area |
| [Balaenoptera musculus](#) Blue Whale [36] | Endangered | | |
| | | Foraging, feeding or related behaviour known to occur within area | In feature area |
| [Balaenoptera physalus](#) Fin Whale [37] | Vulnerable | | |
| | | Foraging, feeding or related behaviour known to occur within area | In feature area |
| [Caperea marginata](#) Pygmy Right Whale [39] | | | |
| | | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Carcharias taurus](#) Grey Nurse Shark [64469] | | | |
| | | Species or species habitat may occur within area | In feature area |
| [Carcharodon carcharias](#) White Shark, Great White Shark [64470] | Vulnerable | | |
| | | Foraging, feeding or related behaviour known to occur within area | In feature area |
| [Caretta caretta](#) Loggerhead Turtle [1763] | Endangered | Breeding likely to occur within area | In feature area |
| [Chelonia mydas](#) Green Turtle [1765] | Vulnerable | | In feature area |
| | | Species or species habitat may occur within area | |
| [Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area | In feature area |
| [Eubalaena australis as Balaena glacialis australis](#) Southern Right Whale [40] | Endangered | Breeding known to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Isurus oxyrinchus](#)<br>Shortfin Mako, Mako Shark [79073] | | Species or species habitat likely to occur within area | In feature area |
| [Lagenorhynchus obscurus](#)<br>Dusky Dolphin [43] | | Species or species habitat likely to occur within area | In feature area |
| [Lamna nasus](#)<br>Porbeagle, Mackerel Shark [83288] | | Species or species habitat likely to occur within area | In feature area |
| [Megaptera novaeangliae](#)<br>Humpback Whale [38] | | Species or species habitat likely to occur within area | In feature area |
| [Orcinus orca](#)<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area | In feature area |
| [Physeter macrocephalus](#)<br>Sperm Whale [59] | | Species or species habitat may occur within area | In buffer area only |

| | | | |
|---|---|---|---|
| **Migratory Terrestrial Species** | | | |
| [Hirundapus caudacutus](#)<br>White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| [Motacilla flava](#)<br>Yellow Wagtail [644] | | Species or species habitat may occur within area | In buffer area only |
| **Migratory Wetlands Species** | | | |
| [Actitis hypoleucos](#)<br>Common Sandpiper [59309] | | Species or species habitat known to occur within area | In feature area |
| [Arenaria interpres](#)<br>Ruddy Turnstone [872] | Vulnerable | Roosting known to occur within area | In buffer area only |
| [Calidris acuminata](#)<br>Sharp-tailed Sandpiper [874] | Vulnerable | Roosting known to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Calidris alba<br>Sanderling [875] | | Roosting known to occur within area | In buffer area only |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat known to occur within area | In feature area |
| Calidris ruficollis<br>Red-necked Stint [860] | | Roosting known to occur within area | In buffer area only |
| Charadrius bicinctus<br>Double-banded Plover [895] | | Roosting known to occur within area | In buffer area only |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| Charadrius mongolus<br>Lesser Sand Plover, Mongolian Plover [879] | Endangered | Roosting known to occur within area | In buffer area only |
| Gallinago hardwickii<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area | In buffer area only |
| Gallinago megala<br>Swinhoe's Snipe [864] | | Roosting likely to occur within area | In buffer area only |
| Gallinago stenura<br>Pin-tailed Snipe [841] | | Roosting likely to occur within area | In buffer area only |
| Limosa lapponica<br>Bar-tailed Godwit [844] | | Species or species habitat known to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| --- | --- | --- | --- |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| Numenius minutus<br>Little Curlew, Little Whimbrel [848] | | Roosting likely to occur within area | In buffer area only |
| Numenius phaeopus<br>Whimbrel [849] | | Roosting known to occur within area | In buffer area only |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area | In buffer area only |
| Pluvialis fulva<br>Pacific Golden Plover [25545] | | Roosting known to occur within area | In buffer area only |
| Thalasseus bergii<br>Greater Crested Tern [83000] | | Breeding known to occur within area | In buffer area only |
| Tringa brevipes<br>Grey-tailed Tattler [851] | | Roosting known to occur within area | In buffer area only |
| Tringa glareola<br>Wood Sandpiper [829] | | Roosting known to occur within area | In buffer area only |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat known to occur within area | In buffer area only |
| Tringa stagnatilis<br>Marsh Sandpiper, Little Greenshank [833] | | Roosting known to occur within area | In buffer area only |

## Other Matters Protected by the EPBC Act

| Commonwealth Lands | [ Resource Information ] |
| --- | --- |

| Listed Marine Species | | | [ Resource Information ] |
|---|---|---|---|
| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| **Bird** | | | |
| The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information. | | | |
| Commonwealth Land Name | | State | Buffer Status |
| **Defence** | | | |
| Defence - WARRNAMBOOL TRAINING DEPOT [21111] | | VIC | In buffer area only |
| Common Sandpiper [59309] | | Species or species habitat known to occur within area | In feature area |
| Anseranas semipalmata<br>Magpie Goose [978] | | Species or species habitat may occur within area overfly marine area | In buffer area only |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Ardenna carneipes as Puffinus carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Ardenna grisea as Puffinus griseus<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Ardenna tenuirostris as Puffinus tenuirostris<br>Short-tailed Shearwater [82652] | | Breeding known to occur within area | In buffer area only |
| Arenaria interpres<br>Ruddy Turnstone [872] | Vulnerable | Roosting known to occur within area | In buffer area only |
| Bubulcus ibis as Ardea ibis<br>Cattle Egret [66521] | | Breeding likely to occur within area overfly marine area | In buffer area only |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Roosting known to occur within area | In feature area |

| | | | |
|---|---|---|---|
| [Calidris alba](#)<br>Sanderling [875] | | Roosting known to occur within area | In buffer area only |
| [Calidris canutus](#)<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area overfly marine area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | habitat known to occur within area<br>overfly marine area | In feature area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat known to occur within area<br>overfly marine area | In feature area |
| Calidris ruficollis<br>Red-necked Stint [860] | | Roosting known to occur within area<br>overfly marine area | In buffer area only |
| Chalcites osculans as Chrysococcyx osculans<br>Black-eared Cuckoo [83425] | | Species or species habitat known to occur within area<br>overfly marine area | In buffer area only |
| Charadrius bicinctus<br>Double-banded Plover [895] | | Roosting known to occur within area<br>overfly marine area | In buffer area only |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| Charadrius mongolus<br>Lesser Sand Plover, Mongolian Plover [879] | Endangered | Roosting known to occur within area | In buffer area only |
| Charadrius ruficapillus<br>Red-capped Plover [881] | | Roosting known to occur within area<br>overfly marine area | In buffer area only |
| Chroicocephalus novaehollandiae as Larus novaehollandiae<br>Silver Gull [82326] | | Breeding known to occur within area | In buffer area only |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Diomedea epomophora](#)<br>Southern Royal Albatross [89221] | Vulnerable | Species or species<br>Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Diomedea exulans](#)<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Diomedea sanfordi](#)<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| [Eudyptula minor](#)<br>Little Penguin [1085] | | Breeding known to occur within area | In buffer area only |
| [Gallinago hardwickii](#)<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area<br>overfly marine area | In buffer area only |
| [Gallinago megala](#)<br>Swinhoe's Snipe [864] | | Roosting likely to occur within area<br>overfly marine area | In buffer area only |
| [Gallinago stenura](#)<br>Pin-tailed Snipe [841] | | Roosting likely to occur within area<br>overfly marine area | In buffer area only |
| [Haliaeetus leucogaster](#)<br>White-bellied Sea-Eagle [943] | | Breeding known to occur within area | In buffer area only |
| [Halobaena caerulea](#)<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area | In feature area |
| [Himantopus himantopus](#)<br>Pied Stilt, Black-winged Stilt [870] | | Roosting known to occur within area<br>overfly marine area | In buffer area only |
| [Hirundapus caudacutus](#)<br>White-throated Needletail [682] | Vulnerable | Species or species | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| | | habitat known to occur within area overfly marine area | |
| Lathamus discolor<br>Swift Parrot [744] | Critically Endangered | Species or species habitat known to occur within area overfly marine area | |
| | | | In buffer area only Limosa lapponica |
| Bar-tailed Godwit [844] | | | In buffer area only |
| | | habitat known to occur within area | |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | | In feature area |
| | | Species or species habitat may occur within area | |
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |
| Merops ornatus<br>Rainbow Bee-eater [670] | | | In buffer area only |
| | | Species or species habitat may occur within area overfly marine area | |
| Monarcha melanopsis<br>Black-faced Monarch [609] | | | In buffer area only |
| | | Species or species habitat may occur within area overfly marine area | |
| Motacilla flava<br>Yellow Wagtail [644] | | | In buffer area only |
| | | Species or species habitat may occur within area overfly marine area | |
| Myiagra cyanoleuca<br>Satin Flycatcher [612] | | | In buffer area only |
| | | Breeding known to occur within area overfly marine area | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Neophema chrysogaster<br>Orange-bellied Parrot [747] | Critically Endangered | Species or species | In feature area |
| Neophema chrysostoma<br>Blue-winged Parrot [726] | Vulnerable | Species or species habitat known to occur within area overfly marine area | In buffer area only |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| Numenius minutus | | occur within area overfly marine area | |
| Numenius phaeopus<br>Whimbrel [849] | | Roosting known to occur within area | In buffer area only |
| Pachyptila turtur<br>Fairy Prion [1066] | | | In feature area |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area | In buffer area only |
| Phalacrocorax fuscescens<br>Black-faced Cormorant [59660] | | Breeding known to occur within area | In buffer area only |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Pluvialis fulva<br>Pacific Golden Plover [25545] | | Roosting known to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Pterodroma mollis<br>Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Recurvirostra novaehollandiae<br>Red-necked Avocet [871] | | Roosting known to occur within area | In buffer area only<br>overfly marine area |
| Rhipidura rufifrons<br>Rufous Fantail [592] | | Species or species | In buffer area only |
| Little Curlew, Little Whimbrel [848] | | Roosting likely to | In buffer area only |
| | | habitat known to occur within area<br>overfly marine area | |
| Rostratula australis as Rostratula benghalensis (sensu lato)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat known to occur within area<br>overfly marine area | |
| Brown Skua [85039] | | | In buffer area only Stercorarius antarcticus as Catharacta skua<br>In feature area |
| | | habitat may occur within area | |
| Sterna striata<br>White-fronted Tern [799] | | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |
| Sternula albifrons as Sterna albifrons<br>Little Tern [82849] | Vulnerable | | In buffer area only |
| | | Species or species habitat may occur within area | |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | | In feature area |
| | | Foraging, feeding or related behaviour likely to occur within area | |
| Thalassarche bulleri platei as Thalassarche sp. nov. | | | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Species or species Foraging, feeding or related behaviour likely to occur within area | |
| Thalassarche carteri Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Thalassarche cauta Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche chrysostoma Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area | In feature area |
| Thalassarche impavida Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Thalassarche melanophris Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or<br>behaviour<br>likely to occur within<br>area | In feature area related |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or<br>related behaviour known to occur<br>within area | In feature area |
| Thalasseus bergii as Sterna bergii<br>Greater Crested Tern [83000] | | Breeding known to<br>occur within area | In buffer area only |
| Thinornis cucullatus as Thinornis rubricollis<br>Hooded Plover, Hooded Dotterel [87735] | | Species or species<br>habitat known to<br>occur within area<br>overfly marine area | In buffer area only |
| Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis<br>Eastern Hooded Plover, Eastern Hooded Vulnerable Plover [90381] | | Species or species<br>habitat known to<br>occur within area<br>overfly marine area | In buffer area only |
| Tringa brevipes as Heteroscelus brevipes<br>Grey-tailed Tattler [851] | | Roosting known to<br>occur within area | In buffer area only |
| Tringa glareola<br>Wood Sandpiper [829] | | Roosting known to<br>occur within area<br>overfly marine area | In buffer area only |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species<br>habitat known to<br>occur within area<br>overfly marine area | In buffer area only |
| Tringa stagnatilis<br>Marsh Sandpiper, Little Greenshank [833] | | Roosting known to<br>occur within area<br>overfly marine area | In buffer area only |
| Fish | | | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| --- | --- | --- | --- |
| Heraldia nocturna<br>Upside-down Pipefish, Eastern Upsidedown Pipefish, Eastern Upside-down | | Pipefish [66227]<br>Species or species habitat may occur within area | In feature area |
| Hippocampus abdominalis<br>Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233] | | Species or species habitat may occur within area | In feature area |
| Hippocampus breviceps<br>Short-head Seahorse, Short-snouted Seahorse [66235] | | Species or species habitat may occur within area | In feature area |
| Histiogamphelus briggsii<br>Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242] | | Species or species habitat may occur within area | In feature area |
| Histiogamphelus cristatus<br>Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243] | | Species or species habitat may occur within area | In feature area |
| Hypselognathus rostratus<br>Knifesnout Pipefish, Knife-snouted Pipefish [66245] | | Species or species habitat may occur within area | In feature area |
| Kaupus costatus<br>Deepbody Pipefish, Deep-bodied Pipefish [66246] | | Species or species habitat may occur within area | In feature area |
| Leptoichthys fistularius<br>Brushtail Pipefish [66248] | | Species or species habitat may occur within area | In feature area |
| Lissocampus caudalis<br>Australian Smooth Pipefish, Smooth Pipefish [66249] | | Species or species habitat may occur within area | In feature area |
| Lissocampus runa<br>Javelin Pipefish [66251] | | Species or species habitat may occur within area | In feature area |
| Maroubra perserrata<br>Sawtooth Pipefish [66252] | | Species or species habitat may occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Mitotichthys semistriatus<br>Halfbanded Pipefish [66261] | | Species or species habitat may occur within area | In feature area |
| Mitotichthys tuckeri<br>Tucker's Pipefish [66262] | | Species or species habitat may occur within area | In feature area |
| Notiocampus ruber<br>Red Pipefish [66265] | | Species or species habitat may occur within area | In feature area |
| Phycodurus eques<br>Leafy Seadragon [66267] | | Species or species habitat may occur within area | In feature area |
| Phyllopteryx taeniolatus<br>Common Seadragon, Weedy Seadragon [66268] | | Species or species habitat may occur within area | In feature area |
| Pugnaso curtirostris<br>Pugnose Pipefish, Pug-nosed Pipefish [66269] | | Species or species habitat may occur within area | In feature area |
| Solegnathus robustus<br>Robust Pipehorse, Robust Spiny Pipehorse [66274] | | Species or species habitat may occur within area | In feature area |
| Solegnathus spinosissimus<br>Spiny Pipehorse, Australian Spiny Pipehorse [66275] | | Species or species habitat may occur within area | In feature area |
| Stigmatopora argus<br>Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276] | | Species or species habitat may occur within area | In feature area |
| Stigmatopora nigra<br>Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277] | | Species or species habitat may occur within area | In feature area |
| Stipecampus cristatus<br>Ringback Pipefish, Ring-backed Pipefish [66278] | | Species or species habitat may occur within area | In feature area |

| | | | |
|---|---|---|---|
| [Urocampus carinirostris](#)<br>Hairy Pipefish [66282] | | Species or species habitat may occur within area | In feature area |
| **Scientific Name** | **Threatened Category** | **Presence Text** | **Buffer Status** |
| [Vanacampus margaritifer](#)<br>Mother-of-pearl Pipefish [66283] | | Species or species habitat may occur within area | In feature area |
| [Vanacampus phillipi](#)<br>Port Phillip Pipefish [66284] | | Species or species habitat may occur within area | In feature area |
| [Vanacampus poecilolaemus](#)<br>Longsnout Pipefish, Australian Longsnout Pipefish, Long-snouted Pipefish [66285] | | Species or species habitat may occur within area | In feature area |
| **Mammal** | | | |
| [Arctocephalus forsteri](#)<br>Long-nosed Fur-seal, New Zealand Furseal [20] | | Species or species habitat may occur within area | In feature area |
| [Arctocephalus pusillus](#)<br>Australian Fur-seal, Australo-African Fur-seal [21] | | Species or species habitat likely to occur within area | In feature area |
| [Neophoca cinerea](#)<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area | In feature area |
| **Reptile** | | | |
| [Caretta caretta](#)<br>Loggerhead Turtle [1763] | Endangered | Breeding likely to occur within area | In feature area |
| [Chelonia mydas](#)<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area | In feature area |
| [Dermochelys coriacea](#)<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area | In feature area |
| **Whales and Other Cetaceans** | | | [ Resource Information ] |

| Current Scientific Name | Status | Type of Presence | Buffer Status |
|---|---|---|---|

| Current Scientific Name | Status | Type of Presence | Buffer Status |
|---|---|---|---|
| **Mammal** | | | |
| Balaenoptera acutorostrata<br>Minke Whale [33] | | Species or species habitat may occur within area Balaenoptera bonaerensis | In feature area |
| Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely to occur within area | In buffer area only |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour known to occur within area | In feature area |
| Berardius arnuxii<br>Arnoux's Beaked Whale [70] | | Species or species habitat may occur within area | In buffer area only |
| Caperea marginata<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour likely to occur within area | In feature area |
| Delphinus delphis<br>Common Dolphin, Short-beaked Common Dolphin [60] | | Species or species habitat may occur within area | In feature area |
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area | In feature area |
| Globicephala macrorhynchus<br>Short-finned Pilot Whale [62] | | Species or species habitat may occur within area | In buffer area only |

| | | | |
|---|---|---|---|
| Globicephala melas<br>Long-finned Pilot Whale [59282] | | | In buffer area only |
| | | Species or species habitat may occur within area | |
| Grampus griseus<br>Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area | In feature area |
| Current Scientific Name | Status | Type of Presence | Buffer Status |
| Kogia breviceps<br>Pygmy Sperm Whale [57] | | Species or species habitat may occur within area | In buffer area only |
| Kogia sima<br>Dwarf Sperm Whale [85043] | | Species or species habitat may occur within area | In buffer area only |
| Lagenorhynchus obscurus<br>Dusky Dolphin [43] | | Species or species habitat likely to occur within area | In feature area |
| Lissodelphis peronii<br>Southern Right Whale Dolphin [44] | | Species or species habitat may occur within area | In buffer area only |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area | In feature area |
| Mesoplodon bowdoini<br>Andrew's Beaked Whale [73] | | Species or species habitat may occur within area | In buffer area only |
| Mesoplodon densirostris<br>Blainville's Beaked Whale, Densebeaked Whale [74] | | Species or species habitat may occur within area | In buffer area only |
| Mesoplodon grayi<br>Gray's Beaked Whale, Scamperdown Whale [75] | | Species or species habitat may occur within area | In buffer area only |
| Mesoplodon hectori<br>Hector's Beaked Whale [76] | | Species or species habitat may occur within area | In buffer area only |

| | | | |
|---|---|---|---|
| Mesoplodon layardii<br>Strap-toothed Beaked Whale, Straptoothed Whale, Layard's Beaked Whale [25556] | | Species or species habitat may occur within area | In buffer area only |
| Mesoplodon mirus<br>True's Beaked Whale [54] | | Species or species habitat may occur within area | In buffer area only |
| **Current Scientific Name** | **Status** | **Type of Presence** | **Buffer Status** |
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area | In feature area |
| Physeter macrocephalus<br>Sperm Whale [59] | | Species or species habitat may occur within area | In buffer area only |
| Pseudorca crassidens<br>False Killer Whale [48] | | Species or species habitat likely to occur within area | In feature area |
| Tursiops aduncus<br>Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | | Species or species habitat likely to occur within area | In feature area |
| Tursiops truncatus s. str.<br>Bottlenose Dolphin [68417] | | Species or species habitat may occur within area | In feature area |
| Ziphius cavirostris<br>Cuvier's Beaked Whale, Goose-beaked Whale [56] | | Species or species habitat may occur within area | In buffer area only |

## Extra Information

| State and Territory Reserves | | | [ Resource Information ] |
|---|---|---|---|
| **Protected Area Name** | **Reserve Type** | **State** | **Buffer Status** |
| Bay of Islands Coastal Park | Conservation Park | VIC | In buffer area only |

| | | | |
|---|---|---|---|
| Brucknell Creek F.F.R | Nature Conservation Reserve | VIC | In buffer area only |
| Carpendeit | Reference Area | VIC | In buffer area only |
| Carpendeit B.R. | Natural Features Reserve | VIC | In buffer area only |
| Cobrico Swamp W.R | Natural Features Reserve | VIC | In buffer area only |
| Cooriemungle | Reference Area | VIC | In buffer area only |
| Cooriemungle Creek F.R | Nature Conservation Reserve | VIC | In buffer area only |
| Coradjil B.R. | Natural Features Reserve | VIC | In buffer area only |

| Protected Area Name | Reserve Type | State | Buffer Status |
|---|---|---|---|
| Coradjil N.C.R. | Natural Features Reserve | VIC | In buffer area only |
| Crinoline Creek | Reference Area | VIC | In buffer area only |
| Curdie Vale N.C.R. | Natural Features Reserve | VIC | In buffer area only |
| Ecklin South Swamp N.C.R. | Natural Features Reserve | VIC | In buffer area only |
| Great Otway | National Park | VIC | In buffer area only |
| Hopkins Falls S.R. | Natural Features Reserve | VIC | In buffer area only |
| Hopkins River, Framlingham SS.R. | Natural Features Reserve | VIC | In buffer area only |
| Jancourt N.C.R. | Natural Features Reserve | VIC | In buffer area only |
| Johanna Falls S.R. | Natural Features Reserve | VIC | In buffer area only |
| Lake Gillear W.R | Natural Features Reserve | VIC | In buffer area only |
| Latrobe B.R. | Natural Features Reserve | VIC | In buffer area only |
| Merri | Marine Sanctuary | VIC | In buffer area only |
| Nullawarre F.R. | Nature Conservation Reserve | VIC | In buffer area only |

| | | | |
|---|---|---|---|
| Port Campbell | National Park | VIC | In buffer area only |
| Princetown W.R | Natural Features Reserve | VIC | In buffer area only |
| The Arches | Marine Sanctuary | VIC | In buffer area only |
| Timboon I1 B.R | Natural Features Reserve | VIC | In buffer area only |
| Tomahawk Creek | Reference Area | VIC | In buffer area only |
| Tower Hill W.R | Natural Features Reserve | VIC | In buffer area only |
| Twelve Apostles | Marine National Park | VIC | In buffer area only |
| Unnamed P0126 | Private Nature Reserve | VIC | In buffer area only |
| Woolsthorpe N.C.R. | Natural Features Reserve | VIC | In buffer area only |

| Protected Area Name | Reserve Type | State | Buffer Status |
|---|---|---|---|

## Regional Forest Agreements

[ Resource Information ]

Note that all areas with completed RFAs have been included. Pleasry information. for specific caveats and use limitations associated with RFA bound

| RFA Name | State | Buffer Status |
|---|---|---|
| West Victoria RFA | Victoria | In buffer area only |

## Nationally Important Wetlands

[ Resource Information ]

| Wetland Name | State | Buffer Status |
|---|---|---|
| Cobden-Terang Volcanic Craters | VIC | In buffer area only |
| Lower Merri River Wetlands | VIC | In buffer area only |
| Princetown Wetlands | VIC | In buffer area only |
| Tower Hill | VIC | In buffer area only |

## EPBC Act Referrals

[ Resource Information ]

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Decommissioning of the Minerva Pipeline in Victorian state waters | 2024/09879 | | Completed | In buffer area only |
| Decommissioning of the Minerva Pipeline in Victorian state waters ? May 2025 | 2025/10138 | | Referral Decision | In buffer area only |

| | | | |
|---|---|---|---|
| Geographe-A gas exploration well | 2000/82 | Completed | In buffer area only |
| Hexham Wind Farm | 2022/09287 | Assessment | In buffer area only |
| Hydrocarbon exploration wells | 2003/1062 | Completed | In buffer area only |
| Marine Route Survey for Subsea Fibre Optic Data Cable System Australia East | 2024/09795 | Completed | In buffer area only |
| Mumblin Wind Farm | 2024/10068 | Assessment | In buffer area only |
| Otway Astrolabe 3D Marine Seismic Survey, Otway Basin | 2012/6421 | Completed | In buffer area only |
| SEA Gas Project transmission pipeline | 2001/513 | Completed | In buffer area only |
| SMAP telecommunications submarine cable installation | 2024/09989 | Completed | In buffer area only |

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Spinifex Offshore Surveys | 2022/09359 | | Completed | In buffer area only |
| Spinifex Offshore Wind Farm Offshore Investigations | 2024/09918 | | Referral Decision | In buffer area only |
| Strike Oil NL Seismic Surveys | 2000/107 | | Completed | In feature area |
| Swansons Lane Wind Farm | 2024/09949 | | Assessment | In buffer area only |
| Thylacine-A Exploration Well | 2000/81 | | Completed | In buffer area only |
| Vic-P51 and Vic-P52 3D seismic survey | 2002/799 | | Completed | In buffer area only |
| Controlled action | | | | |
| Alston-1 petroleum exploration well, permit VIC/P44 | 2003/1315 | Controlled Action | Post-Approval | In buffer |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | area only |
| Casino Gas Field Development | 2003/1295 | Controlled Action | | Post-Approval | In feature area |
| Mortlake Wind Farm | 2008/4128 | Controlled Action | | Post-Approval | In buffer area only |
| Otway Development | 2002/621 | Controlled Action | | Post-Approval | In feature area |
| Residential Subdivision & Infrastructure Parish of Belfast | 2005/1954 | Controlled Action | | Completed | In buffer area only |
| Schomberg 3D Marine Seismic Survey | 2007/3754 | Controlled Action | | Completed | In feature area |
| Strike Oil Gas Exploration Well, Otway Basin (VIC/P44) | 2000/97 | Controlled Action | | Completed | In feature area |
| Twelve Apostles Saddle Lookout | 2019/8571 | Controlled Action | | Post-Approval | In buffer area only |
| VICP61 2D Marine Seismic Survey | 2008/4075 | Controlled Action | | Completed | In feature area |
| Not controlled action | | | | | |
| Alteration of Grass Maintenance Regime within Powling St Wetlands | 2012/6527 | Not Controlled Action | | Completed | In buffer area only |
| Amrit-1 exploration well | 2004/1572 | | | Completed | In buffer area only |
| CO2 geosequestration - Otway Basin Pilot Project | 2006/2699 | Not Controlled Action | | Completed | In buffer area only |

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Not controlled action | | | | |
| Ellerslie Timber Bridge Partial Restoration | 2009/4734 | Not Controlled Action | Completed | In buffer area only |

| | | | | |
|---|---|---|---|---|
| Enterprise 1 Exploration Drilling Program, near Port Campbell, Vic | 2019/8438 | Not Controlled Action | Completed | In buffer area only |
| Exploration drilling for liquid/gaseous hydrocarbons | 2004/1681 | Not Controlled Action | Completed | In feature area |
| Gas Field Development | 2006/2635 | Not Controlled Action | Completed | In feature area |
| Gas Fields Development | 2011/5879 | Not Controlled Action | Completed | In buffer area only |
| Gas Pipeline Installation | 2005/2495 | Not Controlled Action | Completed | In buffer area only |
| Halladale and Speculant Gas Pipeline Project, North of Port Campbell, Vic | 2015/7551 | Not Controlled Action | Completed | In buffer area only |
| Hawkesdale Wind Farm | 2005/2140 | | Completed | |
| Henry-1 Exploration Well, Petroleum Permit Area VIC/P44 | 2005/2147 | Not Controlled Action<br>Not Controlled Action | Completed | In buffer area only<br>In feature area |
| Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia | 2015/7522 | Not Controlled Action | Completed | In buffer area only |
| INDIGO Central Submarine Telecommunications Cable | 2017/8127 | Not Controlled Action | Completed | In feature area |
| Kelly Swamp Boardwalk Construction | 2010/5371 | Not Controlled Action | Completed | In buffer area only |
| Maintenance of Access Track and Weed Removal | 2009/4973 | Not Controlled Action | Completed | In buffer area only |
| Minerva Cut Back Project, Vic | 2017/8036 | Not Controlled Action | Completed | In buffer area only |
| Mortlake South Wind Farm, 5 km south of Mortlake, Vic | 2017/8137 | Not Controlled Action | Completed | In buffer area only |
| Naroghid Wind Farm | 2004/1542 | Not Controlled Action | Completed | In buffer area only |
| Newfield wind farm | 2007/3226 | Not Controlled Action | Completed | In buffer area only |
| Nirranda South Wind Farm Pty Ltd | 2002/763 | Not Controlled Action | Completed | In buffer area only |

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Not controlled action | | | | |

| | | | | |
|---|---|---|---|---|
| Offshore exploration drilling within permit area VIC/P 37(v) | 2004/1466 | Not Controlled Action | Completed | In feature area |
| Port Campbell Headland Walking Trail Realignment | 2012/6676 | Not Controlled Action | Completed | In buffer area only |
| Railway Bridge (H0151) Partial Demolition, Merri River | 2010/5534 | Not Controlled Action | Completed | In buffer area only |
| Salt Creek Wind Farm transmission line, Vic | 2016/7763 | Not Controlled Action | Completed | In buffer area only |
| Stage 1 residential subdivision, Anna Catherine Drive | 2005/1992 | Not Controlled Action | Completed | In buffer area only |
| The Sisters Wind Farm | 2008/4268 | Not Controlled Action | Completed | In buffer area only |
| Track construction - Great Ocean Walk | 2002/793 | Not Controlled Action | Completed | In buffer area only |
| VIC-P44 Stage 2 Gas Field Development | 2007/3767 | Not Controlled Action | Completed | In feature area |
| Victorian Generator Project | 2005/1984 | Not Controlled Action | Completed | In buffer area only |
| Water pipelines, Mortlake Power Station | 2006/2881 | Not Controlled Action | Completed | In buffer area only |
| Wind Farm Construction and Operation | 2001/471 | Not Controlled Action | Completed | In buffer area only |
| Wind farm development | 2005/1960 | Not Controlled Action | Completed | In buffer area only |
| Wind Farm Development | 2004/1929 | Not Controlled Action | Completed | In buffer area only |
| Not controlled action (particular manner) | | | | |
| 'Moonlight Head' 3D seismic survey, VIC/P38(V), VIC/P43 and VIC/RL8 | 2005/2236 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| 2D Marine Seismic Survey | 2005/2295 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| 2D Seismic Survey | 2003/1214 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |

| | | | | |
|---|---|---|---|---|
| 3D marine seismic survey near King Island | 2004/1461 | Not Controlled Action (Particular | Post-Approval | In buffer area only |
| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
| Not controlled action (particular manner) | | | | |
| | | Manner) | | |
| 3D seismic program VIC/P38(v), VIC/P43 and VIC/RL8 | 2003/1137 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Astrolabe 3D Marine Seismic Survey | 2011/6048 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| BHPBilliton Otway 3D Seismic Survey | 2007/3443 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Deepwater Sorell Basin 2001 NonExclusive 2D Seismic Survey | 2001/156 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Drill and Profile Exploration Well Somerset 1, License Area T34P | 2009/5037 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Enterprise Three-dimensional Transition Zone Seismic Survey, Victoria | 2016/7800 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Gas Pipeline Crossing at Mount Emu Creek | 2009/4913 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| INDIGO Marine Cable Route Survey (INDIGO) | 2017/7996 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| La Bella 3D Marine Seismic Survey, Otway Basin, VIC | 2012/6683 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Otway Basin Exploration Drilling Campaign, Vic | 2011/6125 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |

| | | | | |
|---|---|---|---|---|
| Residential Development and Associated Infrastructure at Port Fairy | 2012/6687 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
| Not controlled action (particular manner) | | | | |
| Santos Otway 3d Seismic VIC/P44 | 2007/3367 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Schomberg 3D Marine Seismic survey | 2007/3868 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Shaw River Power Station construct gas pipeline and associated infrastructure | 2009/5089 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Shaw River Power Station Project Water Supply Pipeline | 2009/5091 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Southern Gas Pipeline Project | 2002/619 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Speculant 3D Transition Zone Seismic Survey | 2010/5558 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, Vic | 2012/6565 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| Undertake a three dimensional marine seismic survey | 2010/5700 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |
| Vic/P37(v) and Vic/P44 3D marine seismic survey | 2003/1102 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |
| VIC P44 Gas Exploration Wells | 2002/662 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |

| | | | | |
|---|---|---|---|---|
| Vic-P51 and Vic-P52 2D seismic survey | 2002/811 | Not Controlled Action (Particular Manner) | Post-Approval | In buffer area only |

| Referral decision | | | | |
|---|---|---|---|---|
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, | 2012/6545 | Referral Decision | Completed | In feature area |
| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
| Referral decision | | | | |
| VIC | | | | |
| VICP61 2D Marine Seismic Survey | 2008/3975 | Referral Decision | Completed | In feature area |

## Key Ecological Features [ Resource Information ]

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

| Name | Region | Buffer Status |
|---|---|---|
| Bonney Coast Upwelling | South-east | In buffer area only |
| West Tasmania Canyons | South-east | In buffer area only |

## Biologically Important Areas [ Resource Information ]

| Scientific Name | Behaviour | Presence | Buffer Status |
|---|---|---|---|
| **Seabirds** | | | |
| Ardenna pacifica<br>Wedge-tailed Shearwater [84292] | Foraging | Likely to occur | In feature area |
| Ardenna tenuirostris<br>Short-tailed Shearwater [84292] | Breeding | Known to occur | In buffer area only |
| Ardenna tenuirostris<br>Short-tailed Shearwater [82652] | Foraging | Known to occur | In buffer area only |
| Diomedea exulans (sensu lato)<br>Wandering Albatross [1073] | Foraging | Known to occur | In feature area |
| Diomedea exulans antipodensis<br>Antipodean Albatross [82269] | Foraging | Known to occur | In feature area |
| Morus serrator<br>Australasian Gannet [1020] | Foraging | Known to occur | In buffer area only |

| | | | |
|---|---|---|---|
| Pelecanoides urinatrix<br>Common Diving-petrel [1018] | Foraging | Known to occur | In feature area |
| Thalassarche bulleri<br>Bullers Albatross [64460] | Foraging | Known to occur | In feature area |
| Thalassarche cauta cauta<br>Shy Albatross [82345] | Foraging likely | Likely to occur | In feature area |
| Scientific Name | Behaviour | Presence | Buffer Status |
| Thalassarche chlororhynchos bassi<br>Indian Yellow-nosed Albatross [85249] | Foraging | Known to occur | In feature area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Foraging | Known to occur | In feature area |
| Thalassarche melanophris impavida<br>Campbell Albatross [82449] | Foraging | Known to occur | In feature area |
| **Sharks** | | | |
| Carcharodon carcharias<br>White Shark [64470] | Foraging | Known to occur | In buffer area only |
| **Whales** | | | |
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Foraging | Likely to be present | In buffer area only |
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Foraging (annual high use area) | Known to occur | In feature area |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales

-Department of Environment and Primary Industries, Victoria

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

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

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

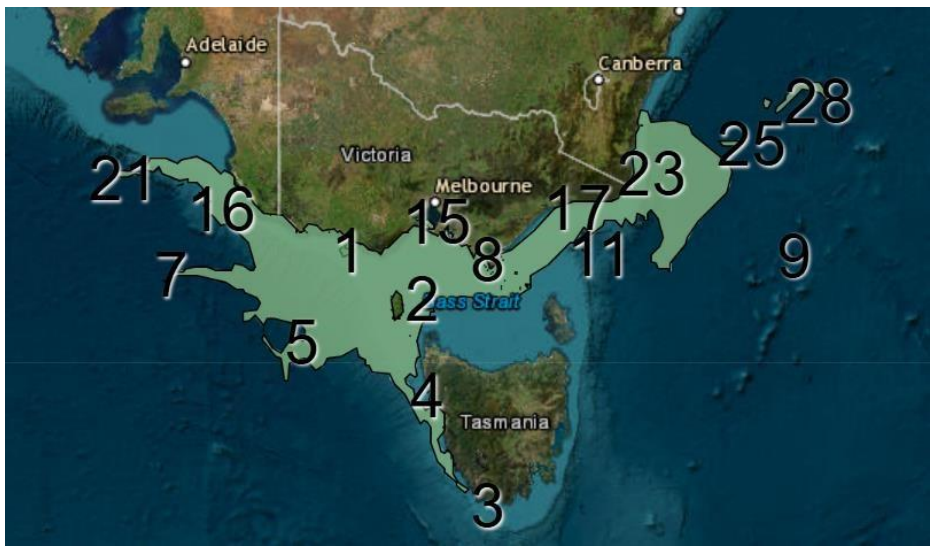
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Department of Climate Change, Energy, the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.




*Monitoring EMBA*

East Coast Project Monitoring Area PMST Report

Report created: 07-May-2025


Summary

Details

Matters of NES

Other Matters Protected by the EPBC Act

Extra Information

Caveat

Acknowledgements

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | 1 |
| National Heritage Places: | 5 |
| Wetlands of International Importance (Ramsar | 7 |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | 2 |
| Listed Threatened Ecological Communities: | 23 |
| Listed Threatened Species: | 210 |
| Listed Migratory Species: | 88 |

## Other Matters Protected by the EPBC Act

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

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

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

| | |
|---|---|
| Commonwealth Lands: | 88 |
| Commonwealth Heritage Places: | 13 |
| Listed Marine Species: | 148 |
| Whales and Other Cetaceans: | 33 |
| Critical Habitats: | 1 |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | 15 |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

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

| | |
|---|---|
| State and Territory Reserves: | 262 |

| | |
|---|---|
| Regional Forest Agreements: | 6 |
| Nationally Important Wetlands: | 45 |
| EPBC Act Referrals: | 353 |
| Key Ecological Features (Marine): | 6 |
| Biologically Important Areas: | 52 |
| Bioregional Assessments: | 1 |
| Geological and Bioregional Assessments: | None |

# Details

## Matters of National Environmental Significance

| World Heritage Properties | | [ Resource Information ] |
|---|---|---|
| Name | State | Legal Status |
| Tasmanian Wilderness | TAS | Declared property |

| National Heritage Places | | [ Resource Information ] |
|---|---|---|
| Name | State | Legal Status |
| Historic | | |
| Great Ocean Road and Scenic Environs | VIC | Listed place |
| Point Nepean Defence Sites and Quarantine Station Area | VIC | Listed place |
| Quarantine Station and Surrounds | VIC | Within listed place |
| Indigenous | | |
| Western Tasmania Aboriginal Cultural Landscape | TAS | Listed place |
| Natural | | |
| Tasmanian Wilderness | TAS | Listed place |

| Wetlands of International Importance (Ramsar Wetlands) | [ Resource Information ] |
|---|---|
| Ramsar Site Name | Proximity |
| Corner inlet | Within Ramsar site |
| Gippsland lakes | Within Ramsar site |
| Glenelg estuary and discovery bay wetlands | Within Ramsar site |
| Lavinia | Within Ramsar site |
| Piccaninnie ponds karst wetlands | Within Ramsar site |

| | |
|---|---|
| Port phillip bay (western shoreline) and bellarine peninsula | Within Ramsar site |
| Western port | Within Ramsar site |

## Commonwealth Marine Area [ Resource Information ]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

| Feature Name |
|---|
| Commonwealth Marine Areas (EPBC Act) |

| Feature Name |
|---|
| Commonwealth Marine Areas (EPBC Act) |

## Listed Threatened Ecological Communities [ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

| Community Name | Threatened Category | Presence Text |
|---|---|---|
| Alpine Sphagnum Bogs and Associated Fens | Endangered | Community may occur within area |
| Araluen Scarp Grassy Forest | Endangered | Community may occur within area |
| Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community | Endangered | Community likely to occur within area |
| Brogo Vine Forest of the South East Corner Bioregion | Endangered | Community likely to occur within area |
| Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community | Endangered | Community likely to occur within area |
| Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland | Endangered | Community may occur within area |
| Giant Kelp Marine Forests of South East Australia | Endangered | Community may occur within area |
| Gippsland Red Gum (Eucalyptus tereticornis subsp. mediana) Grassy Woodland and Associated Native Grassland | Critically Endangered | Community likely to occur within area |

| | | |
|---|---|---|
| Grassy Eucalypt Woodland of the Victorian Volcanic Plain | Critically Endangered | Community known to occur within area |
| Illawarra and south coast lowland forest and woodland ecological community | Critically Endangered | Community may occur within area |
| Karst springs and associated alkaline fens of the Naracoorte Coastal Plain Bioregion | Endangered | Community likely to occur within area |
| King Island scrub complex | Endangered | Community likely to occur within area |
| Littoral Rainforest and Coastal Vine Thickets of Eastern Australia | Critically Endangered | Community likely to occur within area |

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| BIRD | | |

| Community Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Lowland Grassy Woodland in the South East Corner Bioregion | Critically Endangered | Community likely to occur within area |
| Lowland Native Grasslands of Tasmania | Critically Endangered | Community likely to occur within area |
| Natural Damp Grassland of the Victorian Coastal Plains | Critically Endangered | Community likely to occur within area |
| Natural Temperate Grassland of the Victorian Volcanic Plain | Critically Endangered | Community likely to occur within area |
| River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria | Critically Endangered | Community likely to occur within area |
| Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains | Vulnerable | Community likely to occur within area |
| Subtropical and Temperate Coastal Saltmarsh | Critically Endangered | Community likely to occur within area |
| Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (Eucalyptus ovata / E. brookeriana) | Critically Endangered | Community likely to occur within area |
| Tasmanian white gum (Eucalyptus viminalis) wet forest | Critically Endangered | Community likely to occur within area |
| White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | Critically Endangered | Community likely to occur within area |

| Listed Threatened Species | | [ Resource Information ] |
| --- | --- | --- |
| Acanthiza pusilla magnirostris | | |
| King Island Brown Thornbill, Brown Thornbill (King Island) [91709] | Endangered | Species or species habitat known to occur within area |
| Acanthornis magna greeniana | | |

| | | |
|---|---|---|
| King Island Scrubtit, Scrubtit (King Island) [82329] | Critically Endangered | Species or species habitat known to occur within area |
| [Anthochaera phrygia](#)<br>Regent Honeyeater [82338] | Critically Endangered | Species or species habitat known to occur within area |

| | | |
|---|---|---|
| [Aphelocephala leucopsis](#)<br>Southern Whiteface [529] | | Species or species<br>Breeding likely to occur within area |
| [Aquila audax fleayi](#)<br>Tasmanian Wedge-tailed Eagle, Wedgetailed Eagle (Tasmanian) [64435] | Endangered | |
| [Ardenna grisea](#)<br>Sooty Shearwater [82651] | Vulnerable | Breeding known to occur within area |
| [Arenaria interpres](#)<br>Ruddy Turnstone [872] | Vulnerable | |
| [Botaurus poiciloptilus](#)<br>Australasian Bittern [1001] | Endangered | Roosting known to occur within area |
| [Calidris acuminata](#)<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat known to occur within area |
| [Calidris canutus](#)<br>Red Knot, Knot [855] | Vulnerable | |
| [Calidris ferruginea](#)<br>Curlew Sandpiper [856] | Critically Endangered | |
| [Calidris tenuirostris](#)<br>Great Knot [862] | Vulnerable | Roosting known to occur within area |
| [Callocephalon fimbriatum](#) Gang-gang Cockatoo [768] | Endangered | |
| [Calyptorhynchus banksii graptogyne](#)<br>South-eastern Red-tailed Black-Cockatoo [25982] | Endangered | Species or species habitat known to occur within area |
| [Calyptorhynchus lathami lathami](#) | | |

habitat likely to occur within area

| y | Presence Text |
| --- | --- |
| | Vulnerable |
| | Species or species habitat known to occur within area |
| | Roosting known to occur within area |
| | Species or species habitat known to occur within area |
| | Foraging, feeding or related behaviour known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |

| | | |
|---|---|---|
| | | Species or species |
| South-eastern Glossy Black-Cockatoo [67036] | Vulnerable | Species or species habitat known to occur within area |
| Ceyx azureus diemenensis<br>Tasmanian Azure Kingfisher [25977] | Endangered | |
| | | habitat known to occur within area |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | |
| | | Species or species habitat known to occur within area |
| Charadrius mongolus<br>Lesser Sand Plover, Mongolian Plover [879] | Endangered | |
| Climacteris picumnus victoriae<br>Brown Treecreeper (south-eastern) [67062] | Vulnerable | Roosting known to occur within area |
| Dasyornis brachypterus<br>Eastern Bristlebird [533] | Endangered | Species or species habitat known to occur within area |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Species or species habitat known to occur within area |
| Diomedea antipodensis gibsoni<br>Gibson's Albatross [82270] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea sanfordi | | |

Presence Text

| | | |
|---|---|---|
| Vulnerable | | |
| Northern Royal Albatross [64456] | Endangered | Species or species Foraging, feeding or related behaviour likely to occur within area |
| Falco hypoleucos<br>Grey Falcon [929] | | habitat likely to occur within area |
| Fregetta grallaria grallaria<br>White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438] | Vulnerable | Species or species habitat likely to occur within area |
| Gallinago hardwickii<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area |
| Grantiella picta<br>Painted Honeyeater [470] | Vulnerable | Species or species habitat known to occur within area |
| Halobaena caerulea Blue Petrel [1059] | Vulnerable | |
| Hirundapus caudacutus<br>White-throated Needletail [682] | Vulnerable | Species or species habitat may occur within area<br>Roosting known to occur within area |
| Lathamus discolor Swift Parrot [744] | Critically Endangered | Species or species habitat known to occur within area |
| Leipoa ocellata Malleefowl [934] | Vulnerable | Species or species habitat likely to occur within area |
| Limosa lapponica baueri<br>Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380] | Endangered | Species or species habitat known to occur within area |
| Limosa limosa<br>Black-tailed Godwit [845] | Endangered | Roosting known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| [Macronectes giganteus](#)<br>Southern Giant-Petrel, Southern Giant | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Petrel [1060] | | |
| | | Species or species |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Vulnerable | | |
| [Macronectes halli](#)<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Melanodryas cucullata cucullata](#)<br>South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093] | Endangered | Species or species habitat may occur within area |
| [Neophema chrysogaster](#)<br>Orange-bellied Parrot [747] | Critically Endangered | Breeding known to occur within area |
| [Neophema chrysostoma](#) Blue-winged Parrot [726] | Vulnerable | Species or species habitat known to occur within area |
| [Numenius madagascariensis](#)<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| [Pachyptila turtur subantarctica](#) Fairy Prion (southern) [64445] | Vulnerable | Species or species habitat known to occur within area |
| [Pedionomus torquatus](#) Plains-wanderer [906] | Critically Endangered | Species or species habitat likely to occur within area |
| [Phoebetria fusca](#)<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| [Platycercus caledonicus brownii](#)<br>Green Rosella (King Island) [67041] | Vulnerable | Species or species habitat known to occur within area |
| [Pluvialis squatarola](#)<br>Grey Plover [865] | Vulnerable | Roosting known to occur within area |

| | | |
|---|---|---|
| Pterodroma heraldica<br>Herald Petrel [66973] | Critically Endangered | Species or species habitat may occur within area |
| Pterodroma leucoptera leucoptera<br>Gould's Petrel, Australian Gould's Petrel [26033] | Endangered | Breeding known to occur within area |
| Pterodroma mollis<br>Soft-plumaged Petrel [1036] | | Breeding known to occur within area |
| Pterodroma neglecta neglecta<br>Kermadec Petrel (western) [64450] | Vulnerable | |
| | | Foraging, feeding or related behaviour may occur within area |
| Pycnoptilus floccosus Pilotbird [525] | Vulnerable | |
| | | Species or species habitat known to occur within area |
| Rostratula australis<br>Australian Painted Snipe [77037] | Endangered | |
| | | Species or species habitat known to occur within area |
| Stagonopleura guttata<br>Diamond Firetail [59398] | Vulnerable | |
| | | Species or species habitat known to occur within area |
| Sternula albifrons<br>Little Tern [82849] | Vulnerable | |
| | | Breeding known to occur within area |
| Sternula nereis nereis<br>Australian Fairy Tern [82950] | Vulnerable | |
| | | Species or species habitat known to occur within area |
| Strepera fuliginosa colei<br>Black Currawong (King Island) [67113] | Vulnerable | |
| | | Breeding likely to occur within area |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | |
| | | Foraging, feeding or related behaviour likely to occur within area |

Presence Text

| | | |
|---|---|---|
| Vulnerable | | |
| Thalassarche bulleri platei<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| Thalassarche eremita<br>Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Thinornis cucullatus cucullatus | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Eastern Hooded Plover, Eastern Hooded Plover [90381] | Vulnerable | Species or species habitat known to occur within area |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat known to occur within area |
| Tyto novaehollandiae castanops (Tasmanian population)<br>Masked Owl (Tasmanian) [67051] | Vulnerable | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Xenus cinereus<br>Terek Sandpiper [59300] | Vulnerable | Roosting known to occur within area |
| CRUSTACEAN | | |
| Euastacus bidawalus<br>Bidhawal Crayfish, Bidawal Crayfish, East Gippsland Spiny Crayfish [83136] | Endangered | Species or species habitat known to occur within area |
| Euastacus bispinosus<br>Glenelg Spiny Freshwater Crayfish, Pricklyback [81552] | Endangered | Species or species habitat known to occur within area |
| Euastacus diversus<br>Orbost Spiny Crayfish [66782] | Endangered | Species or species habitat may occur within area |
| FISH | | |
| Brachiopsilus ziebelli<br>Ziebell's Handfish, Waterfall Bay Handfish [83757] | Vulnerable | Species or species habitat likely to occur within area |
| Epinephelus daemelii<br>Black Rockcod, Black Cod, Saddled [68449] | Vulnerable Rockcod | Species or species habitat likely to occur within area |
| Gadopsis sp. SWV<br>Western Victorian Blackfish [90722] | Endangered | Species or species habitat likely to occur within area |
| Galaxiella pusilla<br>Eastern Dwarf Galaxias, Dwarf Galaxias [56790] | Endangered | Species or species habitat known to occur within area |
| Hoplostethus atlanticus<br>Orange Roughy, Deep-sea Perch, Red Roughy [68455] | Conservation Dependent | Species or species habitat likely to occur within area |
| Mordacia praecox | | |

| | | |
|---|---|---|
| Non-parasitic Lamprey, Precocious [81530]<br><br>Nannoperca obscura | Endangered Lamprey | Species or species habitat likely to occur within area |
| Yarra Pygmy Perch [26177] | Endangered | Species or species habitat known to occur within area |
| **Scientific Name** | **Threatened Category** | **Presence Text** |
| Nannoperca variegata<br>Variegated Pygmy Perch, Ewens Pygmy Perch, Golden Pygmy Perch [26178] | Vulnerable | Species or species habitat known to occur within area |
| Prototroctes maraena<br>Australian Grayling [26179] | Vulnerable | Species or species habitat known to occur within area |
| Rexea solandri (eastern Australian population)<br>Eastern Gemfish [76339] | Conservation Dependent | Species or species habitat likely to occur within area |
| Seriolella brama<br>Blue Warehou [69374] | Conservation Dependent | Species or species habitat known to occur within area |
| Thymichthys politus Red Handfish [83756] | Critically Endangered | Species or species habitat may occur within area |
| **FROG** | | |
| Heleioporus australiacus flavopunctatus<br>Southern Owl Frog, Southern Giant Burrowing Frog [92014] | Endangered | Species or species habitat known to occur within area |

| | | |
|---|---|---|
| Litoria aurea<br>Green and Golden Bell Frog [1870] | Vulnerable | Species or species habitat known to occur within area |
| Litoria raniformis<br>Southern Bell Frog, Growling Grass Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828] | Vulnerable | Species or species habitat known to occur within area |
| Scientific Name | Threatened Category | Presence Text |
| Synemon plana<br>Golden Sun Moth [25234] | Vulnerable | Species or species habitat may occur within area |
| MAMMAL | | |
| Litoria watsoni<br>Southern Heath Frog, Watson's Tree Frog [91509] | Endangered | Species or species habitat known to occur within area |
| Mixophyes balbus<br>Stuttering Frog, Southern Barred Frog (in Victoria) [1942] | Vulnerable | Species or species habitat may occur within area |
| Uperoleia martini<br>Martin's Toadlet [1873] | Endangered | Species or species habitat known to occur within area |
| INSECT | | |
| Antechinus minimus maritimus<br>Swamp Antechinus (mainland) [83086] | Vulnerable | Species or species habitat known to occur within area |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | |

| | | |
|---|---|---|
| | | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | |
| | | Foraging, feeding or related behaviour known to occur within area |
| Chalinolobus dwyeri<br>Large-eared Pied Bat, Large Pied Bat [183] | Endangered | |
| | | Species or species habitat may occur within area Dasyurus maculatus maculatus (SE mainland population) |
| Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184] | Endangered | Species or species habitat known to occur within area |
| Dasyurus maculatus maculatus (Tasmanian population) | | |
| Spotted-tail Quoll, Spot-tailed Quoll, Tiger Quoll (Tasmanian population) [75183] | Vulnerable | Species or species habitat known to occur within area |
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | |
| | | Breeding known to occur within area |
| Isoodon obesulus obesulus<br>Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (southeastern) [68050] | Endangered | Species or species habitat known to occur within area |
| Mastacomys fuscus mordicus<br>Broad-toothed Rat (mainland), Tooarrana [87617] | Endangered | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Miniopterus orianae bassanii<br>Southern Bent-wing Bat [87645] | Critically Endangered | Breeding known to occur within area |
| Mirounga leonina<br>Southern Elephant Seal [26] | Vulnerable | Breeding may occur within area |
| Neophoca cinerea<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat known to occur within area |
| Perameles gunnii Victorian subspecies<br>Eastern Barred Bandicoot (Mainland) [88020] | Endangered | Translocated population known to occur within area |
| Petauroides volans<br>Greater Glider (southern and central) [254] | Endangered | Species or species habitat known to occur within area |
| Petaurus australis australis<br>Yellow-bellied Glider (south-eastern) [87600] | Vulnerable | Species or species habitat known to occur within area |
| Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)<br>Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104] | Endangered | Species or species habitat known to occur within area |
| Potorous longipes<br>Long-footed Potoroo [217] | Endangered | Species or species habitat known to occur within area |
| Potorous tridactylus trisulcatus<br>Long-nosed Potoroo (southern mainland) [86367] | Vulnerable | Species or species habitat known to occur within area |
| Pseudomys fumeus<br>Smoky Mouse, Konoom [88] | Endangered | Species or species habitat may occur within area |
| Pseudomys novaehollandiae | | |

| | | |
|---|---|---|
| New Holland Mouse, Pookila [96] | Vulnerable | Species or species habitat known to occur within area |
| Scientific Name | Threatened Category | Presence Text |
| | | Species or species habitat likely to occur within area |
| | | Species or species |
| Scientific Name | Threatened Category | Presence Text |
| Pseudomys shortridgei<br>Heath Mouse, Dayang, Heath Rat [77] | Endangered | Species or species habitat known to occur within area |
| Pteropus poliocephalus<br>Grey-headed Flying-fox [186] | Vulnerable | Roosting known to occur within area |
| Sarcophilus harrisii<br>Tasmanian Devil [299] | Endangered | |
| | | Species or species habitat likely to occur within area |
| OTHER | | |
| Hyridella glenelgensis<br>Glenelg Freshwater Mussel [82953] | Critically Endangered | Species or species habitat may occur within area |
| PLANT | | |
| Acacia caerulescens<br>Limestone Blue Wattle, Buchan Blue, Buchan Blue Wattle [21883] | Vulnerable | Species or species habitat known to occur within area |
| Acacia constablei<br>Narrabarba Wattle [10798] | Critically Endangered | Species or species habitat known to occur within area |
| Acacia georgensis<br>Bega Wattle [9848] | Vulnerable | Species or species habitat known to occur |

| | | |
|---|---|---|
| | | within area |
| Acacia lanigera var. gracilipes [31652] | Endangered | Species or species habitat may occur within area |
| Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215] | Vulnerable | Species or species habitat known to occur within area |
| Astelia australiana Tall Astelia [10851] | Vulnerable | Species or species habitat may occur within area |
| Astrotricha crassifolia Thick-leaf Star-hair [10352] | Vulnerable | Species or species habitat may occur within area |
| Astrotricha sp. Howe Range (D.E.Albrecht 1054) Long-leaf Star-hair [85676] | Critically Endangered | |
| Astrotricha sp. Wingan Inlet (J.A.Jeanes 2268) Wingan Star-hair [85675] | Endangered | habitat known to occur within area |
| Caladenia calcicola Limestone Spider-orchid [10065] | Vulnerable | Species or species habitat likely to occur within area |
| Caladenia colorata Coloured Spider-orchid, Small Western Spider-orchid, Painted Spider-orchid [54999] | Endangered | Species or species habitat known to occur within area |
| Caladenia concolor Crimson Spider-orchid, Maroon Spiderorchid [5505] | Vulnerable | Species or species habitat may occur within area |
| Caladenia dienema Windswept Spider-orchid [64858] | Endangered | Species or species habitat known to occur within area |

| | | |
|---|---|---|
| [Caladenia hastata](#)<br>Melblom's Spider-orchid [16118] | Endangered | Species or species habitat likely to occur within area<br>Scientific Name<br>Threatened Category<br>Presence Text |
| [Caladenia insularis](#)<br>French Island Spider-orchid [24372] | Vulnerable | Species or species habitat likely to occur within area |
| [Caladenia orientalis](#)<br>Eastern Spider Orchid [83410] | Endangered | Species or species habitat known to occur within area |
| [Caladenia ornata](#)<br>Ornate Pink Fingers [76213] | Vulnerable | Species or species habitat known to occur within area |
| [Caladenia richardsiorum](#)<br>Little Dip Spider-orchid [55018] | Endangered | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | Endangered | Species or species habitat likely to occur within area |
| Caladenia robinsonii<br>Frankston Spider-orchid [24375] | | Species or species habitat may occur within area |
| Caladenia tensa<br>Greencomb Spider-orchid, Rigid Spiderorchid [24390] | Endangered | habitat may occur within area |
| Caladenia tessellata<br>Thick-lipped Spider-orchid, Daddy Longlegs [2119] | Vulnerable | Species or species habitat known to occur within area |
| Calochilus pulchellus<br>Pretty Beard Orchid, Pretty Beard-orchid [84677] | Endangered | Species or species habitat may occur within area |
| Centrolepis pedderensis<br>Pedder Centrolepis, Pedder Bristlewort [12647] | Endangered | Species or species habitat likely to occur within area |
| Commersonia prostrata Dwarf Kerrawang [87152] | Endangered | Species or species habitat likely to occur within area |
| Correa baeuerlenii<br>Chef's Cap [17007] | Vulnerable | Species or species habitat known to occur within area |
| Correa lawrenceana var. genoensis<br>Genoa River Correa [66626] | Endangered | habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | Endangered | Species or species |
| Corunastylis vernalis listed as Genoplesium vernale | | Species or species habitat may occur within area |
| East Lynne Midge-orchid [78699] | Vulnerable | Species or species habitat |
| | | Species or species habitat likely to occur within area |
| | | Species or species may occur within area |
| Cryptostylis hunteriana Leafless Tongue-orchid [19533] | Vulnerable | Species or species habitat known to occur within area |
| Deyeuxia ramosa Climbing Bent-grass [87970] | Critically Endangered | |
| Dianella amoena Matted Flax-lily [64886] | | |
| Diuris basaltica Small Golden Moths Orchid, Early Golden Moths [64654] | Endangered | habitat may occur within area |
| Dodonaea procumbens Trailing Hop-bush [12149] | Vulnerable | Species or species habitat may occur within area |
| Eucalyptus stenostoma Jillaga Ash [3976] | Endangered | Species or species habitat may occur within area |
| | | habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | Endangered | Species or species |
| Eucalyptus strzeleckii Strzelecki Gum [55400] | Vulnerable | Species or species habitat known to occur within area |
| Euphrasia collina subsp. muelleri Purple Eyebright, Mueller's Eyebright [16151] | Endangered | Species or species habitat known to occur within area |
| Glycine latrobeana Clover Glycine, Purple Clover [13910] | Vulnerable | Species or species habitat known to occur within area |
| Grevillea infecunda Anglesea Grevillea [22026] | Vulnerable | Species or species habitat known to occur within area |
| Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636] | Vulnerable | Species or species habitat known to occur within area |
| Hiya distans listed as Hypolepis distans Scrambling Ground-fern [92548] | Endangered | Species or species habitat known to occur within area |
| Ixodia achillaeoides subsp. arenicola Sand Ixodia, Ixodia [21474] | Vulnerable | |
| Lachnagrostis adamsonii Adamson's Blown-grass, Adamson's Blowngrass [76211] | | |
| Leiocarpa gatesii | | habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | Endangered | Species or species |
| Wrinkled Buttons [76212] | Vulnerable | |
| | | habitat known to occur within area |
| Lepidium aschersonii<br>Spiny Peppercress [10976] | Vulnerable | |
| | | Species or species habitat known to occur within area |
| Lepidium hyssopifolium<br>Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542] | Endangered | |
| | | Species or species habitat known to occur within area |
| | | Species or species |
| Leucochrysum albicans subsp. tricolor | Hoary Sunray, Grassland Paper-daisy [89104] | |
| Lomatia tasmanica<br>King's Lomatia [3745] | | |
| Persicaria elatior<br>Knotweed, Tall Knotweed [5831] | | |
| Phaius australis<br>Lesser Swamp-orchid [5872] | | |
| Pimelea spinescens subsp. spinescens<br>Plains Rice-flower, Spiny Rice-flower, Prickly Pimelea [21980] | | |
| Pomaderris cotoneaster<br>Cotoneaster Pomaderris [2043] | | |
| | | habitat likely to occur within area |
| | | Species or species |
| | | habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Endangered Species or species | | |
| | Endangered | Species or species habitat may occur within area |
| | Critically Endangered | Species or species habitat likely to occur within area |
| | Vulnerable | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Endangered Species or species | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Endangered Species or species | | |
| Critically Endangered | | Species or species habitat likely to occur within area |
| Endangered | | Species or species habitat may occur within area |
| [Pomaderris halmaturina subsp. halmaturina](#)<br>Kangaroo Island Pomaderris [21964] | Vulnerable | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | Endangered | Species or species |
| | | Species or species |
| | | habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | | Species or species habitat known to occur within area |
| Pomaderris parrisiae<br>Parris' Pomaderris [22119] | Vulnerable | Species or species |
| Prasophyllum diversiflorum<br>Gorae Leek-orchid [13210] | Endangered | habitat likely to occur within area |
| Prasophyllum favonium<br>Western Leek-orchid [64949] | Critically Endangered | Species or species habitat may occur within area |
| Prasophyllum frenchii<br>Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704] | Endangered | Species or species habitat known to occur within area |
| Prasophyllum litorale listed as Prasophyllum littorale<br>Coastal Leek Orchid [55234] | Critically Endangered | Species or species habitat known to occur within area |
| Prasophyllum pulchellum<br>Pretty Leek-orchid [64953] | Critically Endangered | Species or species habitat may occur within area |
| Prasophyllum secutum<br>Northern Leek-orchid [64954] | Endangered | Species or species habitat likely to occur within area |
| Prasophyllum spicatum<br>Dense Leek-orchid [55146] | Vulnerable | Species or species habitat known to occur within area |
| Prasophyllum suaveolens<br>Fragrant Leek-orchid [64956] | Endangered | Species or species habitat may occur within area |

| | | |
|---|---|---|
| Pseudocephalozia paludicola<br>Alpine Leafy Liverwort [66441] | Vulnerable | Species or species habitat likely to occur within area |
| Pterostylis chlorogramma<br>Green-striped Greenhood [56510] | Vulnerable | Species or species habitat known to occur within area |
| Pterostylis cucullata<br>Leafy Greenhood [15459] | Vulnerable | |
| Pterostylis tenuissima<br>Swamp Greenhood, Dainty Swamp Orchid [13139] | Vulnerable | habitat known to occur within area |
| Pterostylis ziegeleri<br>Grassland Greenhood, Cape Portland Greenhood [64971] | Vulnerable | Species or species habitat may occur within area |
| Rhodamnia rubescens<br>Scrub Turpentine, Brown Malletwood [15763] | Critically Endangered | Species or species habitat likely to occur within area |
| Rutidosis leptorhynchoides<br>Button Wrinklewort [67251] | Endangered | Species or species habitat may occur within area |
| Senecio macrocarpus<br>Large-fruit Fireweed, Large-fruit Groundsel [16333] | Vulnerable | Species or species habitat likely to occur within area |
| Senecio psilocarpus<br>Swamp Fireweed, Smooth-fruited Groundsel [64976] | Vulnerable | Species or species habitat known to occur within area |
| Spyridium cinereum<br>Tiny Spyridium [13564] | Endangered | Species or species habitat known to occur within area |
| Scientific Name | Threatened Category | Presence Text |

| Scientific NamThelymitra orientalie s | Threatened CategoryCritically Endangered | Presence Text |
| --- | --- | --- |
| Hoary Sun-orchid [88011] | Vulnerable | Species or species<br>Species or species<br>habitat known to<br>habitat known to<br>occur within<br>areaoccur within area |
| Thesium australe<br>Austral Toadflax, Toadflax [15202] | | |
| | | Species or species<br>Species or species<br>habitat known to<br>occur within area |
| Westringia davidii<br>[19079] | Vulnerable | |
| | | Species or species<br>habitat may occur<br>within area |
| Xerochrysum palustre<br>Swamp Everlasting, Swamp Paper Daisy [76215] | Vulnerable | |
| | | Species or species<br>habitat known to<br>occur within area |
| Zieria tuberculata<br>Warty Zieria [56736] | Vulnerable | |
| | | Species or species<br>habitat known to<br>occur within area |
| REPTILE | | |
| Taraxacum cygnorum<br>Coast Dandelion, Native Dandelion [2508] | Vulnerable | Species or species<br>habitat known to<br>occur within area |
| Thelymitra epipactoides<br>Metallic Sun-orchid [11896] | Endangered | Species or species<br>habitat known to<br>occur within area |
| Thelymitra matthewsii<br>Spiral Sun-orchid [4168] | Endangered | Species or species<br>habitat known to<br>occur within area |
| | | Caretta caretta |

| | | |
|---|---|---|
| Loggerhead Turtle [1763] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Carinascincus orocryptus<br>Heath Cool-skink, Mountain Skink [90209] | Endangered | Species or species habitat likely to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Delma impar<br>Striped Legless Lizard, Striped Snakelizard [1649] | Vulnerable | Species or species habitat likely to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Foraging, feeding or related behaviour known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Eretmochelys imbricata Hawksbill Turtle [1766] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Lissolepis coventryi Swamp Skink, Eastern Mourning Skink [84053] | Endangered | Species or species habitat known to occur within area |
| Natator depressus Flatback Turtle [59257] | Vulnerable | Species or species habitat known to occur within area |
| Tympanocryptis pinguicolla Victorian Grassland Earless Dragon [66727] | Critically Endangered | Species or species habitat likely to occur within area |
| SHARK | | |
| Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751] | Critically Endangered | Congregation or aggregation known to occur within area |
| Carcharodon carcharias White Shark, Great White Shark [64470] | Vulnerable | Breeding known to occur within area |
| Centrophorus harrissoni Harrisson's Dogfish, Endeavour Dogfish, Dumb Gulper Shark, Harrison's Deepsea Dogfish [68444] | Conservation Dependent | Species or species habitat likely to occur within area |
| Centrophorus uyato Little Gulper Shark [68446] | Conservation Dependent | Species or species habitat likely to occur within area |
| Galeorhinus galeus School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453] | Conservation Dependent | Species or species habitat likely to occur within area |
| Rhincodon typus Whale Shark [66680] | | |

| Species or species | | |
|---|---|---|
| Scientific Name | Threatened Category | Presence Text |
| | | habitat may occur within area |
| [Anous stolidus](#) | | |

| Listed Migratory Species | | [ Resource Information ] |
|---|---|---|
| Scientific Name | Threatened Category | Presence Text |
| Migratory Marine Birds | | |
| Common Noddy [825] | | Species or species habitat likely to occur within area |
| [Apus pacificus](#) Fork-tailed Swift [678] | | Species or species habitat likely to occur within area |
| [Ardenna carneipes](#) Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Species or species habitat known to occur within area |
| [Ardenna grisea](#) Sooty Shearwater [82651] | Vulnerable | Breeding known to occur within area |
| [Ardenna pacifica](#) Wedge-tailed Shearwater [84292] | | Breeding known to occur within area |
| [Ardenna tenuirostris](#) Short-tailed Shearwater [82652] | | Breeding known to occur within area |
| [Diomedea antipodensis](#) Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea epomophora](#) Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea exulans](#) Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour |

| | | |
|---|---|---|
| | | likely to occur within area |
| Scientific Name | Threatened Category | Presence Text |
| Diomedea sanfordi<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Fregata ariel<br>Lesser Frigatebird, Least Frigatebird [1012] | | Species or species habitat may occur within area |
| Fregata minor<br>Great Frigatebird, Greater Frigatebird [1013] | | Species or species habitat may occur within area |
| Hydroprogne caspia Caspian Tern [808] | | Breeding known to occur within area |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Phaethon lepturus<br>White-tailed Tropicbird [1014] | | Species or species habitat may occur within area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| Sternula albifrons<br>Little Tern [82849] | Vulnerable | Breeding known to occur within area |

| | | |
|---|---|---|
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| Scientific Name | Threatened Category | Presence Text |
| Thalassarche eremita<br>Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| [Thalassarche steadi](#) White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |

Migratory Marine Species

[Balaenoptera bonaerensis](#)

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely to occur within area |
| [Balaenoptera borealis](#) Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| [Balaenoptera edeni](#) Bryde's Whale [35] | | Species or species habitat likely to occur within area |
| [Balaenoptera musculus](#) Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| [Balaenoptera physalus](#) Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| [Caperea marginata](#) Pygmy Right Whale [39] | | Foraging, feeding or related behaviour likely to occur within area |
| [Carcharhinus longimanus](#) | | |

| | | |
|---|---|---|
| Oceanic Whitetip Shark [84108] | | Species or species habitat may occur within area |
| [Carcharias taurus](#)<br>Grey Nurse Shark [64469] | | Congregation or aggregation known to occur within area |
| [Carcharodon carcharias](#)<br>White Shark, Great White [64470] | Vulnerable Shark | Breeding known to occur within area |
| [Caretta caretta](#)<br>Loggerhead Turtle [1763] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| [Chelonia mydas](#)<br>Green Turtle [1765] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| [Dermochelys coriacea](#)<br>Leatherback Turtle, Leathery Turtle, Luth Endangered [1768] | | Foraging, feeding or related behaviour known to occur within area |
| [Eretmochelys imbricata](#) Hawksbill Turtle [1766] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| [Eubalaena australis as Balaena glacialis australis](#)<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Isurus oxyrinchus](#)<br>Shortfin Mako, Mako Shark [79073] | | Species or species habitat likely to occur within area |
| [Lagenorhynchus obscurus](#)<br>Dusky Dolphin [43] | | |

| | | |
|---|---|---|
| | | Species or species habitat likely to occur within area |
| [Lamna nasus](#)<br>Porbeagle, Mackerel Shark [83288] | | Species or species habitat likely to occur within area |
| [Megaptera novaeangliae](#)<br>Humpback Whale [38] | | Foraging, feeding or related behaviour known to occur within area |
| [Mobula birostris as Manta birostris](#)<br>Giant Manta Ray [90034] | | Species or species habitat known to occur within area |
| [Natator depressus](#)<br>Flatback Turtle [59257] | Vulnerable | Species or species habitat known to occur within area |
| [Orcinus orca](#)<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area |
| [Physeter macrocephalus](#)<br>Sperm Whale [59] | | Foraging, feeding or related behaviour known to occur within area |
| [Rhincodon typus](#)<br>Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |
| **Migratory Terrestrial Species** | | |
| [Cuculus optatus](#)<br>Oriental Cuckoo, Horsfield's Cuckoo [86651] | | Species or species habitat known to occur within area |
| [Hirundapus caudacutus](#)<br>White-throated Needletail [682] | Vulnerable | |

| | | |
|---|---|---|
| | | Roosting known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Motacilla cinerea](#) Grey Wagtail [642] | | Species or species habitat known to occur within area |
| [Motacilla flava](#) Yellow Wagtail [644] | | Species or species habitat known to occur within area |

| Migratory Wetlands Species | | |
|---|---|---|
| [Actitis hypoleucos](#) Common Sandpiper [59309] | | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Arenaria interpres](#) Ruddy Turnstone [872] | Vulnerable | Roosting known to occur within area |
| [Calidris acuminata](#) Sharp-tailed Sandpiper [874] | Vulnerable | Roosting known to occur within area |
| [Calidris alba](#) Sanderling [875] | | Roosting known to occur within area |
| [Calidris canutus](#) Red Knot, Knot [855] | Vulnerable | Species or species habitat known to occur within area |
| [Calidris ferruginea](#) Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area |
| [Calidris melanotos](#) | | |

| | | |
|---|---|---|
| Pectoral Sandpiper [858] | | Species or species habitat known to occur within area |
| [Calidris pugnax as Philomachus pugnax](#)<br>Ruff [91256] | | Roosting known to occur within area |
| [Calidris ruficollis](#)<br>Red-necked Stint [860] | | Roosting known to occur within area |
| [Calidris subminuta](#)<br>Long-toed Stint [861] | | Species or species habitat known to occur within area |
| [Calidris tenuirostris](#)<br>Great Knot [862] | Vulnerable | Roosting known to occur within area |
| [Charadrius bicinctus](#)<br>Double-banded Plover [895] | | Roosting known to occur within area |
| [Charadrius leschenaultii](#)<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat known to occur within area |
| [Charadrius mongolus](#)<br>[879] | | Roosting known to occur within area |
| [Gallinago hardwickii](#)<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area |
| [Gallinago megala](#)<br>Swinhoe's Snipe [864] | | Roosting likely to occur within area |
| [Gallinago stenura](#)<br>Pin-tailed Snipe [841] | | Roosting known to occur within area |
| [Limicola falcinellus](#)<br>Broad-billed Sandpiper [842] | | Roosting known to occur within area |

| | | | |
|---|---|---|---|
| Limosa lapponica<br>Bar-tailed Godwit [844] | | Species or species habitat known to occur within area | Lesser Sand Plover, Mongolian Plover Endangered |
| Limosa limosa<br>Black-tailed Godwit [845] | Endangered | Roosting known to occur within area | |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area | |
| Numenius minutus<br>Little Curlew, Little Whimbrel [848] | | Roosting likely to occur within area | |
| Numenius phaeopus<br>Whimbrel [849] | | Roosting known to occur within area | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area |
| Phalaropus lobatus<br>Red-necked Phalarope [838] | | Roosting known to occur within area |
| Pluvialis fulva<br>Pacific Golden Plover [25545] | | Roosting known to occur within area |
| Pluvialis squatarola<br>Grey Plover [865] | Vulnerable | Roosting known to occur within area |
| Thalasseus bergii<br>Greater Crested Tern [83000] | | Breeding known to occur within area |
| Tringa brevipes<br>Grey-tailed Tattler [851] | | Roosting known to occur within area |
| Tringa glareola<br>Wood Sandpiper [829] | | Roosting known to occur within area |
| Tringa incana<br>Wandering Tattler [831] | | Roosting known to occur within area |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat known to occur within area |
| Tringa stagnatilis<br>Marsh Sandpiper, Little Greenshank [833] | | Roosting known to occur within area |
| Xenus cinereus<br>Terek Sandpiper [59300] | Vulnerable | Roosting known to occur within area |

## Other Matters Protected by the EPBC Act

| Commonwealth Lands | [ Resource Information ] |
| --- | --- |

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to

the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

| Commonwealth Land Name | State |
|---|---|
| **Communications, Information Technology and the Arts - Australian Postal Corporation** | |
| Commonwealth Land - Australian Postal Commission [12052] | NSW |
| **Communications, Information Technology and the Arts - Telstra Corporation Limited** | |
| Commonwealth Land - Australian Telecommunications Commission [15611] | NSW |
| Commonwealth Land - Australian Telecommunications Commission [12053] | NSW |
| Commonwealth Land - Telstra Corporation Limited [15888] | NSW |
| Commonwealth Land - Telstra Corporation Limited [12051] | NSW |
| **Defence** | |
| Defence - CROWS NEST CAMP - QUEENSCLIFF [21027] | VIC |
| Defence - CROWS NEST CAMP - QUEENSCLIFF [21028] | VIC |
| Defence - CROWS NEST CAMP - QUEENSCLIFF [21026] | VIC |
| Defence - CROWS NEST CAMP - QUEENSCLIFF [21029] | VIC |
| Defence - HMAS CERBERUS [20092] | VIC |
| Defence - HMAS CERBERUS [20099] | VIC |
| Defence - HMAS CERBERUS [20082] | VIC |
| Defence - HMAS CERBERUS [20083] | VIC |
| Defence - HMAS CERBERUS [20081] | VIC |
| Defence - HMAS CERBERUS [20086] | VIC |
| | VIC |
| | VIC |
| | VIC |
| | VIC |

| | |
|---|---|
| | VIC |
| Defence - HMAS CERBERUS [20087] | |
| Defence - HMAS CERBERUS [20098] | |
| Defence - HMAS CERBERUS [20093] | |
| | VIC |
| Defence - HMAS CERBERUS [20091] | |
| Defence - HMAS CERBERUS [20090] | |
| Defence - HMAS CERBERUS [20097] | |
| Commonwealth Land Name | State |
| Defence - HMAS CERBERUS [20096] | VIC |
| Defence - HMAS CERBERUS [20080] | VIC |
| Defence - HMAS CERBERUS [20085] | VIC |
| Defence - HMAS CERBERUS [20095] | VIC |
| Defence - HMAS CERBERUS [20094] | VIC |
| Defence - HMAS CERBERUS [20084] | VIC |
| Defence - HMAS CERBERUS [20088] | VIC |
| Defence - HMAS CERBERUS [20089] | VIC |
| Defence - HMAS CERBERUS [20104] | VIC |
| Defence - HMAS CERBERUS [20103] | VIC |
| Defence - HMAS CERBERUS [20102] | VIC |
| Defence - HMAS CERBERUS [20101] | VIC |
| Defence - HMAS CERBERUS [20100] | VIC |
| Defence - POINT WILSON EXPLOSIVES AREA [21441] | VIC |
| Defence - POINT WILSON EXPLOSIVES AREA [21442] | VIC |
| | VIC |
| | VIC |
| | VIC |
| | VIC |

| | |
|---|---|
| Defence - STAFF COLLEGE-FORT QUEENSCLIFF [21031] | VIC |
| Defence - STAFF COLLEGE-FORT QUEENSCLIFF [21032] | VIC |
| Defence - STAFF COLLEGE-FORT QUEENSCLIFF [21034] | VIC |
| | VIC |
| Defence - STAFF COLLEGE-FORT QUEENSCLIFF [21030] | VIC |
| Defence - STAFF COLLEGE-FORT QUEENSCLIFF [21033] | VIC |
| Defence - SWAN ISLAND TRAINING AREA [21446] | VIC |
| Defence - SWAN ISLAND TRAINING AREA [21447] | VIC |
| Defence - SWAN ISLAND TRAINING AREA [21448] | |
| Defence - TRAINING CENTRE (Norris Barracks) - Portsea [21025] | |
| Defence - Training Depot, Darts RD 3305 Portland [21010] | |
| Defence - Training Depot, Darts RD 3305 Portland [21013] | |
| Defence - Training Depot, Darts RD 3305 Portland [21012] | |
| Commonwealth Land Name | State |
| Defence - Training Depot, Darts RD 3305 Portland [21014] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21017] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21016] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21011] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21015] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21019] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21024] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21022] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21023] | VIC |
| | VIC |
| | VIC |
| | VIC |
| | VIC |

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|---|---|
| Defence - Training Depot, Darts RD 3305 Portland [21020] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21021] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21018] | VIC |
| | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21007] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21009] | VIC |
| Defence - Training Depot, Darts RD 3305 Portland [21008] | VIC |
| Defence - WARRNAMBOOL TRAINING DEPOT [21111] | VIC |
| Defence - WEST HEAD GUNNERY RANGE [21112] | VIC |

## Transport and Regional Services - Australian Maritime Safety Authority

| | |
|---|---|
| Commonwealth Land - Australian Maritime Safety Authority [41288] | SA |
| Commonwealth Land - Australian Maritime Safety Authority [41289] | SA |
| Commonwealth Land - Australian Maritime Safety Authority [41263] | SA |
| Commonwealth Land - Australian Maritime Safety Authority [41215] | SA |

## Unknown

| | |
|---|---|
| Commonwealth Land - [21487] | |
| Commonwealth Land - [21488] | |
| Commonwealth Land - [21570] | |
| Commonwealth Land - [21583] | |
| Commonwealth Land - [21582] | |
| | VIC |
| | VIC |
| | VIC |
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| Commonwealth Land Name | State |
| --- | --- |
| Commonwealth Land - [60113] | TAS |
| Commonwealth Land - [60112] | TAS |
| Commonwealth Land - [60111] | TAS |
| Commonwealth Land - [21498] | VIC |
| Commonwealth Land - [21491] | VIC |
| Commonwealth Land - [21490] | VIC |
| Commonwealth Land - [21492] | VIC |
| Commonwealth Land - [21497] | VIC |
| Commonwealth Land - [21496] | VIC |
| Commonwealth Land - [21489] | VIC |
| Commonwealth Land - [60115] | TAS |
| Commonwealth Land - [60114] | TAS |
| Commonwealth Land - [22391] | VIC |
| Commonwealth Land - [21509] | VIC |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| **Commonwealth Heritage Places** | | [ Resource Information ] |
| Name | State | Status |
| Historic | | |
| Cape Northumberland Lighthouse | SA | Listed place |
| Cape Sorell Lighthouse | TAS | Listed place |
| Cape Wickham Lighthouse | TAS | Listed place |
| Fort Queenscliff | VIC | Listed place |
| Gabo Island Lighthouse | VIC | Listed place |
| HMAS Cerberus Central Area Group | VIC | Listed place |
| Montague Island Lighthouse | NSW | Listed place |
| Sorrento Post Office | VIC | Listed place |
| Swan Island Defence Precinct | VIC | Listed place |
| Wilsons Promontory Lighthouse | VIC | Listed place |
| Name | State | Status |
| Natural | | |
| HMAS Cerberus Marine and Coastal Area | VIC | Listed place |
| Point Wilson Defence Natural Area | VIC | Listed place |
| Swan Island and Naval Waters | VIC | Listed place |

| Listed Marine Species | | [ Resource Information ] |
|---|---|---|
| Scientific Name | Threatened Category | Presence Text |
| Bird | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat known to occur within area |
| Anous stolidus | | |

| | | |
|---|---|---|
| Common Noddy [825] | | Species or species habitat likely to occur within area |
| Anseranas semipalmata<br>Magpie Goose [978] | | Species or species habitat may occur within area overfly marine area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area |
| Ardenna carneipes as Puffinus carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Species or species habitat known to occur within area |
| Ardenna grisea as Puffinus griseus<br>Sooty Shearwater [82651] | Vulnerable | Breeding known to occur within area |
| Ardenna pacifica as Puffinus pacificus<br>Wedge-tailed Shearwater [84292] | | Breeding known to occur within area |
| Ardenna tenuirostris as Puffinus tenuirostris<br>Short-tailed Shearwater [82652] | | Breeding known to occur within area |
| Arenaria interpres<br>Ruddy Turnstone [872] | Vulnerable | Roosting known to occur within area |
| Bubulcus ibis as Ardea ibis<br>Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Roosting known to occur within area |
| Calidris alba<br>Sanderling [875] | | Roosting known to occur within area |
| Calidris canutus | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Red Knot, Knot [855] | Vulnerable | Species or species habitat known to occur within area overfly marine area |
| [Calidris ferruginea](#)<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat known to occur within area overfly marine area |
| [Calidris melanotos](#)<br>Pectoral Sandpiper [858] | | Species or species habitat known to occur within area overfly marine area |
| [Calidris pugnax as Philomachus pugnax](#)<br>Ruff [91256] | | Roosting known to occur within area overfly marine area |
| [Calidris ruficollis](#)<br>Red-necked Stint [860] | | Roosting known to occur within area overfly marine area |
| [Calidris subminuta](#)<br>Long-toed Stint [861] | | Species or species habitat known to occur within area overfly marine area |
| [Calidris tenuirostris](#)<br>Great Knot [862] | Vulnerable | Roosting known to occur within area overfly marine area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Chalcites osculans as Chrysococcyx osculans<br>Black-eared Cuckoo [83425] | | Species or species habitat known to occur within area<br>overfly marine area |
| Charadrius bicinctus<br>Double-banded Plover [895] | | Roosting known to occur within area<br>overfly marine area |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover | Vulnerable [877] | Species or species habitat known to occur within area |
| Charadrius mongolus<br>Lesser Sand Plover, Mongolian Plover [879] | Endangered | Roosting known to occur within area |
| Charadrius ruficapillus<br>Red-capped Plover [881] | | Roosting known to occur within area<br>overfly marine area |
| Chroicocephalus novaehollandiae as Larus novaehollandiae<br>Silver Gull [82326] | | Breeding known to occur within area |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea antipodensis gibsoni as Diomedea gibsoni<br>Gibson's Albatross [82270] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea sanfordi | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Eudyptula minor<br>Little Penguin [1085] | | Breeding known to occur within area |
| Fregata ariel<br>Lesser Frigatebird, Least Frigatebird [1012] | | Species or species habitat may occur within area |
| Fregata minor<br>Great Frigatebird, Greater Frigatebird [1013] | | Species or species habitat may occur within area |
| Gallinago hardwickii<br>Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat known to occur within area<br>overfly marine area |
| Gallinago megala<br>Swinhoe's Snipe [864] | | Roosting likely to occur within area<br>overfly marine area |
| Gallinago stenura<br>Pin-tailed Snipe [841] | | Roosting known to occur within area<br>overfly marine area |
| Haliaeetus leucogaster<br>White-bellied Sea-Eagle [943] | | Breeding known to occur within area |
| Halobaena caerulea<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area |
| Himantopus himantopus<br>Pied Stilt, Black-winged Stilt [870] | | Roosting known to occur within area<br>overfly marine area |
| Hirundapus caudacutus<br>White-throated Needletail [682] | Vulnerable | Roosting known to occur within area<br>overfly marine area |
| Hydroprogne caspia as Sterna caspia | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Caspian Tern [808] | | Breeding known to occur within area |
| [Larus dominicanus](#)<br>Kelp Gull [809] | | Breeding known to occur within area |
| [Larus pacificus](#)<br>Pacific Gull [811] | | Breeding known to occur within area |
| [Lathamus discolor](#)<br>Swift Parrot [744] | Critically Endangered | Species or species habitat known to occur within area<br>overfly marine area |
| [Limicola falcinellus](#)<br>Broad-billed Sandpiper [842] | | Roosting known to occur within area<br>overfly marine area |
| [Limosa lapponica](#)<br>Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| [Limosa limosa](#)<br>Black-tailed Godwit [845] | Endangered | Roosting known to occur within area<br>overfly marine area |
| [Macronectes giganteus](#)<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| [Macronectes halli](#)<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Merops ornatus](#)<br>Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area |
| [Monarcha melanopsis](#)<br>Black-faced Monarch [609] | | Species or species |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| | | habitat known to occur within area<br>overfly marine area |
| [Morus capensis](#)<br>Cape Gannet [59569] | | Breeding known to occur within area |
| [Morus serrator](#)<br>Australasian Gannet [1020] | | Breeding known to occur within area |
| [Motacilla cinerea](#)<br>Grey Wagtail [642] | | Species or species habitat known to occur within area<br>overfly marine area |
| [Motacilla flava](#)<br>Yellow Wagtail [644] | | Species or species habitat known to occur within area<br>overfly marine area |
| [Myiagra cyanoleuca](#)<br>Satin Flycatcher [612] | | Breeding known to occur within area<br>overfly marine area |
| [Neophema chrysogaster](#)<br>Orange-bellied Parrot [747] | Critically Endangered | Breeding known to occur within area<br>overfly marine area |
| [Neophema chrysostoma](#)<br>Blue-winged Parrot [726] | Vulnerable | Species or species habitat known to occur within area<br>overfly marine area |
| [Numenius madagascariensis](#)<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| [Numenius minutus](#)<br>Little Curlew, Little Whimbrel [848] | | Roosting likely to occur within area<br>overfly marine area |
| [Numenius phaeopus](#)<br>Whimbrel [849] | | Roosting known to occur within area |
| [Onychoprion fuscatus as Sterna fuscata](#) | | |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Sooty Tern [90682] | | Breeding known to occur within area |
| Pachyptila turtur<br>Fairy Prion [1066] | | Species or species habitat known to occur within area |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area |
| Pelagodroma marina<br>White-faced Storm-Petrel [1016] | | Breeding known to occur within area |
| Pelecanoides urinatrix<br>Common Diving-Petrel [1018] | | Breeding known to occur within area |
| Phaethon lepturus<br>White-tailed Tropicbird [1014] | | Species or species habitat may occur within area |
| Phalacrocorax fuscescens<br>Black-faced Cormorant [59660] | | Breeding known to occur within area |
| Phalaropus lobatus<br>Red-necked Phalarope [838] | | Roosting known to occur within area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| Pluvialis fulva<br>Pacific Golden Plover [25545] | | Roosting known to occur within area |
| Pluvialis squatarola<br>Grey Plover [865] | Vulnerable | Roosting known to occur within area<br>overfly marine area |
| Pterodroma cervicalis<br>White-necked Petrel [59642] | | Breeding likely to occur within area |
| Pterodroma macroptera | | |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Great-winged Petrel [1035] | | Foraging, feeding or related behaviour known to occur within area |
| Pterodroma mollis<br>Soft-plumaged Petrel [1036] | Vulnerable | Breeding known to occur within area |
| Recurvirostra novaehollandiae<br>Red-necked Avocet [871] | | Roosting known to occur within area<br>overfly marine area |
| Rhipidura rufifrons<br>Rufous Fantail [592] | | Species or species habitat known to occur within area<br>overfly marine area |
| Rostratula australis as Rostratula benghalensis (sensu lato)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat known to occur within area<br>overfly marine area |
| Stercorarius antarcticus as Catharacta skua<br>Brown Skua [85039] | | Species or species habitat may occur within area |
| Sterna striata<br>White-fronted Tern [799] | | Foraging, feeding or related behaviour likely to occur within area |
| Sternula albifrons as Sterna albifrons<br>Little Tern [82849] | Vulnerable | Breeding known to occur within area |
| Sternula nereis as Sterna nereis<br>Fairy Tern [82949] | | Breeding known to occur within area |
| Stiltia isabella<br>Australian Pratincole [818] | | Species or species habitat known to occur within area<br>overfly marine area |
| Symposiachrus trivirgatus as Monarcha trivirgatus | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Spectacled Monarch [83946] | | Species or species habitat known to occur within area overfly marine area |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross Vulnerable [64460]<br>Thalassarche bulleri platei as Thalassarche sp. nov. | | Foraging, feeding or related behaviour likely to occur within area |
| Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| Thalassarche eremita<br>Chatham Albatross [64457] | Endangered | Foraging, feeding or related behaviour may occur within area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Thalasseus bergii as Sterna bergii<br>Greater Crested Tern [83000] | | Breeding known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Thinornis cucullatus as Thinornis rubricollis<br>Hooded Plover, Hooded Dotterel [87735] | | Species or species habitat known to occur within area<br>overfly marine area |
| Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis<br>Eastern Hooded Plover, Eastern Hooded Vulnerable Plover [90381] | | Species or species habitat known to occur within area<br>overfly marine area |
| Tringa brevipes as Heteroscelus brevipes<br>Grey-tailed Tattler [851] | | Roosting known to occur within area |
| Tringa glareola<br>Wood Sandpiper [829] | | Roosting known to occur within area<br>overfly marine area |
| Tringa incana as Heteroscelus incanus<br>Wandering Tattler [831] | | Roosting known to occur within area |
| Tringa nebularia<br>Common Greenshank, Greenshank [832] | Endangered | Species or species habitat known to occur within area<br>overfly marine area |
| Tringa stagnatilis<br>Marsh Sandpiper, Little Greenshank [833] | | Roosting known to occur within area<br>overfly marine area |
| Xenus cinereus<br>Terek Sandpiper [59300] | Vulnerable | Roosting known to occur within area<br>overfly marine area |
| Fish | | |
| Acentronura australe<br>Southern Pygmy Pipehorse [66185] | | Species or species habitat may occur within area |
| Acentronura tentaculata | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Shortpouch Pygmy Pipehorse [66187] | | Species or species habitat may occur within area |
| Campichthys tryoni<br>Tryon's Pipefish [66193] | | Species or species habitat may occur within area |
| Cosmocampus howensis<br>Lord Howe Pipefish [66208] | | Species or species habitat may occur within area |
| Heraldia nocturna<br>Upside-down Pipefish, Eastern Upsidedown Pipefish, Eastern Upside-down Pipefish [66227] | | Species or species habitat may occur within area |
| Hippocampus abdominalis<br>Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233] | | Species or species habitat may occur within area |
| Hippocampus breviceps<br>Short-head Seahorse, Short-snouted Seahorse [66235] | | Species or species habitat may occur within area |
| Hippocampus minotaur<br>Bullneck Seahorse [66705] | | Species or species habitat may occur within area |
| Histiogamphelus briggsii<br>Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242] | | Species or species habitat may occur within area |
| Histiogamphelus cristatus<br>Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243] | | Species or species habitat may occur within area |
| Hypselognathus rostratus<br>Knifesnout Pipefish, Knife-snouted Pipefish [66245] | | Species or species habitat may occur within area |
| Kaupus costatus<br>Deepbody Pipefish, Deep-bodied Pipefish [66246] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Kimblaeus bassensis<br>Trawl Pipefish, Bass Strait Pipefish [66247] | | Species or species habitat may occur within area |
| Leptoichthys fistularius<br>Brushtail Pipefish [66248] | | Species or species habitat may occur within area |
| Lissocampus caudalis<br>Australian Smooth Pipefish, Smooth Pipefish [66249] | | Species or species habitat may occur within area |
| Lissocampus runa<br>Javelin Pipefish [66251] | | Species or species habitat may occur within area |
| Maroubra perserrata<br>Sawtooth Pipefish [66252] | | Species or species habitat may occur within area |
| Mitotichthys mollisoni<br>Mollison's Pipefish [66260] | | Species or species habitat may occur within area |
| Mitotichthys semistriatus<br>Halfbanded Pipefish [66261] | | Species or species habitat may occur within area |
| Mitotichthys tuckeri<br>Tucker's Pipefish [66262] | | Species or species habitat may occur within area |
| Notiocampus ruber<br>Red Pipefish [66265] | | Species or species habitat may occur within area |
| Phycodurus eques<br>Leafy Seadragon [66267] | | Species or species habitat may occur within area |
| Phyllopteryx taeniolatus | | |

| | | |
|---|---|---|
| Common Seadragon, Weedy Seadragon [66268] | | Species or species habitat may occur within area |
| [Pugnaso curtirostris](#) Pugnose Pipefish, Pug-nosed Pipefish [66269] | | Species or species habitat may occur within area |
| [Solegnathus robustus](#) Robust Pipehorse, Robust Spiny Pipehorse [66274] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Solegnathus spinosissimus](#) Spiny Pipehorse, Australian Spiny Pipehorse [66275] | | Species or species habitat may occur within area |
| [Solenostomus cyanopterus](#) Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183] | | Species or species habitat may occur within area |
| [Stigmatopora argus](#) Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276] | | Species or species habitat may occur within area |
| [Stigmatopora nigra](#) Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277] | | Species or species habitat may occur within area |
| [Stipecampus cristatus](#) Ringback Pipefish, Ring-backed Pipefish [66278] | | Species or species habitat may occur within area |
| [Syngnathoides biaculeatus](#) Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279] | | Species or species habitat may occur within area |
| [Urocampus carinirostris](#) Hairy Pipefish [66282] | | Species or species habitat may occur within area |
| [Vanacampus margaritifer](#) | | |

| | | |
|---|---|---|
| Mother-of-pearl Pipefish [66283] | | Species or species habitat may occur within area |
| [Vanacampus phillipi](#) | | Species or species habitat may occur within area |
| [Vanacampus poecilolaemus](#)<br>Longsnout Pipefish, Australian Longsnout Pipefish, Long-snouted Pipefish [66285] | | Species or species habitat may occur within area |
| [Vanacampus vercoi](#)<br>Verco's Pipefish [66286] | | Species or species habitat may occur within area |
| **Mammal** | | |
| **Scientific Name** | **Threatened Category** | **Presence Text** |
| [Arctocephalus forsteri](#)<br>Long-nosed Fur-seal, New Zealand Furseal [20] | | Breeding known to occur within area |
| [Arctocephalus pusillus](#)<br>Australian Fur-seal, Australo-African Furseal [21] | | Breeding known to occur within area |
| [Mirounga leonina](#)<br>Southern Elephant Seal [26] | Vulnerable | Breeding may occur within area |
| [Neophoca cinerea](#)<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat known to occur within area |
| **Reptile** | | |
| Port Phillip Pipefish [66284] | | |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth Endangered [1768] | | Foraging, feeding or related behaviour known to occur within area |
| Eretmochelys imbricata<br>Hawksbill Turtle [1766] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Natator depressus<br>Flatback Turtle [59257] | Vulnerable | Species or species habitat known to occur within area |

| Whales and Other Cetaceans | | [ Resource Information ] |
|---|---|---|
| Current Scientific Name | Status | Type of Presence |
| Mammal | | |
| Balaenoptera acutorostrata<br>Minke Whale [33] | | Species or species habitat may occur within area |
| Balaenoptera bonaerensis<br>Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely to occur within area |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera edeni | | |

| Current Scientific Name | Status | Type of Presence |
| --- | --- | --- |
| Bryde's Whale [35] | | Species or species habitat likely to occur within area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Berardius arnuxii<br>Arnoux's Beaked Whale [70] | | Species or species habitat may occur within area |
| Caperea marginata<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour likely to occur within area |
| Delphinus delphis<br>Common Dolphin, Short-beaked Common Dolphin [60] | | Species or species habitat may occur within area |
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |
| Globicephala macrorhynchus<br>Short-finned Pilot Whale [62] | | Species or species habitat may occur within area |
| Globicephala melas<br>Long-finned Pilot Whale [59282] | | Species or species habitat may occur within area |
| Grampus griseus<br>Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area |
| Hyperoodon planifrons | | |

| | |
|---|---|
| Southern Bottlenose Whale [71] | Species or species habitat may occur within area |
| [Kogia breviceps](#)<br>Pygmy Sperm Whale [57] | Species or species habitat may occur within area |
| [Kogia sima](#)<br>Dwarf Sperm Whale [85043] | Species or species habitat may occur within area |
| [Lagenorhynchus obscurus](#)<br>Dusky Dolphin [43] | Species or species habitat likely to occur within area |
| [Lissodelphis peronii](#)<br>Southern Right Whale Dolphin [44] | Species or species habitat may occur within area |
| [Megaptera novaeangliae](#)<br>Humpback Whale [38] | Foraging, feeding or related behaviour known to occur within area |
| [Mesoplodon bowdoini](#)<br>Andrew's Beaked Whale [73] | Species or species habitat may occur within area |
| [Mesoplodon densirostris](#)<br>Blainville's Beaked Whale, Densebeaked Whale [74] | Species or species habitat may occur within area |
| [Mesoplodon ginkgodens](#)<br>Gingko-toothed Beaked Whale, Gingkotoothed Whale, Gingko Beaked Whale [59564] | Species or species habitat may occur within area |
| [Mesoplodon grayi](#)<br>Gray's Beaked Whale, Scamperdown Whale [75] | Species or species habitat may occur within area |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| [Mesoplodon hectori](#)<br>Hector's Beaked Whale [76] | | Species or species |

| | |
|---|---|
| | habitat may occur within area |
| Mesoplodon layardii<br>Strap-toothed Beaked Whale, Straptoothed Whale, Layard's Beaked Whale [25556] | Species or species habitat may occur within area |
| Mesoplodon mirus<br>True's Beaked Whale [54] | Species or species habitat may occur within area |
| Orcinus orca<br>Killer Whale, Orca [46] | Species or species habitat likely to occur within area |
| Physeter macrocephalus<br>Sperm Whale [59] | Foraging, feeding or related behaviour known to occur within area |
| Pseudorca crassidens<br>False Killer Whale [48] | Species or species habitat likely to occur within area |
| Tasmacetus shepherdi<br>Shepherd's Beaked Whale, Tasman Beaked Whale [55] | Species or species habitat may occur within area |
| Tursiops aduncus<br>Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | Species or species habitat likely to occur within area |
| Tursiops truncatus s. str.<br>Bottlenose Dolphin [68417] | Species or species habitat may occur within area |
| Ziphius cavirostris<br>Cuvier's Beaked Whale, Goosebeaked Whale [56] | Species or species habitat may occur within area |

## Critical Habitats [ Resource Information ]

| Name | Type of Presence |
|---|---|
| Thalassarche cauta (Shy Albatross) - Albatross Island, The | Listed Critical Habitat |
| Mewstone, Pedra Branca | |

## Australian Marine Parks [ Resource Information ]

| Park Name | Zone & IUCN Categories |
|---|---|
| Murray | Habitat Protection Zone (IUCN IV) |
| Murray | Habitat Protection Zone (IUCN IV) |
| Apollo | Multiple Use Zone (IUCN VI) |
| Beagle | Multiple Use Zone (IUCN VI) |
| Boags | Multiple Use Zone (IUCN VI) |
| East Gippsland | Multiple Use Zone (IUCN VI) |
| Franklin | Multiple Use Zone (IUCN VI) |
| Murray | Multiple Use Zone (IUCN VI) |
| Zeehan | Multiple Use Zone (IUCN VI) |
| Beagle | National Park Zone (IUCN II) |
| Franklin | National Park Zone (IUCN II) |
| Murray | National Park Zone (IUCN II) |
| Nelson | National Park Zone (IUCN II) |
| Zeehan | National Park Zone (IUCN II) |
| Zeehan | Special Purpose Zone (IUCN VI) |

## Extra Information

### State and Territory Reserves [ Resource Information ]

| Protected Area Name | Reserve Type | State |
|---|---|---|

| | | |
|---|---|---|
| Aire River | Heritage River | VIC |
| Aire River W.R. | Natural Features Reserve | VIC |
| Aireys Inlet B.R. | Natural Features Reserve | VIC |
| Anglesea B.R. | Natural Features Reserve | VIC |
| Anser Island | Reference Area | VIC |
| Arthur-Pieman | Conservation Area | TAS |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Arthurs Seat | State Park | VIC |
| Baawang | Reference Area | VIC |
| Badger Box Creek | Nature Reserve | TAS |
| Badger River | Regional Reserve | TAS |
| Bald Hills B.R. | Natural Features Reserve | VIC |
| Balnarring G95 B.R. | Natural Features Reserve | VIC |
| Barham Paradise S.R. | Natural Features Reserve | VIC |
| Barunguba Montague Island | Nature Reserve | NSW |
| Barwon Bluff | Marine Sanctuary | VIC |
| Bass River SS.R. | Natural Features Reserve | VIC |
| Batemans | Marine Park | NSW |
| Bats Ridge W.R | Nature Conservation Reserve | VIC |
| Bay of Islands Coastal Park | Conservation Park | VIC |
| Beachport | Conservation Park | SA |
| Bellarine I109 B.R. | Natural Features Reserve | VIC |
| Bellarine I110 B.R. | Natural Features Reserve | VIC |
| Bemm, Goolengook, Arte and Errinundra Heritage River | River | VIC |
| Benedore River | Reference Area | VIC |
| Beowa | National Park | NSW |
| Beware Reef | Marine Sanctuary | VIC |
| Black Pyramid Rock | Nature Reserve | TAS |
| Bolwarra H43 B.R. | Natural Features Reserve | VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Bolwarra H44 B.R. | Natural Features Reserve | VIC |
| Bolwarra H45 B.R. | Natural Features Reserve | VIC |
| Bournda | National Park | NSW |
| Breamlea F.F.R. | Nature Conservation Reserve | VIC |
| Brodribb River F.F.R | Nature Conservation Reserve | VIC |
| Buckley N.C.R. | Natural Features Reserve | VIC |
| Bucks Lake | Game Reserve | SA |
| Bunurong | Marine National Park | VIC |
| Cabbage Tree Creek F.R | Nature Conservation Reserve | VIC |
| Canunda | National Park | SA |
| Cape Conran Coastal Park | Conservation Park | VIC |
| Cape Howe | Wilderness Zone | VIC |
| Cape Howe | Marine National Park | VIC |
| Cape Liptrap Coastal Park | Conservation Park | VIC |
| Cape Nelson | State Park | VIC |
| Cape Patterson N.C.R | Natural Features Reserve | VIC |
| Cape Sorell | Historic Site | TAS |
| Cape Wickham | State Reserve | TAS |
| Cape Wickham | Conservation Area | TAS |
| Carpenter Rocks | Conservation Park | SA |
| Cataraqui Point | Conservation Area | TAS |
| Christmas Island | Nature Reserve | TAS |

| Protected Area Name | Reserve Type | State |
| --- | --- | --- |
| Churchill Island | Marine National Park | VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| City of Melbourne Bay | Conservation Area | TAS |
| Colliers Forest Reserve | Conservation Covenant | TAS |
| Colliers Swamp | Conservation Area | TAS |
| Cone Islet | Conservation Area | TAS |
| Conewarre K47 SS.R. | Natural Features Reserve | VIC |
| Conewarre K48 SS.R. | Natural Features Reserve | VIC |
| Corner Inlet | Marine National Park | VIC |
| Corner Inlet Marine and Coastal Park | National Parks Act Schedule 4 park or reserve | VIC |
| Councillor Island | Nature Reserve | TAS |
| Counsel Hill | Conservation Area | TAS |
| Crib Point G228 B.R. | Natural Features Reserve | VIC |
| Crib Point G229 B.R. | Natural Features Reserve | VIC |
| Croajingolong | National Park | VIC |
| Currie Lightkeepers Residence | Historic Site | TAS |
| Curtis Island | Nature Reserve | TAS |
| Devils Tower | Nature Reserve | TAS |
| Dingley Dell | Conservation Park | SA |
| Disappointment Bay | State Reserve | TAS |
| Discovery Bay | Marine National Park | VIC |
| Discovery Bay Coastal Park | Conservation Park | VIC |
| Dolphin Tungsten Mine | Conservation Covenant | TAS |
| Double Creek | Natural Catchment Area | VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| | Natural Features Reserve | VIC |
| Drumdlemara H1 B.R | Natural Features Reserve | VIC |
| Drumdlemara H2 B.R | Natural Features Reserve | VIC |
| Drumdlemara H4 B.R | Natural Features Reserve | VIC |
| Dry Creek | Forest Reserve | SA |
| Eagle Rock | Marine Sanctuary | VIC |
| East Gippsland Coastal streams | Natural Catchment Area | VIC |
| East Moncoeur Island | Conservation Area | TAS |
| Edna Bowman N.C.R. | Natural Features Reserve | VIC |
| Eldorado | Conservation Area | TAS |
| Entrance Point | Reference Area | VIC |
| Eurobodalla | National Park | NSW |
| Ewens Ponds | Conservation Park | SA |
| Ewing Morass W.R | Natural Features Reserve | VIC |
| Fingal B.R | Natural Features Reserve | VIC |
| First and Second Islands F.R. | Nature Conservation Reserve | VIC |
| Flinders G234 B.R. | Natural Features Reserve | VIC |
| Flinders N.F.R. | Natural Features Reserve | VIC |
| Four Mile Beach | Regional Reserve | TAS |
| French Island | National Park | VIC |
| French Island | Marine National Park | VIC |
| Douglas Point | Conservation Park | SA |
| Drakes B.R. | | |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| French Island (north) | Reference Area | VIC |
| French Island G230 B.R | Natural Features Reserve | VIC |
| Gentle Annie | Conservation Area | TAS |
| Gippsland Lakes Coastal Park | Conservation Park | VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Glenelg River | Heritage River | |
| Goose Lagoon W.R | Natural Features Reserve | VIC |
| Gorae B.R. | Natural Features Reserve | VIC |
| Great Otway | National Park | VIC |
| Hedditch Hill S.R. | Natural Features Reserve | VIC |
| Hogan Group | Conservation Area | TAS |
| Johanna Falls S.R. | Natural Features Reserve | VIC |
| Johnstones Creek F.R | Nature Conservation Reserve | VIC |
| Kangerong N.C.R | Natural Features Reserve | VIC |
| Kentbruck H14 B.R | Natural Features Reserve | VIC |
| Kentbruck H50 B.R. | Natural Features Reserve | VIC |
| Kent Group | National Park | TAS |
| Kilcunda N.C.R. | Natural Features Reserve | VIC |
| King Island - southern titles Area 1 | Conservation Covenant | TAS |
| Lady Julia Percy Island W.R. | Nature Conservation Reserve | VIC |
| Lake Aringa W.R | Nature Conservation Reserve | VIC |
| Lake Connewarre W.R | Natural Features Reserve | VIC |
| Lake Corringle W.R | Natural Features Reserve | VIC |
| Lake Curlip W.R. | Natural Features Reserve | VIC |

| Protected Area Name | Reserve Type | State |
| --- | --- | --- |
| Lake Frome | Conservation Park | SA |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Lake Gillear W.R | Natural Features Reserve | VIC |
| Lake Robe | Game Reserve | SA |
| Lake St Clair | Conservation Park | SA |
| Lake Tyers S.P. | State Park | VIC |
| Latrobe B.R. | Natural Features Reserve | VIC |
| Lavinia | State Reserve | TAS |
| Lawrence Rocks W.R. | Nature Conservation Reserve | VIC |
| Leongatha H3 B.R. | Natural Features Reserve | VIC |
| Lily Pond B.R. | Natural Features Reserve | VIC |
| Little Dip | Conservation Park | SA |
| Lonsdale Lakes W.R | Nature Conservation Reserve | VIC |
| Lower Glenelg | National Park | VIC |
| Lower Glenelg River | Conservation Park | SA |
| Lower South East | Marine Park | SA |
| Main Ridge N.C.R. | Natural Features Reserve | VIC |
| Mallacoota B.R. | Natural Features Reserve | VIC |
| Marengo N.C.R. | Nature Conservation Reserve | VIC |
| Marengo Reefs | Marine Sanctuary | VIC |
| Merri | Marine Sanctuary | VIC |
| Merricks Creek B.R. | Natural Features Reserve | VIC |
| Millwood Road | Conservation Covenant | TAS |
| Mimosa Rocks | National Park | NSW |

| Protected Area Name | Reserve Type | State |
| --- | --- | --- |
| | | VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Mornington Peninsula | National Park | VIC |
| Mount Heemskirk | Regional Reserve | TAS |
| Mount Richmond | National Park | |
| Mount Vereker Creek | Natural Catchment Area | VIC |
| Mouzie B.R | | VIC |
| Mouzie N.F.R | Natural Features Reserve<br>Natural Features Reserve | VIC |
| Muddy Lagoon | Nature Reserve | TAS |
| Mullins Swamp | Conservation Park | SA |
| Mumbulla | Flora Reserve | NSW |
| Mushroom Reef | Marine Sanctuary | VIC |
| Nadgee | Nature Reserve | NSW |
| Narrawong F.R. | | VIC |
| Nelson SS.R. | Nature Conservation Reserve<br>Natural Features Reserve | VIC |
| Nene Valley | Conservation Park | SA |
| New Year Island | Game Reserve | TAS |
| Nooramunga Marine & Coastal Park | | VIC |
| NOORAMUNGA STATE FAUNAL RESERVE | National Parks Act Schedule 4 park or reserve<br>Nature Conservation Reserve | VIC |
| North East Islet | Nature Reserve | TAS |
| North Western Port N.C.R. | Nature Conservation Reserve | VIC |
| Ocean Beach | Conservation Area | TAS |
| Painkalac Creek | Reference Area | VIC |
| Parker River | Reference Area | VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| | | VIC |
| Pegarah | Private Nature Reserve | TAS |
| Pegarah Forest | Conservation Covenant | TAS |
| Pegarah Rd King Island | Conservation Covenant | TAS |
| Penguin Island | Conservation Park | SA |
| Phillip Island Nature Park | Other | VIC |
| Piccaninnie Ponds | Conservation Park | SA |
| Pieman River | State Reserve | TAS |
| Point Addis | Marine National Park | VIC |
| Point Danger | Marine Sanctuary | VIC |
| Point Hicks | Marine National Park | VIC |
| Point Nepean | National Park | VIC |
| Porky Beach | Conservation Area | TAS |
| Portarlington (Point Richard) F.F.R. | Nature Conservation Reserve | VIC |
| Port Campbell | National Park | VIC |
| Portland H46 B.R. | Natural Features Reserve | VIC |
| Portland H47 B.R. | Natural Features Reserve | VIC |
| Port Phillip Heads | Marine National Park | VIC |
| Princetown W.R | Natural Features Reserve | VIC |
| Queenscliff N.F.R | Natural Features Reserve | VIC |
| Rame Head | Remote and Natural Area - Schedule 6, National Parks Act | VIC |
| Red Hut Point | Conservation Area | TAS |
| Red Hut Road #1 | Conservation Covenant | TAS |
| Red Hut Road #2 | Conservation Covenant | TAS |

| Protected Area Name | Reserve Type | State |
| --- | --- | --- |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| | | VIC |
| Reef Island and Bass River Mouth N.C.R | Natural Features Reserve | |
| Reid Rocks | Nature Reserve | TAS |
| Rodondo Island | Nature Reserve | TAS |
| Rosebud Public Park and Recreation Reserve | Natural Features Reserve | VIC |
| Salt Lagoon, St Leonards W.R | Nature Conservation Reserve | |
| Sandpatch | Wilderness Zone | VIC |
| Screw Creek N.C.R. | Natural Features Reserve | VIC |
| Sea Elephant | Conservation Area | TAS |
| Sea Elephant River | Conservation Covenant | TAS |
| Seal Creek | Reference Area | VIC |
| Seal Islands W.R. | Nature Conservation Reserve | VIC |
| Seal Rocks | State Reserve | TAS |
| Seal Rocks | Conservation Area | TAS |
| Shallow Inlet Marine and Coastal Park | National Parks Act Schedule 4 park or reserve | VIC |
| Snowy River | Heritage River | VIC |
| Southern Wilsons Promontory | Remote and Natural Area - Schedule 6, National Parks Act | VIC |
| South Rd Nugara | Conservation Covenant | TAS |
| Southwest | National Park | TAS |
| Southwest | Conservation Area | TAS |
| Stokes Point | Conservation Area | TAS |
| Stony Creek (Otways) | Reference Area | VIC |
| Sugarloaf Rock | Conservation Area | TAS<br>VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Swan Bay - Edwards Point W.R | Nature Conservation Reserve | VIC |
| Tathams Lagoon | Conservation Area | TAS |
| The Arches | Marine Sanctuary | VIC |
| Tikkawoppa Plateau | Regional Reserve | TAS |
| Tower Hill W.R | Natural Features Reserve | VIC |

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Trewalla H48 B.R. | Natural Features Reserve | VIC |
| Trewalla H49 B.R. | Natural Features Reserve | VIC |
| Trial Harbour | State Reserve | TAS |
| Tully River | Conservation Area | TAS |
| Twelve Apostles | Marine National Park | VIC |
| Tyrendarra F.R | Nature Conservation Reserve | VIC |
| Unnamed (No.HA1038) | Heritage Agreement | SA |
| Unnamed (No.HA1166) | Heritage Agreement | SA |
| Unnamed (No.HA1361) | Heritage Agreement | SA |
| Unnamed (No.HA1404) | Heritage Agreement | SA |
| Unnamed (No.HA1457) | Heritage Agreement | SA |
| Unnamed (No.HA1560) | Heritage Agreement | SA |
| Unnamed (No.HA1626) | Heritage Agreement | SA |
| Unnamed (No.HA177) | Heritage Agreement | SA |
| Unnamed (No.HA197) | Heritage Agreement | SA |
| Unnamed (No.HA245) | Heritage Agreement | SA |
| Unnamed (No.HA26) | Heritage Agreement | SA |
| Unnamed (No.HA42) | Heritage Agreement | SA |
| Unnamed (No.HA497) | Heritage Agreement | SA |
| Unnamed C0293 | Private Nature Reserve | VIC |
| Unnamed P0176 | Private Nature Reserve | VIC |
| Upper South East | Marine Park | SA |
| Ventnor B.R. | Natural Features Reserve | VIC |

VIC

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Vereker Creek | Reference Area | VIC |
| Waratah B.R | Natural Features Reserve | VIC |
| Welshpool H17 B.R | Natural Features Reserve | |
| West Moncoeur Island | Nature Reserve | TAS |
| Wicks Road Nugara | Conservation Covenant | TAS |
| Wild Dog B.R. | Natural Features Reserve | VIC |
| Wild Dog Creek SS.R. | Natural Features Reserve | VIC |
| William Hunter F.R | Nature Conservation Reserve | VIC |
| Wilsons Promontory | Wilderness Zone | VIC |
| Wilsons Promontory | National Park | VIC |
| Wilsons Promontory | Marine National Park | VIC |
| Wilsons Promontory Islands | Remote and Natural Area - Schedule 6, National Parks Act | VIC |
| Wilsons Promontory Marine Park | National Parks Act Schedule 4 park or reserve | VIC |
| Wilsons Promontory Marine Reserve | National Parks Act Schedule 4 park or reserve | VIC |
| Wongarra B.R. | Natural Features Reserve | VIC |
| Wonthaggi G237 B.R. | Natural Features Reserve | VIC |
| Wonthaggi G239 B.R. | Natural Features Reserve | VIC |
| Wonthaggi G240 B.R. | Natural Features Reserve | VIC |
| Wonthaggi G241 B.R. | Natural Features Reserve | VIC |

VIC

| Protected Area Name | Reserve Type | State |
|---|---|---|
| Yambuk F.F.R. | Nature Conservation Reserve | VIC |
| Yambuk Wetlands N.C.R. | Natural Features Reserve | VIC |
| Yanakie F.R | Nature Conservation Reserve | VIC |
| Yaringa | Marine National Park | VIC |

## Regional Forest Agreements

[ Resource Information ]

| | | | |
|---|---|---|---|
| Wonthaggi Wetlands Reserve | Natural Features Reserve | VIC | |
| Yallock-Bulluk Marine and Coastal Park | National Parks Act Other Parks | VIC | Schedule 3 |
| Yambacoona | Conservation Covenant | TAS | |

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

| RFA Name | State |
|---|---|
| East Gippsland RFA | Victoria |
| Eden RFA | New South Wales |
| Gippsland RFA | Victoria |
| Southern RFA | New South Wales |
| Tasmania RFA | Tasmania |
| West Victoria RFA | Victoria |

## Nationally Important Wetlands

[ Resource Information ]

| Wetland Name | State |
|---|---|
| Aire River | VIC |
| Anderson Inlet | VIC |

| | | |
|---|---|---|
| Benedore River | | VIC |
| Bondi Lake | | NSW |
| Bungaree Lagoon | | TAS |
| Protected Area Name | Reserve Type | State |
| | | VIC |
| Corner Inlet | | VIC |
| Ewens Ponds | | SA |
| Ewing's Marsh (Morass) | | VIC |
| Glenelg Estuary | | VIC |
| Glenelg River | | VIC |
| Lake Bunga | | VIC |

| Wetland Name | State |
| --- | --- |
| Lake Connewarre State Wildlife Reserve | VIC |
| Lake Flannigan | TAS |
| Lake Frome & Mullins Swamp | SA |
| Lake King Wetlands | VIC |
| Lake Tyers | VIC |
| Lavinia Nature Reserve | TAS |
| Long Swamp | VIC |
| Lower Aire River Wetlands | VIC |
| Lower Merri River Wetlands | VIC |
| Lower Snowy River Wetlands System | VIC |
| Mallacoota Inlet Wetlands | VIC |
| Mud Islands | VIC |
| Nadgee Lake and tributary wetlands | NSW |
| Nargal Lake | NSW |
| Pearshape Lagoon 1 | TAS |
| Pearshape Lagoon 2 | TAS |
| Pearshape Lagoon 3 | TAS |
| Pearshape Lagoon 4 | TAS |
| Piccaninnie Ponds | SA |
| Powlett River Mouth | VIC |
| Princetown Wetlands | VIC |
| Shallow Inlet Marine & Coastal Park | VIC |
| Snowy River | VIC |
| South East Coastal Salt Lakes | SA |
| Swan Bay & Swan Island | VIC |

| Wetland Name | State |
|---|---|
| Sydenham Inlet Wetlands | VIC |
| Tamboon Inlet Wetlands | VIC |
| Thurra River | VIC |
| Tower Hill | VIC |
| Wallaga Lake | NSW |
| Wallagoot Lagoon (Wallagoot Lake) | NSW |
| Werribee-Avalon Area | VIC |
| Western Port | VIC |
| Yambuk Wetlands | VIC |

| EPBC Act Referrals | | | [ Resource Information ] |
|---|---|---|---|
| Title of referral | Reference | Referral Outcome | Assessment Status |
| Apollo Bay to Skenes Coastal Trail | 2022/09274 | Creek | Assessment |
| Aurora Green Offshore Wind Farm Preliminary Surveys | 2024/09968 | | Completed |
| Barwon Heads Road Reserve Road to Lower Duneed Road Upgrade Project | 2023/09724 | | Completed |
| Blue Mackerel North Offshore Wind Farm Marine Surveys | 2024/09934 | | Completed |
| Blue Marlin Offshore Wind Energy Project | 2023/09532 | | Completed |
| Cape Winds Offshore Windfarm Geophysical, Geotechnical and Marine Studies | 2023/09629 | | Completed |
| City Of Greater Geelong Mosquito Control Program 2021-2030, Vic | 2020/8782 | | Approval |
| Decommissioning of the Minerva Pipeline in Victorian state waters | 2024/09879 | | Completed |

| | | | |
|---|---|---|---|
| Decommissioning of the Minerva Pipeline in Victorian state waters ? May 2025 | 2025/10138 | | Referral Decision |
| Dolphin Tungsten Mine Grassy King Island | 2023/09653 | | Referral Decision |
| Establishment of a 6 windfarm near Wonthaggi | 2002/820 | turbine | Completed |
| Gelliondale Wind Farm Project | 2023/09577 | | Assessment |
| Geographe-A gas exploration well | 2000/82 | | Completed |
| Gippsland Dawn Offshore Wind Project Geophysical and Geotechnical Investigations | 2024/10030 | | Referral Decision |
| Gippsland Offshore Wind Farm Marine Survey Investigations | 2023/09682 | | Completed |
| Gippsland Regional Port Project | 2020/8667 | | Completed |
| Gippsland Skies Offshore Wind Project marine surveys (investigations) | 2024/09991 | | Referral Decision |
| Greater Gippsland Offshore Wind Project | 2022/09379 | | Assessment |
| Greater Gippsland Offshore Wind Project Initial Marine Field Investigations | 2022/09374 | | Completed |
| Great Ocean Road Coastal Trail (GORCT) ? Fairhaven to Grey River | 2024/10073 | | Completed |
| Hydrocarbon exploration wells | 2003/1062 | | Completed |

| | | | |
|---|---|---|---|
| [Krauatungalung Walk] | 2024/10043 | | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| | | | |

| | | |
|---|---|---|
| Marine Farming Expansion, Macquarie Harbour, TAS | 2012/6406 | Assessment |
| Marine Route Survey for Subsea Fibre Optic Data Cable System Australia East | 2024/09795 | Completed |
| Mirador Residential Development Stages 8 & 9 and 13 | 2023/09685 | Assessment |
| Navigator North Offshore Wind Farm ? Early Marine Survey Investigations | 2024/10093 | Referral Decision |
| Nora Creina integrated golf course and tourism development, SA | 2014/7249 | Assessment |
| Normanville Energy Park | 2024/10070 | Assessment |
| Offshore Tidal Energy Facility and Submarine Cable | 2008/4480 | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Point Nepean Research & Education Field Station | 2024/09963 | | Completed |
| Portland Energy Park | 2024/09947 | | Assessment |
| Preliminary Site Investigations for Great Eastern Offshore Wind Project | 2024/09890 | | Referral Decision |
| Seadragon Offshore Wind, Early Marine Surveys | 2023/09670 | | Completed |
| SEA Gas Project transmission pipeline | 2001/513 | | Completed |

| | | | |
|---|---|---|---|
| Otway Astrolabe 3D Marine Seismic Survey, Otway Basin | 2012/6421 | | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| **Controlled action** | | | |
| Shearwater 2D and 3D marine seismic survey | 2005/2180 | | Completed |
| SMAP telecommunications submarine cable installation | 2024/09989 | | Completed |
| South East Australia Carbon Capture and Storage Project, Commonwealth waters | 2023/09732 | | Completed |
| Southern Winds Offshore Wind Project | 2022/09435 | | Completed |
| Southern Winds Offshore Wind Project Initial Marine Field Investigations | 2022/09436 | | Completed |
| Spinifex Offshore Surveys | 2022/09359 | | Completed |
| Spinifex Offshore Wind Farm Offshore Investigations | 2024/09918 | | Referral Decision |
| Strike Oil NL Seismic Surveys | 2000/107 | | Completed |
| supersonic missile launch facility | 2000/120 | | Completed |
| Thylacine-A Exploration Well | 2000/81 | | Completed |
| Vic-P51 and VicP52 3D seismic survey | 2002/799 | | Completed |
| Victorian Renewable Energy Terminal | 2023/09609 | | Referral Decision |
| **Controlled action** | | | |
| Alston-1 petroleum exploration well, | 2003/1315 | Controlled Action | Post-Approval permit VIC/P44 |
| Bald Hills Wind Farm 80 Turbines | 2002/730 | Controlled Action | Post-Approval |

| | | | |
|---|---|---|---|
| Basalt Quarry Extension (Mountainview Quarry) | 2004/1329 | Controlled Action | Completed |
| Casino Gas Field Development | 2003/1295 | Controlled Action | Post-Approval |
| Construction of a factory for the production of ACV's | 2007/3842 | Controlled Action | Completed |
| Crib Point to Pakenham Gas Pipeline, Vic | 2018/8297 | Controlled Action | Completed |
| DPIPWE - Arthur-Pieman Conservation Area - off-road vehicle mitigation actions | 2017/8038 | Controlled Action | Completed |
| Establishment of plantation for use of effluent water | 2003/1063 | Controlled Action | Completed |
| Extension of Mountain View basalt quarry by 490 hectares (Stage 2) | 2004/1590 | Controlled Action | Post-Approval |
| Gas Import Facility, Crib Point, Vic | 2018/8298 | Controlled Action | Completed |
| Glenelg Dolomite Quarry | 2017/8021 | Controlled Action | Post-Approval |
| Green Point Wind Farm | 2001/529 | Controlled Action | Post-Approval |
| Heemskirk Windfarm Development | 2002/678 | Controlled Action | Completed |
| Installation of replacement crudecondensate pipeline, Vic | 2014/7202 | Controlled Action | Post-Approval |
| Kentbruck Green Power Hub, Vic | 2019/8510 | Controlled Action | Assessment Approach |
| Lonsdale Golf Club Redevelopment | 2003/969 | Controlled Action | Post-Approval |
| Lorne Golf Course redevelopment | 2004/1513 | Controlled Action | Post-Approval |
| Mosquito Control | 2005/2132 | Controlled Action | Post-Approval |
| Otway Development | 2002/621 | Controlled Action | Post-Approval |
| Pacific Hydro (Portland) Wind Farm SW Victoria | 2000/18 | Controlled Action | Post-Approval |

| | | | |
|---|---|---|---|
| Pelican Point residential subdivision | 2006/2529 | Controlled Action | Completed |
| Title of referral | Reference | Referral Outcome | Assessment Status |
| Controlled action | | | |
| Port Phillip Bay Channel Deepening | 2002/576 | Controlled Action | Post-Approval |
| Redevelopment of post office and construction of dwellings | 2007/3639 | Controlled Action | Completed |
| Residential and Golf Course Development Project | 2003/1144 | Controlled Action | Post-Approval |
| Residential Subdivision & Infrastructure Parish of Belfast | 2005/1954 | Controlled Action | Completed |
| Schomberg 3D Marine Seismic Survey | 2007/3754 | Controlled Action | Completed |
| Star of the South Offshore Wind Farm Project | 2020/8650 | Controlled Action | Guidelines Issued |
| Strike Oil Gas Exploration Well, Otway Basin (VIC/P44) | 2000/97 | Controlled Action | Completed |
| Twelve Apostles Saddle Lookout | 2019/8571 | Controlled Action | Post-Approval |
| Upgrade and expansion of existing Yaringa Boat Harbour | 2011/6014 | Controlled Action | Post-Approval |
| VIC Offshore Windfarm | 2021/8966 | Controlled Action | Assessment Approach |
| VICP61 2D Marine Seismic Survey | 2008/4075 | Controlled Action | Completed |
| Victorian Desalination Project, Bass Coast | 2008/3948 | Controlled Action | Post-Approval |
| Viva Energy Gas Terminal Project | 2020/8838 | Controlled Action | Assessment Approach |
| Windfarm | 2003/1109 | Controlled Action | Completed |

| | | | | |
|---|---|---|---|---|
| Wind Turbines | 2001/439 | Controlled Action | Completed | |
| Yolla Gas Field (TRL1) Development | 2001/321 | Controlled Action | Post-Approval | |
| Not controlled action Completed | 2004/2005 drilling program for exploration and production (VIC 01-06, 09-11, 16, 18 & 19 and VIC/RL | 2003/1282 | Not Controlled Action | |
| 2D seismic survey, Petroleum Exploration Permit Area T/36P | 2004/1787 | Not Controlled Action | Completed | |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | Action | |
| | | Not Controlled Action | Completed |
| | | Not Controlled | Completed |
| 2D seismic Survey in VIC/P55, VIC/RL2 and VIC/P41 | 2004/1876 | | |
| accomodation units and associatedadministration and recreational facilities | 2001/430 | Not Controlled Action | Completed |
| Acquistion of 2D seismic data in State Waters adjacent to Ninety Mile Beach-VIC/P39(V) | 2004/1889 | Not Controlled Action | Completed |
| Airey Inlet water reclamation plant to Anglesea sewerage system | 2006/2539 | Not Controlled Action | Completed |
| Allendale wind farm | 2007/3549 | Not Controlled Action | Completed |
| Alteration of Grass Maintenance Regime within Powling St Wetlands | 2012/6527 | Not Controlled Action | Completed |
| Amrit-1 exploration well | 2004/1572 | | Completed |
| Angas and Galloway Exploration Wells VIC/P39(v) | 2005/2330 | Not Controlled Action<br>Not Controlled Action | Completed |
| Anglesea Mine South Wall Vegetation removal, Anglesea, Vic | 2017/8060 | Not Controlled Action | Completed |
| Apollo Bay Water Storage Basin, VIC | 2012/6484 | Not Controlled Action | Completed |
| Aquacullture facility for rainbow trout and yabbies and recreational facilities | 2002/822 | Not Controlled Action | Completed |
| Barwon Heads Rd gas pipeline installation | 2006/2769 | Not Controlled Action | Completed |
| Barwon Heads Stormwater Outfall | 2016/7650 upgrade, Victoria | Not Controlled Action | Completed |
| Basker-Manta-Gummy Oil Development | 2011/6052 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | Not Controlled Action | Completed |
| Basker-Manta-Gummy Oil Field Development | 2007/3402 | Not Controlled Action | Completed |
| Basker-Manta Oil Field Development | 2005/2026 | | Completed |
| Bluff Heights Estate Stages 2 to 4 | 2003/1047 | Not Controlled Action | |
| Beardie-1 Field wildcat oil well | 2001/505 | | Completed |
| Boneo Park Equestrian Centre | 2008/4639 | Not Controlled Action | |
| Biodiversity Impacts Audit | 2011/6191 | | Completed |
| Capture of Juvenile Tasmanian Devils for Conservation Purposes | 2007/3261 | Not Controlled Action | |
| Capture of Tasmanian Devils from Disease-Free Areas | 2007/3883 | Not Controlled Action | Completed |
| CO2 geosequestration - Otway Basin Pilot Project | 2006/2699 | Not Controlled Action | Completed |
| Communications tower extension | 2003/1099 | Not Controlled Action | Completed |
| Construct a Recycled Water Pipeline from Somers Treatment Plant to Blue Scope S | 2009/4982 | Not Controlled Action | Completed |
| Construction and operation of Barwon Water biosolids treatment facility | 2008/4345 | Not Controlled Action | Completed |
| Construction of a flexi mat boat ramp | 2011/5838 | | Completed |
| Construction of an ocean access boat ramp at Bastion Point | 2004/1407 | Not Controlled Action | Completed |
| Construction of Barwon Heads Bridge | 2005/2375 | Not Controlled Action | Completed |
| Construction of Infrastructure to Extract, Treat & Transfer Groundwater to Wurde | 2008/4104 | Not Controlled Action | Completed |
| Construction of Overtaking Lanes on Great Ocean Rd | 2008/4044 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | | No |
| | | | No |
| | | Not Controlled | Completed |
| construction of pump station for pump diversion from the Barham River | 2003/1242 | Not Controlled Action | Completed |
| | 2003/1135 | Not Controlled Action | Completed |
| Construction of the Edgars Road Extension, from Childs Road, Lalor to Cooper Street, Epping | | | |
| Cowes Primary School Gymnasium | 2020/8683 | Not Controlled Action | Completed |
| | 2002/618 | | Completed |
| Cunninghame Arm Redevelopment (Stage 3) | | Not Controlled Action | |
| Development of Kipper gas field within Vic/L3, Vic/L4 Vic/RL2 | 2005/2484 | Not Controlled Action | Completed |
| Development of Pt Nepean Quarantine Station (former) National Centre for Coasts and Climate | 2008/4653 | | |
| development of retirement resort | 2004/1828 | | Completed |
| | | Not Controlled Action | |
| Development of Turrum Oil Field and associated infrastructure | 2003/1204 | Not Controlled Action | Completed |
| Divestment of Norris Barracks | 2003/963 | Not Controlled Action | Completed |
| | 2004/1554 | | Completed |
| Dredging of Tuross Lake channel and depositon of spoil in lake | | Not Controlled Action | |
| Drilling and side track completion at Baleen gas production well in Production Licence area VIC/L21 | 2004/1535 | Not Controlled Action | Completed |
| | 2005/2279 | | Completed |
| Drilling of 'Culverin' oil exploration well, permit VIC/P56 | | Not Controlled Action | |
| | 2004/1633 | | Completed |
| Drilling of Callister-1 exploration well in VIC/P51 | | Not Controlled Action | |
| Drilling of Scallop-1 Exploration Well | 2003/917 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| East Pilchard exploration well | 2001/137 | Not Controlled Action | Completed |
| | | Not Controlled Action | Completed |
| Eight Mile Creek Drainage Works, Peacocks Road, Eight Mile Creek, SA | 2014/7170 | Not Controlled Action | Completed |
| | 2019/8438 | | Completed |
| Enterprise 1 Exploration Drilling Program, near Port Campbell, Vic | 2004/1681 | Not Controlled Action | Completed |
| Exploration drilling for liquid/gaseous hydrocarbons | | Not Controlled Action | |
| Exploration Drilling Well Trefoil-1 | 2003/1058 | Not Controlled Action | Completed |
| Extension of Mountain View basalt quarry by 113 hectares (stage one) | 2004/1591 | Not Controlled Action | Completed |
| | 2008/4127 | | Completed |
| Fabrication and Spooling of Pipe Strings at Crib Point | 2001/269 | Not Controlled Action | Completed |
| Ferry Service Infrastructure Development | | Not Controlled Action | |
| Flinders Backlog Sewer Project | 2005/2275 | | |
| Gas Field Development | 2006/2635 | | |
| Gas Fields Development | 2011/5879 | | |
| Gas Pipeline Installation | 2005/2495 | Action<br>Not Controlled Action | Completed |
| Gippsland Basin Seismic Programme | 2004/1866 | | Completed |
| | | Not Controlled Action | |
| | 2011/6164 | | Completed |
| Gleneig Spiny Crayfish Habitat Rehabilitation | | Not Controlled Action | |
| | 2004/1793 | Not Controlled Action | Completed |
| Golflinks Road Residential Development & Water Storage Facility at Barwon Heads | 2005/1979 | | Completed |
| Grevillea infecunda tip cuttings and soil samples | | Not Controlled Action | |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | | No |
| | | | No |
| | | Not Controlled | Completed |
| Halladale and Speculant Gas Pipeline Project, North of Port Campbell, Vic | 2015/7551 | Not Controlled Action | Completed |
| Hemingway1/Oil Exploration | 2001/177 | | Completed |
| | | Not Controlled Action | |
| Henry-1 Exploration Well, Petroleum Permit Area VIC/P44 | 2005/2147 | Not Controlled Action | Completed |
| Huxley Hill Wind Farm expansion | 2005/2499 | | Completed |
| | | Not Controlled Action | |
| Huxley Hill Wind Farm Expansion | 2002/570 | | Completed |
| | | Not Controlled Action | |
| Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia | 2015/7522 | Not Controlled Action | Completed |
| INDIGO Central Submarine Telecommunications Cable | 2017/8127 | Not Controlled Action | Completed |
| Installation of a 35 metre telecommunications facility at Jirrahlinga Animal San | 2003/1151 | Not Controlled Action | Completed |
| Installation of optic fibre cable from Inverloch, Victoria to Stanley, Tasmania | 2002/906 | Not Controlled Action | Completed |
| Kelly Swamp Boardwalk Construction | 2010/5371 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | Not Controlled Action | Completed |
| | | Not Controlled Action | Completed |
| | | Not Controlled | Completed |
| Kipper Tuna Turrum Project Maintenance Dredging | 2010/5430 | | |
| Kongorong Wind Farm | 2002/568 | | |
| | 2005/2494 | | |
| Longtom-3 Gas Appraisal Well, VIC/P54 | | Action | |
| Longtom Gas Pipeline Development, VIC/P54 | 2006/3072 | Not Controlled Action | Completed |
| Lot 5 Pelican Point Road, Pelican Point SA - Proposed New Dwelling | 2021/9011 | Not Controlled Action | Completed |
| Maintenance and priority works to heritage buildings at Point Nepean Quarantine | 2006/3151 | Not Controlled Action | Completed |
| Maintenance dredging of Yaringa Channel | 2004/1360 | Not Controlled Action | Completed |
| Maintenance Dredging South Channel 2012 | 2011/6198 | Not Controlled Action | Completed |
| Maintenance of Access Track and Weed Removal | 2009/4973 | Not Controlled Action | Completed |
| Maintenance works at Barwon Heads Bridge | 2003/1199 | Not Controlled Action | Completed |
| Marine and Freshwater Resources Institute (MAFRI) Facility | 2000/121 | Not Controlled Action | Completed |
| Marlin-Snapper Gas Pipeline Project | 2006/3197 | Not Controlled Action | Completed |
| Melville 1 Oil Exploration Well | 2001/167 | Not Controlled Action | Completed |
| Merricks Beach Backlog Sewer Project | 2010/5300 | Not Controlled Action | Completed |
| Millwood Road Gravel Quarry | 2002/602 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | Not Controlled Action | Completed |
| | | Not Controlled Action | Completed |
| | | Not Controlled | Completed |
| Milton/Ulladulla Sewerage Scheme | 2001/251 | Not Controlled Action | Completed |
| Minerva Cut Back Project, Vic | 2017/8036 | | Completed |
| Newfield wind farm | 2007/3226 | Not Controlled Action | Completed |
| Newhaven Yacht Squadron marina extension | 2004/1450 | Not Controlled Action | Completed |
| New Water Infrastructure Upgrade, Grassy Dam, King Island | 2013/6882 | | |
| Nirranda South Wind Farm Pty Ltd | 2002/763 | | |
| Northright-1 Exploration Well | 2001/209 | | |
| | | Action | |
| Ocean Grove rising main 2 upgrade | 2009/4978 | Not Controlled Action | Completed |
| Ocean Grove Rising Main 2 Upgrade (OGRM2) - East Section & River Crossing | 2010/5508 | Not Controlled Action | Completed |
| Oceanlinx South Australia 1mW Greenwave Project | 2012/6528 | Not Controlled Action | Completed |
| Offshore exploration drilling within permit area VIC/P 37(v) | 2004/1466 | Not Controlled Action | Completed |
| Offshore Petroleum Exploration | 2001/289 | Not Controlled Action | Completed |
| Offshore Seismic Survey | 2001/498 | Not Controlled Action | Completed |
| Optic fibre cable installation - San Remo to Cowes | 2005/2386 | Not Controlled Action | Completed |
| Piccaninnie Ponds flow path restoration project, SA | 2013/6711 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | Not Controlled Action | Completed |
| | | Not Controlled Action | Completed |
| | | Not Controlled | Completed |
| Pipeline easement regrowth removal | 2011/5817 | | Completed |
| | | Not Controlled Action | |
| Point Nepean Quarantine Station (former)/Restoration of Medical Superintendent's | 2006/3149 | Not Controlled Action | Completed |
| Port Campbell Headland Walking Trail Realignment | 2012/6676 | Not Controlled Action | Completed |
| Portland Landfill Borehole Installation, Vic | 2017/7886 | Not Controlled Action | Completed |
| Port Phillip Channel Deepening Project - Trial Dredge Program | 2005/2164 | Not Controlled Action | Completed |
| Port Welshpool Harbour Dredging | 2007/3521 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | Not Controlled Action | Completed |
| | | Not Controlled Action | Completed |
| Residential/Resort/Golf Course development | | | |
| Proposed replacement of existing road culvert | 2013/7077 | Not Controlled Action | Completed |
| Queenscliff Harbour Redevelopment | 2004/1352 | | |
| | 2010/5534 | | |
| Railway Bridge (H0151) Partial Demolition, Merri River | | | |
| Redevelopment Project to Upgrade and Extend the Portland Trawler Wharf | 2008/4317 | Action | |
| | 2002/708 | | Completed |
| Rehabilitation of Lake Connewarre State Game Reserve | | Not Controlled Action | |
| | 2003/1129 | | Completed |
| Remedial Works to the Swan Island Bridge | | Not Controlled Action | |
| Remote power generation project | 2005/2287 | | Completed |
| | | Not Controlled Action | |
| Replacement of sewer pipelines | 2002/623 | | Completed |
| | | Not Controlled Action | |
| | 2002/907 | | Completed |
| | | Not Controlled Action | |
| | | Not Controlled | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| | | Not Controlled Action | Completed |
| | | Not Controlled Action | Completed |
| Residential Development, 409 The Esplanade, St Leonards | 2006/2950 | Not Controlled Action | Completed |
| Residential Dwelling | 2004/1896 | Not Controlled Action | Completed |
| Robe Golf Club - Golf Course Extension, SA | 2017/7928 | Not Controlled Action | Completed |
| Robe Golf Course, Allotment 2, Davenport Street, Robe, SA | 2014/7178 | Not Controlled Action | Completed |
| Ryan Corner Wind Farm | 2005/2142 | Not Controlled Action | Completed |
| Ship to ship crude oil lightering | 2008/4279 | Not Controlled Action | Completed |
| Ship to Ship Crude Oil Lightering | 2001/271 | Not Controlled Action | Completed |
| Sole-2 appraisal gas well, VIC/RL3 | 2002/636 | Not Controlled Action | Completed |
| Sole gas field development | 2003/937 | Not Controlled Action | Completed |
| Stage 1 residential subdivision, Anna Catherine Drive | 2005/1992 | Not Controlled Action | Completed |
| St Quentin Consulting Pty Ltd /Residential development/305 Great Ocean Road, Jan | 2014/7184 | Not Controlled Action | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| Juc/VIC/Development | | | |
| Telstra optic fibre cable across Bass Strait - Sub bottom profiler Surve | 2002/779 | Not Controlled Action | Completed |
| | 2004/1565 | Not Controlled Action | Completed |
| To construct a shared trail within the Arthurs Seat Road, road reserve south side from Mornington Fl | 2004/1704 | Not Controlled Action | Completed |
| Torquay Sewerage Strategy - pipe replacement between Torquay and the Black Rock | 2002/793 | Not Controlled Action | Completed |
| Track construction - Great Ocean Walk | 2008/4521 | Not Controlled Action | Completed |
| Transfer of 90ha Point Nepean Quarantine Station from Commonwealth to Victorian | | | |
| Turrum Phase 2 Development Project | 2008/4191 | Not Controlled Action | Completed |
| Upgrade and Repairs to Flinders Pier | 2008/4331 | Not Controlled Action | Completed |
| Upgrade of existing access track | 2011/5933 | Not Controlled Action | Completed |
| Venus Bay Outfall Extension | 2004/1555 | Not Controlled Action | Completed |
| | 2007/3767 | Not Controlled Action | Completed |
| VIC-P44 Stage 2 Gas Field Development | | | |
| Victorian Generator Project | 2005/1984 | Not Controlled Action | Completed |
| | 2004/1420 | Not Controlled Action | Completed |
| Wastewater Treatment System Upgrade | | | |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| West Triton Drilling Program Gippsland Basin | 2007/3915 | Not Controlled Action (Particular Manner) | Post-Approval<br>Completed |
| Title of referral | Reference | Referral Outcome | Assessment Status |
| Not controlled action (particular manner) | | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| West Triton Drilling Program - Otway Basin | 2007/3909 | Not Controlled Action | Completed |
| Wind Farm | 2002/691 | Not Controlled Action | Completed |
| Wind Farm Construction and Operation | 2001/471 | Not Controlled Action | Completed |
| Not controlled action (particular manner) | | | |
| 'Moonlight Head' 3D seismic survey, VIC/P38(V), VIC/P43 and VIC/RL8 | 2005/2236 | | |
| 2D Marine Seismic Survey | 2005/2295 | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| | | | |
|---|---|---|---|
| 2D Marine Seismic Survey, EPP33 | 2004/1794 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Marine Seismic Survey in Permit Areas T/32P and T/33P | 2002/845 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic Survey | 2008/4131 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic Survey | 2008/3962 | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic Survey | 2008/4066 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic Survey | 2003/1214 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D seismic survey, Petroleum Exploration Permit Area EPP27 | 2006/2776 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D seismic survey in the Sole gas field and adjacent acreage in the Gippsland Basin (VIC RL/3 & VIC/ | 2002/871 | Not Controlled Action (Particular | Post-Approval |
| 2D Seismic Survey in VIC/P50 and VIC/P46 | 2004/1810 | | |
| 2D seismic survey Permit Area VIC/P49 | 2006/2943 | | |
| 2D Seismic Survey Program in Bass Strait | 2008/4040 | | |
| 2D seismic survey VIC/P50 | 2005/2313 | Manner) | Post-Approval |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Siesmic Marine Survey | 2008/4074 | Not Controlled | Post-Approval |
| | | Action (Particular Manner) | |
| 3D marine seismic survey near King Island | 2004/1461 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| 3D Marine Seismic Survey within Torquay Sub-basin off sthn Victoria | 2012/6256 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| 3D seismic program VIC/P38(v), VIC/P43 and VIC/RL8 | 2003/1137 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| 3D Seismic Survey | 2008/4528 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Apache 3D seismic exploration survey | 2006/3146 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Aroo Chappell 3D seismic survey | 2010/5701 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Astrolabe 3D Marine Seismic Survey | 2011/6048 | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular | Post-Approval |
| Barwon Heads Rising Main No.11 Sewerage Pipe Upgrade | 2008/4091 | | |
| Bass Basin 2D and 3D seismic surveys (T/38P & T/37P) | 2007/3650 | | |
| Benbows Paddock residential development, Cape Bridgewater | 2007/3247 | | |
| | | Manner) | |
| Bernoulli 3D Seismic Survey | 2006/3053 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| BHPBilliton Otway 3D Seismic Survey | 2007/3443 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Bitumen Storage Facility | 2007/3676 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Bream 3D seismic survey | 2006/2556 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| construction of a 14km , 33kV | 2003/1108 | | Post-Approval |
| | | Not Controlled | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| distribution line, including connection Bonney Central win | | Not Controlled Action (Particular Manner) to the Lake | Post-Approval |
| Construction of bridge across Barwon River | 2006/2947 | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| Construction of wharf | 2003/1050 | Not Controlled Action (Particular Action (Particular Manner) | Post-Approval |
| Construct private dwelling | 2008/4234 | Not Controlled Action (Particular | Post-Approval |
| Construct single dwelling | 2008/4504 | | |
| Controlled Burn, Understorey Clearance and Removal of UXO | 2003/1030 | | |
| Corio Bay Channel Safety Adjustment Program | 2011/6208 | | |
| Dalrymple 3D Seismic Survey | 2010/5680 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Deepwater Sorell Basin 2001 NonExclusive 2D Seismic Survey | 2001/156 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| | 2003/1133 | | Post-Approval |
| Drainage, Trenching & Cable Laying as Part of the Regional Fast Rail Project | | Not Controlled Action (Particular Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | | Post-Approval |
| Drill and Profile Exploration Well Somerset 1, License Area T34P | 2009/5037 | Not Controlled | |
| | | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| Eden Breakwater Wharf extension, NSW | 2015/7582 | Not Controlled Action (Particular Manner) | Post-Approval |
| Eden Breakwater Wharf Extension, NSW | 2016/7828 | | Completed |
| | | Not Controlled Action (Particular Manner) | |
| | 2016/7800 | | Post-Approval |
| Enterprise Three-dimensional Transition Zone Seismic Survey, Victoria | | Not Controlled Action (Particular Manner) | |
| Exploration drilling of the Craigow-1 and Tolpuddle-1 wells | 2010/5725 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Fuelbreak construction | 2009/4915 | | |
| Gas Pipeline | | | |
| Geelong Bypass Section 3 | 2000/20<br>2005/2099 | | |
| | 2009/5241 | | |
| Gippsland 2D Marine Seismic Survey - VIC/P-63, VIC/P-64 and T/46P | | Manner) | |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled | Post-Approval |
| Golden Beach gas field development | 2003/1031 | | |
| | | Action (Particular Manner) | |
| Granville Wind Farm, TAS | 2012/6585 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| INDIGO Marine Cable Route Survey (INDIGO) | 2017/7996 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| | 2012/6362 | | Post-Approval |
| Inspection of project vessels for presence of invasive marine pests in Commonwealth waters off Victo | | Not Controlled Action (Particular Manner) | |
| Labatt 3D Seismic Survey T/47P Bass Strait | 2007/3759 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| La Bella 3D Marine Seismic Survey, Otway Basin, VIC | 2012/6683 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Lakes Entrance Sand Management Program Trial Dredging | 2007/3852 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Lakes Oil 3D Seismic Survey | 2002/768 | Not Controlled Action (Particular | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | 2012/6498 | Not Controlled Action (Particular | Post-Approval |
| Longtom-5 Offshore Production Drilling (Vic/L29), VIC | | | |
| Longtom South -1 Exploration Drilling | 2011/6217 | | |
| Luxury Cruise on the Gordon River, Tasmanian Wilderness PT 2 | 2006/3044 | | |
| Luxury Cruise on the Gordon River, Tasmanian Wilderness WHA | 2004/1846 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Maintenance Dredging of Oceanic Sand | 2011/5932 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Maintenance Dredging Program | 2009/4953 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Maintenance Dredging Program 2012-21 in Port of Melbourne | 2012/6332 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Non-exclusive 3-D Marine Seismic Survey, Bass Strait | 2002/775 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| Northern Fields 3D Seismic Survey | 2001/140 | Not Controlled | Post-Approval |
| | | Action (Particular Manner) | |
| Origin Energy Silvereye-1 Exploration Drilling Programme | 2010/5702 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| OTE10 2D Marine Seismic Survey | 2009/5223 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Otway Basin Exploration Drilling Campaign, Vic | 2011/6125 | | |
| Pelican 3D Marine Seismic Survey, Gippsland Basin, Vic | 2017/8097 | | |
| Point Wilson Explosives Area Waterside Infrastructure Remediation | 2012/6376 | | |
| Residential Development and Associated Infrastructure at Port Fairy | 2012/6687 | | |
| | | Manner) | |
| | 2009/4776 | | Post-Approval |
| Rockhopper-1 and Trefoil-2 Exploration Drilling in Permit Area T/18P | | Not Controlled Action (Particular Manner) | |
| Santos 2D Seismic Survey VIC/P44 & | 2003/1213 | Not Controlled | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| VIC/P51 | | Not Controlled Action (Particular Manner) | Post-Approval |
| Santos Otway 3d Seismic VIC/P44 | 2007/3367 | | Post-Approval |
| Schomberg 3D Marine Seismic survey | 2007/3868 | Not Controlled Action (Particular Manner) | Post-Approval |
| Seismic Exploration in Permit VIC/P41 | 2001/267 | Not Controlled Action (Particular Manner) | Post-Approval |
| Seismic Survey | 2001/206 | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| Seismic survey, Gippsland Basin | 2001/525 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Seismic Survey in Petroleum Permit Area EPP27 | 2002/648 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Seismic Survey VIC-P46 | 2002/826 | | |
| Shaw River Power Station construct gas pipeline and associated infrastructure | 2009/5089 | | |
| Shaw River Power Station Project Water Supply Pipeline | 2009/5091 | | |
| Silvereye 3D Seismic Survey | 2007/3551 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Southern Flanks 2D Marine Seismic Survey | 2010/5288 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Southern Gas Pipeline Project | 2002/619 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| Southern Margins 3D Seismic Survey VIC/P55 | 2007/3780 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| | | | |
|---|---|---|---|
| | | | Post-Approval |
| Southern Margins T/35P and T/36P 3D Seismic Surveys | 2007/3817 | Not Controlled Action (Particular Manner) | |
| Speculant 3D Transition Zone Seismic Survey | 2010/5558 | Not Controlled Action (Particular Manner) | Post-Approval |
| Surface Geochemical Exploration Program, TAS | 2010/5780 | Not Controlled Action (Particular Manner) | Post-Approval |
| Tap Oil Ltd Molson 2D Seismic Survey T47P | 2008/3967 | Not Controlled Action (Particular Manner) | Post-Approval |
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, Vic | 2012/6565 | | |
| Torquay Sub-basin (VIC/P62) OTE12-3D Seismic Survey | 2012/6655 | | |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| Tuskfish 3D Seismic Survey, Bass Strait | 2010/5700 | Not Controlled Action (Particular Manner) | Post-Approval |
| Undertake a three dimensional marine seismic survey | 2004/1370 | Not Controlled Action (Particular Manner) | Post-Approval |
| Vegetation clearance and residential subdivision near Mt Gambier | 2003/1102 | Not Controlled Action (Particular Manner) | Post-Approval |
| Vic/P37(v) and Vic/P44 3D marine seismic survey | 2002/662 | Not Controlled Action (Particular Manner) | Post-Approval |
| VIC P44 Gas Exploration Wells | 2002/864 | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| Vic-P51 and Vic-P52 2D seismic survey | 2002/811 | | Post-Approval |
| | | Not Controlled Action (Particular Manner) | |
| | 2013/6973 | | Post-Approval |
| West Seahorse Oil Development Project, Commonwealth waters offshore Victoria | | Not Controlled Action (Particular Manner) | |
| Wolseley 3D seismic acquisition survey | 2010/5703 | Not Controlled Action (Particular Manner) | Post-Approval |
| Referral decision | | | |
| 2D & 3D Seismic Surveys - Permit Area - VIC/P50 | 2008/4517 | Referral Decision | Completed |
| 2D Seismic Survey | 2008/3978 | Referral Decision | Completed |
| 3D Marine Seismic Survey | 2011/6156 | Referral Decision | Completed |
| 3D Seismic Survey | 2008/4014 | Referral Decision | Completed |
| 8 Lot Industrial Subdivision | 2008/4527 | Referral Decision | Completed |
| All actions taken in response to the current severe bushfires in | 2009/4787 | Referral Decision | Completed |
| | | Not Controlled Action (Particular Manner) | Post-Approval |
| | | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Referral decision | | | |
| Victoria. Alteration Reconstruction Restoration and Repairs to Buildings | 2008/4179 | Referral Decision | Completed |
| Beardie-1 Field wildcat oil well | 2001/469 | Referral Decision | Completed |
| Breeding program for Grey Nurse Sharks | 2007/3245 | Referral Decision | Completed |
| Darymple 3D Seismic Survey, Petroleum Exploration Permit T/41P | 2010/5322 | Referral Decision | Completed |
| Holloman 2010 Vic/P60 3D Seismic Acquisition Survey Program | 2009/5251 | Referral Decision | Completed |
| Longtom 5 Offshore Production Drilling (VIC/L29) | 2012/6404 | Referral Decision | Completed |
| Longtom-5 Offshore Production Drilling (Vic/L29) | 2012/6413 | Referral Decision | Completed |
| Portland Wave Energy Project | 2008/3946 | Referral Decision | Completed |
| Residential Development Elizabeth Avenue, Rosebud West, VIC | 2015/7603 | Referral Decision | Completed |
| Shark 3D Seismic Survey | 2007/3294 | Referral Decision | Completed |
| Stanton 3D Marine Seismic Survey | 2013/6764 | Referral Decision | Completed |
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, VIC | 2012/6545 | Referral Decision | Completed |
| Upgrade of Corringle Road | 2009/4825 | Referral Decision | Completed |
| Upgrade of Services Infrastructure Point Nepean Quarantine Station | 2008/4591 | Referral Decision | Completed |
| VICP61 2D Marine Seismic Survey | 2008/3975 | Referral Decision Referral | Completed |

| | | | |
|---|---|---|---|
| Wind Farm | 2001/139 | Decision | Completed |
| Wolseley 3D Seismic Acquisition Survey in Permit | 2010/5291 | Referral Decision T/32P | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Referral decision | | | |
| Works to the buildings and surrounds at the former Point Nepean Quarantine Stati | 2008/4156 | Referral Decision | Completed |

## Key Ecological Features [ Resource Information ]

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

| Name | Region |
|---|---|
| Big Horseshoe Canyon | South-east |
| Bonney Coast Upwelling | South-east |
| Canyons on the eastern continental slope | Temperate east |
| Shelf rocky reefs | Temperate east |
| Upwelling East of Eden | South-east |
| West Tasmania Canyons | South-east |

## Biologically Important Areas [ Resource Information ]

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Dolphins | | |
| Tursiops aduncus<br>Indo-Pacific/Spotted Bottlenose Dolphin [68418] | Breeding | Likely to occur |
| Seabirds | | |
| Ardenna carneipes<br>Flesh-footed Shearwater [82404] | Foraging | Known to occur |
| Ardenna grisea<br>Sooty Shearwater [82651] | Breeding | Known to occur |
| Ardenna grisea<br>Sooty Shearwater [82651] | Foraging | Likely to occur |
| Ardenna grisea | | |

| | | | |
|---|---|---|---|
| Sooty Shearwater [82651] | Foraging | Known occur | to |
| [Ardenna pacifica](#)<br>Wedge-tailed Shearwater [84292] | Foraging | Likely to occur | |
| [Ardenna tenuirostris](#)<br>Short-tailed Shearwater [82652] | Breeding | Known occur | to |

| Scientific Name | Behaviour | Presence | |
|---|---|---|---|
| [Ardenna tenuirostris](#)<br>Short-tailed Shearwater [84292] | Breeding | Known occur | to |
| [Ardenna tenuirostris](#)<br>Short-tailed Shearwater [82652] | Foraging | Likely to occur | |
| [Ardenna tenuirostris](#)<br>Short-tailed Shearwater [82652] | Foraging | Known occur | to |
| [Diomedea exulans (sensu lato)](#)<br>Wandering Albatross [1073] | Foraging | Likely to occur | |
| [Diomedea exulans (sensu lato)](#)<br>Wandering Albatross [1073] | Foraging | Known occur | to |
| [Diomedea exulans antipodensis](#)<br>Antipodean Albatross [82269] | Foraging | Known occur | to |
| [Eudyptula minor](#)<br>Little Penguin [1085] | Breeding | Known occur | to |
| [Eudyptula minor](#)<br>Little Penguin [1085] | Breeding | Likely to occur | |
| [Eudyptula minor](#)<br>Little Penguin [1085] | Foraging | Known occur | to |
| [Macronectes giganteus](#)<br>Southern Giant Petrel [1060] | Foraging | Known occur | to |
| [Macronectes halli](#)<br>Northern Giant Petrel [1061] | Foraging | Known occur | to |
| [Morus serrator](#) | | | |

| | | | |
|---|---|---|---|
| Australasian Gannet [1020] | Aggregation | Known occur | to |
| [Morus serrator](#)<br>Australasian Gannet [1020] | Foraging | Known occur | to |
| [Oceanites oceanites](#)<br>Wilsons Storm Petrel [1034] | Migration | Known occur | to |
| [Pelagodroma marina](#)<br>White-faced Storm-petrel [1016] | Breeding | Known occur | to |

| Scientific Name | Behaviour | Presence | |
|---|---|---|---|
| [Pelagodroma marina](#)<br>White-faced Storm-petrel [1016] | Foraging | Known occur | to |
| [Pelecanoides urinatrix](#)<br>Common Diving-petrel [1018] | Breeding | Known occur | to |
| [Pelecanoides urinatrix](#)<br>Common Diving-petrel [1018] | Foraging | Known occur | to |
| [Phalacrocorax fuscescens](#)<br>Black-faced Cormorant [59660] | Breeding | Known occur | to |
| [Phalacrocorax fuscescens](#)<br>Black-faced Cormorant [59660] | Foraging | Known occur | to |
| [Procellaria parkinsoni](#)<br>Black Petrel [1048] | Foraging | Likely to occur | |
| [Pterodroma macroptera](#)<br>Great-winged Petrel [1035] | Foraging | Likely to occur | |
| [Pterodroma mollis](#)<br>Soft-plumaged Petrel [1036] | Breeding | Known occur | to |
| [Pterodroma mollis](#)<br>Soft-plumaged Petrel [1036] | Foraging | Known occur | to |
| [Thalassarche bulleri](#) | | | |

| | | | |
|---|---|---|---|
| Bullers Albatross [64460] | Foraging | Known occur | to |
| Thalassarche cauta cauta<br>Shy Albatross [82345] | Foraging likely | Likely to occur | |
| Thalassarche cauta steadi<br>White-capped Albatross [82344] | Foraging | Known occur | to |
| Thalassarche chlororhynchos bassi<br>Indian Yellow-nosed Albatross [85249] | Foraging | Known occur | to |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Foraging | Known occur | to |
| Thalassarche melanophris impavida<br>Campbell Albatross [82449] | Foraging | Known occur | to |
| Scientific Name | Behaviour | Presence | |
| Thalassarche melanophris impavida | Campbell Albatross [82449] | Foraging | Likely to oc ur |
| Thalasseus bergii<br>Crested Tern [83000] | | | |
| | Breeding | Known to occur | |
| Thalasseus bergii<br>Crested Tern [83000] | | | |
| | Foraging | Likely to occur | |
| Seals | | | |
| Neophoca cinerea<br>Australian Sea Lion [22] | | Known to occur | |
| | Foraging (male) | | |
| Neophoca cinerea<br>Australian Sea Lion [22] | Foraging (male and female) | Known to occur | |
| Sharks | | | |
| Carcharias taurus | | | |

| | | | |
|---|---|---|---|
| Grey Nurse Shark [64469] | Foraging | Known to occur | Carcharias taurus Grey Nurse Shark [64469] |
| | Migration | Known to occur | |
| Carcharodon carcharias White Shark [64470] | | | |
| | Breeding (nursery area) | Known to occur | |
| Carcharodon carcharias White Shark [64470] | Foraging | Known to occur | |

## Whales

| | | |
|---|---|---|
| Balaenoptera musculus brevicauda Pygmy Blue Whale [81317] | Foraging | Likely to be present |
| Balaenoptera musculus brevicauda Pygmy Blue Whale [81317] | Foraging (abundant food source) | Known to occur |
| Balaenoptera musculus brevicauda Pygmy Blue Whale [81317] | Foraging (annual high use area) | Known to occur |
| Balaenoptera musculus brevicauda Pygmy Blue Whale [81317] | Known Foraging Area | Known to occur |

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Megaptera novaeangliae Humpback Whale [38] | Migration (north and south) | Known to occur |
| Physeter macrocephalus Sperm Whale [59] | Foraging likely (abundant food source) | Known to occur |

## Bioregional Assessments

[ Resource Information ]

| SubRegion | BioRegion | Website |
|---|---|---|
| Gippsland | Gippsland Basin | BA website |

# Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory

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

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

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

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Department of Climate Change, Energy, the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

East Coast Project Noise EMBA PMST Report

Report created: 19-May-2025




*Figure 1: Noise EMBA*


Summary

Details

- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat

Acknowledgements

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | None |
| Wetlands of International Importance (Ramsar | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | 2 |
| Listed Threatened Ecological Communities: | None |
| Listed Threatened Species: | 44 |
| Listed Migratory Species: | 43 |

## Other Matters Protected by the EPBC Act

| | |
|---|---|
| State and Territory Reserves: | None |
| Regional Forest Agreements: | None |
| Nationally Important Wetlands: | None |
| EPBC Act Referrals: | 31 |
| Key Ecological Features (Marine): | None |
| Biologically Important Areas: | 10 |
| Bioregional Assessments: | None |

| | |
|---|---|
| Geological and Bioregional Assessments: | None |

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

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

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

| | |
|---|---|
| Commonwealth Lands: | None |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 67 |
| Whales and Other Cetaceans: | 28 |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | None |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

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

# Details

## Matters of National Environmental Significance

### Commonwealth Marine Area [ Resource Information ]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

| Feature Name |
|---|
| Commonwealth Marine Areas (EPBC Act) |

Commonwealth Marine Areas (EPBC Act)

### Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| BIRD | | |
| Ardenna grisea | | |

| | | |
|---|---|---|
| Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea sanfordi<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| [Halobaena caerulea](#)<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area |
| [Limosa lapponica baueri](#)<br>Nunivak Bar-tailed Godwit, Western<br>Alaskan Bar-tailed Godwit [86380] | Endangered | Species or species habitat may occur within area |
| [Macronectes giganteus](#)<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |
| [Macronectes halli](#)<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Neophema chrysogaster](#)<br>Orange-bellied Parrot [747] | Critically Endangered | Migration route likely to occur within area |
| [Numenius madagascariensis](#)<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat may occur within area |
| [Pachyptila turtur subantarctica](#)<br>Fairy Prion (southern) [64445] | Vulnerable | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Phoebetria fusca](#)<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| [Pterodroma leucoptera leucoptera](#)<br>Gould's Petrel, Australian Gould's Petrel [26033] | Endangered | Species or species habitat may occur within area |
| [Pterodroma mollis](#)<br>Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat may occur within area |

| | | |
|---|---|---|
| [Sternula albifrons](#)<br>Little Tern [82849] | Vulnerable | Species or species habitat may occur within area |
| [Sternula nereis nereis](#)<br>Australian Fairy Tern [82950] | Vulnerable | Species or species habitat known to occur within area |
| [Thalassarche bulleri](#)<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche bulleri platei](#)<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche carteri](#)<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| [Thalassarche cauta](#)<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche chrysostoma](#)<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Thalassarche impavida](#)<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche melanophris](#)<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| [Thalassarche salvini](#)<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche steadi](#)<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| [Thinornis cucullatus cucullatus](#)<br>Eastern Hooded Plover, Eastern Hooded Plover [90381] | Vulnerable | Species or species habitat likely to occur within area |
| FISH | | |
| [Hoplostethus atlanticus](#)<br>Orange Roughy, Deep-sea Perch, Red Roughy [68455] | Conservation Dependent | Species or species habitat likely to occur within area |
| [Prototroctes maraena](#)<br>Australian Grayling [26179] | Vulnerable | Species or species habitat likely to occur within area |
| [Seriolella brama](#)<br>Blue Warehou [69374] | Conservation Dependent | Species or species habitat known to occur within area |
| MAMMAL | | |
| Sei Whale [34]<br><br>[Balaenoptera musculus](#) | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| | | | |
|---|---|---|---|
| Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area | Balaenoptera borealis |
| Scientific Name | Threatened Category | Presence Text | |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area | |
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area | |
| Neophoca cinerea<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area | |
| REPTILE | | | |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat likely to occur within area | |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area | |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Species or species habitat likely to occur within area | |
| SHARK | | | |
| Carcharodon carcharias<br>White Shark, Great White Shark [64470] | Vulnerable | Migration route known to occur within area | |
| Centrophorus uyato<br>Little Gulper Shark [68446] | Conservation Dependent | Species or species habitat likely to occur within area | |
| Galeorhinus galeus<br>School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453] | Conservation Dependent | Species or species | |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|

habitat may occur within area

## Listed Migratory Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| **Migratory Marine Birds** | | |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area |
| Ardenna carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Foraging, feeding or related behaviour likely to occur within area |
| Ardenna grisea<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea sanfordi<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |

| | | |
|---|---|---|
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | |
| | | Foraging, feeding or related behaviour likely to occur within area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| Sternula albifrons<br>Little Tern [82849] | Vulnerable | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Migratory Marine Species | | |
| Balaenoptera bonaerensis<br>Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely |

| | | |
|---|---|---|
| to occur within area | | |
| [Balaenoptera borealis](#)<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Scientific Name | Threatened Category | Presence Text |
| [Balaenoptera musculus](#)<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| [Balaenoptera physalus](#)<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Caperea marginata](#)<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour may occur within area |
| [Carcharias taurus](#)<br>Grey Nurse Shark [64469] | | Species or species habitat may occur within area |
| [Carcharodon carcharias](#)<br>White Shark, Great White Shark [64470] | Vulnerable | Migration route known to occur within area |
| [Caretta caretta](#)<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat likely to occur within area |
| [Chelonia mydas](#)<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area |
| [Dermochelys coriacea](#)<br>Leatherback Turtle, Leathery Turtle, Luth<br>Endangered [1768] | | Species or species habitat likely to occur within area |

| | | |
|---|---|---|
| Eubalaena australis as Balaena glacialis australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |
| Isurus oxyrinchus<br>Shortfin Mako, Mako Shark [79073] | | Species or species habitat likely to occur within area |
| Lagenorhynchus obscurus<br>Dusky Dolphin [43] | | Species or species habitat likely to occur within area |
| Scientific Name | Threatened Category | Presence Text |
| Lamna nasus<br>Porbeagle, Mackerel Shark [83288] | | Species or species habitat likely to occur within area |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area |
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area |
| Physeter macrocephalus<br>Sperm Whale [59] | | Species or species habitat may occur within area |
| Migratory Wetlands Species | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area |

| | | |
|---|---|---|
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area |
| Limosa lapponica<br>Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat may occur within area |

## Other Matters Protected by the EPBC Act

| Listed Marine Species | | [ Resource Information ] |
|---|---|---|
| Scientific Name | Threatened Category | Presence Text |
| Bird | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area |
| Ardenna carneipes as Puffinus carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Foraging, feeding or related behaviour likely to occur within area |
| Ardenna grisea as Puffinus griseus<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area |
| Calidris canutus | | |

| | | |
|---|---|---|
| Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area overfly marine area |
| [Calidris ferruginea](#)<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area overfly marine area |
| [Calidris melanotos](#)<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area |
| [Diomedea antipodensis](#)<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Diomedea epomophora](#)<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea exulans](#)<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea sanfordi](#)<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| [Halobaena caerulea](#)<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area |
| [Limosa lapponica](#) | | |

| | | |
|---|---|---|
| Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| [Macronectes giganteus](#) | | |
| Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |
| [Macronectes halli](#) | | |
| Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Neophema chrysogaster](#) | | |
| Orange-bellied Parrot [747] | Critically Endangered | Migration route likely to occur within area overfly marine area |
| [Numenius madagascariensis](#) | | |
| Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat may occur within area |
| [Pachyptila turtur](#) | | |
| Fairy Prion [1066] | | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Phoebetria fusca](#) | | |
| Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| [Pterodroma mollis](#) | | |
| Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat may occur within area |
| [Stercorarius antarcticus as Catharacta skua](#) | | |
| Brown Skua [85039] | | Species or species habitat may occur within area |
| [Sterna striata](#) | | |

| | | |
|---|---|---|
| White-fronted Tern [799] | | Foraging, feeding or related behaviour likely to occur within area |
| [Sternula albifrons as Sterna albifrons](#) | | |
| Little Tern [82849] | Vulnerable | Species or species habitat may occur within area |
| [Thalassarche bulleri](#) | | |
| Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche bulleri platei as Thalassarche sp. nov.](#) | | |
| Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche carteri](#) | | |
| Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| [Thalassarche cauta](#) | | |
| Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche chrysostoma](#) | | |
| Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Thalassarche impavida](#) Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Thinornis cucullatus as Thinornis rubricollis<br>Hooded Plover, Hooded Dotterel [87735] | | Species or species habitat likely to occur within area overfly marine area |
| Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis<br>Eastern Hooded Plover, Eastern Hooded Vulnerable Plover [90381] | | Species or species habitat likely to occur within area overfly marine area |
| Fish | | |
| Heraldia nocturna<br>Upside-down Pipefish, Eastern Upsidedown Pipefish, Eastern Upside-down Pipefish [66227] | | Species or species habitat may occur within area |
| Hippocampus abdominalis<br>Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233] | | Species or species habitat may occur within area |
| Hippocampus breviceps<br>Short-head Seahorse, Short-snouted Seahorse [66235] | | Species or species habitat may occur within area |
| Histiogamphelus briggsii<br>Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Histiogamphelus cristatus<br>Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243] | | Species or species habitat may occur within area |
| Hypselognathus rostratus<br>Knifesnout Pipefish, Knife-snouted Pipefish [66245] | | Species or species habitat may occur within area |
| Kaupus costatus<br>Deepbody Pipefish, Deep-bodied Pipefish [66246] | | Species or species habitat may occur within area |
| Leptoichthys fistularius<br>Brushtail Pipefish [66248] | | Species or species habitat may occur within area |
| Lissocampus caudalis<br>Australian Smooth Pipefish, Smooth Pipefish [66249] | | Species or species habitat may occur within area |
| Lissocampus runa<br>Javelin Pipefish [66251] | | Species or species habitat may occur within area |
| Maroubra perserrata<br>Sawtooth Pipefish [66252] | | Species or species habitat may occur within area |
| Mitotichthys semistriatus<br>Halfbanded Pipefish [66261] | | Species or species habitat may occur within area |
| Mitotichthys tuckeri<br>Tucker's Pipefish [66262] | | Species or species habitat may occur within area |
| Notiocampus ruber<br>Red Pipefish [66265] | | Species or species habitat may occur within area |
| Phycodurus eques | | |

| | | |
|---|---|---|
| Leafy Seadragon [66267] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Phyllopteryx taeniolatus<br>Common Seadragon, Weedy Seadragon [66268] | | Species or species habitat may occur within area |
| Pugnaso curtirostris<br>Pugnose Pipefish, Pug-nosed Pipefish [66269] | | Species or species habitat may occur within area |
| Solegnathus robustus<br>Robust Pipehorse, Robust Spiny Pipehorse [66274] | | Species or species habitat may occur within area |
| Solegnathus spinosissimus<br>Spiny Pipehorse, Australian Spiny Pipehorse [66275] | | Species or species habitat may occur within area |
| Stigmatopora argus<br>Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276] | | Species or species habitat may occur within area |
| Stigmatopora nigra<br>Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277] | | Species or species habitat may occur within area |
| Stipecampus cristatus<br>Ringback Pipefish, Ring-backed Pipefish [66278] | | Species or species habitat may occur within area |
| Urocampus carinirostris<br>Hairy Pipefish [66282] | | Species or species habitat may occur within area |
| Vanacampus margaritifer<br>Mother-of-pearl Pipefish [66283] | | Species or species habitat may occur within area |

| | | |
|---|---|---|
| [Vanacampus phillipi](#)<br>Port Phillip Pipefish [66284] | | Species or species habitat may occur within area |
| [Vanacampus poecilolaemus](#)<br>Longsnout Pipefish, Australian Longsnout Pipefish, Long-snouted Pipefish [66285] | | Species or species habitat may occur within area |
| **Mammal** | | |
| Scientific Name | Threatened Category | Presence Text |
| [Arctocephalus forsteri](#)<br>Long-nosed Fur-seal, New Zealand Furseal [20] | | Species or species habitat may occur within area |
| [Arctocephalus pusillus](#)<br>Australian Fur-seal, Australo-African Fur-seal [21] | | Species or species habitat may occur within area |
| [Neophoca cinerea](#)<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area |
| **Reptile** | | |
| [Caretta caretta](#)<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat likely to occur within area |
| [Chelonia mydas](#)<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area |
| [Dermochelys coriacea](#)<br>Leatherback Turtle, Leathery Turtle, Luth Endangered [1768] | | Species or species habitat likely to occur within area |
| **Whales and Other Cetaceans** | | [ Resource Information ] |
| Current Scientific Name | Status | Type of Presence |
| **Mammal** | | |
| [Balaenoptera acutorostrata](#) | | |

| | | |
|---|---|---|
| Minke Whale [33] | | Species or species habitat may occur within area |
| [Balaenoptera bonaerensis](#)<br>Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] | | Species or species habitat likely to occur within area |
| [Balaenoptera borealis](#)<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Balaenoptera musculus](#)<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area |

| Current Scientific Name | Status | Type of Presence |
| --- | --- | --- |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Berardius arnuxii<br>Arnoux's Beaked Whale [70] | | Species or species habitat may occur within area |
| Caperea marginata<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour may occur within area |
| Delphinus delphis<br>Common Dolphin, Short-beaked Common Dolphin [60] | | Species or species habitat may occur within area |
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |
| Globicephala macrorhynchus<br>Short-finned Pilot Whale [62] | | Species or species habitat may occur within area |
| Globicephala melas<br>Long-finned Pilot Whale [59282] | | Species or species habitat may occur within area |
| Grampus griseus<br>Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area |
| Kogia breviceps<br>Pygmy Sperm Whale [57] | | Species or species habitat may occur within area |
| Kogia sima<br>Dwarf Sperm Whale [85043] | | Species or species habitat may occur within area |
| Lagenorhynchus obscurus | | |

| Current Scientific Name | Status | Type of Presence |
| --- | --- | --- |
| Dusky Dolphin [43] | | Species or species habitat likely to occur within area |
| [Lissodelphis peronii](#)<br>Southern Right Whale Dolphin [44] | | Species or species habitat may occur within area |
| [Megaptera novaeangliae](#)<br>Humpback Whale [38] | | Species or species habitat likely to occur within area |
| [Mesoplodon bowdoini](#)<br>Andrew's Beaked Whale [73] | | Species or species habitat may occur within area |
| [Mesoplodon densirostris](#)<br>Blainville's Beaked Whale, Densebeaked Whale [74] | | Species or species habitat may occur within area |
| [Mesoplodon hectori](#)<br>Hector's Beaked Whale [76] | | Species or species habitat may occur within area |
| [Mesoplodon layardii](#)<br>Strap-toothed Beaked Whale, Straptoothed Whale, Layard's Beaked Whale [25556] | | Species or species habitat may occur within area |
| [Mesoplodon mirus](#)<br>True's Beaked Whale [54] | | Species or species habitat may occur within area |
| [Orcinus orca](#)<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area |
| [Physeter macrocephalus](#)<br>Sperm Whale [59] | | Species or species habitat may occur within area |
| [Pseudorca crassidens](#) | | |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| False Killer Whale [48] | | Species or species habitat likely to occur within area |
| Tursiops aduncus<br>Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | | Species or species habitat likely to occur within area |

| Controlled action | | | |
|---|---|---|---|
| Alston-1 petroleum exploration well, permit VIC/P44 | 2003/1315 | Controlled Action | Post-Approval |
| Casino Gas Field Development | 2003/1295 | Controlled Action | Post-Approval |
| Otway Development | 2002/621 | Controlled Action | Post-Approval |
| | 2007/3754 | Controlled Action | Completed |
| Schomberg 3D Marine Seismic Survey | | | |
| Strike Oil Gas Exploration Well, Otway Basin (VIC/P44) | 2000/97 | Controlled Action | Completed |
| VICP61 2D Marine Seismic Survey | 2008/4075 | Controlled Action | Completed |

| Not controlled action | | | |
|---|---|---|---|
| Exploration drilling for liquid/gaseous hydrocarbons | 2004/1681 | Not Controlled Action | Completed |
| Gas Field Development | 2006/2635 | Not Controlled Action | Completed |
| Henry-1 Exploration Well, Petroleum Permit Area VIC/P44 | 2005/2147 | Not Controlled Action | Completed |
| INDIGO Central Submarine Telecommunications Cable | 2017/8127 | Not Controlled Action | Completed |

| Current Scientific Name | Status | | Type of Presence |
|---|---|---|---|
| Offshore exploration drilling within permit area VIC/P 37(v) | 2004/1466 | Not Controlled Action | Completed |
| Tursiops truncatus s. str.<br>Bottlenose Dolphin [68417] | | | Species or species habitat may occur within area |
| Ziphius cavirostris<br>Cuvier's Beaked Whale, Goose-beaked Whale [56] | | | Species or species habitat may occur within area |

## Extra Information

### EPBC Act Referrals [ Resource Information ]

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Strike Oil NL Seismic Surveys | 2000/107 | | Completed |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action | | | |
| VIC-P44 Stage 2 Gas Field Development | 2007/3767 | Not Controlled Action | Completed |
| Not controlled action (particular manner) | | | |
| 'Moonlight Head' 3D seismic survey, VIC/P38(V), VIC/P43 and VIC/RL8 | 2005/2236 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D marine seismic survey near King Island | 2004/1461 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D seismic program VIC/P38(v), VIC/P43 and VIC/RL8 | 2003/1137 | Not Controlled Action (Particular Manner) | Post-Approval |
| BHPBilliton Otway 3D Seismic Survey | 2007/3443 | Not Controlled Action (Particular Manner) | Post-Approval |
| Deepwater Sorell Basin 2001 NonExclusive 2D Seismic Survey | 2001/156 | Not Controlled Action (Particular Manner) | Post-Approval |
| Enterprise Three-dimensional Transition Zone Seismic Survey, Victoria | 2016/7800 | Not Controlled Action (Particular Manner) | Post-Approval |
| INDIGO Marine Cable Route Survey (INDIGO) | 2017/7996 | Not Controlled Action (Particular Manner) | Post-Approval |
| La Bella 3D Marine Seismic Survey, Otway Basin, VIC | 2012/6683 | Not Controlled Action (Particular Manner) | Post-Approval |
| Otway Basin Exploration Drilling Campaign, Vic | 2011/6125 | Not Controlled Action (Particular Manner) | Post-Approval |

| | | | |
|---|---|---|---|
| Santos Otway 3d Seismic VIC/P44 | 2007/3367 | Not Controlled Action (Particular Manner) | Post-Approval |
| Schomberg 3D Marine Seismic survey | 2007/3868 | Not Controlled Action (Particular Manner) | Post-Approval |
| Title of referral | Reference | Referral Outcome | Assessment Status |
| Not controlled action (particular manner) | | | |
| Speculant 3D Transition Zone Seismic Survey | 2010/5558 | Not Controlled Action (Particular Manner) | Post-Approval |
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, Vic | 2012/6565 | Not Controlled Action (Particular Manner) | Post-Approval |
| Vic/P37(v) and Vic/P44 3D marine seismic survey | 2003/1102 | Not Controlled Action (Particular Manner) | Post-Approval |
| VIC P44 Gas Exploration Wells | 2002/662 | Not Controlled Action (Particular Manner) | Post-Approval |
| Vic-P51 and Vic-P52 2D seismic survey | 2002/811 | Not Controlled Action (Particular Manner) | Post-Approval |
| Referral decision | | | |
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, VIC | 2012/6545 | Referral Decision | Completed |
| VICP61 2D Marine Seismic Survey | 2008/3975 | Referral Decision | Completed |

Seabirds

| Biologically Important Areas | | | [ Resource Information ] |
|---|---|---|---|
| Scientific Name | | Behaviour | Presence |
| Ardenna pacifica | | | |
| Wedge-tailed Shearwater [84292] | | Foraging | Likely to occur |

| | | | |
|---|---|---|---|
| Diomedea exulans (sensu lato)<br>Wandering Albatross [1073] | Foraging | Known to occur | to |
| Diomedea exulans antipodensis<br>Antipodean Albatross [82269] | Foraging | Known to occur | to |
| Pelecanoides urinatrix<br>Common Diving-petrel [1018] | Foraging | Known to occur | to |
| Thalassarche bulleri<br>Bullers Albatross [64460] | Foraging | Known to occur | to |

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Thalassarche cauta cauta<br>Shy Albatross [82345] | Foraging likely | Likely to occur |
| Thalassarche chlororhynchos bassi<br>Indian Yellow-nosed Albatross [85249] | Foraging | Known to occur |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Foraging | Known to occur |
| Thalassarche melanophris impavida<br>Campbell Albatross [82449] | Foraging | Known to occur |

| Whales | | |
|---|---|---|
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Foraging (annual high use area) | Known to occur |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales

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

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

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

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# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

East Coast Project Operational Area PMST Report

Report created: 07-May-2025



*Amplitude OPP Operational Area*


[Summary](#)

[Details](#)

- Matters of NES
- [Other Matters Protected by the EPBC Act](#)
- [Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | None |
| Wetlands of International Importance (Ramsar | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | 2 |
| Listed Threatened Ecological Communities: | None |
| Listed Threatened Species: | 39 |
| Listed Migratory Species: | 39 |

## Other Matters Protected by the EPBC Act

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

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

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

| | |
|---|---|
| Commonwealth Lands: | None |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 63 |
| Whales and Other Cetaceans: | 14 |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | None |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

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

| | |
|---|---|
| State and Territory Reserves: | None |
| Regional Forest Agreements: | None |
| Nationally Important Wetlands: | None |
| EPBC Act Referrals: | 24 |

| | |
|---|---|
| Key Ecological Features (Marine): | None |
| Biologically Important Areas: | 10 |
| Bioregional Assessments: | None |
| Geological and Bioregional Assessments: | None |

# Details

## Matters of National Environmental Significance

### Commonwealth Marine Area [ Resource Information ]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name

Commonwealth Marine Areas (EPBC Act)

Commonwealth Marine Areas (EPBC Act)

### Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| BIRD | | |
| Ardenna grisea<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within |

| | | |
|---|---|---|
| | | area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Diomedea epomophora](#)<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea exulans](#)<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Diomedea sanfordi](#)<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| [Halobaena caerulea](#)<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area |
| [Macronectes giganteus](#)<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |
| [Macronectes halli](#)<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Neophema chrysogaster](#)<br>Orange-bellied Parrot [747] | Critically Endangered | Migration route likely to occur within area |
| [Numenius madagascariensis](#)<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat may occur within area |

| | | |
|---|---|---|
| [Pachyptila turtur subantarctica](#)<br>Fairy Prion (southern) [64445] | Vulnerable | Species or species habitat may occur within area |
| [Phoebetria fusca](#)<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Pterodroma leucoptera leucoptera](#)<br>Gould's Petrel, Australian Gould's Petrel [26033] | Endangered | Species or species habitat may occur within area |
| [Pterodroma mollis](#)<br>Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat may occur within area |
| [Sternula nereis nereis](#)<br>Australian Fairy Tern [82950] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche bulleri](#)<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche bulleri platei](#)<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Thalassarche carteri](#)<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| [Thalassarche cauta](#)<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| FISH | | |
| Prototroctes maraena<br>Australian Grayling [26179] | Vulnerable | Species or species habitat may occur within area |
| Seriolella brama<br>Blue Warehou [69374] | Conservation Dependent | Species or species habitat known to occur within area |
| MAMMAL | | |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| [Balaenoptera musculus](#)<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| [Balaenoptera physalus](#)<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| [Eubalaena australis](#)<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |
| [Neophoca cinerea](#)<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area |
| REPTILE | | |
| [Caretta caretta](#)<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat likely to occur within area |
| Scientific Name | Threatened Category | Presence Text |
| [Chelonia mydas](#)<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area |
| [Dermochelys coriacea](#)<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Species or species habitat likely to occur within area |
| SHARK | | |
| [Carcharodon carcharias](#)<br>White Shark, Great White Shark [64470] | Vulnerable | Migration route known to occur within area |
| [Galeorhinus galeus](#)<br>School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453] | Conservation Dependent | Species or species habitat may occur within area |
| Listed Migratory Species | | [ Resource Information ] |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Migratory Marine Birds | | |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area |
| Ardenna carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Species or species habitat likely to occur within area |
| Ardenna grisea<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Diomedea sanfordi<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |

| | | |
|---|---|---|
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta<br>Shy Albatross [89224] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Scientific Name | Threatened Category | Presence Text |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |

| | | |
|---|---|---|
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Migratory Marine Species | | |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Caperea marginata<br>Pygmy Right Whale [39] | | Foraging, feeding or related behaviour may occur within area |
| Carcharias taurus<br>Grey Nurse Shark [64469] | | Species or species habitat may occur within area |
| Carcharodon carcharias<br>White Shark, Great White Shark [64470] | Vulnerable | Migration route known to occur within area |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat likely to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area |
| Scientific Name | Threatened Category | Presence Text |

| | | |
|---|---|---|
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Species or species habitat likely to occur within area |
| Eubalaena australis as Balaena glacialis australi<br>Southern Right Whale [40] | s<br>Endangered | Breeding known to occur within area |
| Isurus oxyrinchus<br>Shortfin Mako, Mako Shark [79073] | | Species or species habitat likely to occur within area |
| Lagenorhynchus obscurus<br>Dusky Dolphin [43] | | Species or species habitat may occur within area |
| Lamna nasus<br>Porbeagle, Mackerel Shark [83288] | | Species or species habitat likely to occur within area |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area |
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area |
| Migratory Wetlands Species | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area |
| Calidris ferruginea | | |

| | | |
|---|---|---|
| Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat may occur within area |

## Other Matters Protected by the EPBC Act

| Listed Marine Species | | [ Resource Information ] |
|---|---|---|
| Scientific Name | Threatened Category | Presence Text |
| **Bird** | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area |
| Ardenna carneipes as Puffinus carneipes<br>Flesh-footed Shearwater, Fleshy-footed Shearwater [82404] | | Species or species habitat likely to occur within area |
| Ardenna grisea as Puffinus griseus<br>Sooty Shearwater [82651] | Vulnerable | Species or species habitat may occur within area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area |
| Calidris canutus<br>Red Knot, Knot [855] | Vulnerable | Species or species habitat may occur within area overfly marine area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area Calidris melanotos<br><br>habitat may occur within area overfly marine area |
| Diomedea antipodensis<br>Antipodean Albatross [64458] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea epomophora<br>Southern Royal Albatross [89221] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea exulans<br>Wandering Albatross [89223] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Diomedea sanfordi<br>Northern Royal Albatross [64456] | Endangered | Foraging, feeding or related behaviour likely to occur within area |
| Halobaena caerulea<br>Blue Petrel [1059] | Vulnerable | Species or species habitat may occur within area |
| Macronectes giganteus<br>Southern Giant-Petrel, Southern Giant Petrel [1060] | Endangered | Species or species habitat may occur within area |
| Macronectes halli<br>Northern Giant Petrel [1061] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Neophema chrysogaster | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Orange-bellied Parrot [747] | Critically Endangered | Species or species Migration route likely to occur within area overfly marine area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat may occur within area |
| Pachyptila turtur<br>Fairy Prion [1066] | | habitat may occur within area |
| Phoebetria fusca<br>Sooty Albatross [1075] | Vulnerable | Species or species habitat likely to occur within area |
| Pterodroma mollis<br>Soft-plumaged Petrel [1036] | Vulnerable | Species or species habitat may occur within area |
| Stercorarius antarcticus as Catharacta skua<br>Brown Skua [85039] | | Species or species habitat may occur within area |
| Sterna striata<br>White-fronted Tern [799] | | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche bulleri<br>Buller's Albatross, Pacific Albatross [64460] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche bulleri platei as Thalassarche sp. nov.<br>Northern Buller's Albatross, Pacific Albatross [82273] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche carteri<br>Indian Yellow-nosed Albatross [64464] | Vulnerable | Species or species habitat likely to occur within area |
| Thalassarche cauta | | |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Shy Albatross [89224] | Endangered | Species or species Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche chrysostoma<br>Grey-headed Albatross [66491] | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Thalassarche impavida<br>Campbell Albatross, Campbell Blackbrowed Albatross [64459] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche melanophris<br>Black-browed Albatross [66472] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche salvini<br>Salvin's Albatross [64463] | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Thalassarche steadi<br>White-capped Albatross [64462] | Vulnerable | Foraging, feeding or related behaviour known to occur within area |
| Fish | | |
| Heraldia nocturna<br>Upside-down Pipefish, Eastern Upsidedown Pipefish, Eastern Upside-down Pipefish [66227] | | Species or species habitat may occur within area |
| Hippocampus abdominalis<br>Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233] | | Species or species habitat may occur within area |
| Hippocampus breviceps<br>Short-head Seahorse, Short-snouted Seahorse [66235] | | Species or species habitat may occur within area |
| Histiogamphelus briggsii<br>Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242] | | Species or species habitat may occur within area |
| Histiogamphelus cristatus<br>Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243] | | Species or species habitat may occur within area |
| Hypselognathus rostratus | | |

| | | |
|---|---|---|
| Knifesnout Pipefish, Knife-snouted Pipefish [66245] | | Species or species habitat may occur within area |
| Scientific Name | Threatened Category | Presence Text |
| Kaupus costatus<br>Deepbody Pipefish, Deep-bodied Pipefish [66246] | | Species or species habitat may occur within area |
| Leptoichthys fistularius<br>Brushtail Pipefish [66248] | | Species or species habitat may occur within area |
| Lissocampus caudalis<br>Australian Smooth Pipefish, Smooth Pipefish [66249] | | Species or species habitat may occur within area |
| Lissocampus runa<br>Javelin Pipefish [66251] | | Species or species habitat may occur within area |
| Maroubra perserrata<br>Sawtooth Pipefish [66252] | | Species or species habitat may occur within area |
| Mitotichthys semistriatus<br>Halfbanded Pipefish [66261] | | Species or species habitat may occur within area |
| Mitotichthys tuckeri<br>Tucker's Pipefish [66262] | | Species or species habitat may occur within area |
| Notiocampus ruber<br>Red Pipefish [66265] | | Species or species habitat may occur within area |
| Phycodurus eques<br>Leafy Seadragon [66267] | | Species or species habitat may occur within area |
| Phyllopteryx taeniolatus | | |

| | | |
|---|---|---|
| Common Seadragon, Weedy Seadragon [66268] | | Species or species habitat may occur within area |
| Pugnaso curtirostris<br>Pugnose Pipefish, Pug-nosed Pipefish [66269] | | Species or species habitat may occur within area |
| Scientific Name | Threatened Category | Presence Text |
| Solegnathus robustus<br>Robust Pipehorse, Robust Spiny Pipehorse [66274] | | Species or species habitat may occur within area |
| Solegnathus spinosissimus<br>Spiny Pipehorse, Australian Spiny Pipehorse [66275] | | Species or species habitat may occur within area |
| Stigmatopora argus<br>Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276] | | Species or species habitat may occur within area |
| Stigmatopora nigra<br>Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277] | | Species or species habitat may occur within area |
| Stipecampus cristatus<br>Ringback Pipefish, Ring-backed Pipefish [66278] | | Species or species habitat may occur within area |
| Urocampus carinirostris<br>Hairy Pipefish [66282] | | Species or species habitat may occur within area |
| Vanacampus margaritifer<br>Mother-of-pearl Pipefish [66283] | | Species or species habitat may occur within area |
| Vanacampus phillipi<br>Port Phillip Pipefish [66284] | | Species or species habitat may occur within area |

| | | |
|---|---|---|
| Vanacampus poecilolaemus<br>Longsnout Pipefish, Australian Longsnout Pipefish, Long-snouted Pipefish [66285] | | Species or species habitat may occur within area |
| **Mammal** | | |
| Arctocephalus forsteri<br>Long-nosed Fur-seal, New Zealand Furseal [20] | | Species or species habitat may occur within area |
| Arctocephalus pusillus<br>Australian Fur-seal, Australo-African Fur-seal [21] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Neophoca cinerea<br>Australian Sea-lion, Australian Sea Lion [22] | Endangered | Species or species habitat may occur within area |
| **Reptile** | | |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat likely to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Species or species habitat may occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth Endangered [1768] | | Species or species habitat likely to occur within area |

| Whales and Other Cetaceans | | [ Resource Information ] |
|---|---|---|
| Current Scientific Name | Status | Type of Presence |
| **Mammal** | | |
| Balaenoptera acutorostrata<br>Minke Whale [33] | | Species or species habitat may occur within area |
| Balaenoptera borealis | | |

| | | |
|---|---|---|
| Sei Whale [34]<br>Balaenoptera musculus | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Blue Whale [36]<br>Balaenoptera physalus | Endangered | Foraging, feeding or related behaviour known to occur within area |
| Fin Whale [37]<br>Caperea marginata | Vulnerable | Foraging, feeding or related behaviour likely to occur within area |
| Pygmy Right Whale [39] | | Foraging, feeding or related behaviour may occur within area |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| Delphinus delphis<br>Common Dolphin, Short-beaked Common Dolphin [60] | | Species or species habitat may occur within area |
| Eubalaena australis<br>Southern Right Whale [40] | Endangered | Breeding known to occur within area |
| Grampus griseus<br>Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area |
| Lagenorhynchus obscurus<br>Dusky Dolphin [43] | | Species or species habitat may occur within area |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area |
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat likely to occur within area |
| Pseudorca crassidens | | |

| | |
|---|---|
| False Killer Whale [48] | Species or species habitat likely to occur within area |
| Tursiops aduncus<br>Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | Species or species habitat likely to occur within area |
| Tursiops truncatus s. str.<br>Bottlenose Dolphin [68417] | Species or species habitat may occur within area |

## Extra Information

### EPBC Act Referrals [ Resource Information ]

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Strike Oil NL Seismic Surveys | 2000/107 | | Completed |

**Controlled action**

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| **Controlled action** | | | |
| Casino Gas Field Development | 2003/1295 | Controlled Action | Post-Approval |
| Otway Development | 2002/621 | Controlled Action | Post-Approval |
| | 2007/3754 | Controlled Action | Completed |
| Schomberg 3D Marine Seismic Survey | | | |
| Strike Oil Gas Exploration Well, Otway Basin (VIC/P44) | 2000/97 | Controlled Action | Completed |
| VICP61 2D Marine Seismic Survey | 2008/4075 | Controlled Action | Completed |
| **Not controlled action** | | | |
| Exploration drilling for liquid/gaseous hydrocarbons | 2004/1681 | Not Controlled Action | Completed |
| Gas Field Development | 2006/2635 | Not Controlled Action | Completed |
| Henry-1 Exploration Well, Petroleum Permit Area VIC/P44 | 2005/2147 | Not Controlled Action | Completed |

| | | | |
|---|---|---|---|
| INDIGO Central Submarine Telecommunications Cable | 2017/8127 | Not Controlled Action | Completed |
| Offshore exploration drilling within permit area VIC/P 37(v) | 2004/1466 | Not Controlled Action | Completed |
| VIC-P44 Stage 2 Gas Field Development | 2007/3767 | Not Controlled Action | Completed |
| Not controlled action (particular manner) | | | |
| 'Moonlight Head' 3D seismic survey, VIC/P38(V), VIC/P43 and VIC/RL8 | 2005/2236 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D seismic program VIC/P38(v), VIC/P43 and VIC/RL8 | 2003/1137 | Not Controlled Action (Particular Manner) | Post-Approval |
| BHPBilliton Otway 3D Seismic Survey | 2007/3443 | Not Controlled Action (Particular Manner) | Post-Approval |
| INDIGO Marine Cable Route Survey (INDIGO) | 2017/7996 | Not Controlled Action (Particular Manner) | Post-Approval |
| La Bella 3D Marine Seismic Survey, Otway Basin, VIC | 2012/6683 | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| Santos Otway 3d Seismic VIC/P44 | 2007/3367 | Not Controlled Action (Particular Manner) | Post-Approval |
| Schomberg 3D Marine Seismic survey | 2007/3868 | Not Controlled Action (Particular Manner) | Post-Approval |
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, Vic | 2012/6565 | Not Controlled Action (Particular Manner) | Post-Approval |

| | | | |
|---|---|---|---|
| Vic/P37(v) and Vic/P44 3D marine seismic survey | 2003/1102 | Not Controlled Action (Particular Manner) | Post-Approval |
| VIC P44 Gas Exploration Wells | 2002/662 | Not Controlled Action (Particular Manner) | Post-Approval |

| Referral decision | | | |
|---|---|---|---|
| The Enterprise 3D Seismic Acquisition Survey, Otway Basin, VIC | 2012/6545 | Referral Decision | Completed |
| VICP61 2D Marine Seismic Survey | 2008/3975 | Referral Decision | Completed |

Seabirds

| Biologically Important Areas | | | [ Resource Information ] |
|---|---|---|---|
| Scientific Name | | Behaviour | Presence |
| Ardenna pacifica<br>Wedge-tailed Shearwater [84292] | | Foraging | Likely to occur |
| Diomedea exulans (sensu lato)<br>Wandering Albatross [1073] | | Foraging | Known to occur |
| Diomedea exulans antipodensis<br>Antipodean Albatross [82269] | | Foraging | Known to occur |
| Pelecanoides urinatrix<br>Common Diving-petrel [1018] | | Foraging | Known to occur |

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Thalassarche bulleri<br>Bullers Albatross [64460] | Foraging | Known to occur |
| Thalassarche cauta cauta<br>Shy Albatross [82345] | Foraging likely | Likely to occur |
| Thalassarche chlororhynchos bassi<br>Indian Yellow-nosed Albatross [85249] | Foraging | Known to occur |

| | | |
|---|---|---|
| [Thalassarche melanophris](#)<br>Black-browed Albatross [66472] | Foraging | Known to occur |
| [Thalassarche melanophris impavida](#)<br>Campbell Albatross [82449] | Foraging | Known to occur |

| Whales | | |
|---|---|---|
| [Balaenoptera musculus brevicauda](#)<br>Pygmy Blue Whale [81317] | Foraging (annual high use area) | Known to occur |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales

-Department of Environment and Primary Industries, Victoria

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

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

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

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# Appendix 2. Environmental Survey – Otway Basin

| | | | |
|---|---|---|---|
| **Project:** | **Otway Pipeline / Umbilical Route Survey** | | |
| **Vendor:** | Fugro | | |
| **Company Doc No:** | VOB-EN-REP-4900-0001 | **Company Rev:** | 1 |
| **Vendor Doc No:** | 157827-52-REP-002 | **Vendor Rev:** | 1 |
| **Document Title:** | Environmental Survey Report | | |

| **REVIEW CODE** | | |
|---|---|---|
| **Code** | **Description** | **Tick** |
| 1 | No Comment. Work may proceed. | ☑ |
| 2 | Revise as noted and re-submit final. Work may proceed. | ☐ |
| 3 | Revise as directed and re-submit. Work may NOT proceed. | ☐ |
| 4 | Information Only. Re-submission not required | ☐ |
| 5 | As-Built | ☐ |

| **Signed** | **Dated** |
|---|---|
| Shane Taraborrelli | Digitally signed by Shane Taraborrelli<br>Date: 2020.06.09 12:06:37 +08'00' |

Contractor remains responsible for the due and proper performance in accordance with the Contract. Comments shall not be construed as authorisation of variations.

Intended for
**Fugro Australia Pty Ltd**

Document type
**Report**

Date
**June 2020**

# OP3D ENVIRONMENTAL SURVEY
# COOPER ENERGY




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# OP3D ENVIRONMENTAL SURVEY
# COOPER ENERGY

| | |
|---|---|
| Project name | **Cooper Energy OP3D Environmental Survey** |
| Project no. | **318000966** |
| Recipient | **Lee Findlay, Fugro Marine Australia Pty Ltd** |
| Document type | **Report** |
| Version | **Rev 1** |
| Date | **03/06/2020** |
| Prepared by | **E Jones, S Lemmens** |
| Checked by | **D McClary** |
| Approved by | **J Miragliotta** |
| Description | **Results of the environmental survey for the Cooper Energy OP3D project** |

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# 1. INTRODUCTION

## 1.1 Background

This report presents the results of the environmental survey carried out from 3 to 17 April 2020 in the Otway Basin off southwest Victoria, in support of the Otway Phase 3 Development (OP3D) geophysical survey Project for Cooper Energy (CH) Pty Ltd (Cooper Energy).

As part of this project, Fugro Australia Marine Pty Ltd (Fugro) carried out offshore geophysical and geotechnical surveys and Ramboll Australia Pty Ltd (Ramboll) were contracted by Fugro to carry out the environmental survey. These activities were located in Commonwealth waters approximately approximately 30 km southwest of Port Campbell and in water depths ranging from 60 m to 70 m.

## 1.2 Objectives

The key objective of the survey in Otway Basin was to confirm or amend intended field layouts and associated pipeline or flowline and electro-hydraulic umbilical (EHU) seabed routes, with additional video and photographs taken along the routes to provide benthic analysis data.

The objectives of environmental sampling as part of the Otway pipeline/umbilical surveys were to obtain:

- Approximately eight video transects along Route 1 and two video transects along Route 5 with enough good quality video footage from which the environmental scientists could determine the type of seabed fauna and substrate along the routes; and
- Grab samples (for geophysical data ground-truthing) for analysis of benthic organisms.

The environmental scientist on board was also responsible for keeping watch for marine mammals (MMO).

Fugro was responsible for the operation of equipment to collect the samples from the seabed, with Ramboll taking responsibility for the analytical processes on retrieval of the sampling equipment onboard the survey vessel.

## 1.3 Report Scope

The scope of the environmental survey carried out in Otway Basin included investigations of:

- Benthic epifauna from seabed video footage;
- Benthic infauna (greater than 1 cm) in seabed sediment samples; and
- Marine mammal sightings during survey operations.

The seabed video transects acquired during the survey were assessed with the intention of identifying the conspicuous macrobiota present and noting, in particular, if any EPBC Act habitats or species were present. Other gross physical features of relevance to epifaunal communities were described. The conspicuous benthic fauna in sediment collected by grab sampler were assessed to describe the benthic fauna assemblage. This information is presented in the context of the known benthic communities present in the wider Otway Basin offshore region.

As summary of marine mammal sightings made by the onboard environmental scientists during the survey operations is also provided.

# 2. SURVEY LOCATIONS

These investigations were based around the "Casino-Henry-Netherby" gas fields (Figure 1). Cooper Energy is the titleholder for Production Licences VIC/L24 ("Casino") and VIC/L31 ('Henry' and "Netherby") which contain the "Casino-Henry-Netherby" (CHN) gas fields, approximately 30 km southwest from Port Campbell off Victoria's southwest coast in Bass Strait.

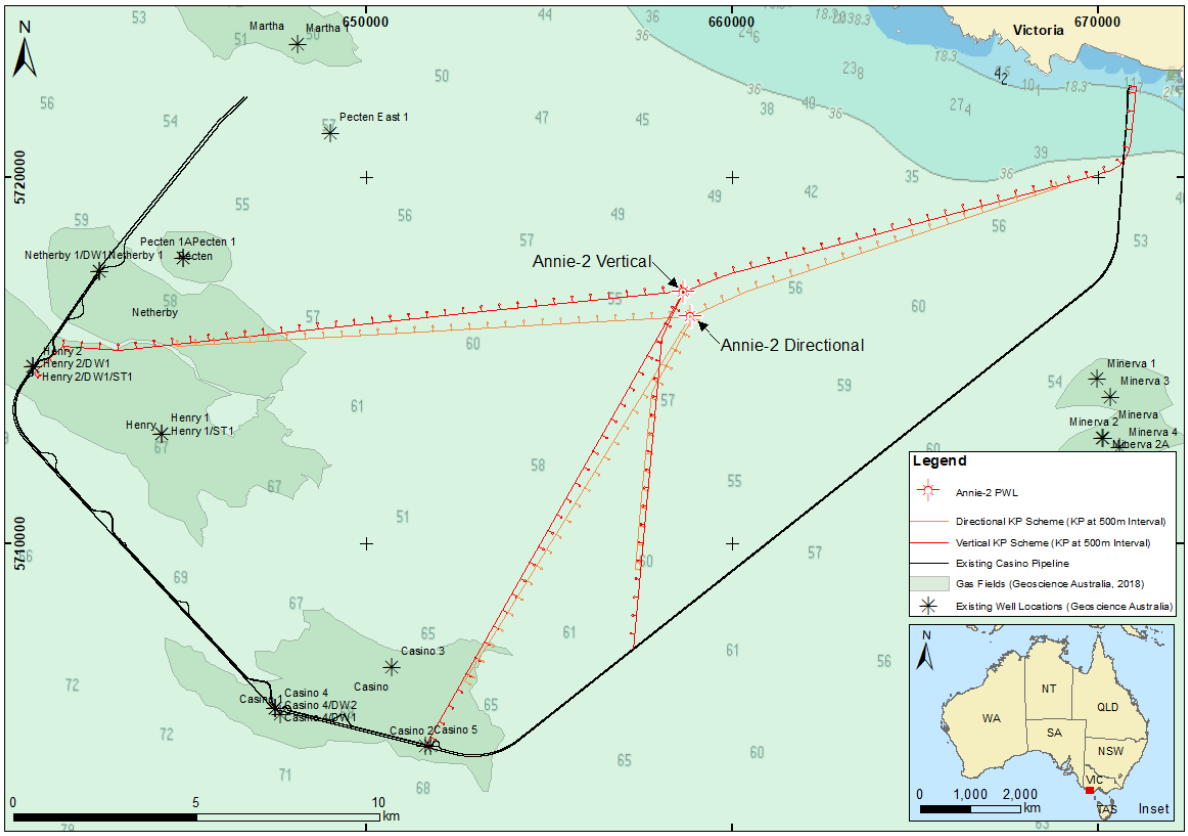



**Figure 1 Plan of survey area and relevant gas fields in Otway Basin. Provided by Fugro, April 2020.**

Cooper Energy is also the titleholder for Pipeline Licences VIC/PL37 and VIC/PL37(V) ("Casino" Gas Pipeline) and VIC/PL42 ("Casino-Pecten-East" Gas Pipeline) which is used to transport gas and condensate from the CHN wells to the Iona Gas Plant (IGP) for gas processing.

The offshore CHN facilities include:

- The "Casino"-4, "Casino"-5, 'Henry'-2 and "Netherby"-1 gas production wells;
- A 32.6 km subsea pipeline, the "Casino" pipeline, connecting the "Casino" wells to the Iona Gas Plant;
- A 22 km subsea pipeline, the "Casino" to "Pecten East" pipeline, tying in to the "Casino" pipeline, carrying gas from the 'Henry'-2 and "Netherby"-1 wells, with an additional section to a potential production well in the "Pecten" reservoir;
- A 31.2 km EHU cable connecting the "Casino" wells to the onshore Iona Gas Plant; and
- A 22 km EHU cable, which is an extension of the umbilical above, connecting the 'Henry' and "Netherby" wells to the Iona Gas Plant.

The survey extent within the basin, including the production and exploration wells, is shown in Figure 2. Cetacean sightings were made thoughout all areas of the survey.

The video transects were taken along:

- Route 1: ~31.21 km pipeline route from 'Henry' 3 via "Annie 2" to "Minerva HDD" tail.
- Route 2: ~1.09 km EHU route from 'Henry' 3 to 'Henry' 2.
- Route 3: ~14.31km EHU route from Annie 2 (vertical) to Casino 5
- Route 5: ~9.97km flowline route from Annie 2 (vertical) to Black Watch Tee

Transect coordinates are presented in Table 1 and shown in Figure 2.

**Table 1 Location of video transects in Otway Basin, 3-17 April 2020 (GDA94 UTM 54 S).**

| Transect Name | Start/Finish | GDA94 UTM 54 S | | WGS84 | |
|---|---|---|---|---|---|
| | | Easting | Northing | Longitude | Latitude |
| P1A | Start | 657978 | 5712262 | 142° 49' 2.2752430" | 38° 43' 27.085505" |
| | Finish | 656519 | 5713393 | 142° 48' 0.9617290" | 38° 42' 51.345949" |
| P1B | Start | 655696 | 5712190 | 142° 47' 27.873277" | 38° 43' 30.878338" |
| | Finish | 655858 | 5710812 | 142° 47' 35.696538" | 38° 44' 15.459179" |
| P1C | Start | 653230 | 5707854 | 142° 45' 49.252549" | 38° 45' 53.033315" |
| | Finish | 653377 | 5706765 | 142° 45' 56.211596" | 38° 46' 28.254080" |
| P2A | Start | 641462 | 5715598 | 142° 37' 36.123637" | 38° 41' 48.975994" |
| | Finish | 641864 | 5715222 | 142° 37' 53.036101" | 38° 42' 0.9376470" |
| P2B | Start | 657584 | 5707257 | 142° 48' 50.072720" | 38° 46' 9.6309500" |
| | Finish | 657167 | 5708373 | 142° 48' 31.886794" | 38° 45' 33.711336" |
| P3A | Start | 667729 | 5719658 | 142° 55' 39.442486" | 38° 39' 20.806927" |
| | Finish | 668304 | 5719465 | 142° 56' 3.3877260" | 38° 39' 26.672187" |
| P3B | Start | 666440 | 5719246 | 142° 54' 46.495910" | 38° 39' 35.041176" |
| | Finish | 667017 | 5719058 | 142° 55' 10.519786" | 38° 39' 40.745961" |
| P3C | Start | 662449 | 5718148 | 142° 52' 2.3746350" | 38° 40' 13.312010" |
| | Finish | 663111 | 5717737 | 142° 52' 30.103301" | 38° 40' 26.200633" |
| P3D | Start | 659729 | 5717428 | 142° 50' 10.467841" | 38° 40' 38.440411" |
| | Finish | 660450 | 5717355 | 142° 50' 40.353247" | 38° 40' 40.338038" |
| P3E | Start | 652552 | 5715586 | 142° 45' 15.034932" | 38° 41' 42.729649" |
| | Finish | 653163 | 5716448 | 142° 45' 39.631267" | 38° 41' 14.397254" |
| HDD Exit | Start | 670950 | 5722638 | 142° 57' 49.994210" | 38° 37' 41.967425" |
| | Finish | 670741 | 5720969 | 142° 57' 42.830772" | 38° 38' 36.227806" |
| Crossing | Start | 670602 | 5719949 | 142° 57' 37.985604" | 38° 39' 9.3964610" |
| | Finish | 670985 | 5720964 | 142° 57' 52.922941" | 38° 38' 36.220568" |

Grab samples were taken along all routes, with sample site coordinates presented in Table 2 and shown in Figure 3.

**Table 2 Location of video transects and sediment sampling suites relative to Cooper Otway well locations (GDA94 UTM 54 S).**

| Grab Sample Site Code | GDA94 UTM 54 S | | WGS84 | |
|---|---|---|---|---|
| | Easting | Northing | Longitude | Latitude |
| GS_01 | 668,383 | 5,719,641 | 142° 56' 06.50" E | 38° 39' 20.91" S |
| GS_02 | 668,145 | 5,719,575 | 142° 55' 56.71" E | 38° 39' 23.21" S |
| GS_03 | 658,743 | 5,716,776 | 142° 49' 30.21" E | 38° 41' 00.22" S |
| GS_04 | 658,168 | 5,715,914 | 142° 49' 07.13" E | 38° 41' 28.54" S |
| GS_05 | 657,713 | 5,712,656 | 142° 48' 50.98" E | 38° 43' 14.48" S |
| GS_06 | 656,388 | 5,713,030 | 142° 47' 55.83" E | 38° 43' 03.20" S |
| GS_07 | 655,041 | 5,716,090 | 142° 46' 57.61" E | 38° 41' 24.82" S |
| GS_08 | 657,330 | 5,707,360 | 142° 48' 39.46" E | 38° 46' 06.45" S |
| GS_09 | 651,982 | 5,704,866 | 142° 44' 59.93" E | 38° 47' 30.70" S |
| GS_10 | 642,046 | 5,715,338 | 142° 38' 00.48" E | 38° 41' 57.07" S |

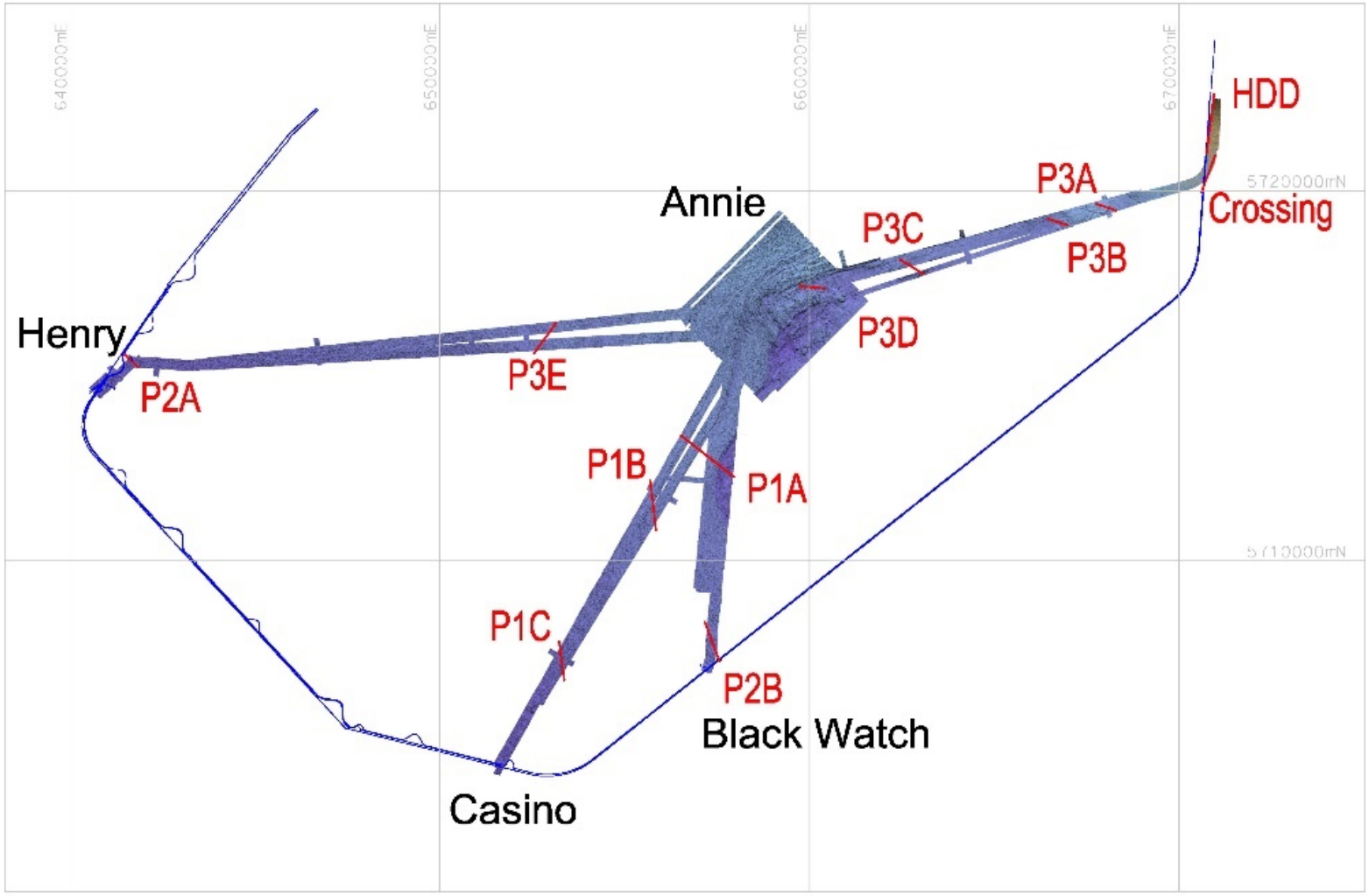



**Figure 2 Bathymetric maps of Cooper Otway well locations (black text), video transect locations. Provided by Fugro, May 2020.**

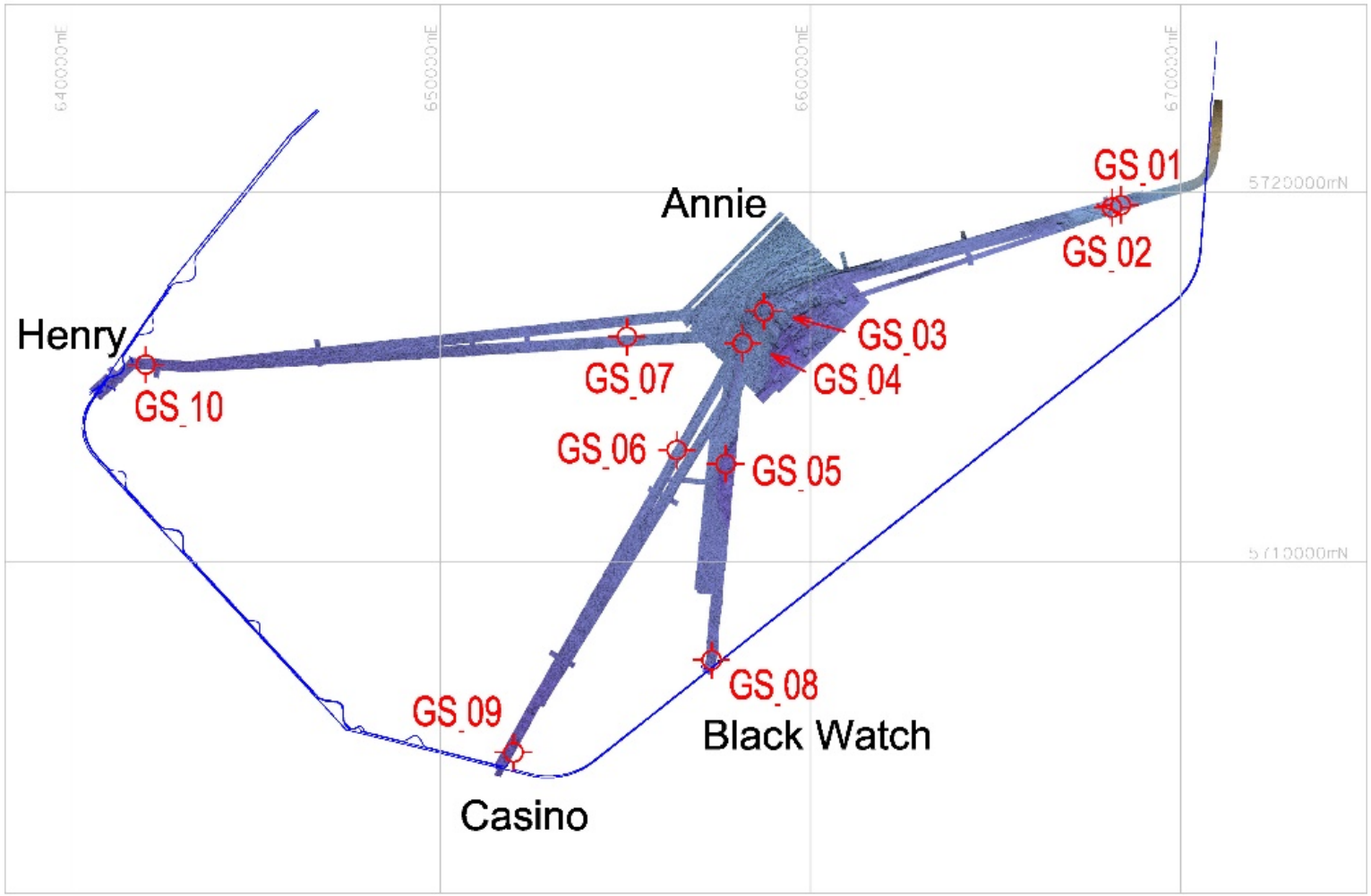



**Figure 3 Bathymetric maps of Cooper Otway well locations (black text), sediment sample sites. Provided by Fugro, May 2020.**

# 3. METHOD

## 3.1 Survey Operations

The environmental survey was undertaken between 3 and 17 April 2020 from the vessel MSV *Silver Star*. The vessel mobilised from Lakes Entrance, Victoria on 6 April after waiting out a storm in port on 4 to 5 April. The vessel arrived onsite on 7 April after approximately 36 hours of transit time.

Due to an incoming storm, the vessel headed to Portsea on 10 April for shelter and returned to the survey location on 12 April. Survey activity recommenced late on 12 April and was completed by early morning on 15 April. The vessel arrived at the home port in the late afternoon of 16 April for demobilisation on 17 April.




**Figure 4 MSV *Silver Star*.**

### 3.1.1 Noise Mitigation Measures

The survey activity was not deemed to be a 'Petroleum Activity' as defined in the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and the survey tools operated during this survey do not strictly fall within the definition of the 'EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales' (DEWHA, 2008). However, Cooper Energy chose to apply their noise mitigation measures during the survey activities as a precautionary approach.

The noise mitigation measures are presented in Figure 5. Multibeam echosounder and sidescan sonar activities occurred continuously over 24 hours, therefore night time operations were undertaken in accordance with EPBC Act Policy Statement 2.1 (Figure 6).

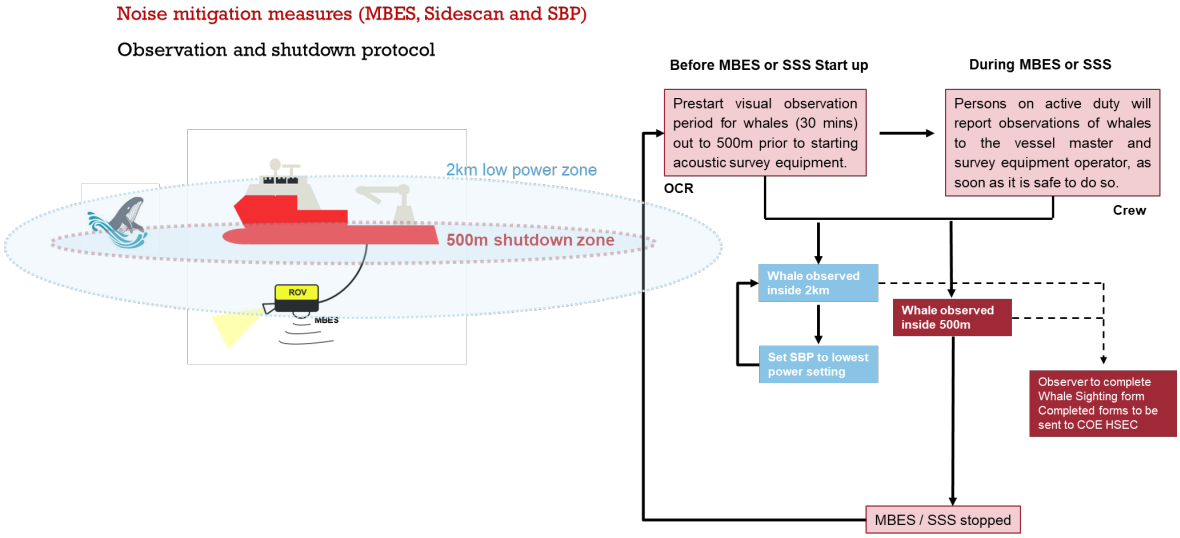



**Figure 5 Noise mitigation measures employed during the survey when using the multibeam echosounder (MBES), sidescan sonar (SSS) and sub-bottom profiler (SBP). Provided by Fugro, April 2020.**

**A.3.6 Night-time and Low Visibility Procedures**

At **night-time** or at other times of **low-visibility** (when observations cannot extend to 3km from the acoustic source, e.g. during fog or periods of high winds), the following measures apply for start up and operations:

**Start up** may be commenced according to A.3.2 Soft-Start Procedure:

- provided that there have not been 3 or more whale instigated power-down or shut-down situations during the preceding 24 hour period; or
- if operations were not previously underway during the preceding 24 hours, the vessel (and/or a spotter vessel or aircraft) has been in the vicinity (approximately 10km) of the proposed start up position for at least 2 hours (under good visibility conditions) within the preceding 24 hour period, and no whales have been sighted.

**Operations** may proceed provided that there have not been 3 or more whale instigated power-down or shut-down situations during the preceding 24 hour period.

During **low visibility**, where conditions allow, continuous observations to spot whales should be maintained with a particular focus on the *Low power* and *Shut-down* zones. If whales are detected then the procedures outlined in A.3.5 Stop Work Procedures should apply.

If sightings of whales have been frequent or are higher than were anticipated during the planning of the survey, the proponent should contact the Department to discuss appropriate night-time provisions and whether additional management measures should be employed for day and/or night-time operations.

**Figure 6 Extract from EPBC Act Policy Statement 2.1 requirements for night-time operations.**

## 3.2 Marine Mammal Observation Procedures

Observations for marine mammals were made by the onboard environmental scientist and adhereing to the processes described in Section 3.1.1. Observations were undertaken from the bridge, from first light until sunset. The species, abundance, sighting confidence, location, date, time and any relevant notes were recorded.

## 3.3 Digital Imagery Sampling and Processing Procedures

A STR SeaSpyder system (Figure 7) fitted with a digital stills camera and low latency live video was deployed to collect seabed imagery and video transects. The SeaSpyder Telemetry system is designed for operation in water depths up to 1000 m using standard coaxial sonar umbilicals. The stills camera is fitted with a high quality 18 mega pixel digital SLR camera offering full control of

all photographic parameters including manual focus, shutter speed and aperture. The stills camera is housed within a 1000 m rated aluminium enclosure, along with the video camera. All data is transferred directly to the surface unit for live interpretation.




**Figure 7 STR SeaSypder Telemetry system. ( Source: https://www.str-subsea.com/str-seaspyder-telemetry-drop-camera-system).**

The camera system is fitted with a Sonodyne Ranger USBL positioning system to accurately track locations during deployment. The SeaSpyder is equipped with twin lasers, aimed within the camera field of view with calibrated separation distances to permit accurate recording of the image scale.

The camera system recorded continuous high-definition video and high-resolution still images when triggered by the attending environmental scientist. A real-time video feed to the surface enabled representative photographs of epibenthic fauna to be taken along the video transect as an aid in the identification of species during video footage analysis.

The drop camera was deployed via a winch over the stern of the vessel. All data was transferred directly to the surface unit and saved onto a dedicated Fugro server. The camera system was lowered to the seafloor at the first transect site and then towed by the vessel along the transect routes. The camera system remained submerged for the duration of video footage collection and was towed underwater between transect locations.

Each video transect was approximately 30 to 45 minutes covering 1.0 50 1.5 naultical miles (approximately 1.8 to 2.8 km) of seabed. When assessing the video footage, the environmental scientist recorded the following attributes approximately every 30 seconds along the transect route:

- A high-level description of the epifauna composition;
- Coverage of epifauna;
- An estimate of individual fauna (i.e., singular, mobile species);
- The type pf sediment present; and
- Coverage of sediment (not covered by epifauna).

Representative photographs of the seabed were used to elaborate on the description of the epifauna observed in video transects.

### 3.4 Sediment Grab Sampling and Benthic Fauna Assessment Procedures

Seabed sediment samples were collected using a Van Veen grab sampler (Figure 8). These types of samplers are designed for sampling the top layer of consolidated sediment consisting of silt and/or sand.



**Figure 8 Van Veen grab sampler. Provided by Fugro, March 2020.**

On retrieval at the surface, the grab sample was inspected and comments made in the field data sheet on whether:

- The jaws of the grab are closed;
- The surface of the sediment sample covers at least 70% of the grab;
- The surface of the sediment sample is undisturbed;
- There is evidence of the sample being washed out.

Once the grab sample contents had been used for geophysical ground truthing, the remaining sediment was examined for conspicuous benthic fauna. The following information was collected and recorded on the field data sheet:

1. Sample name, site/location, time
2. Gross sediment texture (mud, sand, gravel, or combination of)
3. Sediment colour
4. Presence of organic fragments and description (i.e., dead coral fragments, shells)
5. Identification and abundance of conspicuous benthic biota greater than 1 cm in size.

For each grab sample, a photograph was taken of the sample surface with sample name, site, date and time shown on a label plate.

To aid in the identification and enumeration of biota, the sediment sample contents was spread out in a sorting tray. Organisms of 1 cm or greater were identified to at least the level of higher order taxonomic group. Where possible, different species within these groups were recorded (i.e., sp. 1, sp. 2 and so on). It is often not possible to count the number of individuals for encrusting and sessile epifauna, such as bryozoan or hydroids. In this instance, their presence or absence was simply noted. However, comments of general abundance were noted if, for example, a particular organism is high abundant and a predominant feature of the epifauna. Physical samples of benthic fauna were not retained after onboard analysis.

# 4. RESULTS

## 4.1 Marine Mammal Observations

Marine mammal observation activities are recorded in Table 3 and sightings made during field activities are recorded in Table 4 and Appendix 1. Common bottlenose dolphins were regularly observed bow riding, both during transit to site and during MBES/SSS operations. On one occasion, a large school of dolphins was observed to starboard of the vessel. No evasive action was required, however a large group split off and headed towards the vessel to continue bow riding for an extended period. During survey operations, vessel speed was around 4 knots, except during video transects which were undertaken at about 2 knots. Cruising speed of the vessel was approximately 8 knots.

**Table 3 Marine mammal observation activities during multibeam echosounder and sidescan sonar operations in Otway Basin, 3-17 April 2020.**

| Date | Reason for firing* | Time (UTC+10) | | | | | | | | Mitigating action required? | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | pre-shooting search | Search end | Ramp-up | Full Power | Start of line | End of line | Reduced Output | Source stopped | | |
| 8/04/2020 | t | 6:45 | 8:05 | N/A | 8:05 | 8:10 | 9:10 | 9:10 | N/A | n | Boomer, X-Star (Chirp), SSS, MBES |
| 8/04/2020 | l | 9:15 | 18:30 | | | | | N/A | N/A | n | Continuous operations. MFO during daylight |
| 9/04/2020 | l | 6:35 | 18:45 | | | | | N/A | N/A | n | Large school of dolphins along vessel. Many riding bow. |
| 10/04/2020 | l | 6:45 | | | | | 9:45 | 9:45 | N/A | n | Retreived probes. Heading to port |
| 11/04/2020 | l | N/A | | | | | N/A | N/A | N/A | n | In Port (Portland) |
| 12/04/2020 | l | 15:45 | 18:45 | | | | | N/A | N/A | n | Survey lines continuing during night |
| 13/04/2020 | l | 6:45 | 15:30 | | | | | N/A | N/A | n | End of lines. All gear back on board 4 pm |
| 14/04/2020 | l | 16:15 | 18:35 | N/A | 17:47 | | | N/A | N/A | | Start extra lines after sediment & video transects |
| 15/04/2020 | | 6:45 | 8:15 | | | | 8:00 | 8:00 | N/A | | Gear retrieved 8:15 am. Heading to port |

* Reason for firing: l = survey line, t = test

**Table 4 Marine mammal observations made during multibeam echosounder and sidescan sonar operations in the Otway Basin, 3-17 April 2020.**

| Date (UTC) | Time (UTC) | Latitude | Longitude | Species (Confidence*) | Abundance (Confidence*) | Number of Adults | Number of Calves | Identification | Behaviour | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| 9/04/20 | 18:48 | 38.6570 | 142.9317 | Common bottlenose dolphin (C) | 50 (C) | ? | ? | Dorsal fin | Milling | Large school. Estimate around 50, but possiby many more. Adults and young. Feeding on fish. Many heading to vessel, riding bow wave. |
| 12/04/20 | 5:20 | 38.7030 | 142.6322 | Common bottlenose dolphin (D) | 6 (D) | 0 | 6 | Dorsal fin | Bow Riding | |
| 13/04/20 | 0:55 | 38.6474 | 142.9621 | Common bottlenose dolphin (D) | 10 (C) | 4 | 6 | Dorsal fin | Bow Riding | |
| 13/04/20 | 02:40 | 38.6532 | 142.9425 | Common bottlenose dolphin (D) | 20 (C) | 7 | 13 | Dorsal fin | Bow Riding | |
| 14/04/20 | 6:40 | 38.6464 | 142.9610 | Common bottlenose dolphin (D) | 4 (C) | 3 | 1 | Dorsal fin | Bow Riding | |

* Confidence: C=Certain; D=Definitive

### 4.2 Sediment and Benthic Ecology

A total of ten sediment samples were collected using the grab sampler. A record of the field data sheets complied by the geotechnical and environmental scientists during the survey is included in Appendix 2. On a number occasions, repeat samples were collected because the grab had failed to trigger or had triggered early, or where insufficient sediment material was collected. A summary of the sediment composition and fauna (greater than 1 cm) observed in the samples is presented in Table 5.

It is noted that there was very little conspicuous fauna found in the samples, which likely reflects the relatively coarse nature of the sediment collected. This result is notably different to the observations of abundant epibiota noted during video transects. These differences are most likely due to the sampling methods such that epifauna is typically attached to hard substratum which would not be penetrated by a grab sampler. Microscopic analysis of seabed sediment would be required to provide a more detailed description of seabed fauna for statistical analysis. No organisms of significance under the EPBC Act were noted during this assessment of the grab samples.

**Table 5 Sediment type and benthic fauna observed in grab samples collected in Otway Basin, 3-17 April 2020.**

| Grab Sample Site Code | Sediment Description | Benthic Fauna Description |
|---|---|---|
| **GS_01b** | Fine-grained carbonate sand with silt. Sand is pale yellowish orange, well sorted, fine grained and composed primarily of mixed carbonates. | Polychaete tubes visible. |
| **GS_02** | Cobble-sized limestone fragments. | Limestone fragments covered with crustose coralline algae (Rhodophyta). Also colonial tunicates (ascidians) visible (Botryllinae, possibly *Botryllus stewardensis*). Presence of calcified tube worm casings (Serpulidae, possibly *Galeolaria caespitosa*) and colonial hydroids (possibly *Leptothecata*). |
| **GS_03d** | Fine-medium carbonate sand. Sand is dark yellowish orange, well sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces. | Few pieces of red algae (Rhodophyta, possibly *Hemineura frondosa*). |
| **GS_04** | Coarse gravelly carbonate sand. Sand fraction varies from white to reddish olive-brown, poorly sorted, medium to coarse grained and composed primarily of mixed carbonates. Major fraction shell fragments. | No fauna present. |
| **GS_05** | Fine-medium carbonate sand. Sand is light yellowish orange, moderately sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces. | No fauna present. |
| **GS_06** | Carbonate sand and gravels. Sand is light yellowish orange, fine to coarse grained and composed primarily of mixed carbonates. Gravels are reddish brown and poorly sorted with sand and shell fragments. Minor fraction of shell pieces. | Single live Brittle star (Ophiuridae, Genus Ophionereis, possibly *Ophionereis schayeri*). |
| **GS_07, 7a, 7b, 7c** | Four attempts were made, however no sample was recovered. Small limestone rock caught in grab on first attempt, prohibiting grab from closing, but not retained. | No sample for assessment. |
| **GS_08** | Carbonate sand and gravels. Sand is light yellowish orange, fine to medium grained and composed primarily of mixed carbonates. Moderately sorted with shell fragments. Fraction of shell pieces and lacy bryozoan fragments (Phidoloporidae). | No fauna present. |

| Grab Sample Site Code | Sediment Description | Benthic Fauna Description |
|---|---|---|
| **GS_09a** | Carbonate gravels and sand. Gravels are light gray to grayish orange in color, very poorly sorted amongst fine to coarse grained sands composed primarily of mixed carbonates. Large fraction of shells, shell pieces and lacy bryozoan fragments (Phidoloporidae). | No fauna present. |
| **GS_10** | Fine-medium Carbonate  sand. Sand is dark yellowish orange, well sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces. | No fauna present. |

### 4.3 Epibenthic Ecology

The substrate observed in the video transects was recorded as:

- Gravelly/shelly sand
- Sand
- Mud or silt
- Hard platform; or
- Rubble.

The general abundance of epifauna ranged from (Figure 9):

- Highly abundant; 75-100% coverage;
- Abundant; 50-75% coverage;
- Frequent; 25-50% abundance;
- Occasional; <25% coverage; or
- No fauna or flora

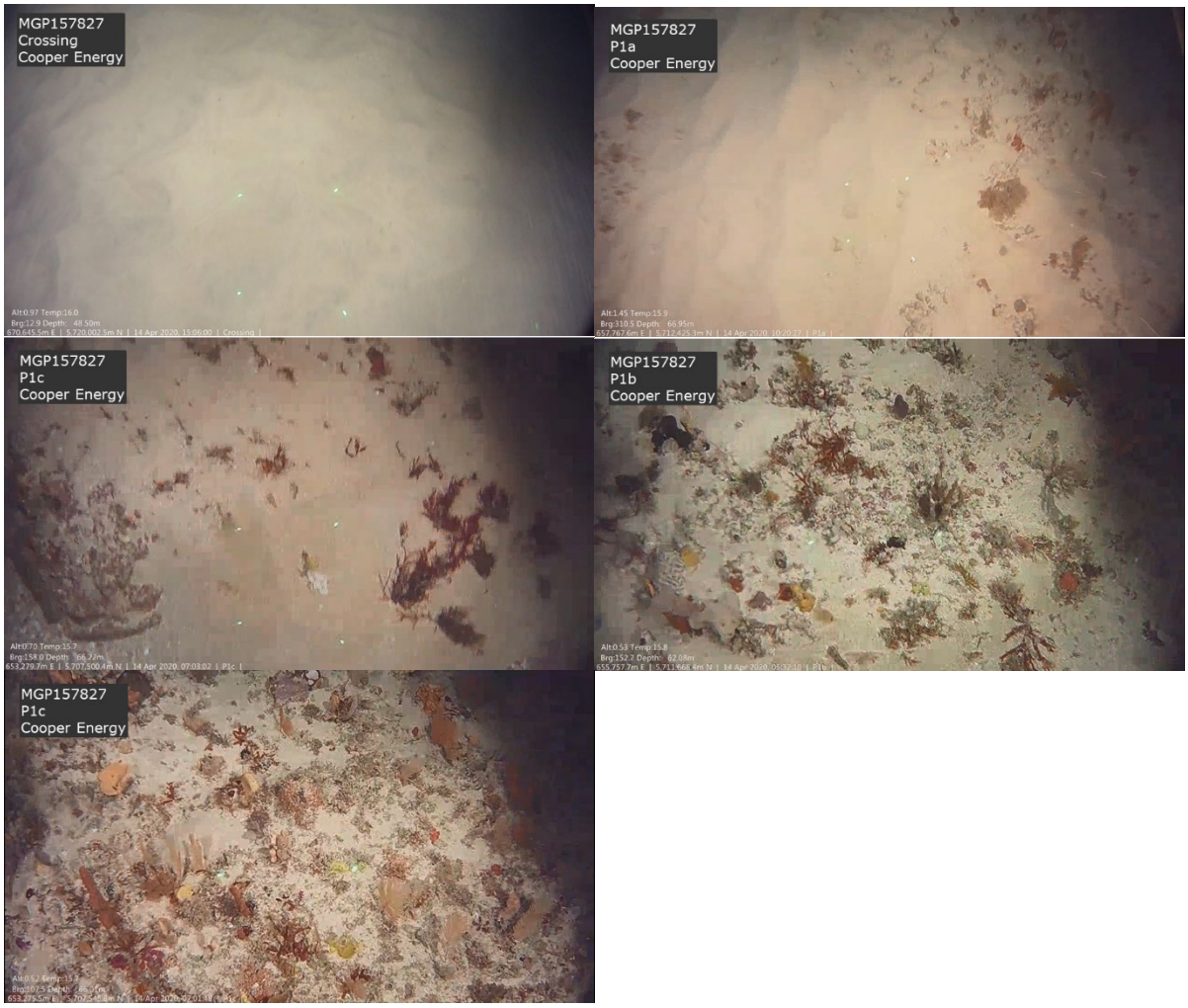



**Figure 9 Examples of epifauna coverage: no fauna or flora (top left); occasional (top right): frequent (middle left); abundant (middle right); and highly abundant (bottom left).**

Where an epifauna component was observed in video transects, this was recorded at a broad scale as either:

- Erect and encrusting/prostrate epifauna (e.g., upright sponges, low lying hydroids); or
- Prostrate epifauna, low lying hydroids, bryozoans, and macroalgae.

These compositions were made using representative photographs of the seabed.

The occurrence of habitat that could be considered as follows was noted:

- Areas of high relief
- Reefs
- Sponge beds
- Wrecks

The video assessment log of observations is included in Appendix 3. A description of the observations follows.

### 4.3.1 Overview Observations

As an overview, no areas of high relief, reefs, sponge beds or ship wrecks were noted throughout the video transects. While sponges (as part of "erect and encrusting epifauna") were present, they were not so highly abundant and morphological diverse as a taxonomic group to be considered as a sponge bed, rather sponges were interspersed throughout the patchy epifaunal covering that also included bryozoans and hydroids as shown in Figure 10. Similarly, while hard platform (i.e., consolidated substrate) was noted for some transects, this was not considered to be an example of "high relief" and was typically no more than a 2-5 cm projection above the adjacent sandy seafloor, and in most instances was at the same level as the unconsolidated seabed substrates. Examples of hard platform are shown in Figure 11.

The patchy epifauna and presence of hard platform is consistent with the description of a key ecological feature (KEF) of the South-East bioregion, that is, shelf rocky reefs and hard substrates. This KEF is described as (Commonwealth of Australia, 2015):

***"High productivity, aggregations of marine life***
*Rocky reefs and hard grounds are located in all areas of the South-east Marine Region continental shelf including Bass Strait, from the sub-tidal zone shore to the continental shelf break. The continental shelf break generally occurs in 50 m to 150–220 m water depth. The shallowest depth at which the rocky reefs occur in Commonwealth waters is approximately 50 m.*
*On the continental shelf, rocky reefs and hard grounds provide attachment sites for macroalgae and sessile invertebrates, increasing the structural diversity of shelf ecosystems. The reefs provide habitat and shelter for fish and are important for aggregations of biodiversity and enhanced productivity".*

Hard ground was patchy and scattered throughout most of the transects as described below, providing attachment opportunities for epifauna. Epifauna was also noted to occur on unconsolidated substrates (sand and gravel) and amongst biogenic rubble. The hard ground observed during the video transects was low-lying and did not provide a reef-type structure of high relief.

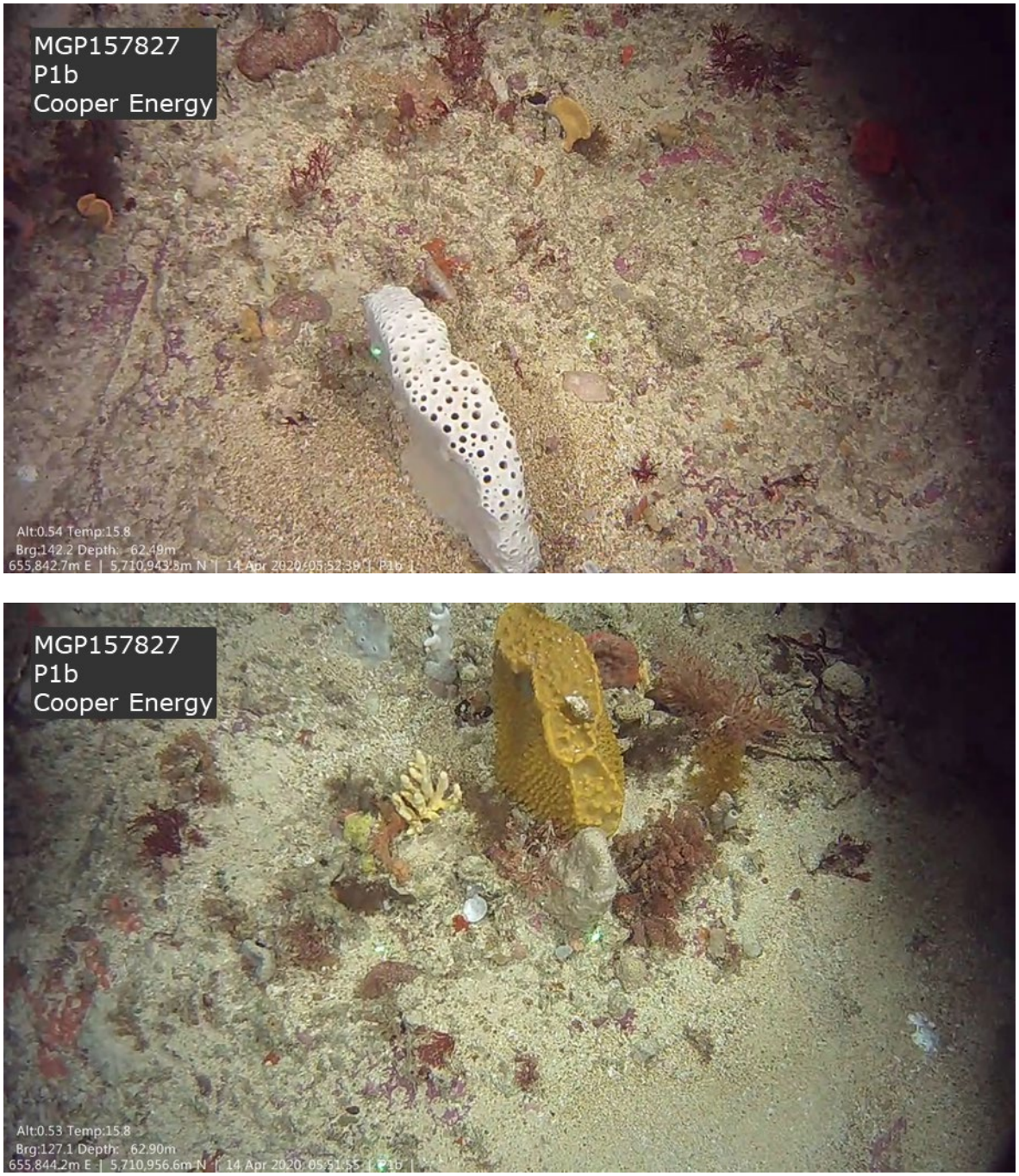



**Figure 10 Examples of typical epifauna observed within the study area, at transect P1B, April 2020.**




**Figure 11 Examples of hard platform with encrusting/prostrate epifauna along transect P1A.**

### 4.3.2 Transect P2A

Starting at the beginning of Route 1 in the vicinity of the "Henry" well sites, the epifauna was generally prostrate epifauna with some occasional patches of erect epifauna throughout the entire transect P2A. The abundance of epifauna ranged from occasional to frequent coverage with three instances of highly abundant fauna. Two crinoids (feather stars) and one teleost fish were noted.

### 4.3.3 Transect P2B

The epifauna type, abundance and patchiness of transect P2B, between the 'Henry' well sites and "Annie 2", was largely similar to that described for transect P2A, with the exception that no hard platform was present. Observations included several snapper, file fish, other teleost fish and starfish. Man-made pipes were observed on the seabed surface, covered in epifauna. These pipes are known, existing infrastructure – the pipe at E 657550, N 5707334 is the CHN to HDD ECU (umbilical), and the pipe at E 657567, N 5707316 is the CHN to HDD 12PP (pipeline).

### 4.3.4 Transects P3C and P3D

The epifauna in closest proximity to "Annie 2", at transect P3D, was less abundant covering <25% of the seabed and was only present as prostrate epifauna. Occasional teleost fish were observed. The epifauna at transect P3C, between "Annie 2" and "HDD/Iona", was very similar.

### 4.3.5 Transects P3A and P3B

A greater abundance of erect epifauna was noted along transects P3B and P3A, between "Annie 2" and "HDD/Iona", but generally epifauna remained patchy as for other transects. Rubble substrate was often associated with erect epifauna, which would be providing attachment opportunities for such fauna.

### 4.3.6 Transects "Crossing" and "HDD Exit"

At the end of this route, near "HDD/Iona", within transects labelled as "Crossing" and "HDD Exit", there was a notable lack of epifauna compared to other transects described along this route. No epifauna was observed along the "Crossing" transect or and very occasional patches of prostrate epifauna was noted along the "HDD Exit" transect. Sand was the predominant substrate type in these transects.

### 4.3.7 Transects P1A, P1B and P1C

Between "Casino" and "Annie 2" well sites, in transects P1A, P1B (Figure 10) and P1C, the epifauna was present for most of each transect with only small patches (1-2 m length) where epifauna was absent. Epifauna was various prostrate and erect with not specific pattern or relationship to the sediment. The sediment was more varied along these transects than those described above, including hard platform (usually with a covering of sand), rubble, and gravel or shell gravel.

### 4.3.8 Transect P1B

Epifauna in the vicinity of the "Black Watch" tee site, in transect P1B, was highly to frequently abundant and was both prostrate and erect, over a sediment bed consisting largely of sand with some hard platform.

# 5. DISCUSSION

The survey was conducted in the Otway Basin covering five survey routes and four well sites. The survey areas were located in State and Commonwealth waters approximately 30 km southwest of Port Campbell and in water depths ranging from 20 m to 70 m.

The sandy, gravelly/rubble and hard platform substrates described throughout the survey areas are consistent with the reported description for the area of unconsolidated seabed sediments made up of carbonate sands (Barton et al., 2012; Murray-Wallace and Woodroffe, 2014). The sediment quality results were also consistent with Jones and Davies (1983) who described the grain size distribution as sand and gravel covering the entire shelf except for areas of silty sand in central Bass Strait and other locations more remote from the survey area. The authors noted a regional trend of 'reverse grading' whereby sediment tended to become coarser with distance from shore.

Fine sand was reported to be the predominant sediment type along the inner shelf of Victoria and off much of Tasmania, grading seawards into medium-grain sand, and locally into coarse sand at the edge of the shelf (Jones and Davies, 1983). This feature was observed in the differences in sediment composition between the transects closer to the well sites (gravel, shell and rubble) compared to the sand substrates observed near the "HDD/Iona" site.

The Otway Basin is part of the Southeast Marine Bioregion which extends from the far south coast of New South Wales to Kangaroo Island (Commonwealth of Australia, 2015). Significant variation in seafloor features and water depth contribute to the high level of species diversity in the Region and the shelf habitats are reported to support a diverse range of species from a broad range of taxonomic groups (Commonwealth of Australia, 2015). However, there is no readily-available literature describing the seabed fauna of Otway Basin, meaning it is not possible to make a comparison of infauna and epifauna communities detected to prior studies. Most descriptions of the ecological values of the Basin or the Bioregion are at a broad scale and focus of key features such as cetaceans, birds, fisheries and macroalgae habitats (Commonwealth of Australia, 2015). However, the patchy epifauna and presence of hard platform is consistent with the description of a key ecological feature (KEF) of the South-East bioregion, that is, shelf rocky reefs and hard substrates. Hard ground was patchy and scattered throughout most of the transects, providing attachment opportunities for epifauna. The hard ground observed during the video transects was low-lying and did not provide a reef-type structure of high relief. Epifauna was also noted to occur on unconsolidated substrates (sand and gravel) and amongst biogenic rubble.

Based on the assessment of epifauna using seabed video transects and photographs, the general impression of the seafloor is of an unmodified marine environment that supports a patchy complex of prostrate and branching or erect epibiota (i.e., bryozoans, gorgonian cnidarians and sponges). This complex was highly patchy, covering between 25 and 100% of the available substrate. The most notable change in epifauna abundance was the lack of epifauna in the 'Crossing' transect and the very low abundance of epifauna in the '"HDD/Iona"' transect. No areas of high relief, reefs, sponge beds or ship wrecks were noted throughout the video transects. While sponges were present, they were not so highly abundant or morphological diverse as a taxonomic group to be considered as a sponge bed, rather sponges were interspersed throughout the patchy epifaunal covering.

By comparison, there was a very low abundance and diversity of fauna observed in grab samples, which likely reflects the coarse nature of the substrate. It could be expected that, given the abundance of epifauna observed in video transects, that some of this epifauna would be recovered

from the seafloor. However, the Van Veen grab sampler used is not ideal for obtaining undisturbed epifauna samples and would be less likely to work effectively at obtaining a sample from the hard substratum preferred by epifauna. Therefore, the grab samples are not considered to be a good representation of the benthic fauna present within the survey area and the video footage should be relied on in this instance. However, the grab samples provided an adequate example of the nature of the seabed sediment which was also observed in the video transects, and was variously gravelly or rubble with some sand.

In summary, the epibiota on the seabed in the survey area is representative of what is expected within the Otway Basin based on the sediment type and water depth. No species or ecological communities listed as threatened under the Environmental Protection and Biodiversity Conservation Act 1999 (the EPBC Act) were observed. No areas of high relief, reefs, sponge beds or ship wrecks were noted throughout the video transects.

# 6. REFERENCES

Barton, J.; Pope, A.; Howe S. (2012) Marine Natural Values Study Vol 2: Marine Protected Areas of the Otway Bioregion. Parks Victoria Technical series No. 75. Parks Victoria, Melbourne.

Commonwealth of Australia (2015) South-east marine region profile: A description of the ecosystems, conservation values and uses of the South-east Marine Region. 87 p. https://www.environment.gov.au/system/files/resources/7a110303-f9c7-44e4-b337-00cb2e4b9fbf/files/south-east-marine-region-profile.pdf [Accessed February 2020].

Jones, H.A.; Davies, P.J. (1983) Superficial sediments of the Tasmanian continental shelf and part of Bass Strait. Bureau of Mineral Resources, Geology and Geophysics bulletin no. 218. Canberra, Australian Government Publishing Service, 25 p.

Murray-Wallace, C.V.; Woodroffe, C.D. (2014) Quaternary sea-level changes: a global perspective. Cambridge University Press, Cambridge 484 p.

# APPENDIX 1
# MARINE MAMMAL SIGHTING REGISTER

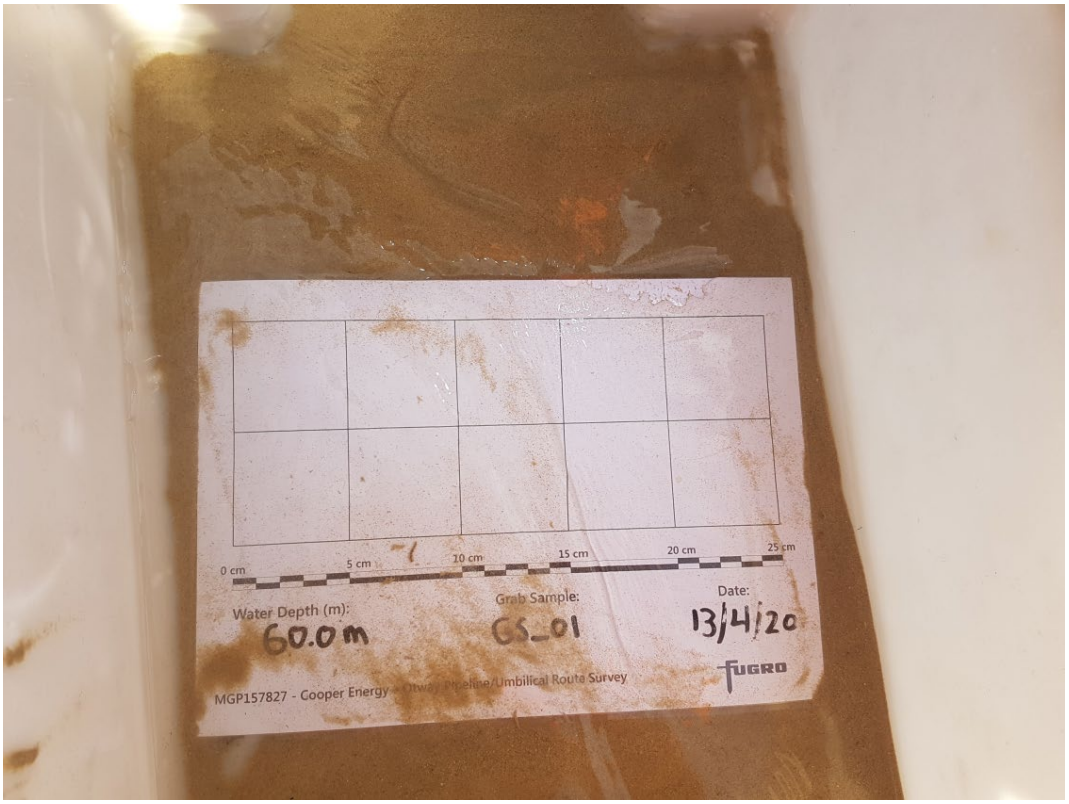
| First name | Last name | Email address | Species Category | Species | How confident are you in the species? | How many in group? | Group size confidence level | Total adults | Total calves | Sighting cue | Behaviour | Date (UTC) | Time (UTC) | Sighted from | Vessel name | Jurisdiction | Latitude | Longitude | Location description | Sighting notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sjaak | Lemmens | sjaak@Enigmatic-group.com.au | Dolphin or porpoise | Bottlenose dolphin - Common | Definitive | 50 | Certain | | | Dorsal fin | Milling | 9/04/2020 | 6:48:00 PM | Vessel | Silver Star | Victoria | 38.6570 | 142.9317 | Open water off 12 Apostles | Large school. Estimate around 50, but possiby many more. Adults & young. Feeding on fish. Many heading to vessel,riding bow wave. |
| Sjaak | Lemmens | sjaak@Enigmatic-group.com.au | Dolphin or porpoise | Bottlenose dolphin - Common | Definitive | 6 | Definitive | 0 | 6 | Dorsal fin | Bow ride | 12/04/2020 | 5:20:00 AM | Vessel | Silver Star | Victoria | 38.7030 | 142.6322 | Open water off 12 Apostles | |
| Sjaak | Lemmens | sjaak@Enigmatic-group.com.au | Dolphin or porpoise | Bottlenose dolphin - Common | Definitive | 10 | Certain | 4 | 6 | Dorsal fin | Bow ride | 13/04/2020 | 12:55:00 AM | Vessel | Silver Star | Victoria | 38.6474 | 142.9621 | Open water off 12 Apostles | |
| Sjaak | Lemmens | sjaak@Enigmatic-group.com.au | Dolphin or porpoise | Bottlenose dolphin - Common | Definitive | 20 | Certain | 7 | 13 | Dorsal fin | Bow ride | 13/04/2020 | 2:40:00 AM | Vessel | Silver Star | Victoria | 38.6532 | 142.9425 | Open water off 12 Apostles | |
| Sjaak | Lemmens | sjaak@Enigmatic-group.com.au | Dolphin or porpoise | Bottlenose dolphin - Common | Definitive | 4 | Definitive | 3 | 1 | Dorsal fin | Bow ride | 14/04/2020 | 6:40:00 AM | Vessel | Silver Star | Victoria | 38.6464 | 142.9610 | Open water off 12 Apostles | |

# APPENDIX 2
# GRAB SAMPLE FIELD RECORDS

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_01b |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 16:55 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 10% |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 56.1 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 668383.50 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5719641.58 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

Fine-grained CARBONATE SAND with silt

Sand is pale yellowish orange, well sorted, fine grained and composed primarily of mixed carbonates. Buried *Polychaete tubes visible*.

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_02 |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 17:05 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 5 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 55.4 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 668145.29 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5719575.17 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

Cobble-sized limestone fragments

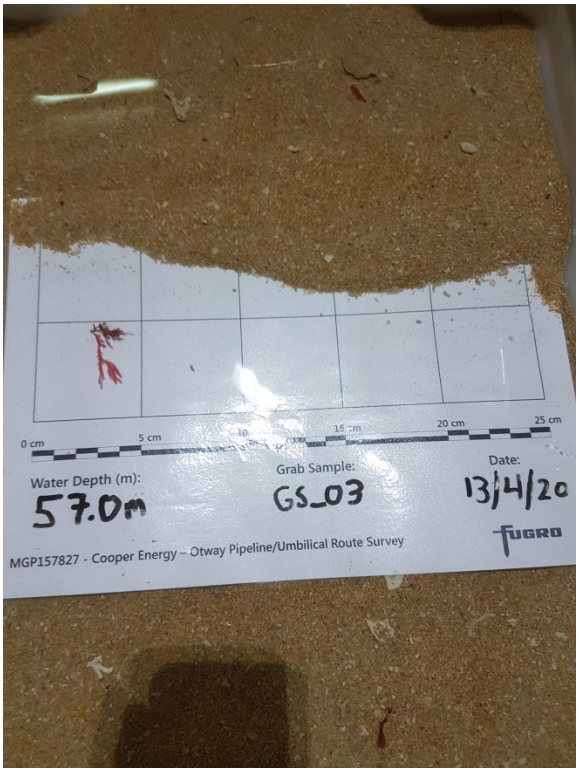
Limestone fragments covered with *Crustose coralline algae (Rhodophyta)*. Alsocolonial tunicates (ascidians) visible (Botryllinae, possibly *Botryllus stewardensis*).

Presence of calcified tube worm casings (Serpulidae, possibly *Galeolaria caespitosa*) and colonial hydroids (possibly Leptothecata).

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_03d |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 18:38 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 20 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 58.2 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 658744.87 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5716775.62 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

Fine-medium CARBONATE SAND

Sand is dark yellowish orange, well sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces. Few pieces of red algae (Rhodophyta, possibly *Hemineura frondosa*).

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_04 |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 18:55 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 20 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 58.8 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 658167.99 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5715913.97 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

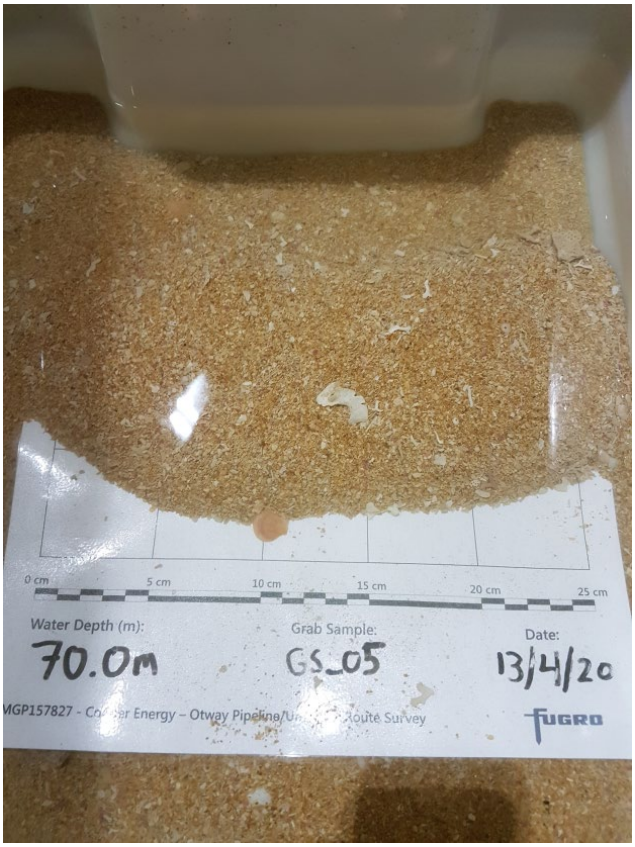
Coarse gravelly CARBONATE SAND

Sand fraction varies from white to reddish olive-brown, poorly sorted, medium to coarse grained and composed primarily of mixed carbonates. Major fraction shell fragments.

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_05 |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 19:25 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 20 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 67.2 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 657713.25 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5712656.07 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

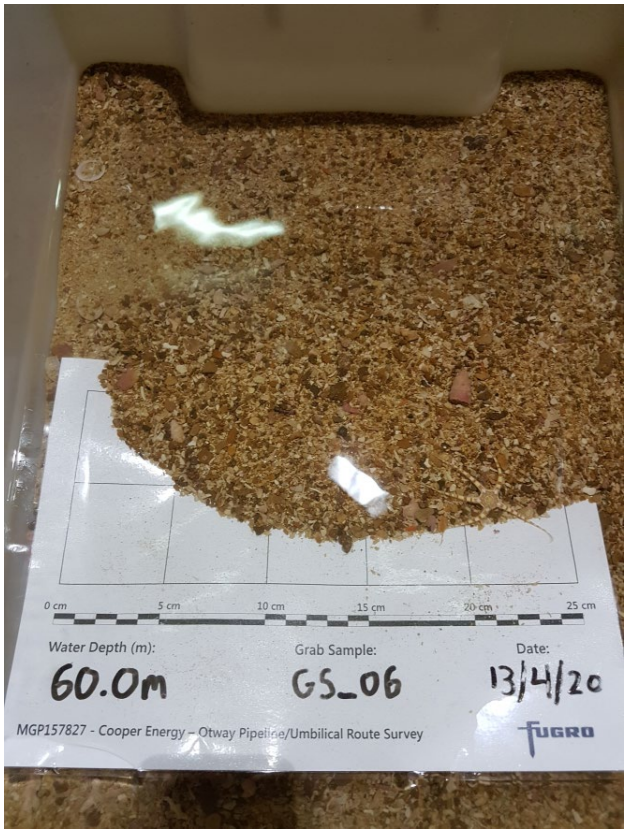
Fine-medium CARBONATE SAND

Sand is light yellowish orange, moderately sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces.

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_06 |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 19:38 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 20 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 58.6 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 656388.40 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5713029.78 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

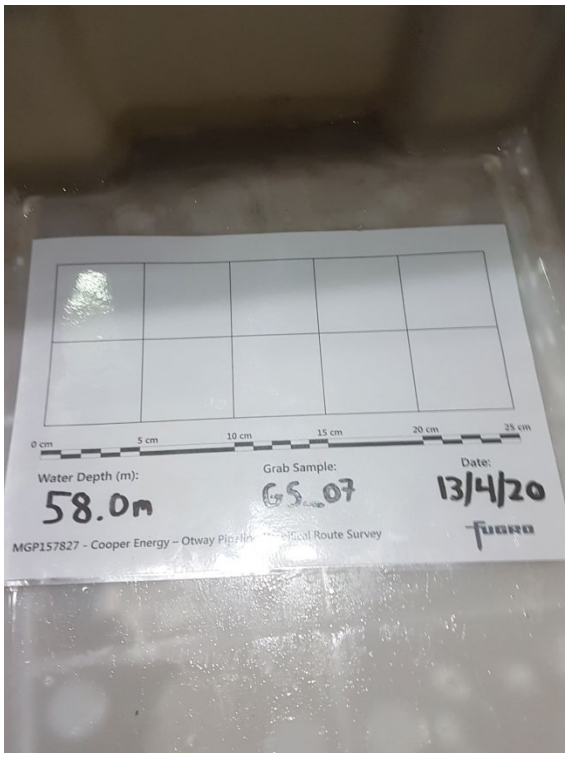
CARBONATE SAND and GRAVELS

Sand is light yellowish orange, fine to coarse grained and composed primarily of mixed carbonates. Gravels are reddish brown and poorly sorted with sand and shell fragments. Minor fraction of shell pieces. Single live Brittle star (Ophiuridae, Genus *Ophionereis, possibly Ophionereis schayeri*).

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_07c |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 20:24 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 0 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 59.5 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 655036.16 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5716083.73 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo



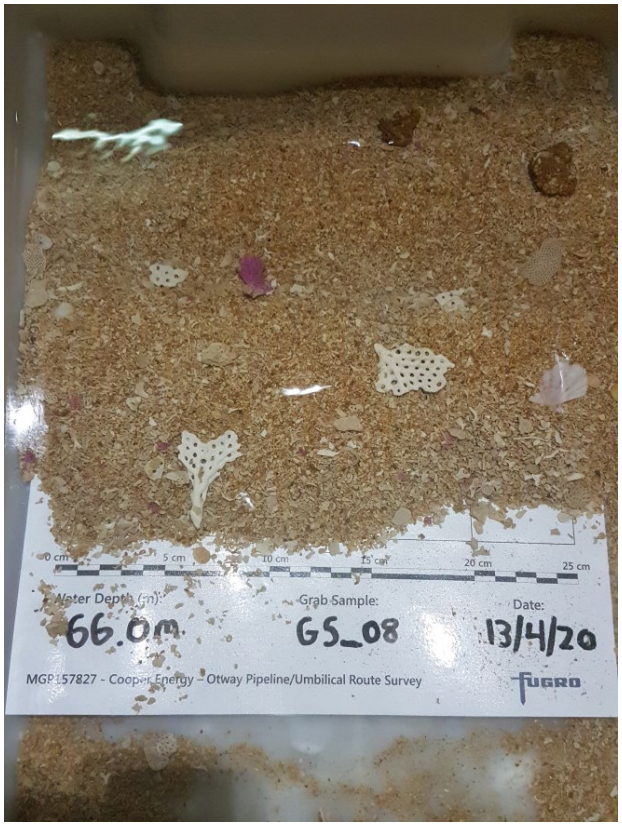

## Sample Description

Four attempts were made, however no sample was recovered.  Small limestone rock caught in grab on first attempt, prohibiting grab from closing, but not retained.

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_08 |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 21:35 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 20 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 63.2 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 657330.48 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5707359.54 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

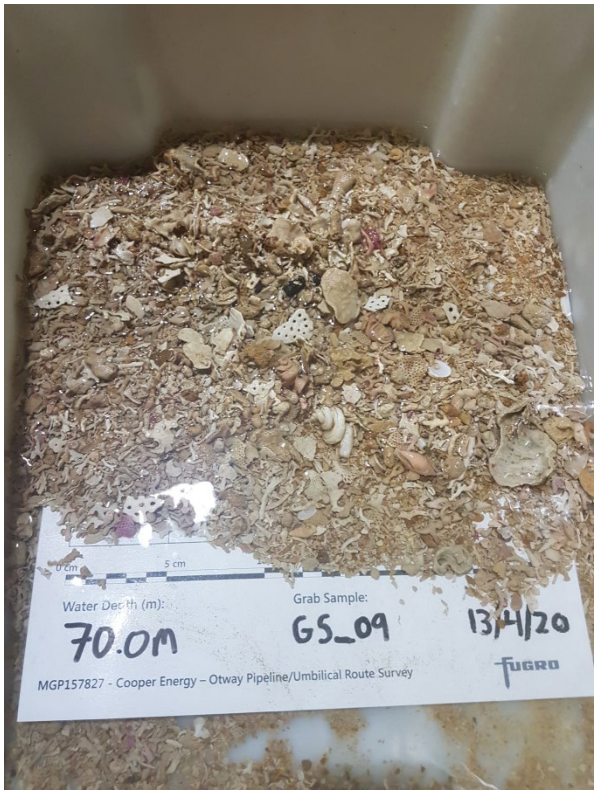
CARBONATE SAND and GRAVELS

Sand is light yellowish orange, fine to medium grained and composed primarily of mixed carbonates. Moderately sorted with shell fragments. Fraction of shell pieces and lacy bryozoan fragments (Phidoloporidae).

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 13/04/2020 | **Sample No** | GS_09a |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 22:29 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 30 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 68.4 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 651976.17 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5704863.93 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

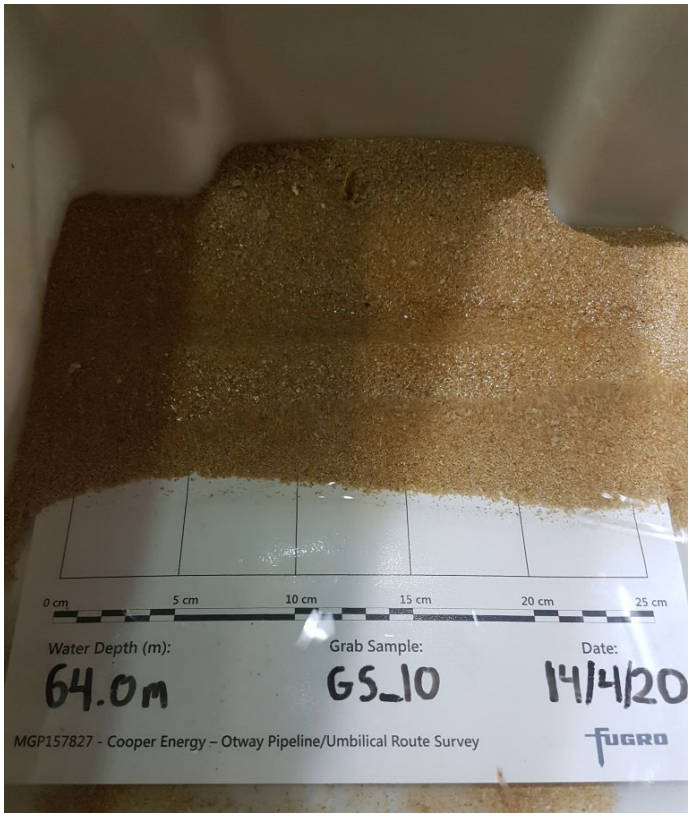
CARBONATE GRAVELS and SAND

Gravels are light gray to grayish orange in color, very poorly sorted amongst fine to coarse grained sands composed primarily of mixed carbonates. Large fraction of shells, shell pieces and lacy bryozoan fragments (Phidoloporidae).

# Grab Sample Log

| | | | | | |
|---|---|---|---|---|---|
| **Project No** | MGP157827 | **Date (local)** | 14/04/2020 | **Sample No** | GS_10 |
| **Project Name** | Otway Pipeline/Umbilical Route Survey | **Time (local)** | 00:14 | **Sampler Capacity** | 0.1 $m^3$ |
| **Client** | Cooper Energy | **Time Zone** | GMT+10 | **Recovery** | 10 % |
| **Vessel** | MV Silver Star | **Water Depth (m)** | 65.4 | **Grab Sampler** | Van Veen |
| **Geo** | Ryan M. Vitas | **Vertical Datum** | Lowest Astronomical Tide (LAT) | | |
| **Easting (m)** | 642045.82 | **Projection** | Universal Transverse Mercator UTM Z54 (S) | | |
| **Northing (m)** | 5715337.53 | **Horizontal Datum** | International Terrestrial Reference Frame 2014 (ITRF 2014) | | |

## Sample Photo




## Sample Description

Fine-medium CARBONATE SAND

Sand is dark yellowish orange, well sorted, fine to medium grained and composed primarily of mixed carbonates. Minor fraction of shell pieces.

# APPENDIX 3
# VIDEO TRANSECT ASSESSMENT LOG

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| Crossing | 2020_04_14_050424902 | 00:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424903 | 01:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424904 | 01:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424905 | 02:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424906 | 02:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424907 | 03:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424908 | 03:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424909 | 04:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424910 | 04:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424911 | 05:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424912 | 05:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424913 | 06:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424914 | 06:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424915 | 07:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424916 | 07:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424917 | 08:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424918 | 08:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424919 | 09:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424920 | 09:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424921 | 10:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424922 | 10:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424923 | 11:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424924 | 11:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424925 | 12:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424926 | 12:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424927 | 13:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424928 | 13:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424929 | 14:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424930 | 14:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424931 | 15:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424932 | 15:30 | No Fauna | | 75-100% | Sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| Crossing | 2020_04_14_050424933 | 16:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424934 | 16:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424935 | 17:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424936 | 17:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424937 | 18:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424938 | 18:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424939 | 19:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424940 | 19:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424941 | 20:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424942 | 20:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424943 | 21:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424944 | 21:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424945 | 22:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424946 | 22:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424947 | 23:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424948 | 23:30 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424949 | 24:00 | No Fauna | | 75-100% | Sand | |
| Crossing | 2020_04_14_050424950 | 24:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150956 | 00:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150957 | 01:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150958 | 01:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150959 | 02:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150960 | 02:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150961 | 03:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150962 | 03:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150963 | 04:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150964 | 04:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150965 | 05:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150966 | 05:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150967 | 06:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150968 | 06:30 | No Fauna | | 75-100% | Sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| HDD_Exit | 2020_04_14_055150969 | 07:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150970 | 07:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150971 | 08:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150972 | 08:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| HDD_Exit | 2020_04_14_055150973 | 09:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| HDD_Exit | 2020_04_14_055150974 | 09:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150975 | 10:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150976 | 10:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150977 | 11:00 | Frequent | Prostrate epifauna | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150978 | 11:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150979 | 12:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150980 | 12:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150981 | 13:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150982 | 13:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150983 | 14:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150984 | 14:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150985 | 15:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150986 | 15:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150987 | 16:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150988 | 16:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150989 | 17:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150990 | 17:30 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150991 | 18:00 | No Fauna | | 75-100% | Sand | |
| HDD_Exit | 2020_04_14_055150992 | 18:30 | No Fauna | | 75-100% | Sand | |
| P1a | 2020_04_14_001345689 | 00:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345690 | 01:00 | Abundant | Prostrate epifauna | 50-75% | Sand | |
| P1a | 2020_04_14_001345691 | 01:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345692 | 02:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345693 | 02:30 | No Fauna | | 75-100% | Sand | |
| P1a | 2020_04_14_001345694 | 03:00 | No Fauna | | 75-100% | Sand | Asteroidea, Teleost (gurnard/cod-like) |
| P1a | 2020_04_14_001345695 | 03:30 | No Fauna | | 75-100% | Sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P1a | 2020_04_14_001345696 | 04:00 | No Fauna | | 75-100% | Sand | |
| P1a | 2020_04_14_001345697 | 04:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345698 | 05:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1a | 2020_04_14_001345699 | 05:30 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P1a | 2020_04_14_001345700 | 06:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345701 | 06:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345702 | 07:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345703 | 07:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345704 | 08:00 | Frequent | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345705 | 08:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345706 | 09:00 | Occasional | Erect epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345707 | 09:30 | No Fauna | | 75-100% | Sand | |
| P1a | 2020_04_14_001345708 | 10:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345709 | 10:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1a | 2020_04_14_001345710 | 11:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345711 | 11:30 | No Fauna | | 75-100% | Sand | |
| P1a | 2020_04_14_001345712 | 12:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P1a | 2020_04_14_001345713 | 12:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345714 | 13:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | Teleost |
| P1a | 2020_04_14_001345715 | 13:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1a | 2020_04_14_001345716 | 14:00 | Frequent | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345717 | 14:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345718 | 15:00 | Abundant | Prostrate epifauna | 50-75% | Hard Platform/Sand | Asteroidea |
| P1a | 2020_04_14_001345719 | 15:30 | Occasional | Prostrate epifauna | 75-100% | Sand | Asteroidea |
| P1a | 2020_04_14_001345720 | 16:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345721 | 16:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345722 | 17:00 | Frequent | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P1a | 2020_04_14_001345723 | 17:30 | Frequent | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345724 | 18:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345725 | 18:30 | Frequent | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345726 | 19:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P1a | 2020_04_14_001345727 | 19:30 | Abundant | Prostrate epifauna | <25% | Sand | |
| P1a | 2020_04_14_001345728 | 20:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1a | 2020_04_14_001345729 | 20:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345730 | 21:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345731 | 21:30 | Occasional | Prostrate epifauna | 75-100% | Sand | 2 teleost |
| P1a | 2020_04_14_001345732 | 22:00 | Abundant | Erect epifauna | <25% | Sand | |
| P1a | 2020_04_14_001345733 | 22:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345734 | 23:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1a | 2020_04_14_001345735 | 23:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345736 | 24:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1a | 2020_04_14_001345737 | 24:30 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P1a | 2020_04_14_001345738 | 25:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1a | 2020_04_14_001345739 | 25:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345740 | 26:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345741 | 26:30 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P1a | 2020_04_14_001345742 | 27:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345743 | 27:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345744 | 28:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345745 | 28:30 | Frequent | Prostrate epifauna | 75-100% | Hard Platform/Sand | 6 teleost |
| P1a | 2020_04_14_001345746 | 29:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345747 | 29:30 | No Fauna | | 75-100% | Sand | |
| P1a | 2020_04_14_001345748 | 30:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345749 | 30:30 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P1a | 2020_04_14_001345750 | 31:00 | Abundant | Erect epifauna | 50-75% | Sand | |
| P1a | 2020_04_14_001345751 | 31:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345752 | 32:00 | No Fauna | | 75-100% | Sand | |
| P1a | 2020_04_14_001345753 | 32:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345754 | 33:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P1a | 2020_04_14_001345755 | 33:30 | Abundant | Prostrate epifauna | 25-50% | Hard Platform/Sand | |
| P1a | 2020_04_14_001345756 | 34:00 | Occasional | Prostrate epifauna | 75-100% | Sand | Teleost |
| P1a | 2020_04_14_001345757 | 34:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P1a | 2020_04_14_001345758 | 35:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1a | 2020_04_14_001345759 | 35:30 | Abundant | Erect epifauna | <25% | Sand | |
| P1a | 2020_04_14_001345760 | 36:00 | Frequent | Prostrate epifauna | 50-75% | Sand | Brittle star |
| P1a | 2020_04_14_001345761 | 36:30 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P1a | 2020_04_14_001345762 | 37:00 | Highly Abundant | Prostrate epifauna | 25-50% | Sand | Asteroidea |
| P1a | 2020_04_14_001345763 | 37:30 | Frequent | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345764 | 38:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345765 | 38:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345766 | 39:00 | Frequent | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345767 | 39:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345768 | 40:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P1a | 2020_04_14_001345769 | 40:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1a | 2020_04_14_001345770 | 41:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1a | 2020_04_14_001345771 | 41:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1a | 2020_04_14_001345772 | 42:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P1a | 2020_04_14_001345773 | 42:30 | Frequent | Erect epifauna | 50-75% | Sand | |
| P1a | 2020_04_14_001345774 | 43:00 | Abundant | Prostrate epifauna | <25% | Sand | |
| P1a | 2020_04_14_001345775 | 43:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P1b | 2020_04_13_191653134 | 00:30 | No Fauna | | 75-100% | Sand with Gravel | Teleost |
| P1b | 2020_04_13_191653134 | 01:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | Teleost |
| P1b | 2020_04_13_191653134 | 01:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1b | 2020_04_13_191653134 | 02:00 | Occasional | Prostrate epifauna | 50-75% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 02:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 03:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 03:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 04:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 04:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 05:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | Asteroidea |
| P1b | 2020_04_13_191653134 | 05:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 06:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 06:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P1b | 2020_04_13_191653134 | 07:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 07:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 08:00 | Frequent | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 08:30 | Frequent | Erect epifauna | 50-75% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 09:00 | Frequent | Erect epifauna | 50-75% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 09:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 10:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 10:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 11:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 11:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 12:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 12:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 13:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 13:30 | No Fauna | | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 14:00 | Abundant | Erect epifauna | <25% | Sand | |
| P1b | 2020_04_13_191653134 | 14:30 | Abundant | Prostrate epifauna | 25-50% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 15:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1b | 2020_04_13_191653134 | 15:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1b | 2020_04_13_191653134 | 16:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 16:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 17:00 | Frequent | Prostrate epifauna | 50-75% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 17:30 | Frequent | Erect epifauna | 50-75% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 18:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 18:30 | Frequent | Prostrate epifauna | 50-75% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 19:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 19:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 20:00 | Frequent | Prostrate epifauna | 50-75% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 20:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1b | 2020_04_13_191653134 | 21:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 21:30 | Frequent | Erect epifauna | 50-75% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 22:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P1b | 2020_04_13_191653134 | 22:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 23:00 | Occasional | Erect epifauna | 75-100% | Gravelly (shelly) sand | Teleost |
| P1b | 2020_04_13_191653134 | 23:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 24:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 24:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | 4 teleost (big head bullet-like) |
| P1b | 2020_04_13_191653134 | 25:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | Asteroidea (2 diff spp), 1 teleost |
| P1b | 2020_04_13_191653134 | 25:30 | No Fauna | | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 26:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 26:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1b | 2020_04_13_191653134 | 27:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 27:30 | Frequent | Prostrate epifauna | 50-75% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 28:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 28:30 | Abundant | Erect epifauna | 25-50% | Sand | Stingray |
| P1b | 2020_04_13_191653134 | 29:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 29:30 | Frequent | Prostrate epifauna | 50-75% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 30:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 30:30 | Frequent | Prostrate epifauna | 75-100% | Sand | Teleost |
| P1b | 2020_04_13_191653134 | 31:00 | Frequent | Erect epifauna | 50-75% | Sand | |
| P1b | 2020_04_13_191653134 | 31:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1b | 2020_04_13_191653134 | 32:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 32:30 | Frequent | Erect epifauna | 50-75% | Sand | |
| P1b | 2020_04_13_191653134 | 33:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | Cephalopod |
| P1b | 2020_04_13_191653134 | 33:30 | Occasional | Erect epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 34:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 34:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 35:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | Teleost |
| P1b | 2020_04_13_191653134 | 35:30 | Frequent | Erect epifauna | 50-75% | Gravelly (shelly) sand | Teleost |
| P1b | 2020_04_13_191653134 | 36:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | Teleost |
| P1b | 2020_04_13_191653134 | 36:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | Teleost |
| P1b | 2020_04_13_191653134 | 37:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1b | 2020_04_13_191653134 | 37:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P1b | 2020_04_13_191653134 | 38:00 | Frequent | Erect epifauna | 50-75% | Sand with Gravel | |
| P1b | 2020_04_13_191653134 | 38:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1c | 2020_04_13_205235711 | 00:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 01:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1c | 2020_04_13_205235711 | 01:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 02:00 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 02:30 | Abundant | Prostrate epifauna | 25-50% | Sand | Nudibranchia eggs |
| P1c | 2020_04_13_205235711 | 03:00 | Frequent | Prostrate epifauna | 50-75% | Sand with Gravel | |
| P1c | 2020_04_13_205235711 | 03:30 | Occasional | Prostrate epifauna | 50-75% | Sand with Gravel | Asteroidea |
| P1c | 2020_04_13_205235711 | 04:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1c | 2020_04_13_205235711 | 04:30 | Abundant | Erect epifauna | 25-50% | Sand | |
| P1c | 2020_04_13_205235711 | 05:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1c | 2020_04_13_205235711 | 05:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1c | 2020_04_13_205235711 | 06:00 | Occasional | Prostrate epifauna | 75-100% | Sand | 1 crinoid |
| P1c | 2020_04_13_205235711 | 06:30 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 07:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1c | 2020_04_13_205235711 | 07:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 08:00 | Abundant | Erect epifauna | 50-75% | Hard Platform/Sand | |
| P1c | 2020_04_13_205235711 | 08:30 | Frequent | Erect epifauna | 50-75% | Sand | |
| P1c | 2020_04_13_205235711 | 09:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 09:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 10:00 | Frequent | Erect epifauna | 50-75% | Hard Platform/Sand | |
| P1c | 2020_04_13_205235711 | 10:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1c | 2020_04_13_205235711 | 11:00 | Frequent | Prostrate epifauna | 75-100% | Sand | 3 crinoid |
| P1c | 2020_04_13_205235711 | 11:30 | Frequent | Erect epifauna | 50-75% | Hard Platform/Sand | |
| P1c | 2020_04_13_205235711 | 12:00 | Abundant | Prostrate epifauna | 25-50% | Hard Platform/Sand | |
| P1c | 2020_04_13_205235711 | 12:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1c | 2020_04_13_205235711 | 13:00 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P1c | 2020_04_13_205235711 | 13:30 | Occasional | Erect epifauna | 75-100% | Sand with Gravel | |
| P1c | 2020_04_13_205235711 | 14:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 14:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P1c | 2020_04_13_205235711 | 15:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1c | 2020_04_13_205235711 | 15:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 16:00 | Abundant | Prostrate epifauna | 25-50% | Sand | Teleost |
| P1c | 2020_04_13_205235711 | 16:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 17:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 17:30 | Abundant | Erect epifauna | 25-50% | Sand | |
| P1c | 2020_04_13_205235711 | 18:00 | Abundant | Erect epifauna | 25-50% | Sand | |
| P1c | 2020_04_13_205235711 | 18:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1c | 2020_04_13_205235711 | 19:00 | Abundant | Erect epifauna | 25-50% | Hard Platform/Sand | |
| P1c | 2020_04_13_205235711 | 19:30 | Frequent | Prostrate epifauna | 50-75% | Sand | A |
| P1c | 2020_04_13_205235711 | 20:00 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 20:30 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | 1crinoid |
| P1c | 2020_04_13_205235711 | 21:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 21:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 22:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 22:30 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 23:00 | Frequent | Prostrate epifauna | 50-75% | Sand | 3 crinoid |
| P1c | 2020_04_13_205235711 | 23:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P1c | 2020_04_13_205235711 | 24:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1c | 2020_04_13_205235711 | 24:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P1c | 2020_04_13_205235711 | 25:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 25:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P1c | 2020_04_13_205235711 | 26:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 26:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P1c | 2020_04_13_205235711 | 27:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P1c | 2020_04_13_205235711 | 27:30 | Frequent | Prostrate epifauna | 50-75% | Gravelly (shelly) sand | |
| P1c | 2020_04_13_205235711 | 28:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P1c | 2020_04_13_205235711 | 28:30 | Frequent | Prostrate epifauna | 50-75% | Sand with Gravel | |
| P1c | 2020_04_13_205235711 | 29:00 | Frequent | Prostrate epifauna | 50-75% | Sand with Gravel | |
| P1c | 2020_04_13_205235711 | 29:30 | Frequent | Erect epifauna | 50-75% | Sand | |
| P1c | 2020_04_13_205235711 | 30:00 | Frequent | Prostrate epifauna | 50-75% | Sand | 4 teleost |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P1c | 2020_04_13_205235711 | 30:30 | N/A | N/A | N/A | N/A | Drop cam not close enough to seabed |
| P2a | 2020_04_13_152130731 | 00:30 | N/A | N/A | N/A | N/A | Drop cam not close enough to seabed |
| P2a | 2020_04_13_152130731 | 01:00 | N/A | N/A | N/A | N/A | Drop cam not close enough to seabed |
| P2a | 2020_04_13_152130731 | 01:30 | N/A | N/A | N/A | N/A | Drop cam not close enough to seabed |
| P2a | 2020_04_13_152130731 | 02:00 | N/A | N/A | N/A | N/A | Drop cam not close enough to seabed |
| P2a | 2020_04_13_152130731 | 02:30 | N/A | N/A | N/A | N/A | Drop cam not close enough to seabed |
| P2a | 2020_04_13_152130731 | 03:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2a | 2020_04_13_152130731 | 03:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2a | 2020_04_13_152130731 | 04:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2a | 2020_04_13_152130731 | 04:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2a | 2020_04_13_152130731 | 05:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P2a | 2020_04_13_152130731 | 05:30 | Frequent | Erect epifauna | 50-75% | Sand | 1 crinoid |
| P2a | 2020_04_13_152130731 | 06:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2a | 2020_04_13_152130731 | 06:30 | Frequent | Prostrate epifauna | 50-75% | Sand | Teleost (triplefin-like) |
| P2a | 2020_04_13_152130731 | 07:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2a | 2020_04_13_152130731 | 07:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P2a | 2020_04_13_152130731 | 08:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2a | 2020_04_13_152130731 | 08:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2a | 2020_04_13_152130731 | 09:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2a | 2020_04_13_152130731 | 09:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2a | 2020_04_13_152130731 | 10:00 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P2a | 2020_04_13_152130731 | 10:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2a | 2020_04_13_152130731 | 11:00 | Frequent | Erect epifauna | 50-75% | Sand | |
| P2a | 2020_04_13_152130731 | 11:30 | Frequent | Prostrate epifauna | 50-75% | Sand | Cone shell |
| P2a | 2020_04_13_152130731 | 12:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2a | 2020_04_13_152130731 | 12:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2a | 2020_04_13_152130731 | 13:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P2a | 2020_04_13_152130731 | 13:30 | Abundant | Prostrate epifauna | 25-50% | Sand | 1 crinoid |
| P2a | 2020_04_13_152130731 | 14:00 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P2a | 2020_04_13_152130731 | 14:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2a | 2020_04_13_152130731 | 15:00 | No Fauna | | 75-100% | Sand with Gravel | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P2b | 2020_04_13_223043238 | 00:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 01:00 | Highly Abundant | Prostrate epifauna | <25% | Hard Platform/Sand | 1 filefish |
| P2b | 2020_04_13_223043238 | 01:30 | Frequent | Prostrate epifauna | 50-75% | Sand | 4 filefish |
| P2b | 2020_04_13_223043238 | 02:00 | Abundant | Prostrate epifauna | 25-50% | Sand | Man-made wide diameter pipe structure - acting as artificial reef - Refer to Section 4.3.3 for comment |
| P2b | 2020_04_13_223043238 | 02:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P2b | 2020_04_13_223043238 | 03:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | Man-made thin diameter pipe structure - acting as artificial reef - Refer to Section 4.3.3 for comment |
| P2b | 2020_04_13_223043238 | 03:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 04:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 04:30 | Abundant | Prostrate epifauna | 25-50% | Hard Platform/Sand | |
| P2b | 2020_04_13_223043238 | 05:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P2b | 2020_04_13_223043238 | 05:30 | Abundant | Erect epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 06:00 | Abundant | Prostrate epifauna | 25-50% | Hard Platform/Sand | |
| P2b | 2020_04_13_223043238 | 06:30 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P2b | 2020_04_13_223043238 | 07:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 07:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 08:00 | Frequent | Erect epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 08:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 09:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P2b | 2020_04_13_223043238 | 09:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 10:00 | Frequent | Erect epifauna | 50-75% | Sand | Teleost |
| P2b | 2020_04_13_223043238 | 10:30 | Frequent | Prostrate epifauna | 50-75% | Sand | Teleost |
| P2b | 2020_04_13_223043238 | 11:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 11:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 12:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 12:30 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P2b | 2020_04_13_223043238 | 13:00 | Frequent | Prostrate epifauna | 50-75% | Sand | 2/3 snapper, stingray |
| P2b | 2020_04_13_223043238 | 13:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 14:00 | Occasional | Prostrate epifauna | 75-100% | Sand | Asteroidea |
| P2b | 2020_04_13_223043238 | 14:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 15:00 | Frequent | Erect epifauna | 50-75% | Sand | 2 crinoid, snapper |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P2b | 2020_04_13_223043238 | 15:30 | Frequent | Erect epifauna | 50-75% | Gravelly (shelly) sand | |
| P2b | 2020_04_13_223043238 | 16:00 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P2b | 2020_04_13_223043238 | 16:30 | Frequent | Prostrate epifauna | 50-75% | Sand | Snapper |
| P2b | 2020_04_13_223043238 | 17:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 17:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 18:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P2b | 2020_04_13_223043238 | 18:30 | Highly Abundant | Erect epifauna | <25% | Sand | |
| P2b | 2020_04_13_223043238 | 19:00 | Highly Abundant | Prostrate epifauna | Not Visible | | |
| P2b | 2020_04_13_223043238 | 19:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 20:00 | Frequent | Erect epifauna | 50-75% | Sand with Gravel | |
| P2b | 2020_04_13_223043238 | 20:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 21:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P2b | 2020_04_13_223043238 | 21:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 22:00 | Frequent | Prostrate epifauna | 50-75% | Sand with Gravel | |
| P2b | 2020_04_13_223043238 | 22:30 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P2b | 2020_04_13_223043238 | 23:00 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P2b | 2020_04_13_223043238 | 23:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 24:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 24:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 25:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 25:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 26:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 26:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 27:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P2b | 2020_04_13_223043238 | 27:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 28:00 | Highly Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 28:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P2b | 2020_04_13_223043238 | 29:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 29:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 30:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P2b | 2020_04_13_223043238 | 30:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P2b | 2020_04_13_223043238 | 31:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P2b | 2020_04_13_223043238 | 31:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 32:00 | Frequent | Erect epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 32:30 | Frequent | Erect epifauna | 50-75% | Sand | 5 snapper |
| P2b | 2020_04_13_223043238 | 33:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 33:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 34:00 | No Fauna | | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 34:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P2b | 2020_04_13_223043238 | 35:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P2b | 2020_04_13_223043238 | 35:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 36:00 | Occasional | Erect epifauna | 75-100% | Sand | Asteroidea |
| P2b | 2020_04_13_223043238 | 36:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 37:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 37:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P2b | 2020_04_13_223043238 | 38:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 38:30 | Abundant | Prostrate epifauna | 25-50% | Sand | Snapper |
| P2b | 2020_04_13_223043238 | 39:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 39:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P2b | 2020_04_13_223043238 | 40:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 40:30 | Frequent | Prostrate epifauna | 50-75% | Sand with Gravel | |
| P2b | 2020_04_13_223043238 | 41:00 | Abundant | Erect epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 41:30 | Frequent | Erect epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 42:00 | Abundant | Erect epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 42:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P2b | 2020_04_13_223043238 | 43:00 | Frequent | Erect epifauna | 25-50% | Sand | Asteroidea |
| P2b | 2020_04_13_223043238 | 43:30 | Frequent | Erect epifauna | 50-75% | Sand | |
| P2b | 2020_04_13_223043238 | 44:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P2b | 2020_04_13_223043238 | 44:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P3a | 2020_04_14_042325042 | 00:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P3a | 2020_04_14_042325043 | 01:00 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |
| P3a | 2020_04_14_042325044 | 01:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P3a | 2020_04_14_042325045 | 02:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3a | 2020_04_14_042325046 | 02:30 | Highly Abundant | Prostrate epifauna | <25% | Sand | 1crinoid |
| P3a | 2020_04_14_042325047 | 03:00 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |
| P3a | 2020_04_14_042325048 | 03:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3a | 2020_04_14_042325049 | 04:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3a | 2020_04_14_042325050 | 04:30 | Frequent | Erect epifauna | 50-75% | Sand | |
| P3a | 2020_04_14_042325051 | 05:00 | Frequent | Erect epifauna | 50-75% | Sand | |
| P3a | 2020_04_14_042325052 | 05:30 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |
| P3a | 2020_04_14_042325053 | 06:00 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P3a | 2020_04_14_042325054 | 06:30 | Occasional | Prostrate epifauna | 75-100% | Rubble | |
| P3a | 2020_04_14_042325055 | 07:00 | Abundant | Erect epifauna | 25-50% | Sand with Rubble | |
| P3a | 2020_04_14_042325056 | 07:30 | Occasional | Erect epifauna | 75-100% | Rubble | |
| P3a | 2020_04_14_042325057 | 08:00 | Occasional | Erect epifauna | 75-100% | Rubble | |
| P3a | 2020_04_14_042325058 | 08:30 | Occasional | Erect epifauna | 75-100% | Rubble | |
| P3a | 2020_04_14_042325059 | 09:00 | Occasional | Prostrate epifauna | 75-100% | Rubble | |
| P3a | 2020_04_14_042325060 | 09:30 | Occasional | Prostrate epifauna | 75-100% | Rubble | |
| P3a | 2020_04_14_042325061 | 10:00 | Occasional | Prostrate epifauna | 75-100% | Rubble | |
| P3a | 2020_04_14_042325062 | 10:30 | Occasional | Erect epifauna | 75-100% | Sand with Rubble | |
| P3a | 2020_04_14_042325063 | 11:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3a | 2020_04_14_042325064 | 11:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3b | 2020_04_14_035718866 | 00:30 | No Fauna | | 75-100% | Hard Platform/Sand | |
| P3b | 2020_04_14_035718867 | 01:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3b | 2020_04_14_035718868 | 01:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P3b | 2020_04_14_035718869 | 02:00 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |
| P3b | 2020_04_14_035718870 | 02:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P3b | 2020_04_14_035718871 | 03:00 | Occasional | Erect epifauna | 75-100% | Sand with Rubble | |
| P3b | 2020_04_14_035718872 | 03:30 | Occasional | Erect epifauna | 75-100% | Sand with Rubble | |
| P3b | 2020_04_14_035718873 | 04:00 | Occasional | Erect epifauna | 75-100% | Rubble | |
| P3b | 2020_04_14_035718874 | 04:30 | Occasional | Erect epifauna | 75-100% | Sand with Rubble | Stingray |
| P3b | 2020_04_14_035718875 | 05:00 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P3b | 2020_04_14_035718876 | 05:30 | Abundant | Prostrate epifauna | 25-50% | Hard Platform/Sand | |
| P3b | 2020_04_14_035718877 | 06:00 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |
| P3b | 2020_04_14_035718878 | 06:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P3b | 2020_04_14_035718879 | 07:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3b | 2020_04_14_035718880 | 07:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3b | 2020_04_14_035718881 | 08:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3b | 2020_04_14_035718882 | 08:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3b | 2020_04_14_035718883 | 09:00 | Occasional | Erect epifauna | 75-100% | Sand | Teleost |
| P3b | 2020_04_14_035718884 | 09:30 | Highly Abundant | Prostrate epifauna | <25% | Sand with Rubble | Teleost |
| P3b | 2020_04_14_035718885 | 10:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3b | 2020_04_14_035718886 | 10:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3b | 2020_04_14_035718887 | 11:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3c | 2020_04_14_025448837 | 00:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P3c | 2020_04_14_025448838 | 01:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3c | 2020_04_14_025448839 | 01:30 | No Fauna | | 75-100% | Sand with Rubble | 1 crinoid |
| P3c | 2020_04_14_025448840 | 02:00 | | Prostrate epifauna | 75-100% | Sand | |
| P3c | 2020_04_14_025448841 | 02:30 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |
| P3c | 2020_04_14_025448842 | 03:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3c | 2020_04_14_025448843 | 03:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3c | 2020_04_14_025448844 | 04:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3c | 2020_04_14_025448845 | 04:30 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P3c | 2020_04_14_025448846 | 05:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P3c | 2020_04_14_025448847 | 05:30 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |
| P3c | 2020_04_14_025448848 | 06:00 | N/A | N/A | N/A | N/A | Drop cam too far from seabed to classify, poor vis and moving too quicly |
| P3c | 2020_04_14_025448849 | 06:30 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P3c | 2020_04_14_025448850 | 07:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P3c | 2020_04_14_025448851 | 07:30 | Occasional | Prostrate epifauna | 75-100% | Rubble | |
| P3c | 2020_04_14_025448852 | 08:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3c | 2020_04_14_025448853 | 08:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3c | 2020_04_14_025448854 | 09:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P3c | 2020_04_14_025448855 | 09:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3c | 2020_04_14_025448856 | 10:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3c | 2020_04_14_025448857 | 10:30 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | Teleost |
| P3c | 2020_04_14_025448858 | 11:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3c | 2020_04_14_025448859 | 11:30 | Frequent | Prostrate epifauna | 50-75% | Hard Platform/Sand | |
| P3c | 2020_04_14_025448860 | 12:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | Teleost |
| P3c | 2020_04_14_025448861 | 12:30 | Abundant | Prostrate epifauna | 25-50% | Hard Platform/Sand | |
| P3c | 2020_04_14_025448862 | 13:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P3c | 2020_04_14_025448863 | 13:30 | Occasional | Prostrate epifauna | 75-100% | Sand | Teleost |
| P3c | 2020_04_14_025448864 | 14:00 | Occasional | Erect epifauna | 75-100% | Sand with Rubble | |
| P3c | 2020_04_14_025448865 | 14:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3c | 2020_04_14_025448866 | 15:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | Teleost |
| P3d | 2020_04_14_021010789 | 00:30 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P3d | 2020_04_14_021010790 | 01:00 | Frequent | Prostrate epifauna | 50-75% | Sand with Rubble | |
| P3d | 2020_04_14_021010791 | 01:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3d | 2020_04_14_021010792 | 02:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3d | 2020_04_14_021010793 | 02:30 | Abundant | Prostrate epifauna | 25-50% | Sand | |
| P3d | 2020_04_14_021010794 | 03:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3d | 2020_04_14_021010795 | 03:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P3d | 2020_04_14_021010796 | 04:00 | Frequent | Prostrate epifauna | 50-75% | Sand with Rubble | |
| P3d | 2020_04_14_021010797 | 04:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | Teleost |
| P3d | 2020_04_14_021010798 | 05:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3d | 2020_04_14_021010799 | 05:30 | No Fauna | | 75-100% | Sand with Rubble | |
| P3d | 2020_04_14_021010800 | 06:00 | Abundant | Prostrate epifauna | 25-50% | Sand | Teleost |
| P3d | 2020_04_14_021010801 | 06:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3d | 2020_04_14_021010802 | 07:00 | Occasional | Erect epifauna | 75-100% | Sand with Rubble | |
| P3d | 2020_04_14_021010803 | 07:30 | No Fauna | | 75-100% | Hard Platform/Sand | Teleost |
| P3d | 2020_04_14_021010804 | 08:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P3d | 2020_04_14_021010805 | 08:30 | Frequent | Prostrate epifauna | 50-75% | Sand | Teleost |
| P3d | 2020_04_14_021010806 | 09:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3d | 2020_04_14_021010807 | 09:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P3d | 2020_04_14_021010808 | 10:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3d | 2020_04_14_021010809 | 10:30 | Abundant | Erect epifauna | 25-50% | Sand | |
| P3d | 2020_04_14_021010810 | 11:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3d | 2020_04_14_021010811 | 11:30 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P3d | 2020_04_14_021010812 | 12:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3d | 2020_04_14_021010813 | 12:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3d | 2020_04_14_021010814 | 13:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P3d | 2020_04_14_021010815 | 13:30 | Frequent | Prostrate epifauna | 50-75% | Sand with Rubble | |
| P3d | 2020_04_14_021010816 | 14:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 00:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 01:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P3e | 2020_04_13_172701675 | 01:30 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 02:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 02:30 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P3e | 2020_04_13_172701675 | 03:00 | Occasional | Prostrate epifauna | 75-100% | Sand with Gravel | |
| P3e | 2020_04_13_172701675 | 03:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3e | 2020_04_13_172701675 | 04:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 04:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3e | 2020_04_13_172701675 | 05:00 | No Fauna | | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 05:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 06:00 | Occasional | Prostrate epifauna | 75-100% | Gravel and Rubble | |
| P3e | 2020_04_13_172701675 | 06:30 | Occasional | Prostrate epifauna | 75-100% | Hard Platform with Gravel | |
| P3e | 2020_04_13_172701675 | 07:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 07:30 | Frequent | Prostrate epifauna | 50-75% | Sand with Rubble | |
| P3e | 2020_04_13_172701675 | 08:00 | Highly Abundant | Prostrate epifauna | <25% | Sand | |
| P3e | 2020_04_13_172701675 | 08:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | |
| P3e | 2020_04_13_172701675 | 09:00 | Abundant | Erect epifauna | 25-50% | Sand | |
| P3e | 2020_04_13_172701675 | 09:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | 1 crinoid |
| P3e | 2020_04_13_172701675 | 10:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | Teleost |
| P3e | 2020_04_13_172701675 | 10:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 11:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P3e | 2020_04_13_172701675 | 11:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 12:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | 1 crinoid |
| P3e | 2020_04_13_172701675 | 12:30 | Occasional | Erect epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 13:00 | Occasional | Erect epifauna | 75-100% | Hard Platform with Grav | 2 teleost, 1 crinoid |
| P3e | 2020_04_13_172701675 | 13:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | Stingray |
| P3e | 2020_04_13_172701675 | 14:00 | Frequent | Erect epifauna | 50-75% | Sand with Rubble | |
| P3e | 2020_04_13_172701675 | 14:30 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Sand | |
| P3e | 2020_04_13_172701675 | 15:00 | Occasional | Prostrate epifauna | 75-100% | Gravel and Rubble | |
| P3e | 2020_04_13_172701675 | 15:30 | Frequent | Erect epifauna | 50-75% | Sand | |
| P3e | 2020_04_13_172701675 | 16:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform with Gravel | |
| P3e | 2020_04_13_172701675 | 16:30 | Occasional | Prostrate epifauna | 75-100% | Sand with Rubble | Asteroidea |
| P3e | 2020_04_13_172701675 | 17:00 | Frequent | Prostrate epifauna | 50-75% | Sand | |
| P3e | 2020_04_13_172701675 | 17:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 18:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 18:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 19:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 19:30 | No Fauna | | 75-100% | Hard Platform with Grav | Teleost |
| P3e | 2020_04_13_172701675 | 20:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 20:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 21:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 21:30 | Occasional | Prostrate epifauna | 75-100% | Sand | Asteroidea |
| P3e | 2020_04_13_172701675 | 22:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Gravel | |
| P3e | 2020_04_13_172701675 | 22:30 | Occasional | Prostrate epifauna | 75-100% | Gravel and Rubble | |
| P3e | 2020_04_13_172701675 | 23:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Gravel | |
| P3e | 2020_04_13_172701675 | 23:30 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Gravel | |
| P3e | 2020_04_13_172701675 | 24:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 24:30 | Frequent | Prostrate epifauna | 50-75% | Sand with Rubble | |
| P3e | 2020_04_13_172701675 | 25:00 | Occasional | Erect epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 25:30 | Occasional | Erect epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 26:00 | No Fauna | | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 26:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |

| Transect Name | Video Name | Video Time Log (mm:ss) | Epifauna | | Substrate | | Comments |
|---|---|---|---|---|---|---|---|
| | | | Abundance | Composition | Coverage | Composition | |
| P3e | 2020_04_13_172701675 | 27:00 | Frequent | Erect epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 27:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 28:00 | Occasional | Erect epifauna | 75-100% | Gravelly (shelly) sand | Teleost |
| P3e | 2020_04_13_172701675 | 28:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 29:00 | Occasional | Prostrate epifauna | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 29:30 | Occasional | Erect epifauna | 75-100% | Hard Platform/Sand | |
| P3e | 2020_04_13_172701675 | 30:00 | No Fauna | | 75-100% | Sand | |
| P3e | 2020_04_13_172701675 | 30:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 31:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 31:30 | No Fauna | | 75-100% | Gravelly (shelly) sand | Asteroidea |
| P3e | 2020_04_13_172701675 | 32:00 | Occasional | Prostrate epifauna | 75-100% | Hard Platform/Gravel | |
| P3e | 2020_04_13_172701675 | 32:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 33:00 | Frequent | Erect epifauna | 50-75% | Sand with Rubble | |
| P3e | 2020_04_13_172701675 | 33:30 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |
| P3e | 2020_04_13_172701675 | 34:00 | Occasional | Prostrate epifauna | 75-100% | Gravelly (shelly) sand | |

# Appendix 3. Oil Spill Trajectory Modelling

# EAST COAST GAS SUPPLY

## Oil Spill Modelling

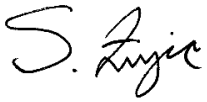


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Dr. Sasha Zigic  8 December 2023

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# TERMS AND ABBREVIATIONS

| | |
|---|---|
| AMP | Australian Marine Park |
| AMSA | Australian Maritime Safety Authority |
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| API | American Petroleum Institute gravity. A measure of how heavy or light a petroleum liquid is compared to water. |
| ARMCANZ | Agriculture and Resource Management Council of Australia and New Zealand |
| ASTM | American Society for Testing and Materials |
| BIA | Biologically Important Area |
| Bonn Agreement | An agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances, 1983, includes: Governments of the Kingdom of Belgium, the Kingdom of Denmark, the French Republic, the Federal Republic of Germany, the Republic of Ireland, the Kingdom of the Netherlands, the Kingdom of Norway, the Kingdom of Sweden, the United Kingdom of Great Britain and Northern Ireland and the European Union. |
| BP | Boiling point. The temperature at which the vapor pressure of the liquid is equal to the pressure exerted on it by the surrounding atmosphere |
| BTEX | Benzene, Toluene, Ethylbenzene, and Xylenes |
| CFSR | Climate Forecast System Reanalysis |
| Decay | The process where oil components are changed either chemically or biologically (biodegradation) to another compound. It includes breakdown to simpler organic carbon compounds by bacteria and other organisms, photo-oxidation by solar energy, and other chemical reactions. |
| Deterministic oil spill modelling | Oil spill modelling involving a computer simulation of a single hypothetical oil spill event subject to a single sequence of wind, current and other sea conditions over time. Single oil spill modelling, also referred to as “deterministic modelling” provides a simulation of one possible outcome of a given spill scenario, subject to the metocean conditions that are imposed. Single oil spill modelling is commonly used to consider the fate and effects of ‘worst-case’ oil spill scenarios that are carefully selected in consideration of the nature and scale of the offshore petroleum activity and the local environment (NOPSEMA, 2017). Because the outcomes of a single oil spill simulation can only represent the outcome of that scenario under one sequence of metocean conditions, worst-case conditions are often identified from stochastic modelling. It is impossible to calculate the likelihood of any outcome from a single oil spill simulation. Single oil spill modelling is generally used for response planning, preparedness planning and for supporting oil spill response operations in the event of an actual spill |
| Dynamic viscosity | The dynamic viscosity of a fluid expresses its resistance to shearing flows, where adjacent layers move parallel to each other with different speeds. |
| Floating oil exposure | Contact by floating oil on the sea surface at concentrations equal to or exceeding defined threshold concentrations. The consequence will vary depending on the threshold and the receptors |
| GODAE | Global Ocean Data Assimilation Experiment |
| HYCOM | Hybrid Coordinate Ocean Model. A data-assimilative, three-dimensional ocean model |
| HYDROMAP | Advanced ocean/coastal tidal model used to predict tidal water levels, current speed and current direction. |
| IMCRA | Integrated marine and coastal regionalisation areas |
| IOA | Index of Agreement |
| ITOPF | International Tanker Owners Pollution Federation Limited |
| KEF | Key Ecological Feature |
| LGA | Local Government Areas |
| MAE | Mean Absolute Error |
| MAHs | Monoaromatic Hydrocarbons |
| MNP | Marine National Park |

| | |
|---|---|
| MP | Marine Park |
| NASA | National Aeronautics and Space Administration (USA) |
| NCEP | National Centres for Environmental Prediction (USA) |
| NOAA | National Oceanic and Atmospheric Administration (USA) |
| NOPSEMA | National Offshore Petroleum Safety and Environmental Management Authority |
| NP | National Park |
| NR | Nature Reserve |
| PAH | Polynuclear Aromatic Hydrocarbons |
| Pour Point | The pour point of a liquid is the temperature below which the liquid loses its flow characteristics |
| ppb | Parts per billion (concentration) |
| psu | Practical salinity units |
| Ramsar site | A site listed under the Ramsar Convention on wetlands which is an international intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. |
| RSB | Reefs, Shoals and Banks |
| Shoreline accumulation | Arrival of oil at or near shorelines at on-water concentrations equal to or exceeding defined threshold concentrations. Shoreline contact is judged for floating oil arriving within a 2 km buffer zone from any shoreline as a conservative measure |
| SIMAP | Spill Impact Model Application Package. SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for surface or subsea releases |
| SRTM | Shuttle Radar Topography Mission |
| State Waters | Low water mark seaward for three nautical miles |
| STB | Standard Barrel |
| Stochastic oil spill modelling | Stochastic oil spill modelling is created by overlaying and statistically analysing the outcomes of many single oil-spill simulations of a defined spill scenario, where each simulation was subject to a different sequence of metocean conditions, selected objectively (typically by random selection) from a long sequence of historic conditions for the study area. Analysis of this larger set of simulations provides a more accurate indication of the area of hydrocarbon exposure and indicates which locations are more likely to be exposed (as well as other statistics). Stochastic oil spill modelling avoids biases that affect single oil spill modelling (due to the reliance on only one possible sequence of conditions). However, when interpreting stochastic modelling, which is based on a wide range of potential conditions that might happen to occur, it is essential to understand that calculations will encompass a much larger area than could be exposed in any single spill event, where a more limited set of conditions will occur. Consequently, it is misleading to imply that the region derived from stochastic modelling indicate the outcomes expected from a single spill event (NOPSEMA, 2017) Stochastic modelling is generally used for risk assessment and preparedness planning by indicating locations that could be exposed and may require response or subsequent impact assessment |
| Sub-LGA | Sub-Local Government Areas |
| TOPEX/Poseidon | A joint satellite mission between NASA and CNES to map ocean surface topography using an array of satellites equipped with detailed altimeters |
| US EPA | United States Environmental Protection Agency |
| World Ocean Atlas | A collection of physicochemical parameters (e.g. temperature, salinity, oxygen, phosphate, silicate, and nitrate) based on profile data from the World Ocean Database (NCEI, 2021) established by NOAA's National Centers for Environmental Information (NCEI) |
| WGS 1984 | World Geodetic System 1984 (WGS84); reference coordinate system |

# EXECUTIVE SUMMARY

## Background

Cooper Energy (Cooper) is progressing plans to drill the Elanora-1 ST1, Pecten East-2 and Annie-2 wells in the Otway Basin, Victoria.

In order to inform the offshore environmental impact and risk assessments Cooper commissioned RPS to conduct a detailed oil spill modelling study assessing the following hypothetical scenarios:

- **Scenario 1**: A 105,289 bbl (16,740 $m^3$) subsurface release of condensate over 102 days following a loss of well control (LOWC) incident at Elanora-1 ST1.
- **Scenario 2**: An 83,273 bbl (13,239 $m^3$) subsurface release of condensate over 102 days following a LOWC incident at Pecten East-2; and
- **Scenario 3**: A 66,430 bbl (10,562 $m^3$) subsurface release of condensate over 104 days following a LOWC incident at Annie-2.

Note, the 104-day model duration for Scenario 3 relates to slightly more conservative response time for the relief well to kill Annie-2. This duration was carried over from the specifications of the original Annie-2 modelling.

The modelling assessment was undertaken on a seasonal basis (summer – November to April, and winter – May to October), with 100 modelling simulations completed for each season.

The purpose of the modelling is to provide an understanding of a conservative 'outer envelope' of the potential area of exposure in the unlikely event of hydrocarbon spill. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill. Therefore, the modelling results represent the maximum extent of hydrocarbon exposure.

The spill modelling was performed using an advanced three-dimensional trajectory and fates model; Spill Impact Model Application 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.

## Methodology

The modelling study was carried out in several stages. Firstly, a 10-year wind and current dataset (2010–2019) was generated and the currents included the combined influence of three-dimensional large-scale ocean currents and tidal currents. Secondly, the currents, winds and detailed condensate characteristics were used as inputs in the three-dimensional oil spill model (SIMAP) to simulate the drift, spread, weathering and fate of the spilled oil.

As spills can occur during any set of wind and current conditions, modelling was conducted using a stochastic (random or non-deterministic) approach, which involved running 100 randomly selected single trajectory simulations per season, per scenario, with each simulation having the same spill information (location, spill volume, duration and composition of hydrocarbons) but varying start times. This ensured that each spill simulation was subject to a unique set of wind and current conditions.

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 F2067-22 "*Standard Practice for Development and Use of Oil Spill Models*".

## Condensate Properties

An exploration well has been drilled within the Annie field with hydrocarbon properties being known for that location. Annie condensate has a higher residuals profile when compared with other offset fields representing a more conservative analogue and therefore Annie condensate was selected for all scenarios

modelled in this assessment. While a comprehensive oil assay for Annie-1 condensate was provided by the client (Core Lab RFL201903231), it should be noted that essential data pertaining to the pour point, dynamic viscosity, and aromatic content for distinct boiling point ranges were absent from the dataset. Consequently, a pragmatic approach was adopted to supplement these missing values by sourcing relevant information from the Minerva condensate assay data. Minerva condensate is found in a nearby reservoir.

The Annie-2 condensate has an API of 41.0, density of 820.0 kg/m$^3$ (at 16 ºC), with low viscosity (1.063 cP at 20 ºC) classifying it as a Group II (light-persistent) oil according to the International Tankers Owners Pollution Federation (ITOPF, 2020) and US EPA/USCG classifications. The condensate comprises a significant portion of volatiles and semi- to low-volatiles (82.5% total) with 17.5% residual components. This means the condensate will evaporate readily when on the water surface, with the persistent components to remain on the water surface or in the water column over time.

# Results

## Scenario: 105,289 bbl (16,740 m$^3$) subsurface release from a loss of well control at Elanora-1 ST1

- The maximum distance and corresponding direction from the release location to the low (1–10 g/m$^2$) and moderate (10–50 g/m$^2$) floating oil exposure zones was 75.7 km (east, winter) and 11.7 km (east-southeast, summer), respectively. There was no floating oil exposure predicted above the high (>50 g/m$^2$) threshold.
- The probability of accumulation to any shoreline at, or above, the low (10 g/m$^2$) threshold was 100%. The minimum time before oil accumulation at, or above, the low threshold was 1.83 days whilst the maximum total volume ashore for a single spill trajectory was 251.0 m$^3$, and the maximum length of shoreline with accumulation above the low, moderate and high thresholds were 295.0 km, 48.0 km and 1.0 km, respectively, all occurring during winter.
- Excluding the BIAs that the release location resides within, the highest probabilities of low (10 ppb) dissolved hydrocarbon exposure were 15% (Southern Right Whale – Aggregation BIA, summer) and 21% (Short-tailed Shearwater – Foraging BIA, winter).
- Except for the receptors the release location is located within, during summer the highest probability of low (10 ppb) entrained hydrocarbon exposure was 100% recorded for Southern Right Whale – Aggregation BIA. Additional receptors including LGAs, sub-LGAs, and AMPs were predicted with entrained hydrocarbon exposure (refer to Table 11.9). During winter, several receptors, including the Apollo AMP, Southern Right Whale – Aggregation and White-faced Storm-petrel - Foraging BIAs revealed 100% probability of low entrained hydrocarbon exposure.

## Scenario: 83,273 bbl (13,239 m$^3$) subsurface release from a loss of well control at Pecten East-2

- The maximum distance and corresponding direction from the release location to the low and moderate exposure zones was 74.4 km (east-southeast, winter) and 15.2 km (east-southeast, winter), respectively. There was no floating oil exposure observed above the high threshold.
- The probability of accumulation to any shoreline at, or above, the low threshold was 100%. The minimum time before oil accumulation at, or above, the low threshold was 1.17 days whilst the maximum total volume ashore for a single spill trajectory was 406.6 m$^3$, and the maximum length of shoreline accumulation at the low, moderate and high thresholds were 269.0 km (summer), 75.0 km (summer) and 6.0 km (winter), respectively.
- Excluding the BIAs that the release location resides within, the highest probability of low dissolved hydrocarbon exposure was 21% during summer (Short-tailed Shearwater - Foraging) and 59% during winter (Short-tailed Shearwater - Foraging).
- The highest probability of low entrained hydrocarbon exposure was recorded at 100% for receptors that the release location doesn't reside within, including Southern Right Whale – Aggregation BIA and

Warrnambool Plain IBRA. Additional receptors including sub-LGAs, and AMPs were predicted with entrained hydrocarbon exposure.

## Scenario: 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2

- The maximum distance and corresponding direction from the release location to the low and moderate exposure zones was 55.7 km (east, winter) and 3.2 km (east, winter), respectively. There was no floating oil exposure predicted above the high threshold.
- The probability of accumulation to any shoreline at, or above, the low threshold was 100%. The minimum time before oil accumulation at, or above, the low threshold was 0.96 day whilst the maximum total volume ashore for a single spill trajectory was 312.1 $m^3$, and the maximum length of shoreline accumulation at the low, moderate and high thresholds were 224.0 km (winter), 62.0 km (winter) and 6.0 km (winter), respectively.
- Excluding the BIAs that the release location resides within, the highest probability of low dissolved hydrocarbon exposure was 10% during summer and 33% during winter at the Short-tailed Shearwater – Foraging BIA receptor.
- The highest probability of low entrained hydrocarbon exposure was recorded at 100% for receptors that the release location doesn't reside within, including Short-tailed Shearwater – Foraging, Southern Right Whale – Aggregation BIAs and Warrnambool Plain IBRA. Additional receptors including sub-LGAs, and AMPs were predicted with entrained hydrocarbon exposure.

# 1 INTRODUCTION

## 1.1 Background

Cooper Energy (Cooper) is progressing plans to drill the Elanora-1 ST1, Pecten East-2 and Annie-2 wells in the Otway Basin (Figure 1.1).

In order to inform the offshore environmental impact and risk assessments Cooper commissioned RPS to conduct a detailed oil spill modelling study assessing the following hypothetical scenarios:

- **Scenario 1**: A 105,289 bbl (16,740 $m^3$) subsurface release of condensate over 102 days following a loss of well control (LOWC) incident at Elanora-1 ST1;
- **Scenario 2**: An 83,273 bbl (13,239 m3) subsurface release of condensate over 102 days following a LOWC incident at Pecten East-2; and
- **Scenario 3**: A 66,430 bbl (10,562 $m^3$) subsurface release of condensate over 104 days following a LOWC incident at Annie-2.

Note, the 104-day model duration for Scenario 3 relates to slightly more conservative response time for the relief well to kill Annie-2. This duration was carried over from the specifications of the original Annie-2 modelling.

The coordinates for the release location used for the above mentioned scenarios are presented in Table 1.1 and are illustrated in Figure 1.1.

The modelling assessment was undertaken on a seasonal basis (summer – November to April, and winter – May to October), with 100 simulations completed for each season.

The purpose of the modelling is to provide an understanding of a conservative 'outer envelope' of the potential area of exposure in the unlikely event of hydrocarbon spill. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill, except well kill via a relief well at the specified modelled days. Therefore, the modelling results represent the maximum extent of hydrocarbon exposure.

The spill modelling was performed using an advanced three-dimensional trajectory and fates model; Spill Impact Model Application 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.

Note that the oil spill model, the method and analysis presented herein uses modelling algorithms which have been anonymously peer reviewed and published in international journals. Furthermore, RPS warrants that this work meets and exceeds the American Society for Testing and Materials (ASTM) Standard F2067-22 "*Standard Practice for Development and Use of Oil Spill Models*".

**Table 1.1 Coordinates of the release locations.**

| Infrastructure | Latitude | Longitude | Water Depth (m) |
|---|---|---|---|
| Elanora-1 ST1 | 38° 47' 41.5" S | 142° 37' 56.5" E | 75 |
| Pecten East-2 | 38° 37' 59.7" S | 142° 40' 9.7" E | 55 |
| Annie-2 | 38° 41' 1.68" S | 142° 49' 28.56" E | 56 |

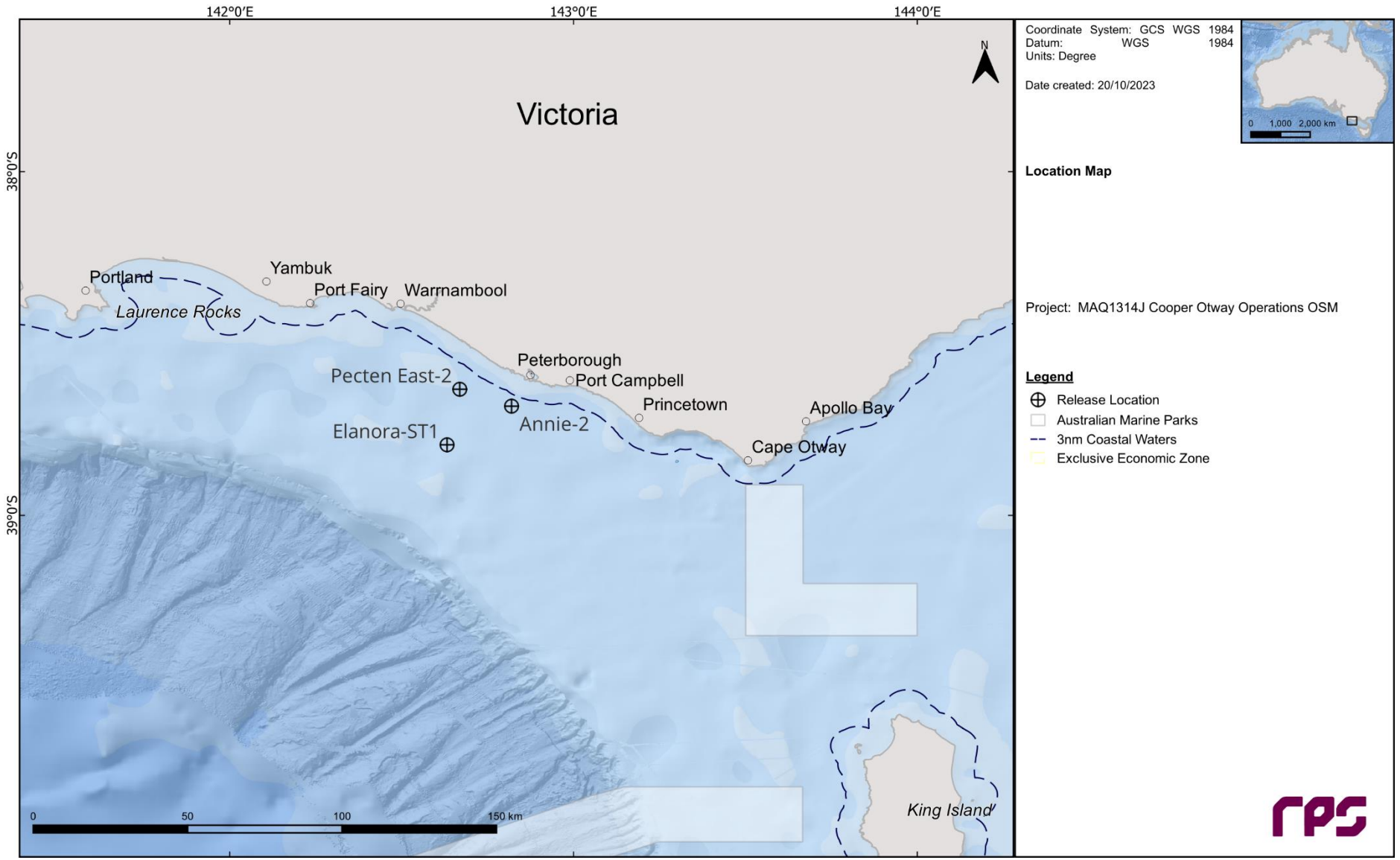



**Figure 1.1 Map of the Elanora-1 ST1, Pecten East-2 and Annie-2 release locations.**

## 1.2 What is Oil Spill Modelling?

Oil spill modelling is a valuable tool widely used for risk assessment, emergency response and contingency planning where it can be particularly helpful to proponents and decision makers. By modelling a series of the most likely oil spill scenarios, decisions concerning suitable response measures and strategic locations for deploying equipment and materials can be made, and the locations at most risk can be identified. The two types of oil spill modelling often used are stochastic (Section 1.2.1) and deterministic (Section 1.2.2) modelling.

### 1.2.1 Stochastic Modelling (Multiple Spill Simulations)

Stochastic oil spill modelling is created by overlaying a great number (often hundreds) of individual, computer-simulated hypothetical spills (NOPSEMA, 2018; Figure 1.2).

Stochastic modelling is a common means of assessing the potential risks from oil spills related to new projects and facilities. Stochastic modelling typically utilises hydrodynamic data for the location in combination with historic wind data. Typically, 100 iterations of the model will be run utilising the data that is most relevant to the season or timing of the project.

The outcomes are often presented as a probability of exposure and is primarily used for risk assessment purposes in view to understand the range of environments that may be affected or impacted by a spill. Elements of the stochastic modelling can also be used in oil spill preparedness and planning.

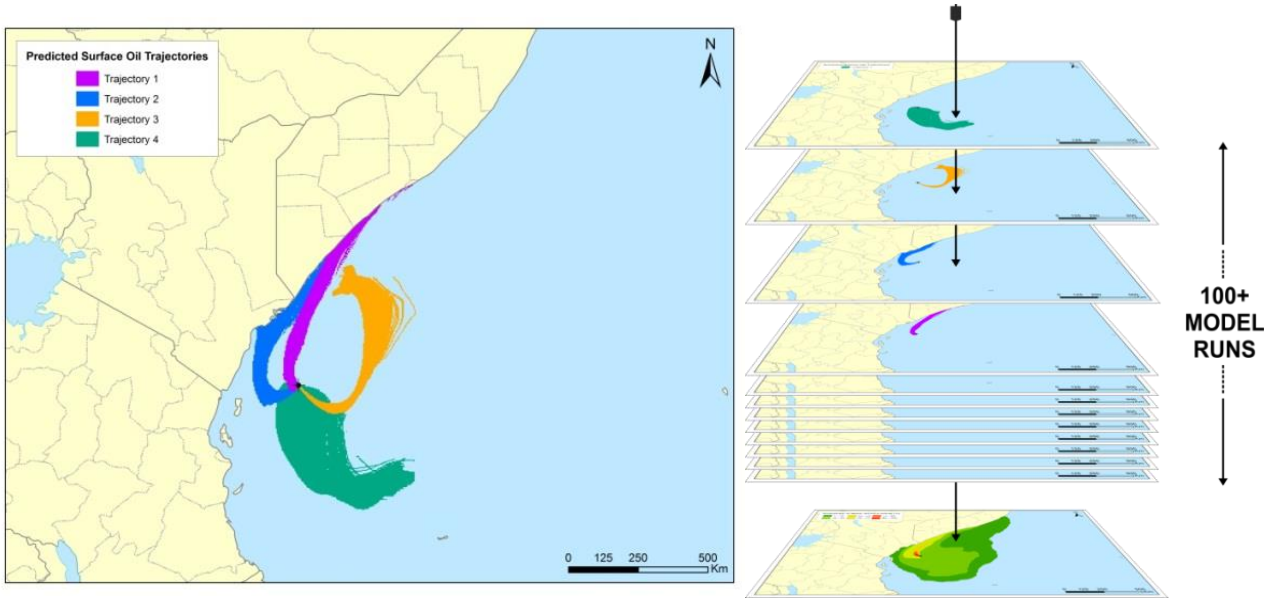



**Figure 1.2 Examples of four individual spill trajectories (four replicate simulations) predicted by SIMAP for a spill scenario. The frequency of contact with given locations is used to calculate the probability of impacts during a spill. Essentially, all model runs are overlain (shown as the stacked runs on the right) and the number of times that trajectories contact a given location at a concentration is used to calculate the probability.**

### 1.2.2 Deterministic Modelling (Single Spill Simulation)

Deterministic modelling is the predictive modelling of a single incident subject to a single sample of wind and weather conditions over time (NOPSEMA, 2018; Figure 1.3).

Deterministic modelling is often paired with stochastic modelling to place the large stochastic footprint into perspective. This deterministic analysis is generally a single run selected from the stochastic analysis and serves as the basis for developing the plans and equipment needs for a realistic spill response. Deterministic spills can be selected on several basis such as minimum time to shoreline, largest swept area, maximum volume ashore, longest length of shoreline contacted by oil or largest area of entrained or dissolved hydrocarbons.

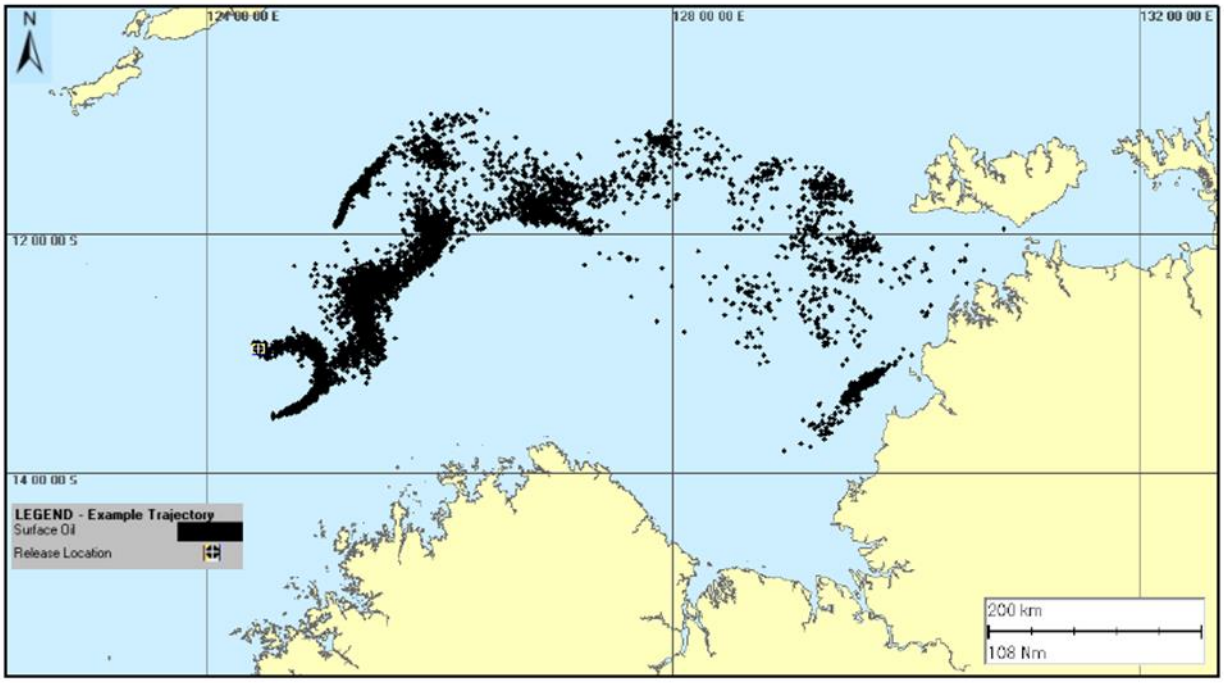



**Figure 1.3 Example of an individual spill trajectory predicted by SIMAP for a spill scenario. Note, this image represents surface oil as spillets and do not take any thresholds into consideration.**

# 2 SCOPE OF WORK

The scope of work included the following components:

- Generate 10 years of winds and three-dimensional currents from 2010 to 2019 (inclusive). The currents included the combined influence of tidal and ocean currents;
- Include the wind and current data and characteristics of the condensate as input into the three-dimensional oil spill model (SIMAP), to model the movement, spreading, weathering and shoreline contact by hydrocarbons over time;
- Use SIMAP's stochastic model (also known as a probability model) to calculate exposure to surrounding waters and shorelines. This involved running 100 randomly selected single trajectory simulations per scenario (per season), with each simulation having the same spill information (spill volume, duration and composition of hydrocarbons) but varying start times. This ensured that each spill simulation was subject to a unique set of wind and current conditions;
- Results were assessed to determine the exposure to surrounding waters and contact to shorelines based upon the thresholds outlined in the NOPSEMA Oil Spill Modelling Bulletin (NOPSEMA, 2019); and
- The stochastic modelling results were reviewed, and the "worst case" deterministic runs were identified and presented based on the following criteria (if applicable):
    a. Largest swept area for surface oil above 10 g/m$^2$;
    b. Largest volume of oil ashore;
    c. Longest length of shoreline with oil accumulation above 100 g/m$^2$;
    d. Largest area of entrained hydrocarbon exposure above 100 ppb; and
    e. Largest area of dissolved hydrocarbon exposure above 50 ppb.

# 3 REGIONAL CURRENTS

The Bass Strait is a body of water separating Tasmania from the southern Australian mainland, specifically the state of Victoria. The strait is a relatively shallow area of the continental shelf, connecting the southeast Indian Ocean with the Tasman Sea. Currents within the straight are primarily driven by tides, winds, incident continental shelf waves and density driven flows; high winds and strong tidal currents are frequent within the area (Jones, 1980).

The varied geography and bathymetry of the region, in addition to the forcing of the south-eastern Indian Ocean and local meteorology lead to complex shelf and slope circulation patterns (Middleton & Bye, 2007). Figure 3.1 displays seasonal current trends within the Bass Strait. During winter there is a strong eastward water flow due to the strengthening of the South Australian Current (fed by the Leeuwin Current in the Northwest Shelf), which bifurcates with one extension moving though the Bass Strait, and another forming the Zeehan Current off western Tasmania (Sandery & Kämpf, 2007). During summer, water flow reverses off Tasmania, King Island and the Otway Basin travelling eastward, as the coastal current develops due to south-easterly winds.

To accurately describe the variability in currents between the inshore and offshore region, a hybrid regional dataset was developed by combining ocean predictions obtained from HYCOM (Hybrid Coordinate Ocean Model) with surface tidal currents developed by RPS. The following sections provide a summary of the hybrid regional dataset.

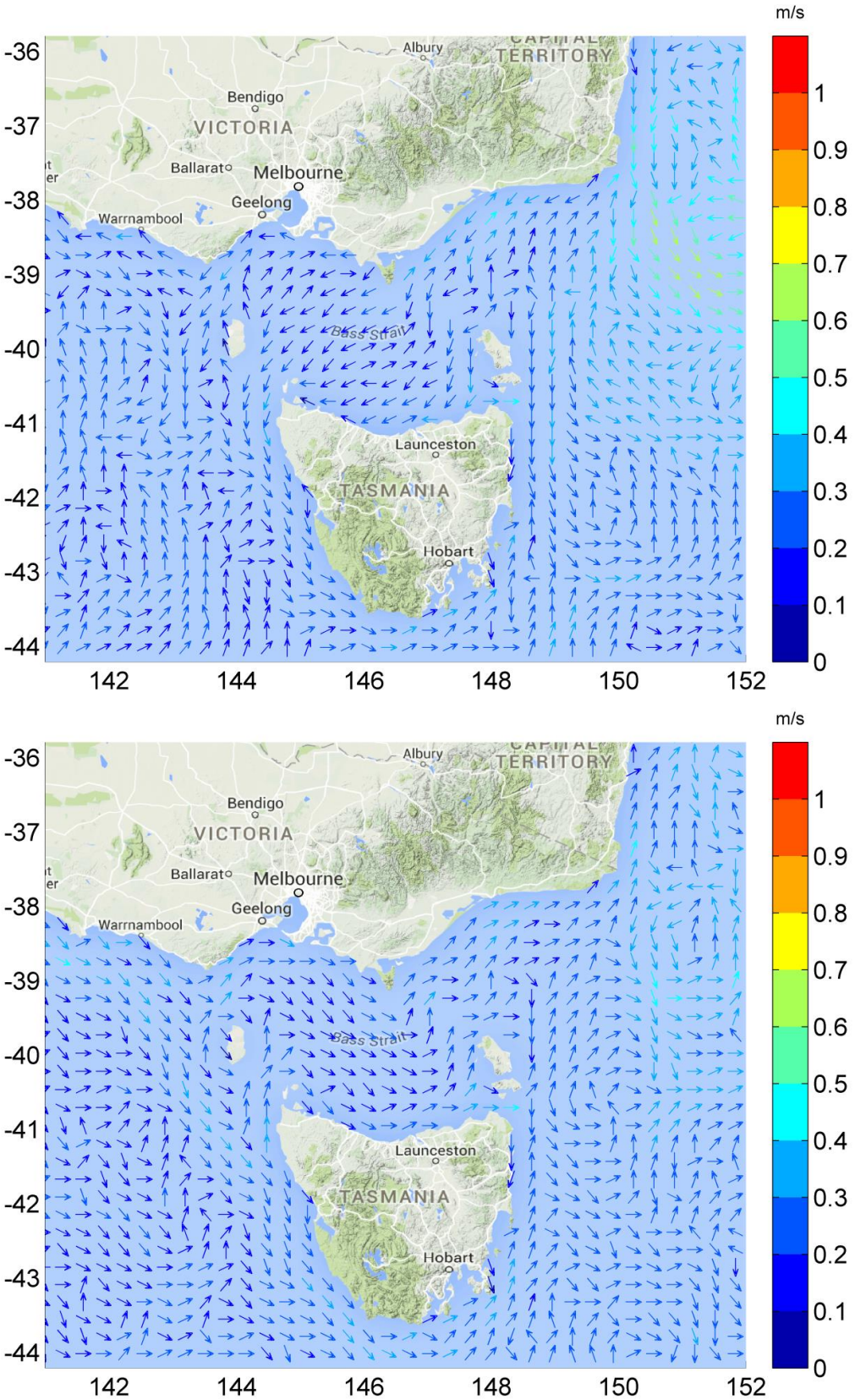



**Figure 3.1 HYCOM averaged seasonal surface drift currents during summer (upper image) and winter (lower image).**

## 3.1 Tidal currents

Tidal current data was generated using RPS's advanced ocean/coastal model, HYDROMAP. The HYDROMAP model has been thoroughly tested and verified through field measurements throughout the world for more than 30 years (Isaji & Spaulding, 1984; Isaji, et al., 2001; Zigic, et al., 2003). HYDROMAP tidal current data has been used as input to forecast (in the future) and hindcast (in the past) pollutant spills in Australian waters and forms part of the Australian National Oil Spill Emergency Response System operated by AMSA (Australian Maritime Safety Authority).

HYDROMAP employs a sophisticated sub-gridding strategy, which supports up to six levels of spatial resolution, halving the grid cell size as each level of resolution is employed. The sub-gridding allows for higher resolution of currents within areas of greater bathymetric and coastline complexity, and/or of interest to a study.

The numerical solution methodology follows that of Davies (1977a and 1977b) with further developments for model efficiency by Owen (1980) and Gordon (1982). A more detailed presentation of the model can be found in Isaji and Spaulding (1984) and Isaji et al. (2001).

### 3.1.1 Grid Setup

The tidal model domain is sub-gridded to a resolution of 500 m for shallow and coastal regions, starting from an offshore (or deep water) resolution of 8 km. The finer grids are progressively allocated in a step-wise fashion to more accurately resolve flows along the coastline, around islands and over regions with more complex bathymetry. Figure 3.2 shows the tidal model grid covering the study domain.

A combination of datasets was used and merged to describe the shape of the seabed within the grid domain (Figure 3.3). These included spot depths and contours which were digitised from nautical charts released by the hydrographic offices as well as Geoscience Australia database and depths extracted from the Shuttle Radar Topography Mission (SRTM30_PLUS) Plus dataset (see Becker et al., 2009).

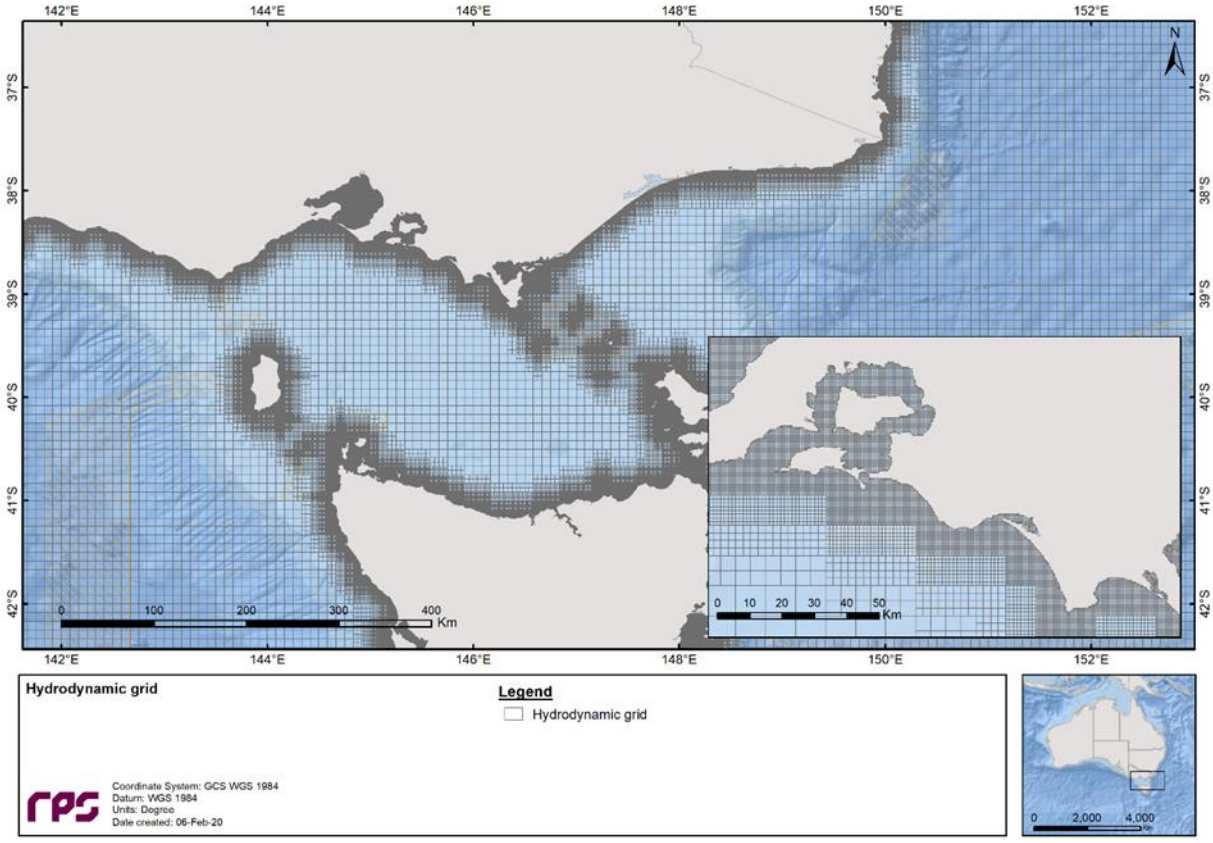



**Figure 3.2 Sample of the model grid used to generate the tidal currents for the study region. Higher resolution areas are shown by the denser mesh.**

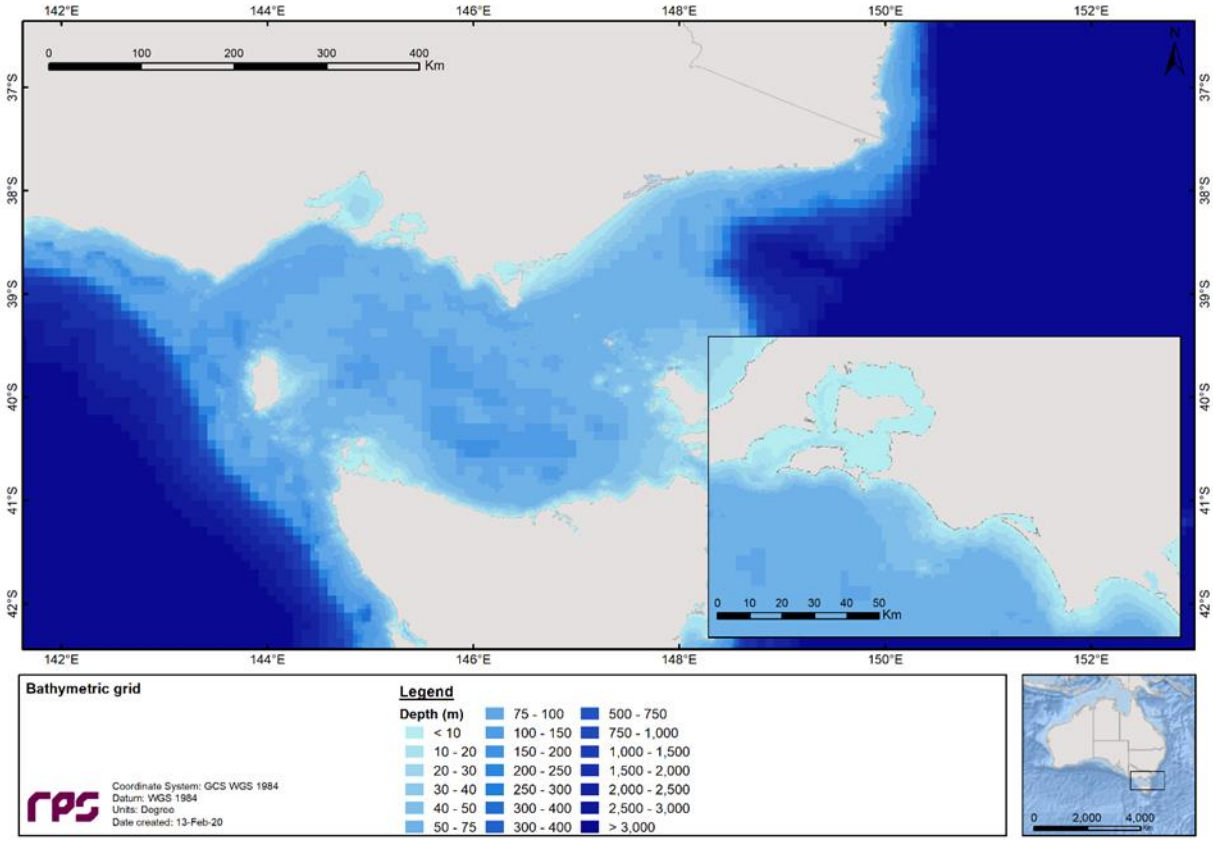



**Figure 3.3 Bathymetry defined throughout the tidal model domain.**

### 3.1.2 Tidal Conditions

The ocean boundary data for the regional model was obtained from satellite measured altimetry data (TOPEX/Poseidon 8.0) which provided estimates of the eight dominant tidal constituents at a horizontal scale of approximately 0.25 degrees. The eight major tidal constituents used were $K_2$, $S_2$, $M_2$, $N_2$, $K_1$, $P_1$, $O_1$ and $Q_1$. Using the tidal data, time series surface heights were calculated along the open boundaries for the simulation period.

The Topex/Poseidon satellite data has a resolution of 0.25 degrees globally, with higher resolution in coastal regions, and is produced and quality controlled by NASA (National Aeronautics and Space Administration). The data capturing satellites, equipped with two altimeters capable of taking sea level measurements accurate to less than ± 5 cm, measured oceanic surface elevations (and the resultant tides) for the period 1992–2005. In total these satellites carried out 62,000 orbits of the planet. The Topex/Poseidon tidal data has been widely used amongst the oceanographic community, being refereced in more than 2,100 research publications (e.g. Andersen, 1995; Ludicone et al., 1998; Matsumoto et al., 2000; Kostianoy et al., 2003; Yaremchuk & Tangdong, 2004; Qiu & Chen 2010). The Topex/Poseidon tidal data is considered suitably accurate for this study.

### 3.1.3 Surface Elevation Validation

To ensure that tidal predictions were accurate, predicted surface elevations were compared to data observed at a location situated within the study area (Figure 3.4).

To provide a statistical measure of the model performance, the Index of Agreement (IOA – Willmott, 1981) and the Mean Absolute Error (MAE – Willmott, 1982; Willmott & Matsuura, 2005) were used.

The MAE (Eq.1) is simply the average of the absolute values of the difference between the model-predicted (P) and observed (O) variables. It is a more natural measure of the average error (Willmott & Matsuura, 2005) and more readily understood. The MAE is determined by:

$$MAE = N^{-1} \sum_{i=1}^{N} |P_i - O_i| \qquad \text{Eq.1}$$

Where: $N$ = Number of observations

$P_i$ = Model predicted surface elevation

$O_i$ = Observed surface elevation

The Index of Agreement (IOA; Eq. 2) in contrast, gives a non-dimensional measure of model accuracy or performance. A perfect agreement between the model predicted and observed surface elevations exists if the index gives an agreement value of 1, and complete disagreement between model and observed surface elevations will produce an index measure of 0 (Wilmott, 1981). Willmott et al. (1985) also suggests that values larger than 0.5 may represent good model performance. The IOA is determined by:

$$IOA = 1 - \frac{\sum |X_{model} - X_{obs}|^2}{\sum (|X_{model} - \overline{X_{obs}}| + |X_{obs} - \overline{X_{obs}}|)^2} \qquad \text{Eq.2}$$

Where: $X_{model}$ = Model predicted surface elevation

$X_{obs}$ = Observed surface elevation

Clearly, a greater IOA and lower MAE represent a better model performance.

Figure 3.5 and Figure 3.6 illustrate a comparison of the predicted and observed surface elevations in February 2017. As shown on the graph, the model accurately reproduced the phase and amplitudes throughout the spring and neap tidal cycles.

Table 3.1 shows the IOA and MAE values for the selected tide station locations indicating that the model is performing well.

**Table 3.1 Statistical comparison between the observed and HYDROMAP predicted surface elevations.**

| Tide Station | IOA | MAE (m) |
|---|---|---|
| Gabo Island | 0.98 | 0.08 |
| Port MacDonnell | 0.98 | 0.05 |
| Port Welshpool | 0.92 | 0.30 |
| Portland | 0.97 | 0.07 |
| Stack Island | 0.96 | 0.22 |

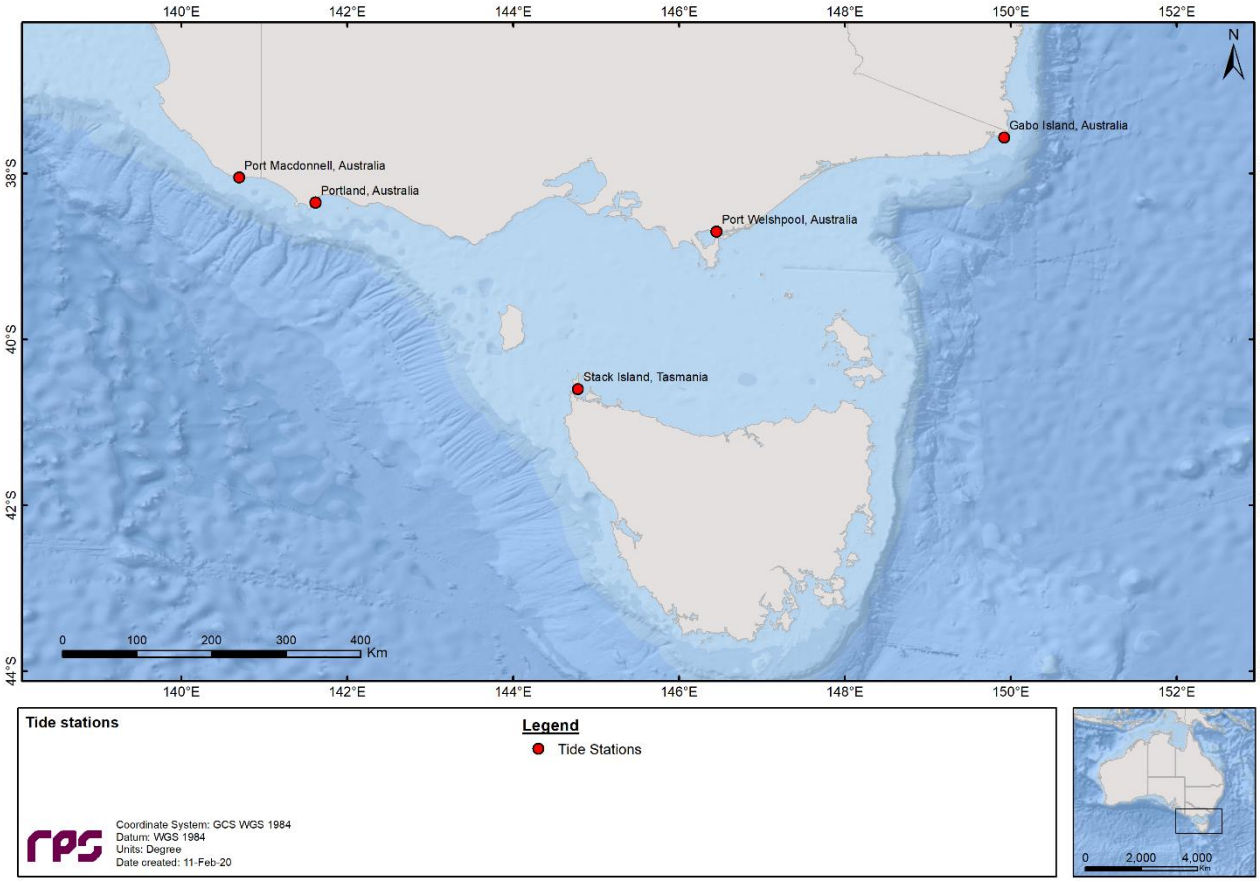



**Figure 3.4 Location of the tide stations used in the surface elevation validation.**

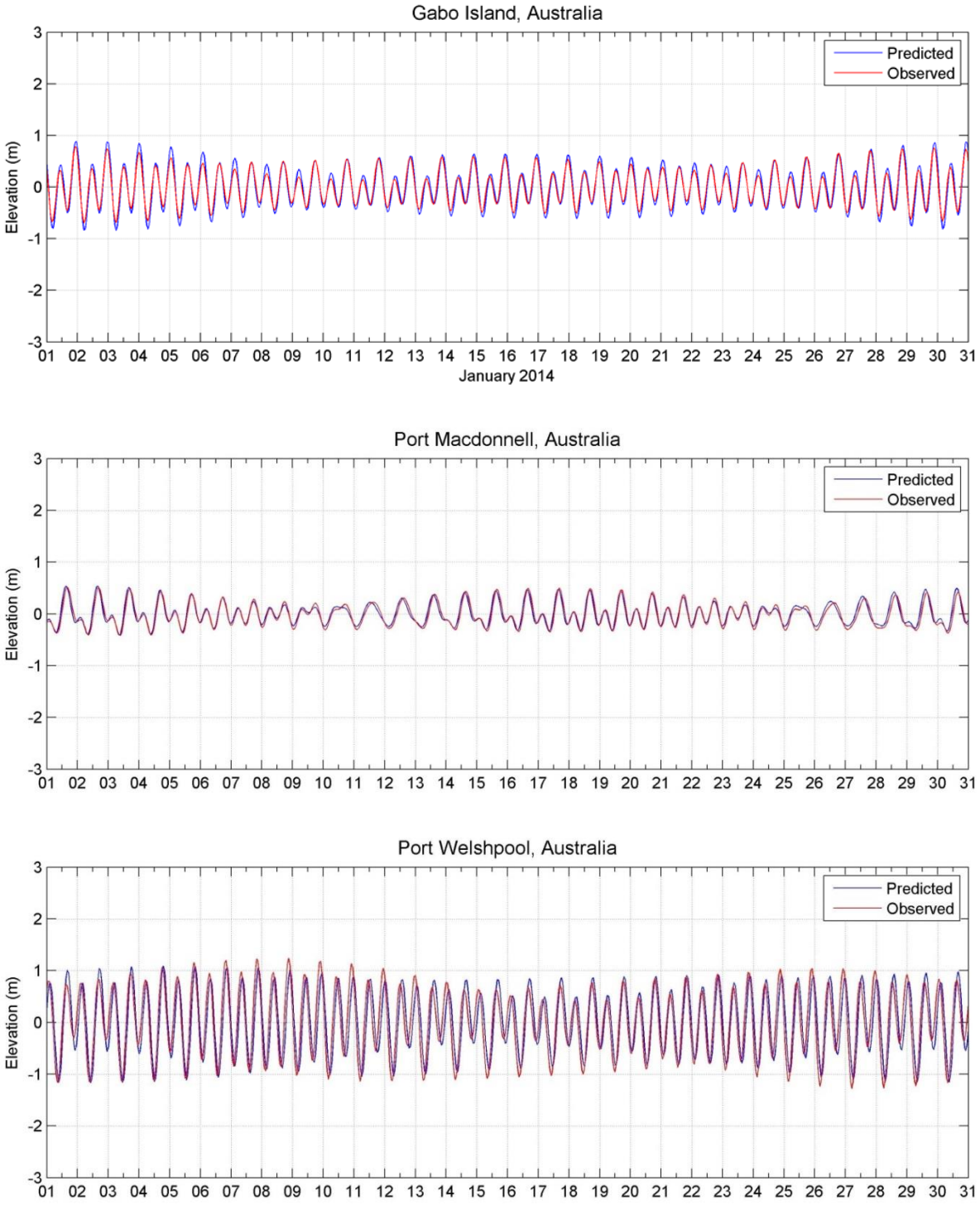



**Figure 3.5 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation at tidal stations Gabo Island (upper image), Port MacDonnell (middle image) and Port Welshpool (lower image).**

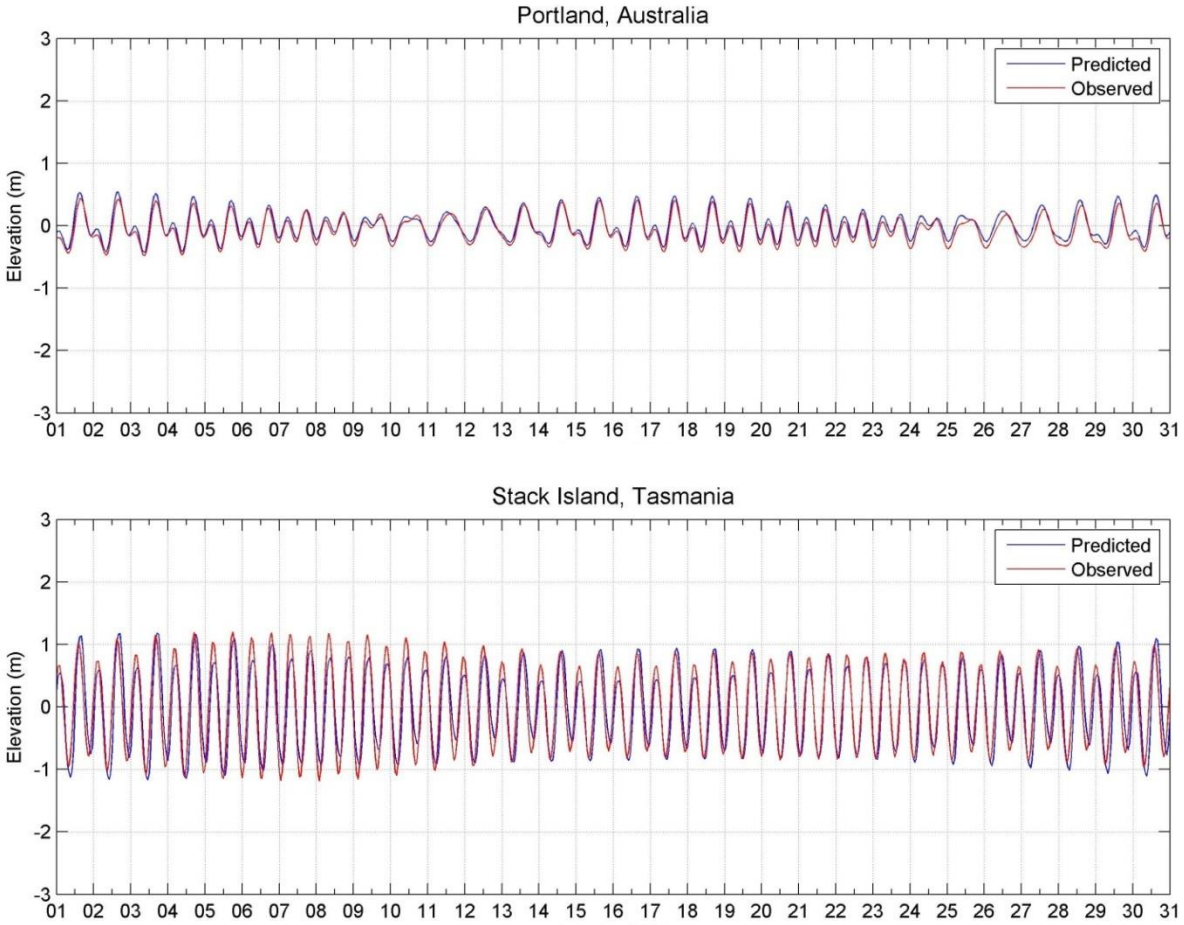



**Figure 3.6 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation at tidal stations Portland (upper image) and Stack Island (lower image).**

## 3.2 Ocean Currents

Data describing the flow of ocean currents for the years 2010 to 2019 (inclusive) was obtained from HYCOM (Hybrid Coordinate Ocean Model, Chassignet et al., 2007), which is operated by the HYCOM Consortium, sponsored by the Global Ocean Data Assimilation Experiment (GODAE). HYCOM is a data-assimilative, three-dimensional ocean model that is run as a hindcast (for a past period), assimilating time-varying observations of sea surface height, sea surface temperature and in-situ temperature and salinity measurements (Chassignet et al., 2009). The HYCOM predictions for drift currents are produced at a horizontal spatial resolution of approximately 8.25 km (1/12$^{th}$ of a degree) over the region, at a frequency of once per day. HYCOM uses isopycnal layers in the open, stratified ocean, but uses the layered continuity equation to make a dynamically smooth transition to a terrain-following coordinate in shallow coastal regions, and to z-level coordinates in the mixed layer and/or unstratified seas.

## 3.3 Surface Currents

Table 3.2 to Table 3.4 present the average and maximum surface current speeds nearby the Elanora-1 ST1 (Isabella), Pecten East-2 and Annie-2 wells by combining the ocean and tidal currents.

Near the Elanora-1 ST1 well current speeds varied throughout the year with maximum current speeds ranging between approximately 0.68 m/s (January) and 1.07 m/s (July). The dominant surface current direction was identified as easterly (towards the east) during the whole year, except for January and February.

Nearby Pecten-East 2, maximum current speeds ranged between 0.66 m/s (February) and 1.08 m/s (September). Current direction varied throughout the year, flowing mostly towards the east-southeast during winter months.

Close to Annie-2, maximum current speeds varied between 0.72 m/s (February) and 1.10 m/s (September). Similar to Pecten-East 2, current directions predominantly flowed east-southeast during winter months.

Figure 3.7 to Figure 3.12 show the monthly and total surface current rose distributions for the selected locations.

Note the convention for defining current direction is the direction the current flows towards, which is used to reference current direction throughout this report. Each branch of the rose represents the currents flowing to that direction, with north to the top of the diagram. Sixteen directions are used. The branches are divided into segments of different colour, which represent the current speed ranges for each direction. Speed intervals of 0.1 m/s are predominantly used in these current roses. The length of each coloured segment is relative to the proportion of currents flowing within the corresponding speed and direction.

**Table 3.2 Predicted monthly average and maximum surface current speeds for Elanora-1 ST1 well. The data was derived by combining the HYCOM ocean data and HYDROMAP tidal data from 2010–2019 (inclusive).**

| Month | Average current speed (m/s) | Maximum current speed (m/s) | General direction(s) (Towards) |
|---|---|---|---|
| January | 0.16 | 0.68 | West |
| February | 0.16 | 0.71 | West |
| March | 0.16 | 0.93 | East |
| April | 0.15 | 0.87 | East |
| May | 0.19 | 0.96 | East |
| June | 0.20 | 1.05 | East |
| July | 0.24 | 1.07 | East |
| August | 0.23 | 1.05 | East |
| September | 0.20 | 1.01 | East |
| October | 0.19 | 0.91 | East |
| November | 0.17 | 0.75 | East |
| December | 0.18 | 0.75 | East |
| **Minimum** | **0.15** | **0.68** | - |
| **Maximum** | **0.24** | **1.07** | |

**Table 3.3 Predicted monthly average and maximum surface current speeds for Pecten East-2 well. The data was derived by combining the HYCOM ocean data and HYDROMAP tidal data from 2010–2019 (inclusive).**

| Month | Average current speed (m/s) | Maximum current speed (m/s) | General direction(s) (Towards) |
|---|---|---|---|
| January | 0.17 | 0.68 | West-northwest |
| February | 0.19 | 0.66 | West-northwest |
| March | 0.18 | 0.86 | West |
| April | 0.15 | 0.75 | East |
| May | 0.19 | 0.91 | East-southeast |
| June | 0.19 | 1.05 | East-southeast |
| July | 0.24 | 0.99 | East-southeast |
| August | 0.23 | 1.02 | East-southeast |
| September | 0.20 | 1.08 | East-southeast |
| October | 0.19 | 0.92 | East |
| November | 0.17 | 0.74 | East |
| December | 0.18 | 0.80 | East |
| **Minimum** | **0.15** | **0.66** | - |
| **Maximum** | **0.24** | **1.08** | |

**Table 3.4 Predicted monthly average and maximum surface current speeds for Annie-2 well. The data was derived by combining the HYCOM ocean data and HYDROMAP tidal data from 2010–2019 (inclusive).**

| Month | Average current speed (m/s) | Maximum current speed (m/s) | General direction(s) (Towards) |
|---|---|---|---|
| January | 0.17 | 0.77 | West |
| February | 0.19 | 0.72 | West |
| March | 0.18 | 0.92 | West |
| April | 0.15 | 0.83 | East |
| May | 0.19 | 0.90 | East-southeast |
| June | 0.19 | 1.07 | East-southeast |
| July | 0.24 | 1.05 | East-southeast |
| August | 0.23 | 1.05 | East-southeast |
| September | 0.20 | 1.10 | East |
| October | 0.20 | 0.88 | East |
| November | 0.18 | 0.82 | East |
| December | 0.18 | 0.92 | East |
| **Minimum** | **0.15** | **0.72** | - |
| **Maximum** | **0.24** | **1.10** | |

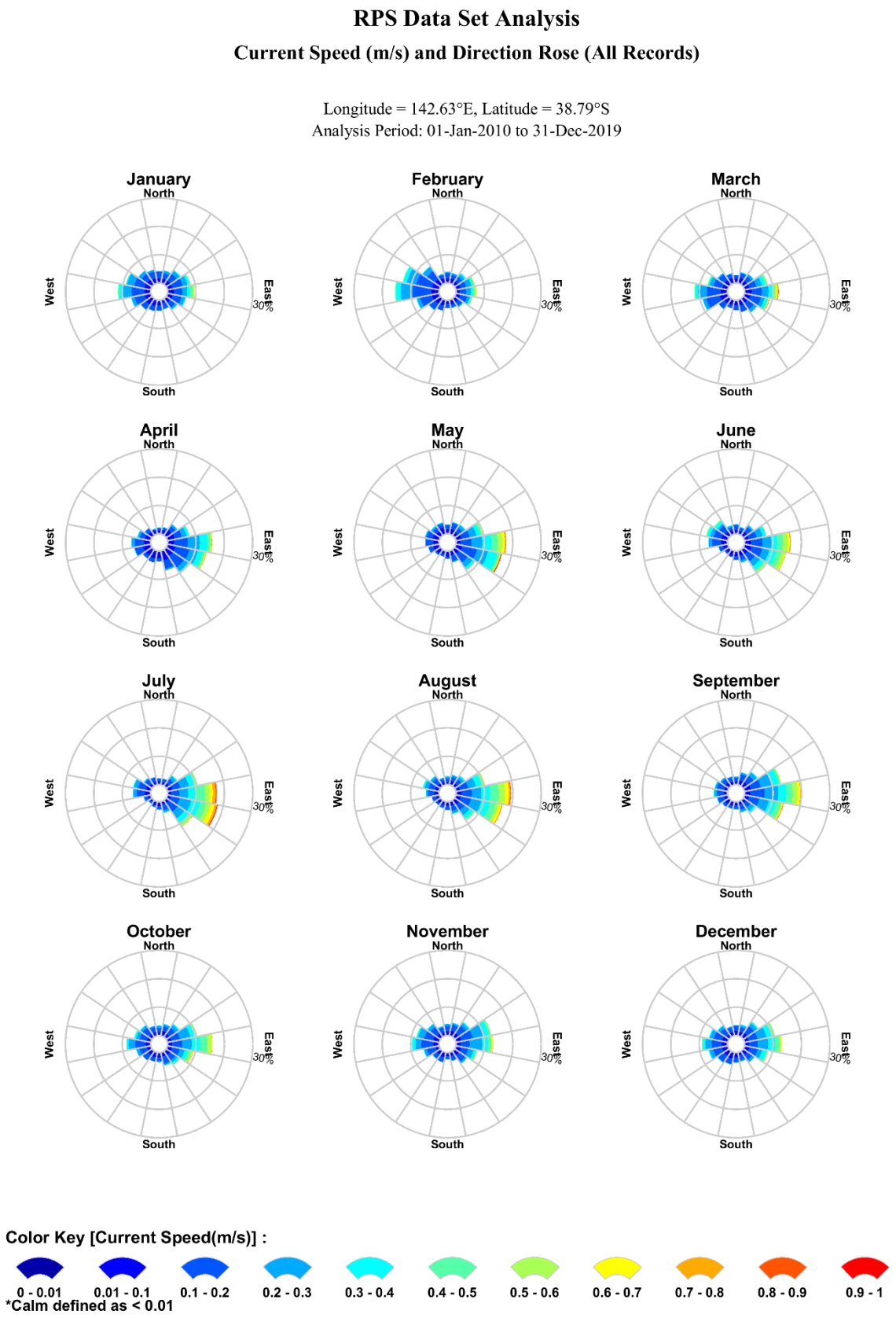



**Figure 3.7 Monthly surface current rose plots nearby the Elanora-1 ST1 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

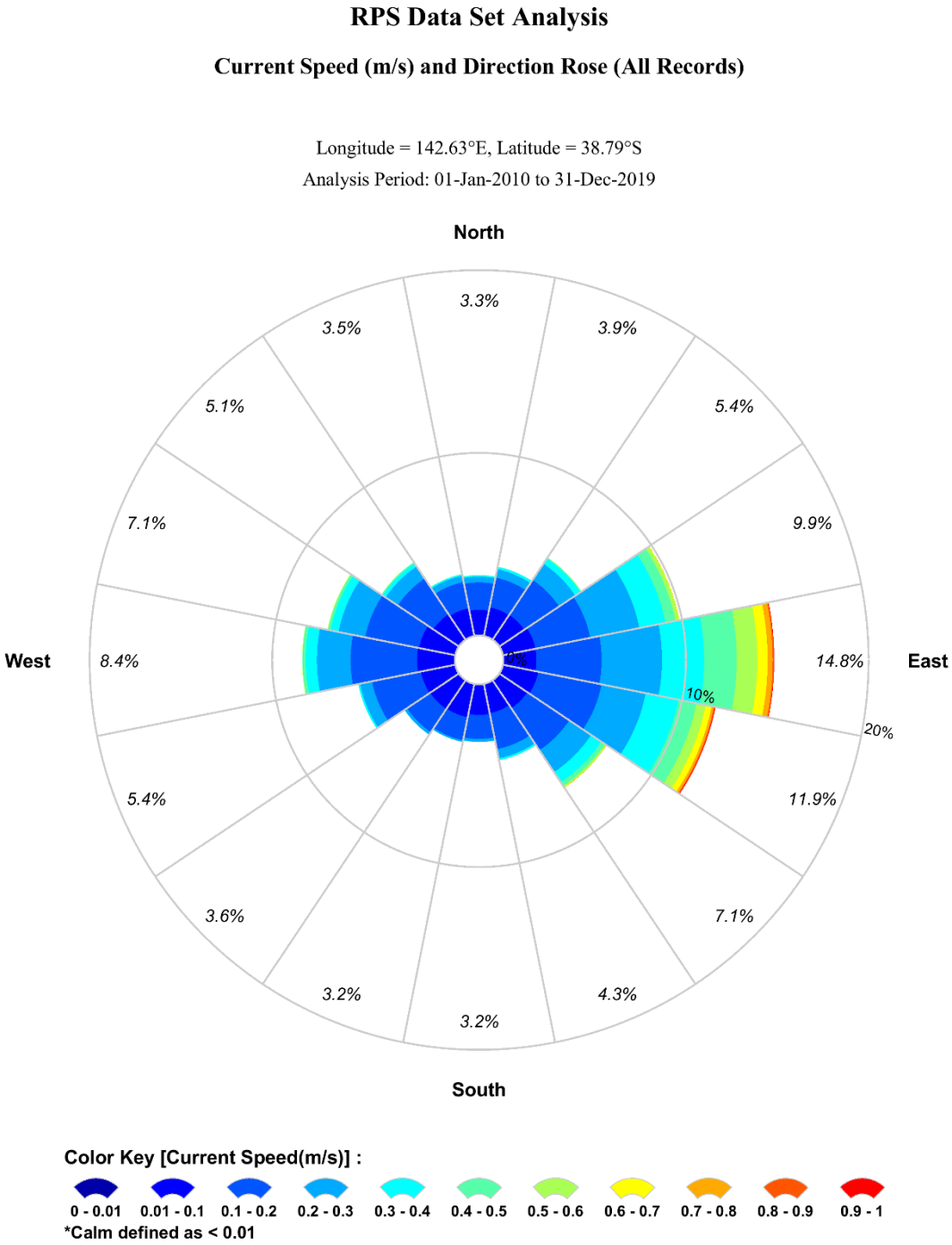



**Figure 3.8 Total surface current rose plot nearby the Elanora-1 ST1 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

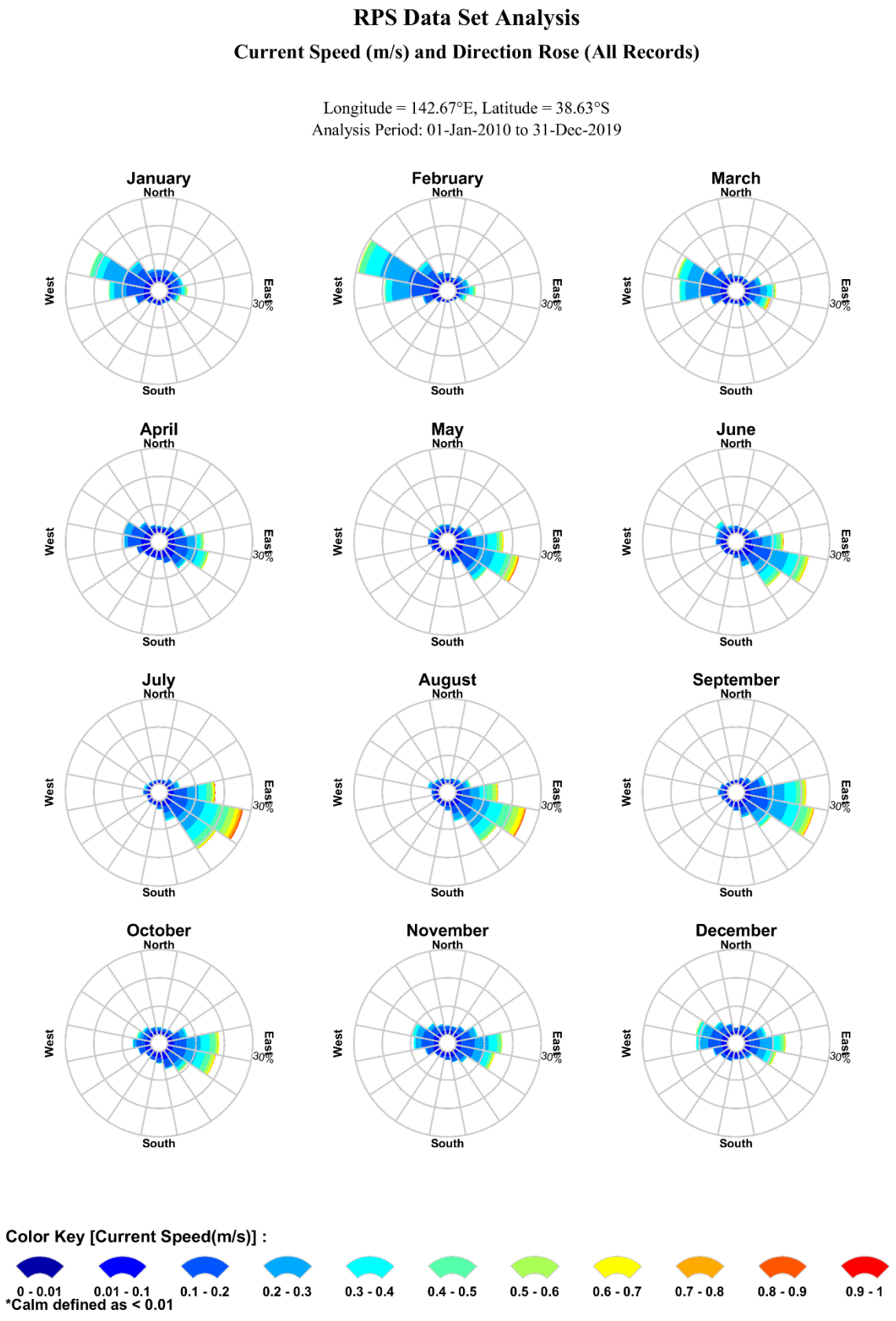



**Figure 3.9 Monthly surface current rose plots nearby the Pecten East-2 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

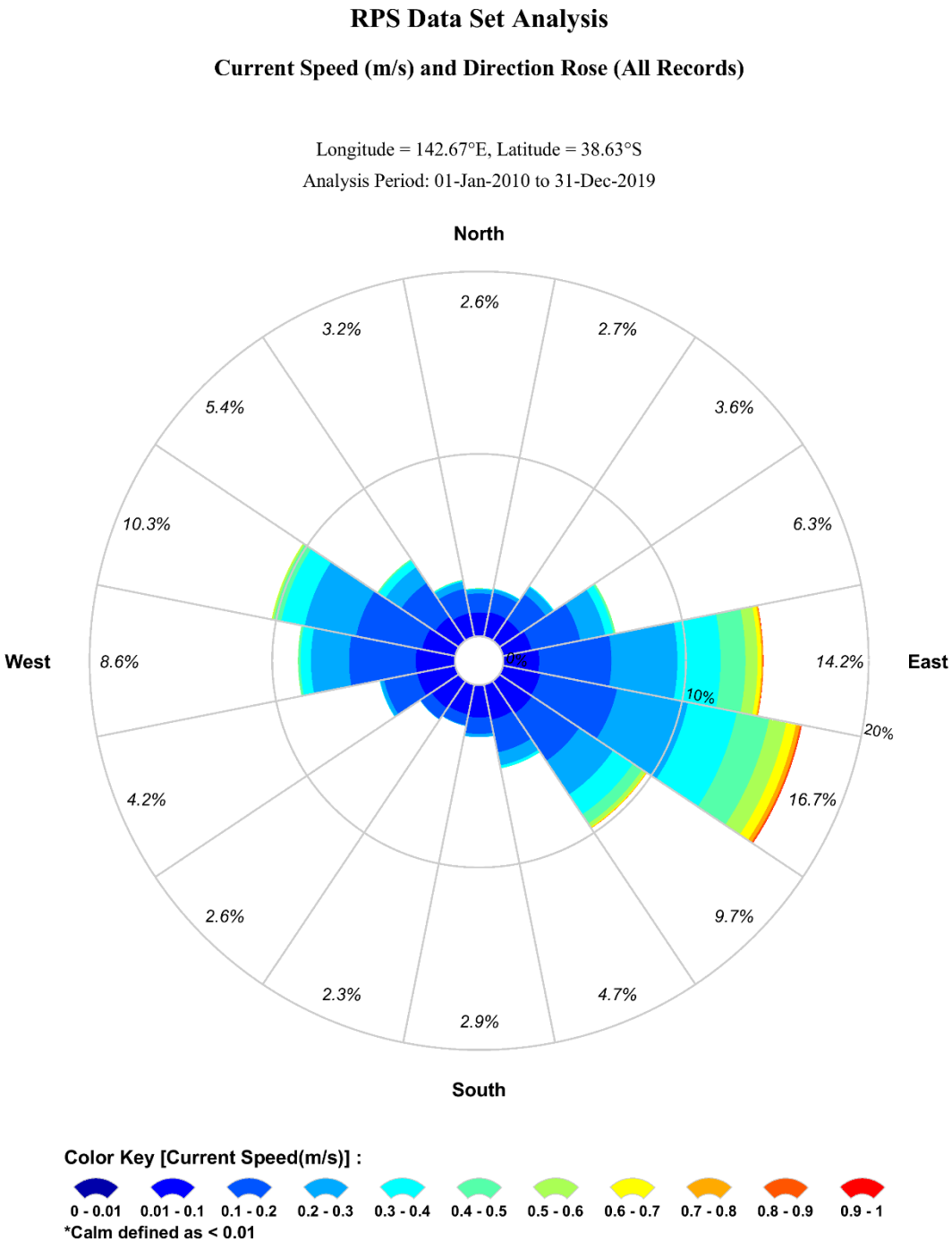



**Figure 3.10 Total surface current rose plot nearby the Pecten East-2 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

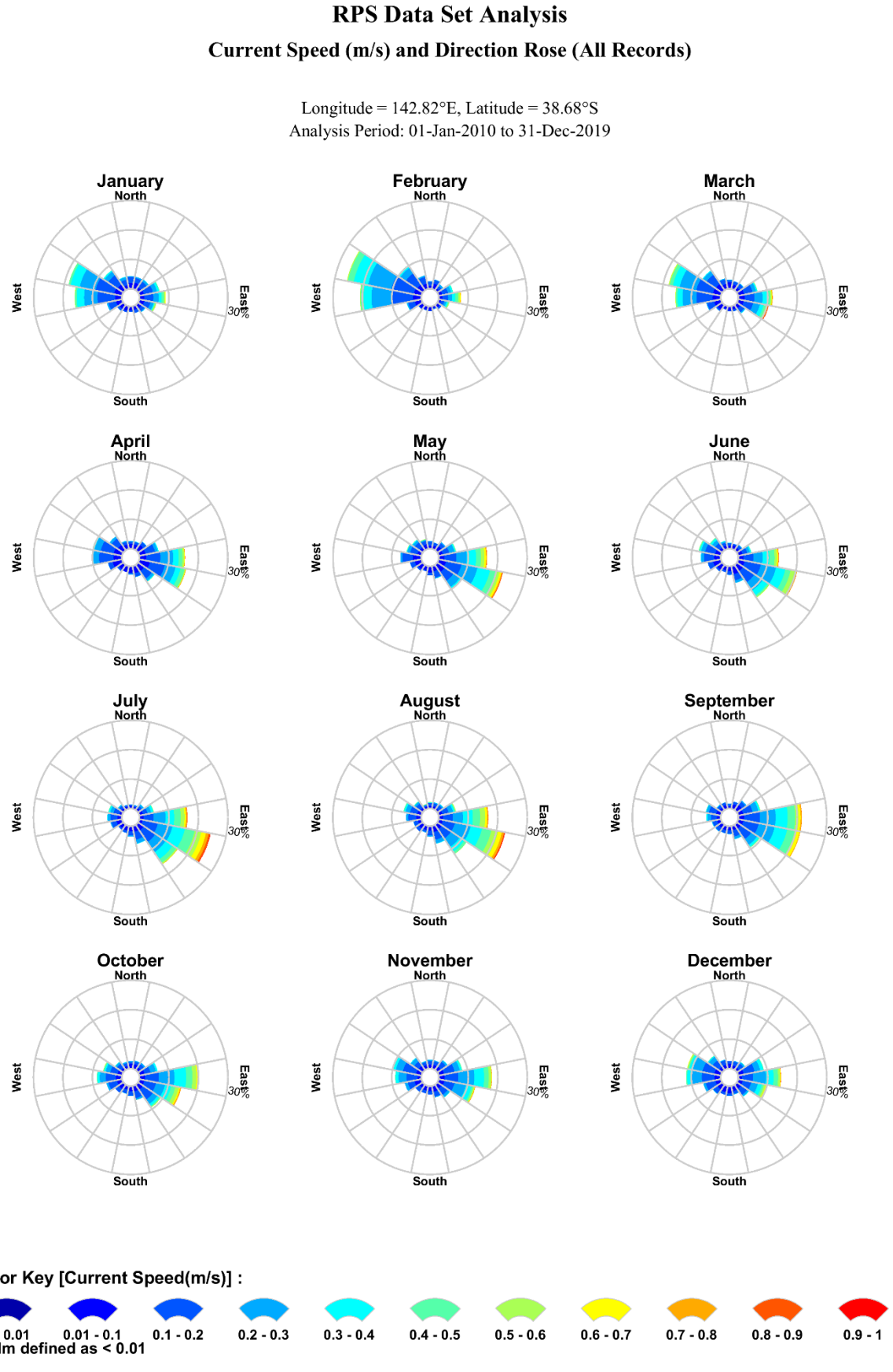



**Figure 3.11 Monthly surface current rose plots nearby the Annie-2 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

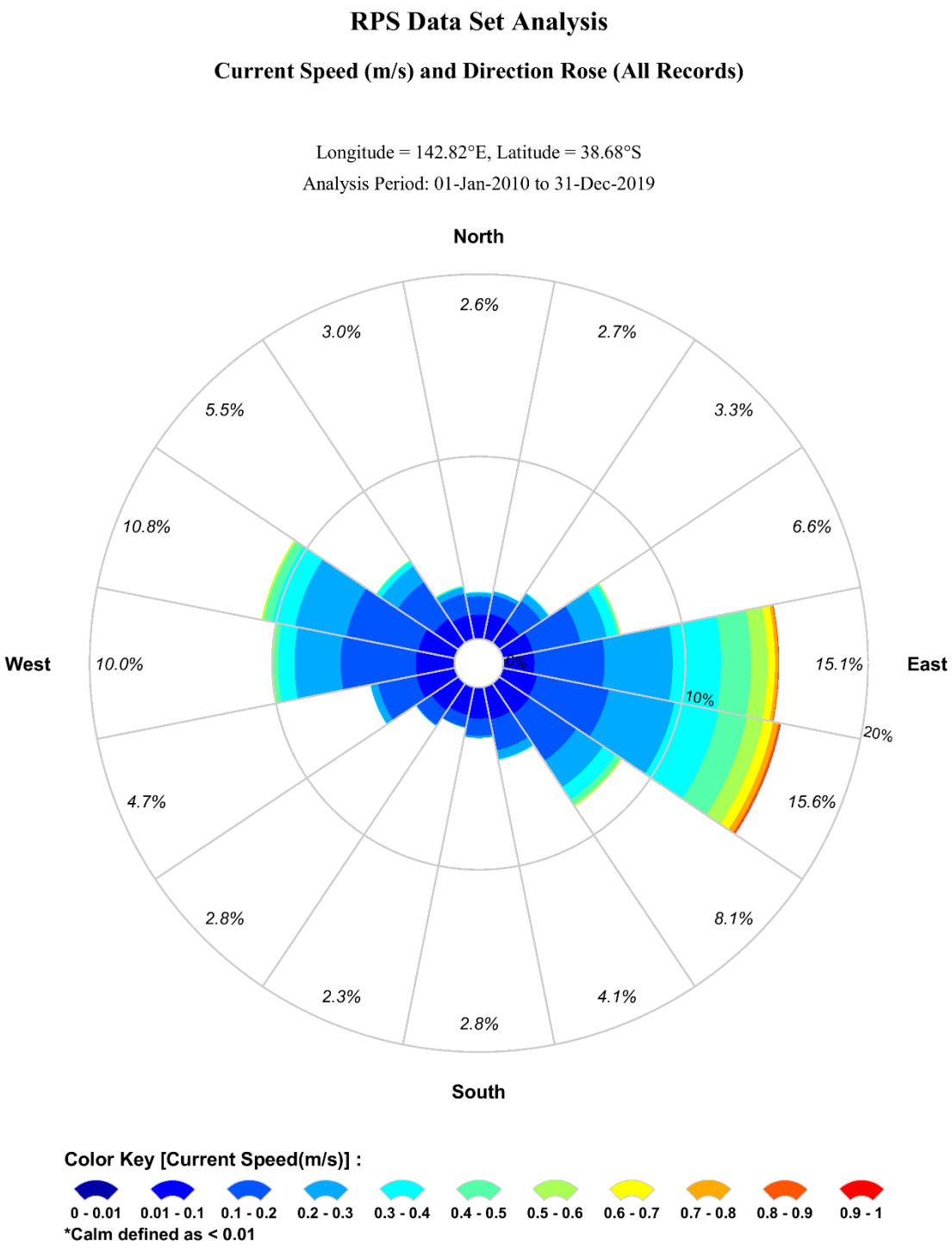



**Figure 3.12 Total surface current rose plot nearby the Annie-2 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

## 3.4 Currents at 50 m below Surface

Table 3.5 to Table 3.7 present the average and maximum current speeds (at 50m below surface) nearby the Elanora-1 ST1, Pecten East-2 and Annie-2 wells by combining the ocean and tidal currents.

Near the Elanora-1 ST1 well current speeds varied throughout the year with maximum current speeds ranging between approximately 0.36 m/s (January) and 0.59 m/s (July).

Nearby Pecten-East 2, maximum current speeds ranged between 0.21 m/s (February) and 0.36 m/s (July).

Close to Annie-2, maximum current speeds varied between 0.28 m/s (November) and 0.39 m/s (July). Similar to Pecten-East 2.

Figure 3.13 to Figure 3.18 show the monthly and total current rose distributions for the selected locations.

**Table 3.5 Predicted monthly average and maximum current speeds (at 50m below surface) for Elanora-1 ST1 well. The data was derived by combining the HYCOM ocean data and HYDROMAP tidal data from 2010–2019 (inclusive).**

| Month | Average current speed (m/s) | Maximum current speed (m/s) | General direction(s) (Towards) |
|---|---|---|---|
| January | 0.10 | 0.36 | West |
| February | 0.09 | 0.39 | West |
| March | 0.10 | 0.41 | East-southeast |
| April | 0.09 | 0.52 | East-southeast |
| May | 0.10 | 0.52 | East-southeast |
| June | 0.11 | 0.47 | East-southeast |
| July | 0.12 | 0.59 | East-southeast |
| August | 0.11 | 0.53 | East-southeast |
| September | 0.10 | 0.50 | East-southeast |
| October | 0.10 | 0.46 | East-southeast |
| November | 0.09 | 0.40 | East-southeast |
| December | 0.10 | 0.40 | East-southeast |
| **Minimum** | **0.09** | **0.36** | - |
| **Maximum** | **0.12** | **0.59** | |

**Table 3.6 Predicted monthly average and maximum surface current speeds (at 50m below surface) for Pecten East-2 well. The data was derived by combining the HYCOM ocean data and HYDROMAP tidal data from 2010–2019 (inclusive).**

| Month | Average current speed (m/s) | Maximum current speed (m/s) | General direction(s) (Towards) |
|---|---|---|---|
| January | 0.06 | 0.27 | East and west |
| February | 0.06 | 0.21 | East and west |
| March | 0.06 | 0.31 | East and west |
| April | 0.06 | 0.27 | East and west |
| May | 0.06 | 0.31 | East and west |
| June | 0.06 | 0.29 | East and west |
| July | 0.07 | 0.36 | East and west |
| August | 0.07 | 0.31 | East and west |
| September | 0.06 | 0.33 | East and west |
| October | 0.06 | 0.26 | East and west |
| November | 0.06 | 0.24 | East and west |
| December | 0.06 | 0.27 | East and west |
| **Minimum** | **0.06** | **0.21** | - |
| **Maximum** | **0.07** | **0.36** | |

**Table 3.7 Predicted monthly average and maximum surface current speeds (at 50m below surface) for Annie-2 well. The data was derived by combining the HYCOM ocean data and HYDROMAP tidal data from 2010–2019 (inclusive).**

| Month | Average current speed (m/s) | Maximum current speed (m/s) | General direction(s) (Towards) |
|---|---|---|---|
| January | 0.09 | 0.35 | West-northwest and east-southeast |
| February | 0.09 | 0.29 | |
| March | 0.09 | 0.37 | |
| April | 0.09 | 0.30 | |
| May | 0.09 | 0.39 | |
| June | 0.09 | 0.35 | |
| July | 0.09 | 0.39 | |
| August | 0.09 | 0.36 | |
| September | 0.09 | 0.34 | |
| October | 0.09 | 0.30 | |
| November | 0.09 | 0.28 | |
| December | 0.09 | 0.30 | |
| **Minimum** | **0.09** | **0.28** | - |
| **Maximum** | **0.09** | **0.39** | |

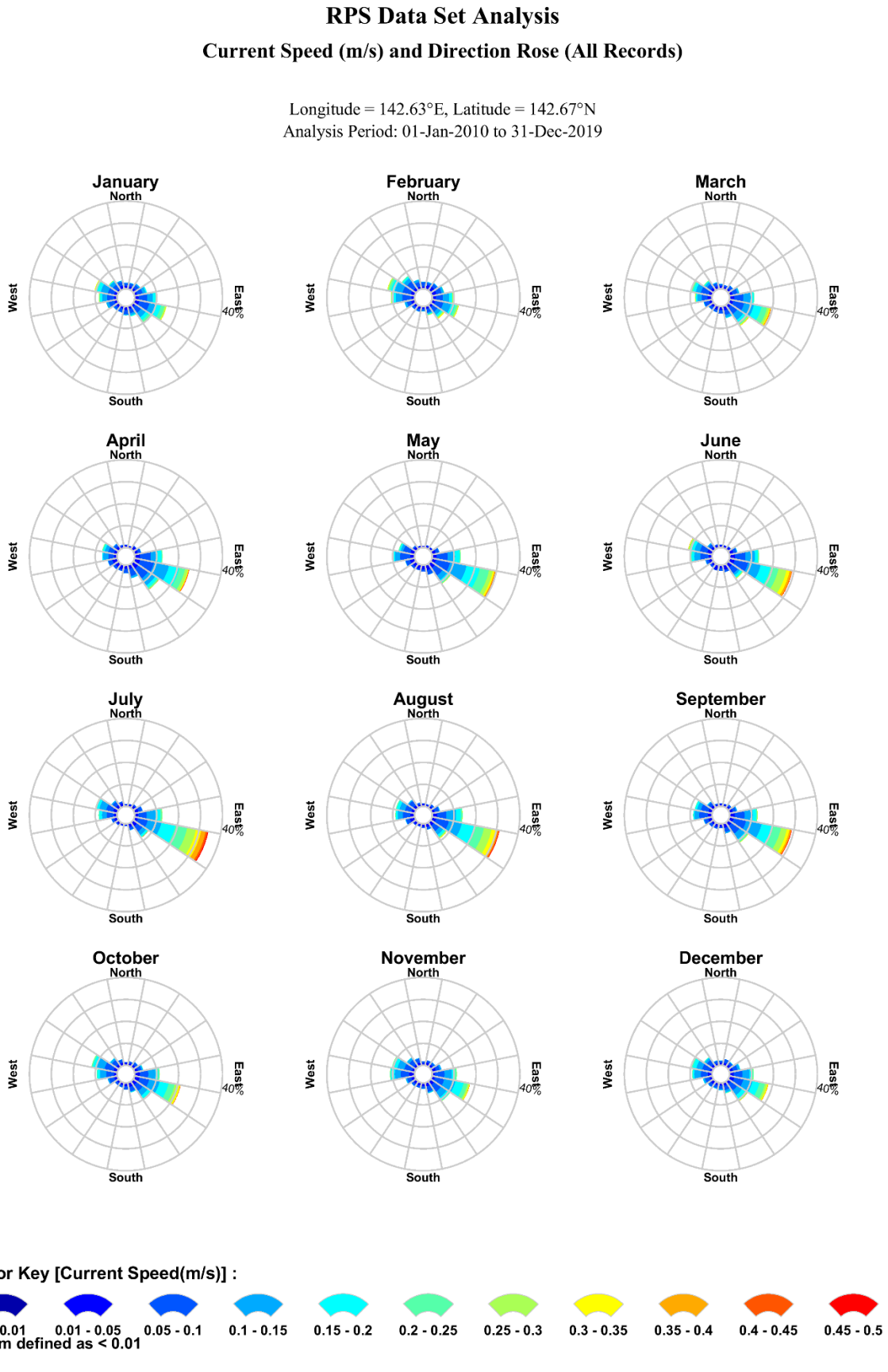



**Figure 3.13 Monthly current rose plots (at 50m below surface) nearby the Elanora-1 ST1 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

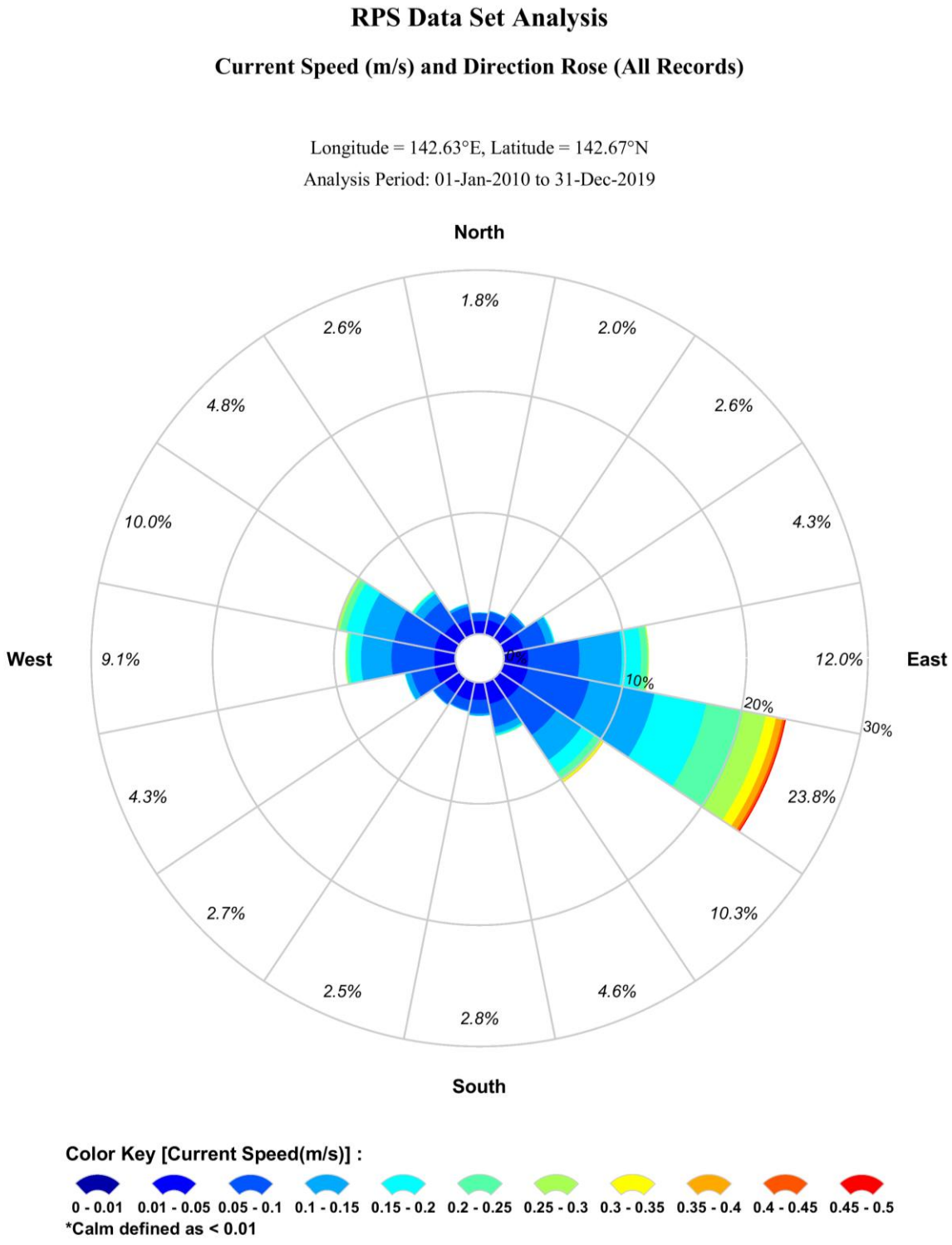



**Figure 3.14 Total surface current rose plot (at 50m below surface) nearby the Elanora-1 ST1 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

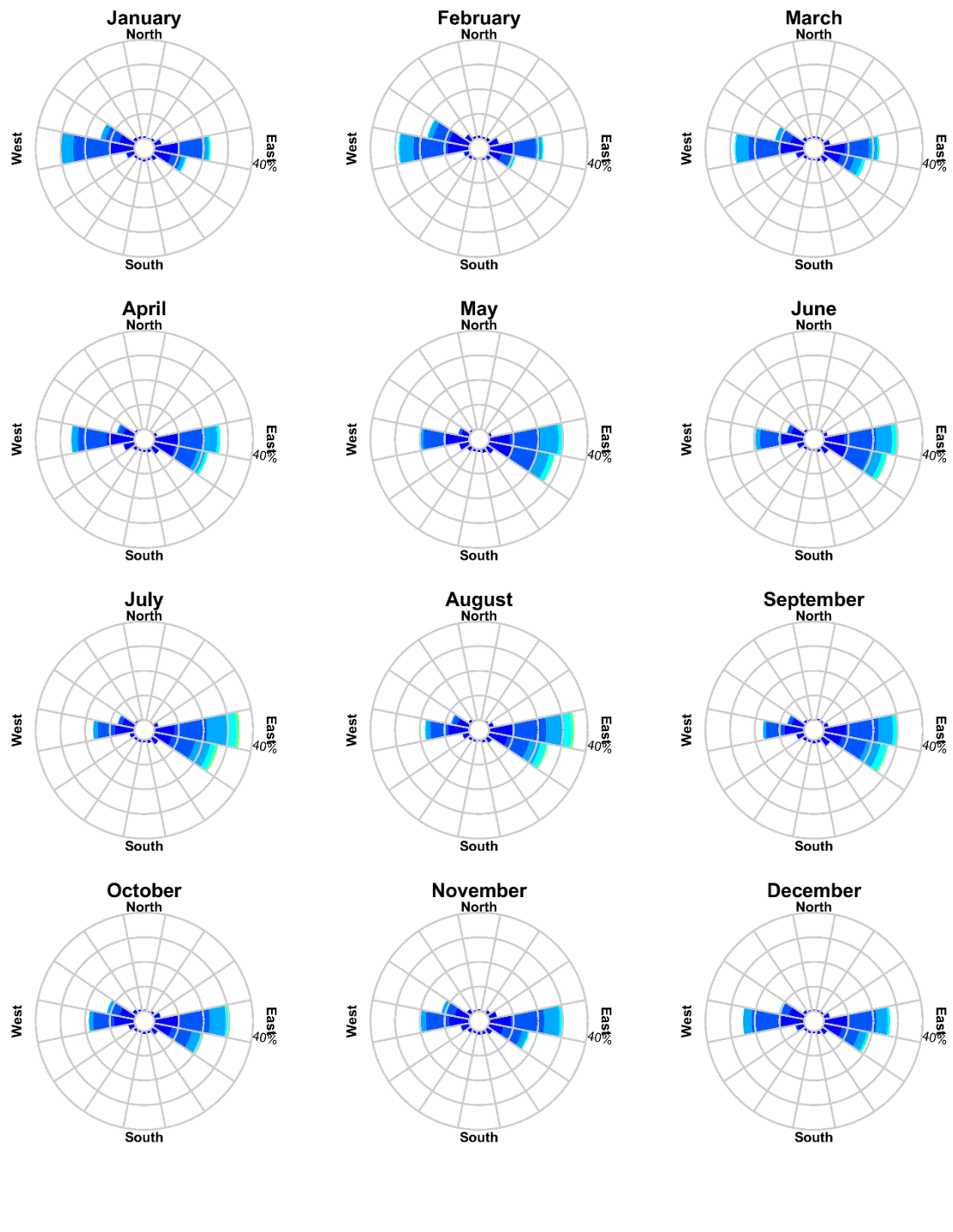



**Figure 3.15 Monthly surface current rose plots (at 50m below surface) nearby the Pecten East-2 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

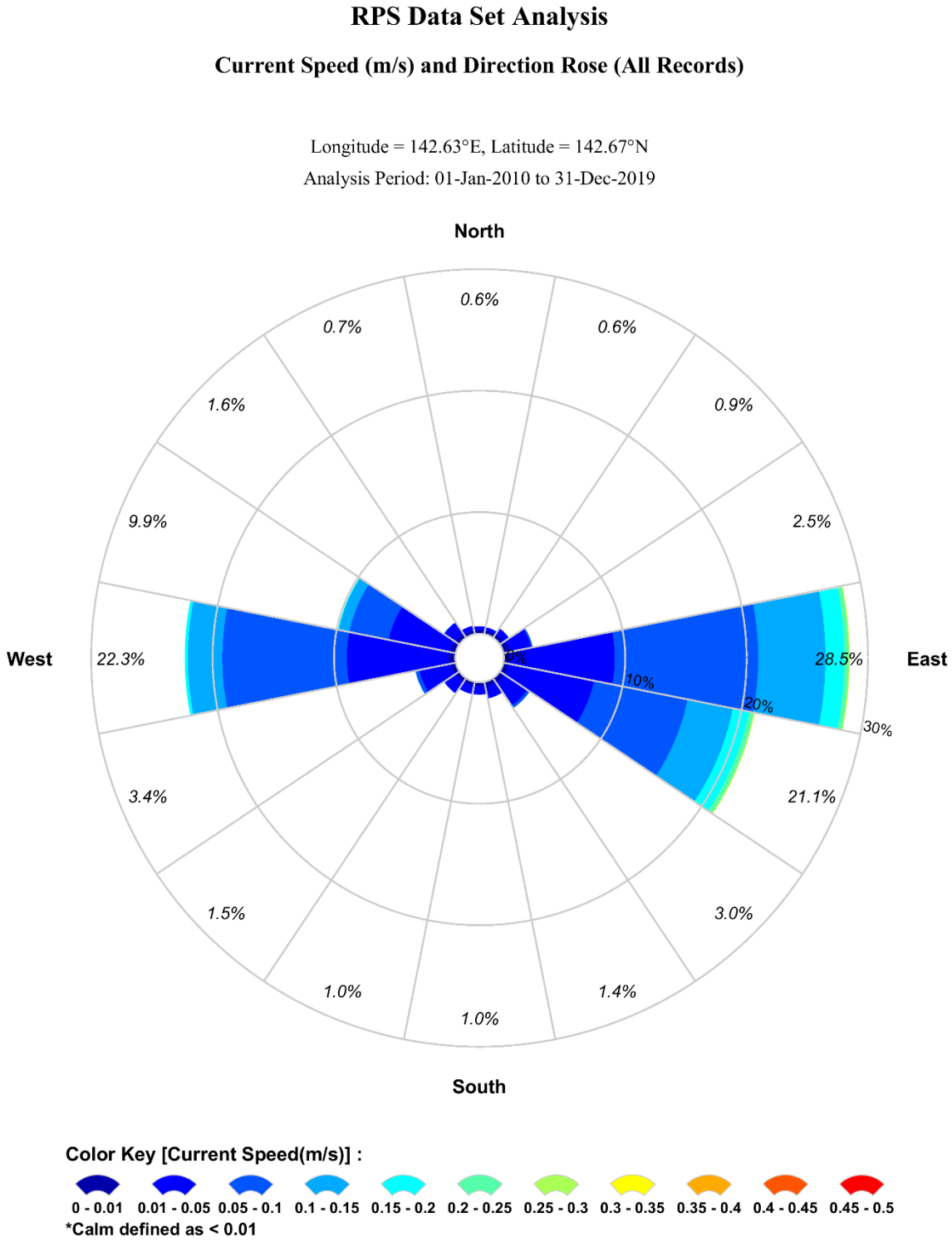



**Figure 3.16 Total surface current rose plot (at 50m below surface) nearby the Pecten East-2 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

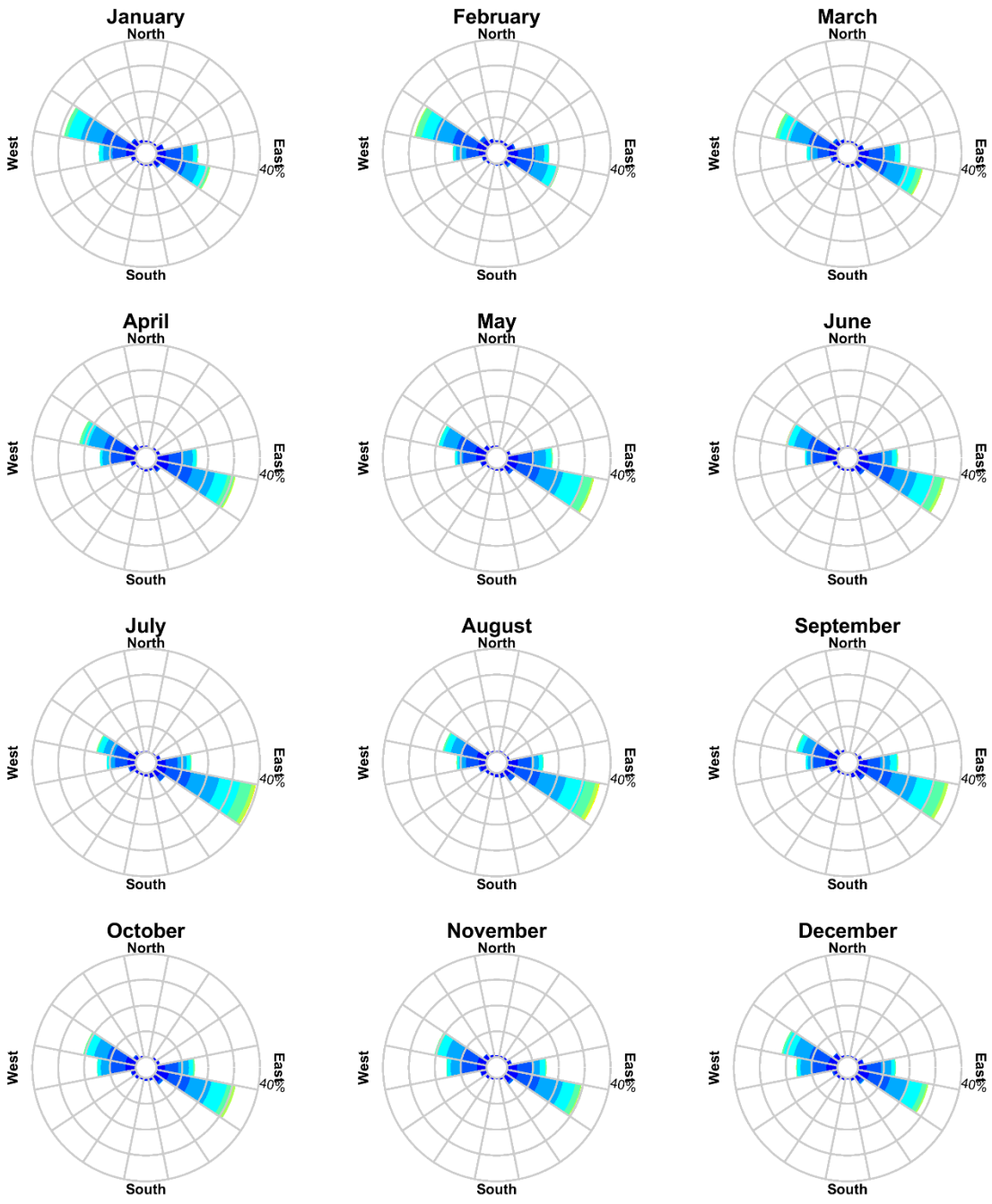



**Figure 3.17 Monthly surface current rose plots (at 50m below surface) nearby the Annie-2 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

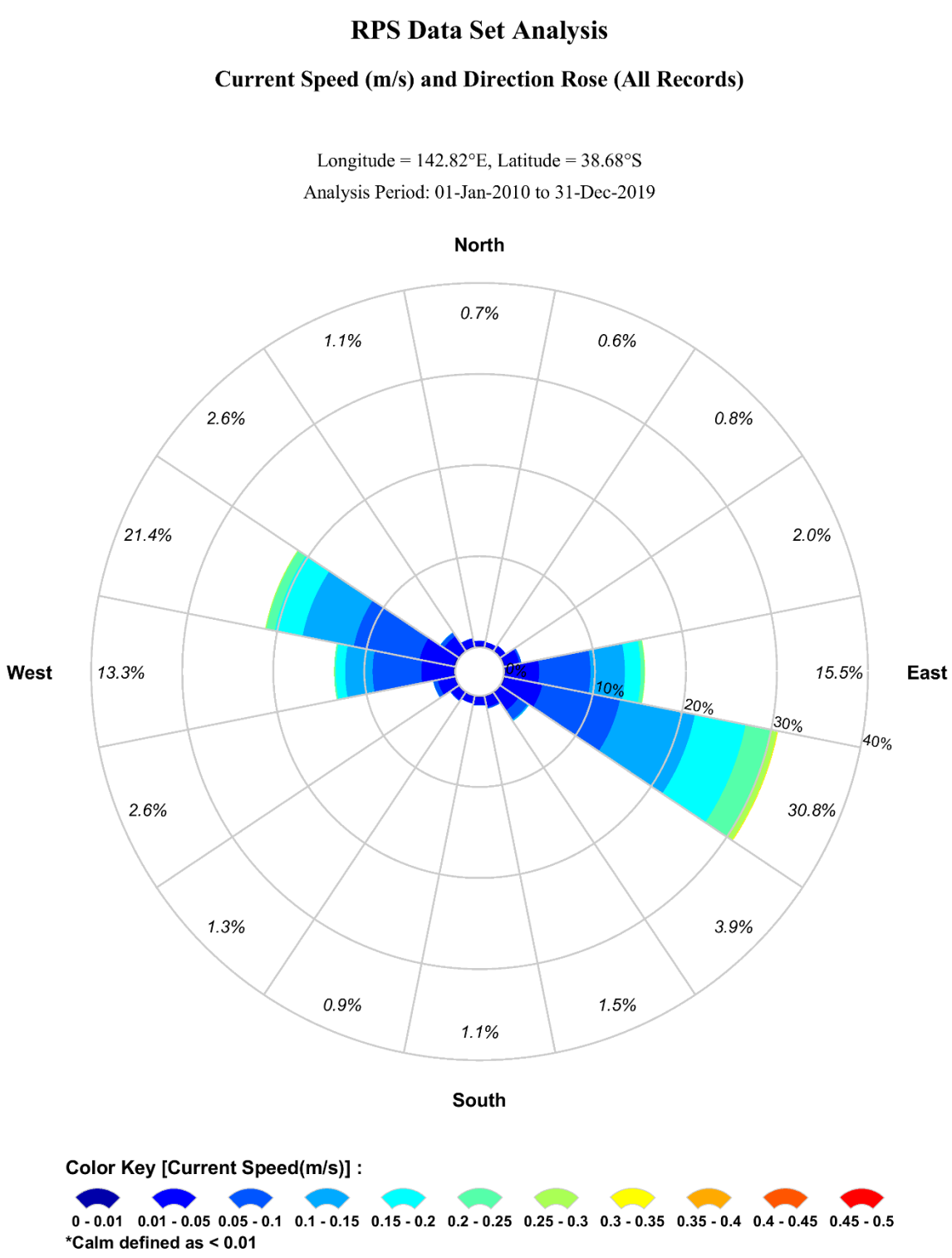



**Figure 3.18 Total surface current rose plot (at 50m below surface) nearby the Annie-2 well derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

# 4 WIND DATA

High resolution wind data for the years 2010 to 2019 (inclusive) was sourced from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis dataset (CFSR; see Saha et al., 2010). The CFSR wind model is a fully coupled, data-assimilative hindcast model representing the interaction between the earth's oceans, land, and atmosphere. The gridded wind data output is available at ¼ of a degree resolution (~33 km) and 1-hourly time intervals. Figure 4.1 shows the spatial resolution of the wind field used as input into the oil spill model.

Table 4.1 to Table 4.3 present the monthly average and maximum winds derived from a CFSR wind node nearby the Elanora-1 ST1, Pecten East-2 and Annie-2 wells. The wind data demonstrated average monthly wind speeds ranging from 14 knots during summer months to 19 knots during winter months at Elanora-1 ST1 (Isabella), whilst near Pecten East-2 and Annie-2 seasonal wind speeds were 10 knots and 13 knots respectively (same wind node). Maximum monthly speeds ranged between 39 knots (January) and 53 knots (June) at Elanora-ST1 and 30 knots (January and November) and 42 knots (June) nearby Pecten East-2 and Annie-2. The dominant wind direction varied throughout the year, though westerly winds tended to dominate nearby all release locations during September to November.

Figure 4.2 to Figure 4.7 show the monthly and total wind rose distributions derived from the CFSR data for the selected node nearby the release locations.

Note that the atmospheric convention for defining wind direction, that is, the direction the wind blows from, is used to reference wind direction throughout this report. Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Sixteen directions are used. The branches are divided into segments of different colour, which represent wind speed ranges from that direction. Speed ranges of 5 knots are typically used in these wind roses. The length of each segment within a branch is proportional to the frequency of winds blowing within the corresponding range of speeds from that direction.

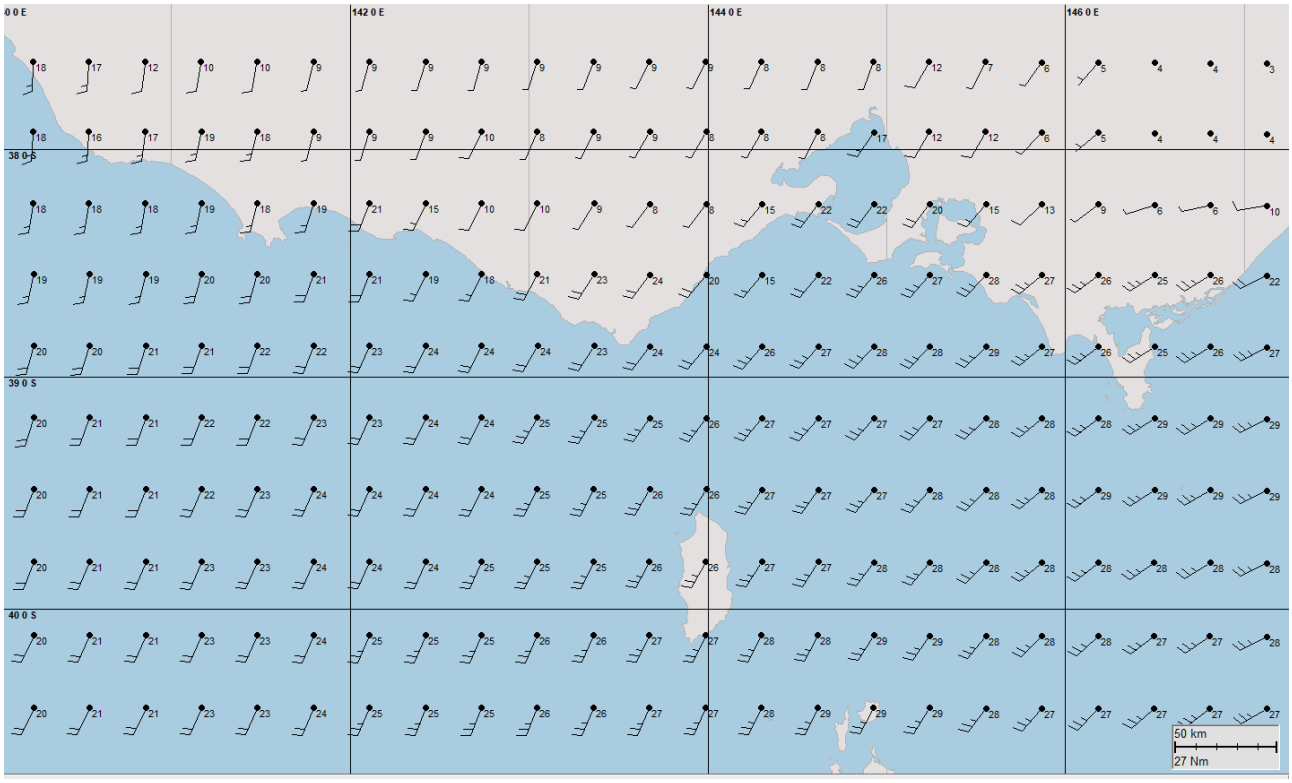



**Figure 4.1 Spatial resolution of the CFSR modelled wind data used as input into the oil spill model.**

**Table 4.1 Predicted average and maximum winds representative for the selected node nearby the Elanora-1 ST1 well. Data derived from CFSR hindcast model from 2010–2019 (inclusive).**

| Month | Average wind speed (knots) | Maximum wind speed (knots) | General direction(s) (From) |
|---|---|---|---|
| January | 14 | 39 | South |
| February | 14 | 42 | Southeast |
| March | 14 | 44 | West |
| April | 14 | 42 | West |
| May | 17 | 45 | West |
| June | 17 | 53 | West-northwest |
| July | 19 | 46 | West-northwest |
| August | 19 | 47 | West |
| September | 17 | 49 | West |
| October | 16 | 45 | West |
| November | 15 | 44 | West |
| December | 14 | 40 | West-southwest |
| **Minimum** | **14** | **39** | - |
| **Maximum** | **19** | **53** | |

**Table 4.2 Predicted average and maximum winds representative for the selected node nearby the Pecten East-2 well. Data derived from CFSR hindcast model from 2010–2019 (inclusive).**

| Month | Average wind speed (knots) | Maximum wind speed (knots) | General direction(s) (From) |
|---|---|---|---|
| January | 10 | 30 | Southeast |
| February | 10 | 31 | Southeast |
| March | 10 | 34 | Southeast |
| April | 10 | 33 | West |
| May | 11 | 32 | Northwest |
| June | 11 | 42 | North-northwest |
| July | 13 | 35 | North-northwest |
| August | 13 | 39 | Northwest |
| September | 12 | 41 | West |
| October | 11 | 31 | West |
| November | 10 | 30 | West |
| December | 10 | 31 | West |
| **Minimum** | **10** | **30** | - |
| **Maximum** | **13** | **42** | |

**Table 4.3 Predicted average and maximum winds representative for the selected node nearby the Annie-2 well. Data derived from CFSR hindcast model from 2010–2019 (inclusive).**

| Month | Average wind speed (knots) | Maximum wind speed (knots) | General direction(s) (From) |
|---|---|---|---|
| January | 10 | 30 | Southeast |
| February | 10 | 31 | Southeast |
| March | 10 | 34 | Southeast |
| April | 10 | 33 | West |
| May | 11 | 32 | Northwest |
| June | 11 | 42 | North-northwest |
| July | 13 | 35 | North-northwest |
| August | 13 | 39 | Northwest |
| September | 12 | 41 | West |
| October | 11 | 31 | West |
| November | 10 | 30 | West |
| December | 10 | 31 | West |
| **Minimum** | **10** | **30** | - |
| **Maximum** | **13** | **42** | |

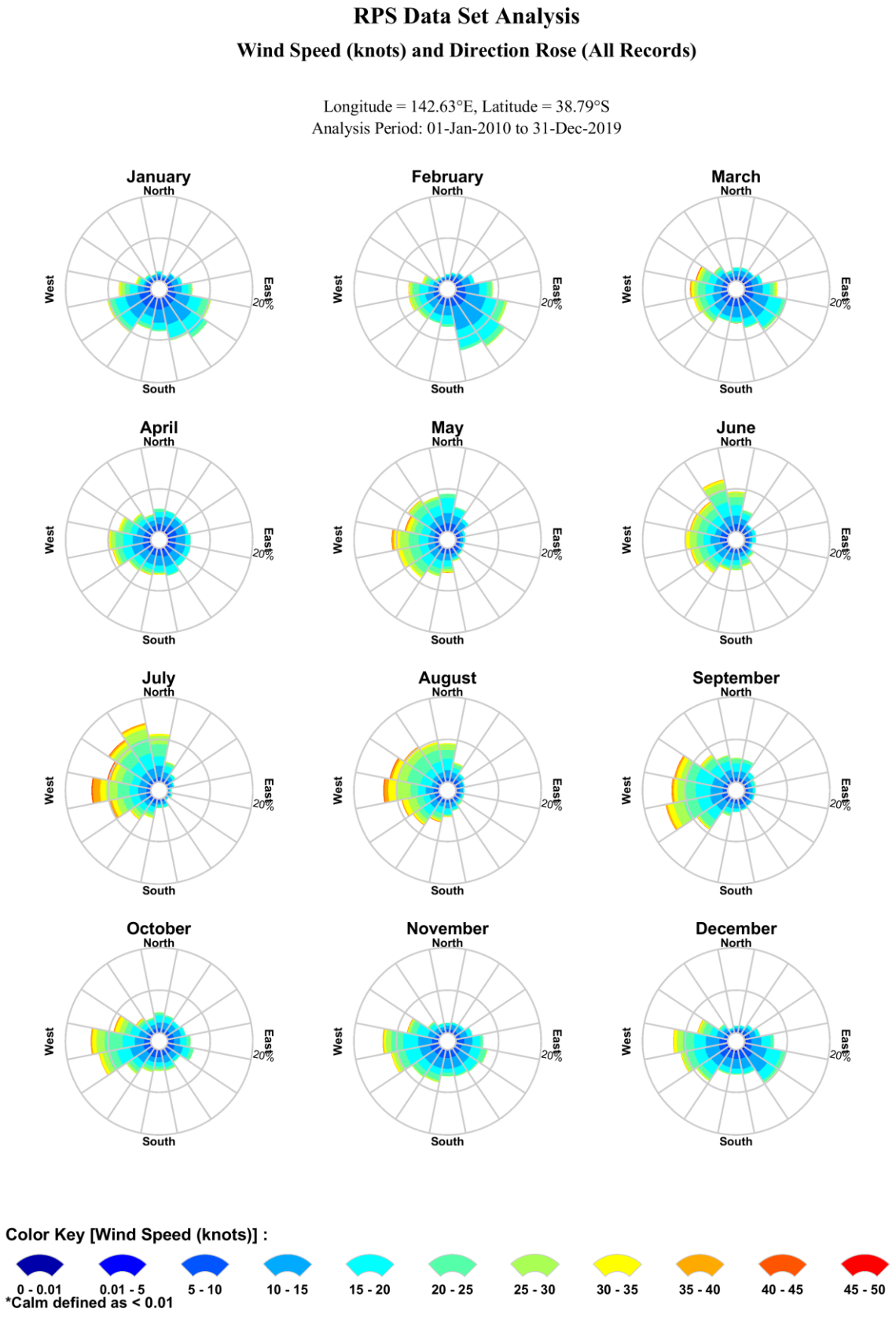



**Figure 4.2 Modelled monthly wind rose distributions from 2010–2019 (inclusive) for the node nearby the Elanora-1 ST1 well.**

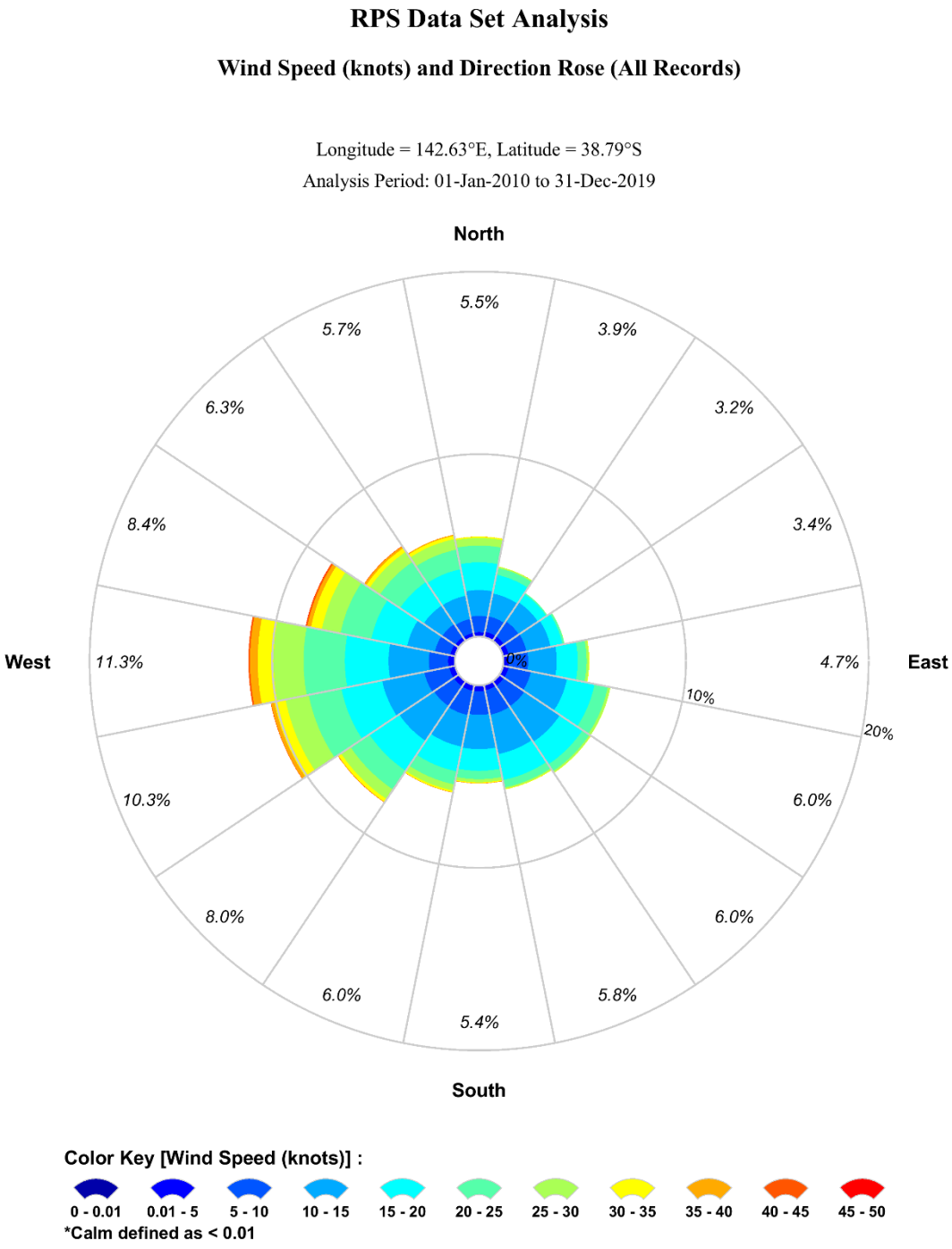



**Figure 4.3 Modelled total wind rose distributions from 2010–2019 (inclusive) for the node nearby the Elanora-1 ST1 well.**

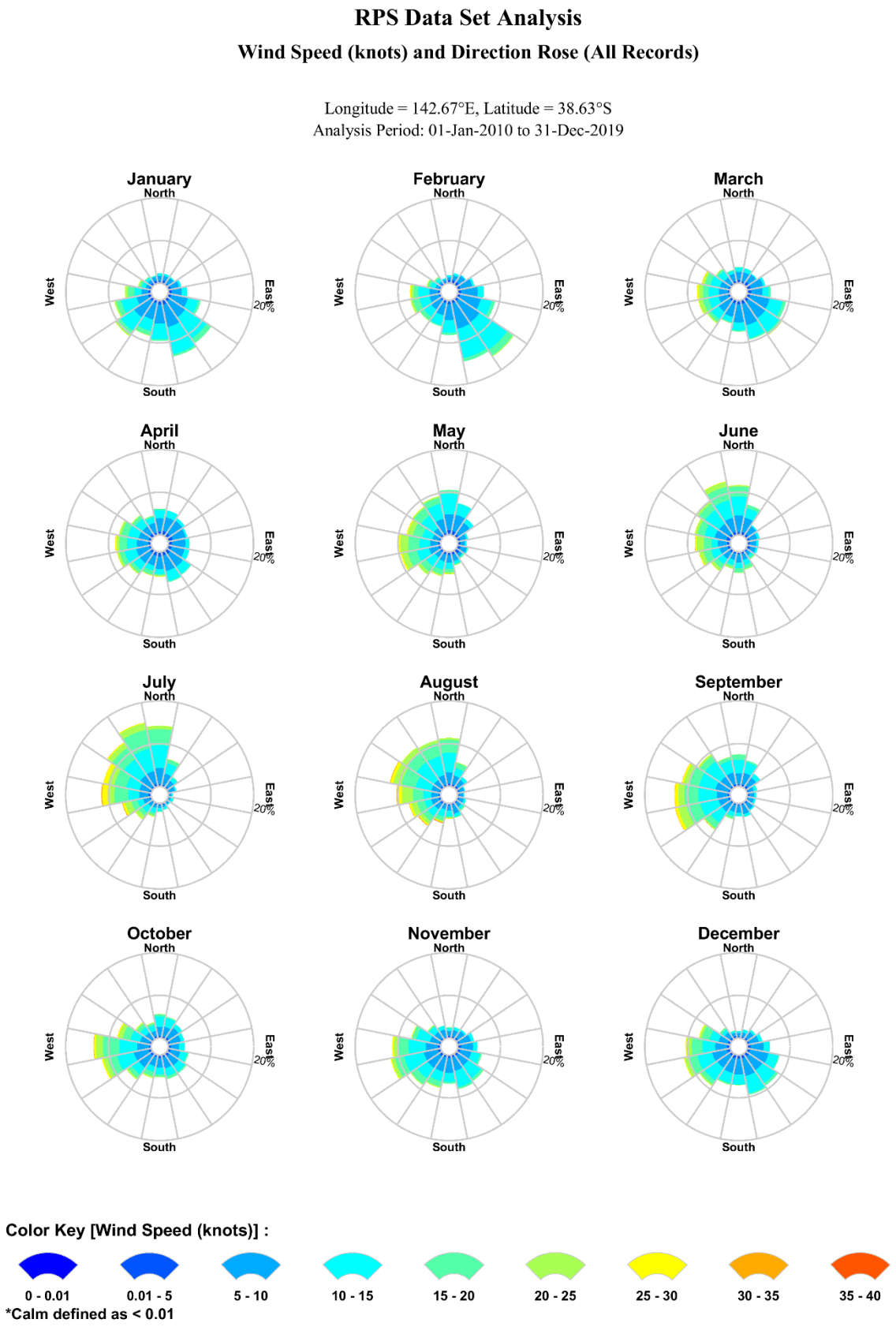



**Figure 4.4 Modelled monthly wind rose distributions from 2010–2019 (inclusive) for the node nearby the Pecten East-2 well.**

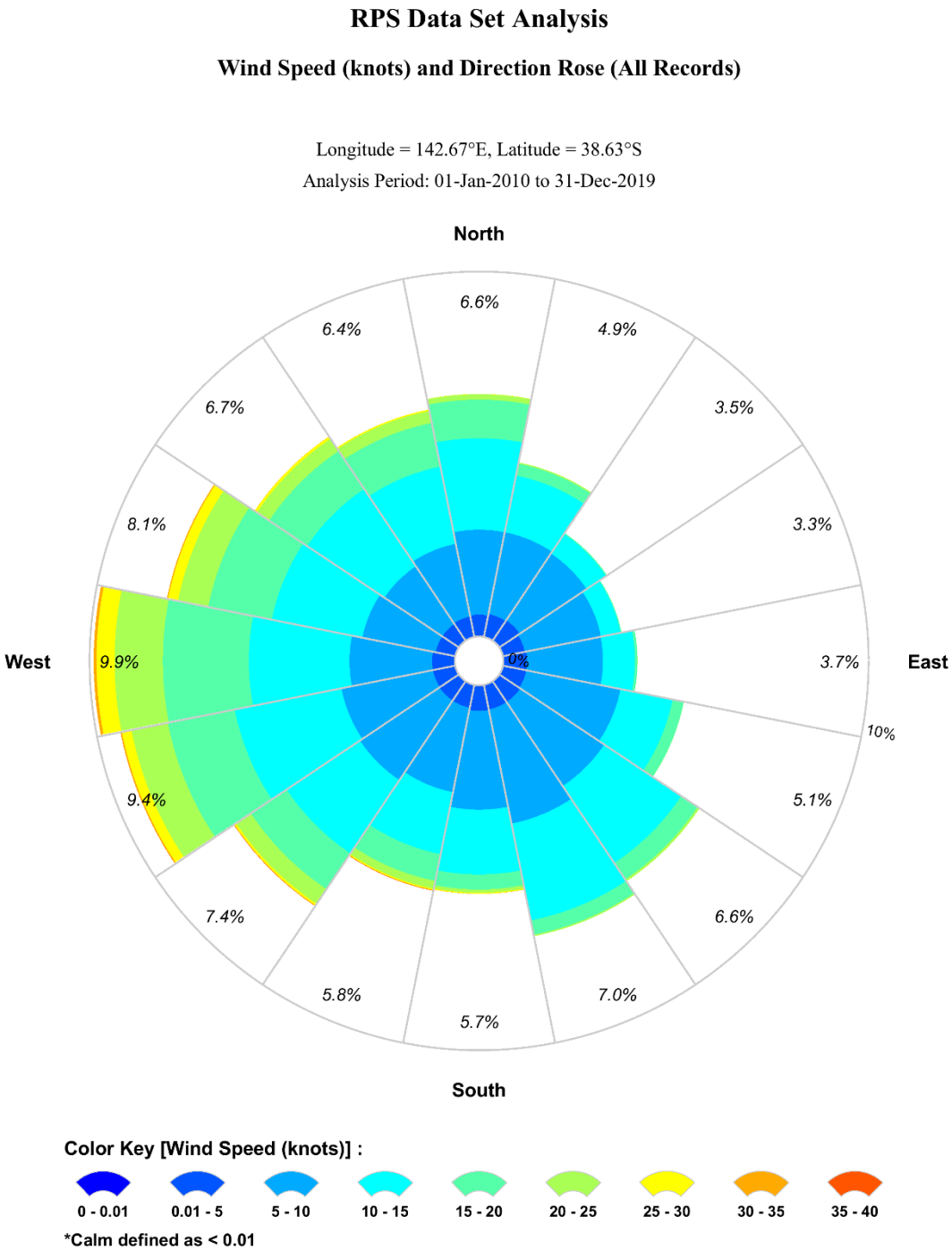



**Figure 4.5 Modelled total wind rose distributions from 2010–2019 (inclusive) for the node nearby the Pecten East-2 well.**

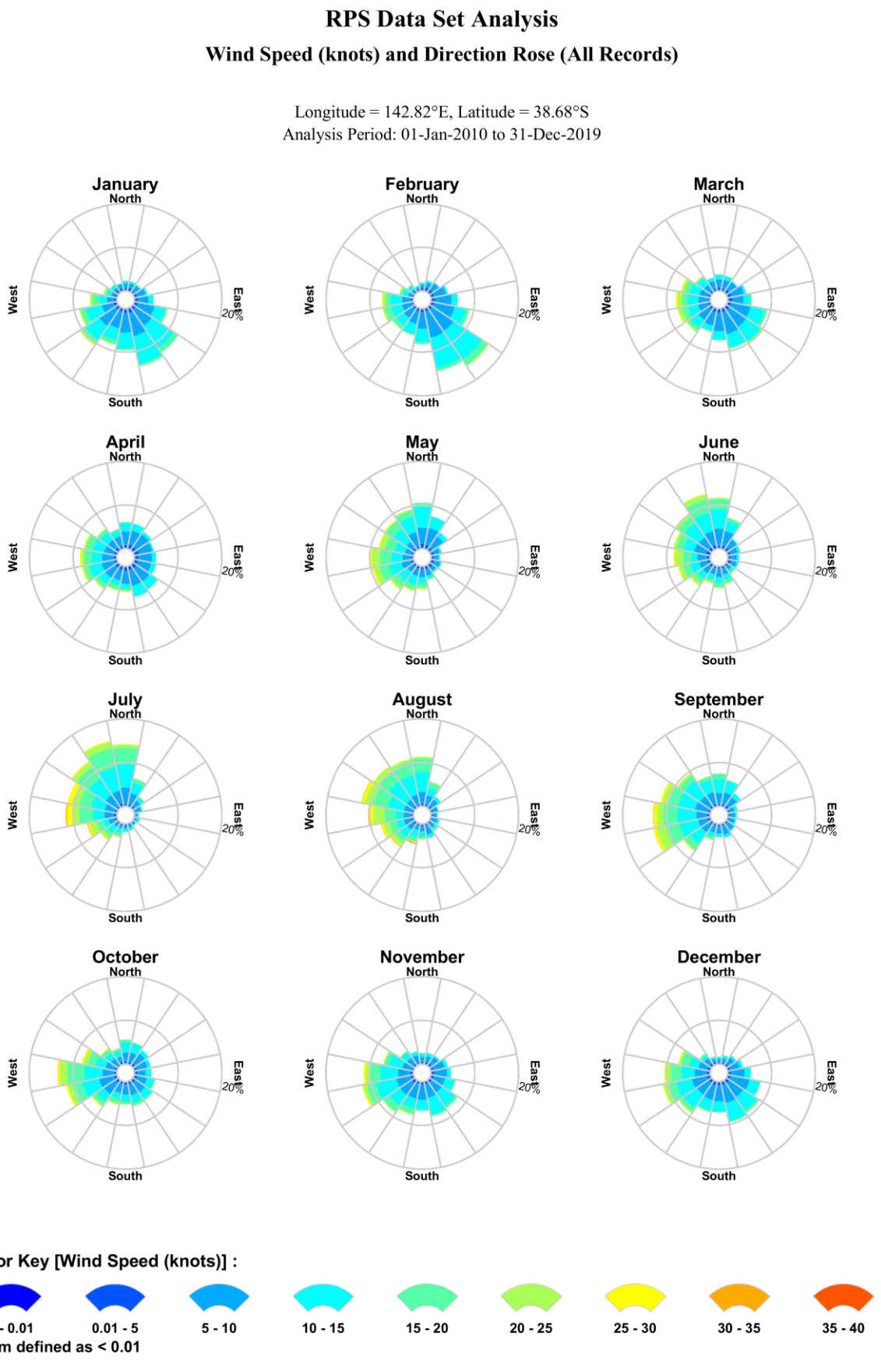



**Figure 4.6 Modelled monthly wind rose distributions from 2010–2019 (inclusive) for the node nearby the Annie-2 well.**

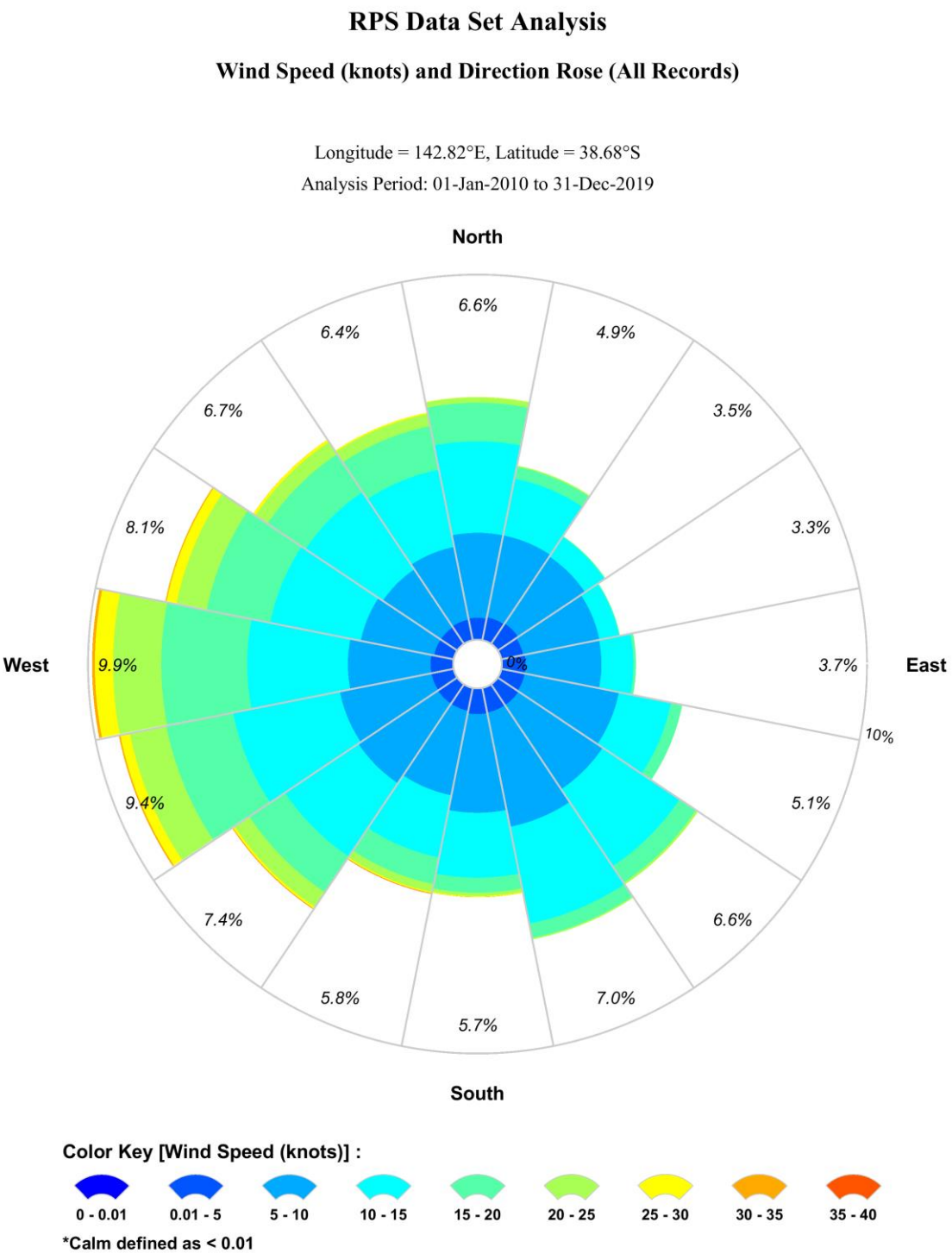



**Figure 4.7 Modelled total wind rose distributions from 2010–2019 (inclusive) for the node nearby the Annie-2 well.**

# 5 WATER TEMPERATURE AND SALINITY

The monthly sea temperature and salinity profiles of the water column within the study was obtained from the World Ocean Atlas 2018 database produced by the National Oceanographic Data Centre (National Oceanic and Atmospheric Administration) and its co-located World Data Center for Oceanography (see Levitus et al., 2013). These parameters were used as factors to inform the weathering, movement, and evaporative loss of hydrocarbon spills in the surface and sub-surface layers.

Figure 5.1 to Figure 5.3 illustrate the vertical profile of sea temperature and salinity nearby the release locations.

Table 5.1 to Table 5.3 present the sea temperature and salinity of the surface layer nearby the Elanora-1 ST1, Pecten East-2 and Annie-2 wells, respectively. The monthly average sea surface temperatures ranged between 13.5°C (September) and 18.9°C (February) nearby Elanora-1 ST1, and 13.3°C (September) and 18.3°C (January) nearby Pecten East-2 and 13.3°C (September) and 18.5°C (March) nearby Annie-2. The monthly average surface salinity values remain relatively consistent ranging between 35.3 psu and 35.5 psu across all three release locations.

**Table 5.1 Monthly average sea surface temperature and salinity in the Elanora-1 ST1 well area.**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (ºC) | 18.3 | 18.9 | 18.8 | 17.1 | 15.8 | 15.1 | 14.8 | 14.1 | 13.5 | 13.9 | 14.7 | 16.0 |
| Salinity (psu) | 35.4 | 35.4 | 35.4 | 35.3 | 35.4 | 35.4 | 35.5 | 35.5 | 35.4 | 35.4 | 35.4 | 35.3 |

**Table 5.2 Monthly average sea surface temperature and salinity in the Pecten East-2 well area.**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (ºC) | 18.3 | 18.1 | 18.0 | 17.1 | 15.7 | 14.8 | 14.4 | 13.8 | 13.3 | 14.0 | 15.0 | 16.1 |
| Salinity (psu) | 35.4 | 35.4 | 35.3 | 35.3 | 35.4 | 35.4 | 35.5 | 35.4 | 35.4 | 35.4 | 35.3 | 35.4 |

**Table 5.3 Monthly average sea surface temperature and salinity in the Annie-2 well area.**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (ºC) | 18.3 | 18.4 | 18.5 | 17.1 | 15.7 | 14.7 | 14.2 | 13.7 | 13.3 | 14.0 | 14.9 | 16.1 |
| Salinity (psu) | 35.4 | 35.4 | 35.4 | 35.3 | 35.3 | 35.4 | 35.5 | 35.5 | 35.4 | 35.5 | 35.4 | 35.3 |

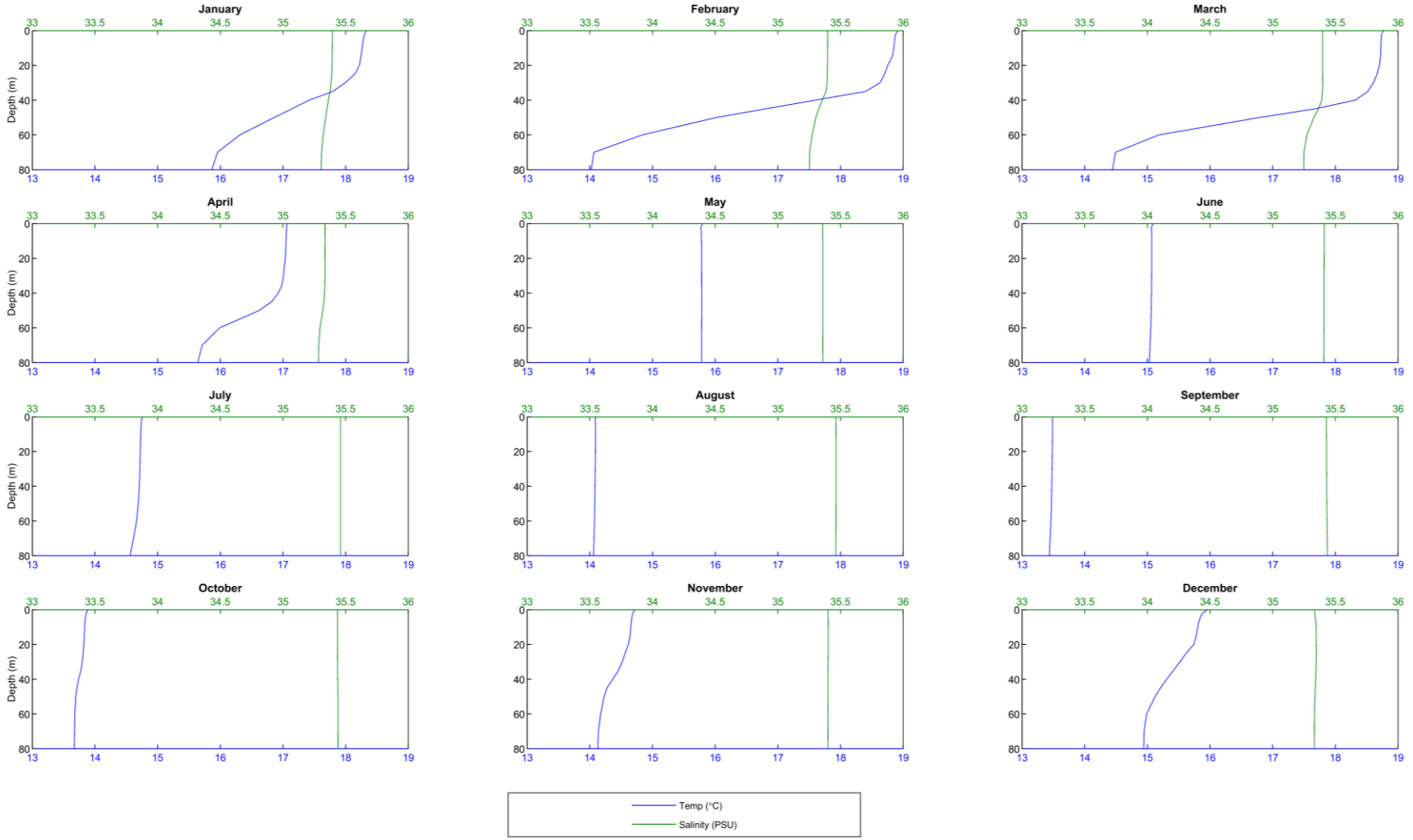



**Figure 5.1 Temperature and salinity profiles nearby the Elanora-1 ST1 well.**

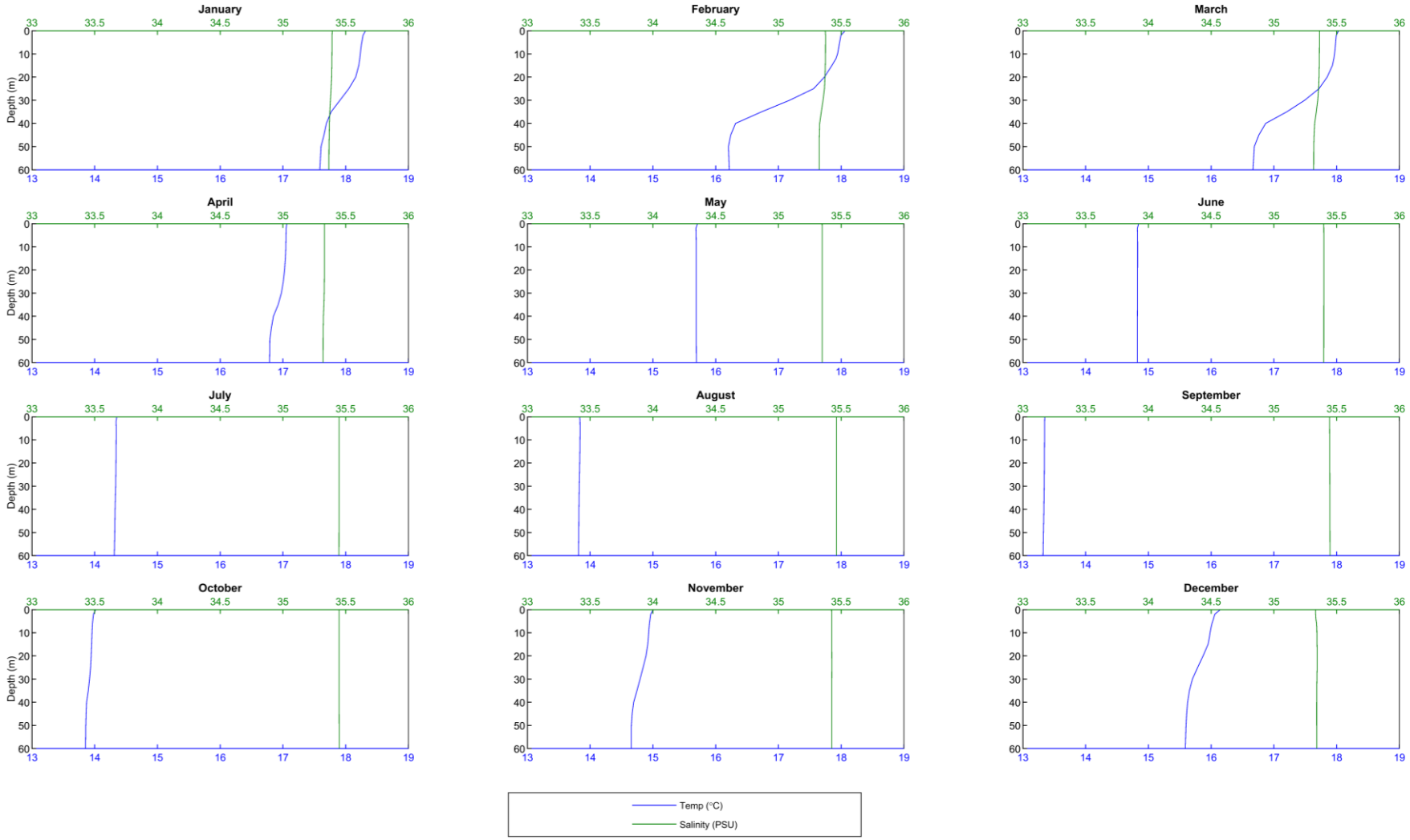



**Figure 5.2 Temperature and salinity profiles nearby the Pecten East-2 well.**

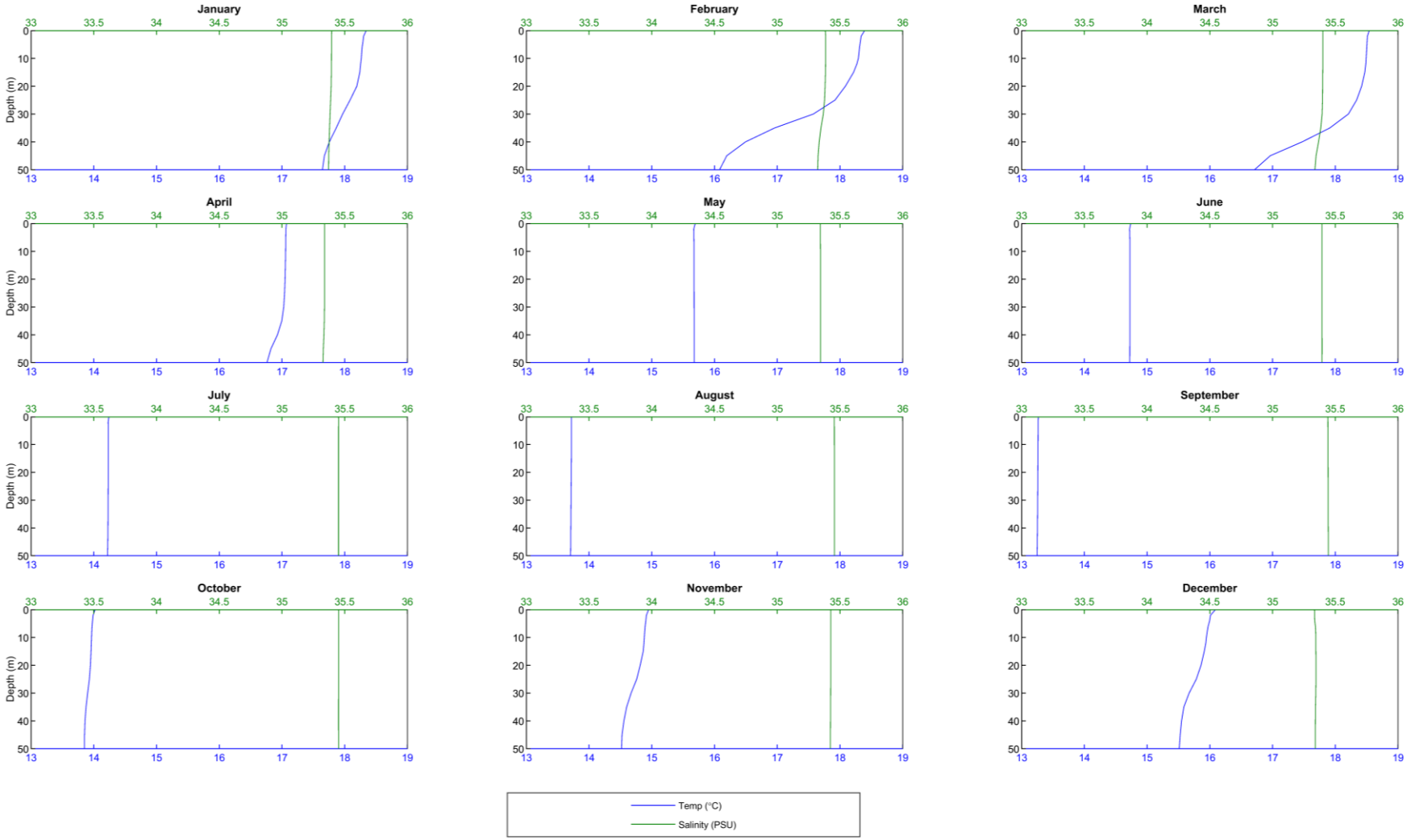



**Figure 5.3 Temperature and salinity profiles nearby the Annie-2 well.**

# 6 SUBSEA PLUME MODEL – OILMAP DEEP

In the event of an uncontrolled subsea LOWC, the gas and condensate will initially behave like a jet, which dissipates in the water column over a short distance (<10 m). The escaping condensate shears into small droplets due to turbulence generated by passing through the exit hole and subsequent turbulence generated in the plume jet. The size-distribution of the droplets varies with the exit velocity and viscosity of the condensate. Following this phase, the density and buoyancy difference of the gas and condensate mixture relative to the surrounding waters, forces the plume upward. As the plume rises, the volume of gas will increase due to reduction of water pressure, with gas bubbles dividing into an increasing number of bubbles due to the shearing effect exerted by the water column.

In shallow water (<150 m) the rising plume of gas and condensate will tend to reach the sea surface before deflecting away from the centre of the plume (Spaulding et al., 2000). Figure 6.1 conceptually illustrates the various stages of a subsea release of oil and gas.

OILMAP Deep model (Spaulding et al., 2015) was used to simulate the near-field behaviour of the gas-condensate subsea release in two phases – the initial jet phase and the buoyant plume phase. The initial jet phase is predominately driven by the exit velocity. During this phase, the condensate droplet-size-distributions are calculated for a range of classes or bins. Next, the plume model predicts the rise dynamics of the condensate and gas plumes to calculate at which point gas lift will be lost (i.e. the trapping height).

Outputs which include the plume trapping height, plume diameter and droplet size distribution are used as input to the SIMAP model to simulate the rise and dispersion of the condensate droplets from this point onwards.

More details on the OILMAP-DEEP model, can be found in Spaulding et al. (2015). The model has been validated against observations from Deepwater Horizon as well as small and large-scale laboratory studies on subsurface oil releases (Brandvik et al., 2013, 2014; Belore, 2014; Spaulding et al., 2015; Li et al., 2017).

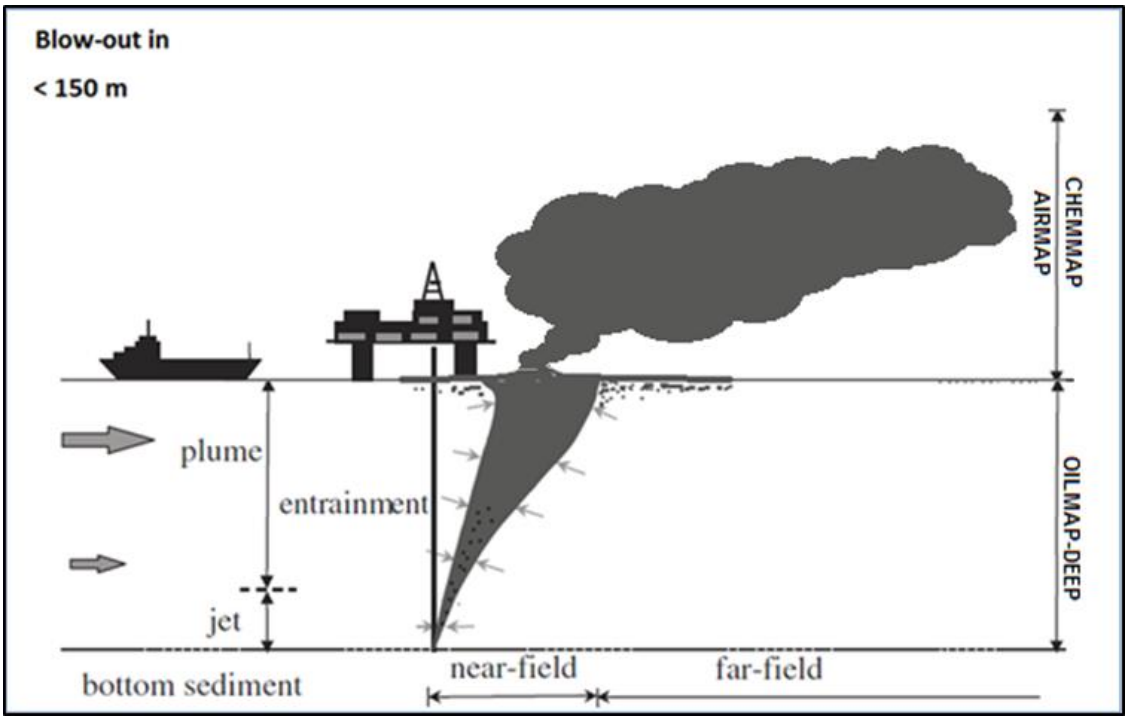



**Figure 6.1 Example of a subsea plume and the various stages of the plume in the water column (Source: ASA, 2011).**

Table 6.1 presents the input parameters and key results for the subsea plume modelling. Note a depleting release rate was assessed. The subsea modelling showed that in the event of a LOWC, the amalgamated gas and condensate would propel rapidly upward from the seabed and rupture the sea surface at all three locations assessed.

**Table 6.1 Input data and key results for the subsea plume modelling.**

| Input Variable | Value | | |
|---|---|---|---|
| Scenario | LOWC at Elanora-1 ST1 (Isabella) | LOWC at Pecten East-2 | LOWC at Annie-2 |
| Water depth (m) | 56 (from top of the BOP stack) | 34 (from top of the BOP stack) | 36 (from top of the BOP stack) |
| Top of release diameter (inch) | 18.75 | 18.75 | 18.75 |
| Condensate discharge rate (stb/day) | 1326 (day 1) depleting to 798 (day 102) | 1250 (day 1) depleting to 505 (day 102) | 878 (day 1) depleting to 453 (day 104) |
| Gas rate (MMscf/day) | 663 (day 1) depleting to 399 (day 102) | 625 (day 1) depleting to 253 (day 102) | 438.9 (day 1) depleting to 226.4 (day 104) |
| Formation water flow rate (stb/day) | 356 (day 1) depleting to 293 (day 102) | 496 (day 1) depleting to 353 (day 102) | 444.9 (day 1) depleting to 298.0 (day 104) |
| **Key results** | | | |
| Plume execution depth (m BMSL^) | 0 (Breach the sea surface) | 0 (Breach the sea surface) | 0 (Breach the sea surface) |
| Droplet sizes (µm) | 1,399 to 6,044 (day 1) to 1,761 to 7,607 (day 104) | 1,268 to 5,479 (day 1) to 1,884 to 8,137 (day 104) | 1,584 to 6,843 (day 1) to 2,056 to 8,882 (day 104) |

^Below mean sea level

# 7 OIL SPILL MODEL – SIMAP

Modelling of the fate of oil was performed using the Spill Impact Mapping Analysis Program (SIMAP). SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for both the surface and subsurface releases (Spaulding et al., 1994; French et al., 1999; French-McCay, 2003, 2004; French-McCay et al., 2004).

SIMAP has been used to predict the weathering and fate of oil spills during and after major incidents including: Montara (Australia) well blowout August 2009 in the Timor Sea (Asia-Pacific ASA, 2010); Macondo (USA) well blowout April 2010 in the Gulf of Mexico; Bohai Bay (China) oil spill August 2011; and the pipeline oil spill July 2013 in the Gulf of Thailand.

The SIMAP model calculates the transport, spreading, entrainment, evaporation and decay of surface hydrocarbon slicks as well as the entrained and dissolved oil components in the water column, either from surface slicks or from oil discharged subsea. The movement and weathering of the spilled oil is calculated for specific oil types. Input specifications for oil mixtures include the density, viscosity, pour point, distillation curve (volume lost versus temperature) and the aromatic/aliphatic component ratios within given boiling point (BP) ranges.

SIMAP is a three-dimensional model that allows for various response actions to be modelled including oil removal from skimming, burning, or collection booms, and surface and subsurface dispersant application.

The SIMAP oil spill model includes advanced weathering algorithms, specifically focussed on unique oils that tend to form emulsions and/or tar balls. The weathering algorithms are based on 5 years of extensive research conducted in response to the Deepwater Horizon oil spill in the Gulf of Mexico (French-McCay et al., 2015).

Biodegradation is included in the oil spill model. In the model, SIMAP, degradation is calculated for the surface slick, deposited oil on the shore, the entrained oil and dissolved constituents in the water column, and oil in the sediments. For surface oil, water column oil and sedimented oil a first order degradation rate is specified. Biodegradation rates are relatively high for hydrocarbons in dissolved state or in dispersed small droplets.

## 7.1 Stochastic Modelling

For the stochastic modelling presented herein, 100 oil spills (per season) were modelled for each scenario using the same spill information (release location, spill volume, duration and oil type) but with varied start dates. During each simulation, the model records whether any grid cells are exposed to any oil concentrations, the concentrations involved and the elapsed time before exposure. The results of all 100 oil spill simulations (per season) were analysed to determine the following statistics for every grid cell:

- Exposure load (concentrations and volumes);
- Minimum time before exposure;
- Probability of contact above defined concentrations;
- Volume of oil that may accumulate on shorelines from any single simulation;
- Concentration that might occur on sections of individual shorelines;
- Exposure to dissolved hydrocarbons in the water column; and
- Exposure to entrained hydrocarbons in the water column.

## 7.2 Floating, Shoreline and In-Water Thresholds

The thresholds and their relationship to exposure for the sea surface, shoreline and water column (entrained and dissolved hydrocarbons) are presented in Sections 7.2.1 to 7.2.3. Supporting justifications of the adopted thresholds applied during the study and additional context relating to the area of potential exposure are also provided. It is important to note that the thresholds herein are based on NOPSEMA (2019).

### 7.2.1 Floating Oil Exposure Thresholds

The modelling results can be presented to any levels; therefore, thresholds have been specified (based on scientific literature) to record floating oil exposure to the sea-surface at meaningful levels only, described in the following paragraphs.

The low threshold to assess the potential for floating oil exposure, was 1 g/m$^2$, which equates approximately to an average thickness of 1 µm, referred to as visible oil. Oil of this thickness is described as rainbow sheen in appearance, according to the Bonn Agreement Oil Appearance Code (Bonn Agreement, 2009; AMSA, 2014) (see Table 7.1). Figure 7.1 shows photographs highlighting the difference in appearance between a silvery sheen, rainbow sheen and metallic sheen. This threshold is considered below levels which would cause environmental harm and it is more indicative of the areas perceived to be affected due to its visibility on the sea surface and potential to trigger temporary closures of areas (i.e. fishing grounds) as a precautionary measure. Table 7.1 provides a description of the appearance in relation to exposure zone thresholds used to classify the zones of floating oil exposure.

Ecological impact has been estimated to occur at 10 g/m$^2$ (a film thickness of approximately 10 µm or 0.01 mm) according to French et al. (1996) and French-McCay (2009) as this level of fresh oiling has been observed to mortally impact some birds through adhesion of oil to their feathers, exposing them to secondary effects such as hypothermia. The appearance of oil at this average thickness has been described as a metallic sheen (Bonn Agreement, 2009).

Scholten et al. (1996) and Koops et al. (2004) indicated that at oil concentrations on the sea surface of 25 g/m$^2$ (or greater), would be harmful for all birds that have landed in an oil film due to potential contamination of their feathers, with secondary effects such as loss of temperature regulation and ingestion of oil through preening. The appearance of oil at this thickness is also described as metallic sheen (Bonn Agreement, 2009). For this study the high exposure threshold was set to 50 g/m$^2$ and above based on NOPSEMA (2019). This threshold can also be used to inform response planning.

Table 7.2 defines the thresholds used to classify the zones of floating oil exposure reported herein.

**Table 7.1 The Bonn Agreement Oil Appearance Code.**

| Code | Description Appearance | Layer Thickness Interval (g/m$^2$ or µm) | Litres per km$^2$ |
|---|---|---|---|
| 1 | Sheen (silvery/grey) | 0.04 – 0.30 | 40 – 300 |
| 2 | Rainbow | 0.30 – 5.0 | 300 – 5,000 |
| 3 | Metallic | 5.0 – 50 | 5,000 – 50,000 |
| 4 | Discontinuous True Oil Colour | 50 – 200 | 50,000 – 200,000 |
| 5 | Continuous True Oil Colour | ≥ 200 | ≥ 200,000 |

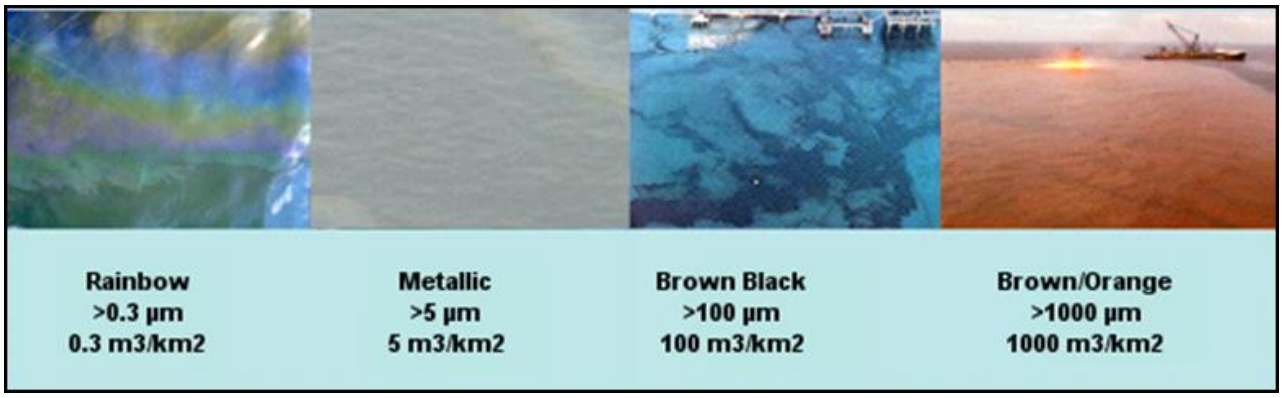



**Figure 7.1 Photographs showing the difference between oil colour and thickness on the sea surface (source: adapted from Oil Spill Solutions, 2015).**

**Table 7.2 Floating oil exposure thresholds used in this report (in alignment with NOPSEMA (2019)).**

| Threshold level | Floating oil (g/m$^2$) | Description |
|---|---|---|
| Low | 1 | Approximates range of socioeconomic effects and establishes planning area for scientific monitoring |
| Moderate | 10 | Approximates lower limit for harmful exposures to birds and marine mammals |
| High | 50 | Approximates surface oil slick and informs response planning |

### 7.2.2 Shoreline Accumulation Thresholds

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 accumulation. This is a conservative threshold used to define regions of socio-economic impact, such as triggering temporary closures of adjoining fisheries or the need for shore clean-up on beaches or man-made features/amenities (breakwaters, jetties, marinas, etc.). It would equate to approximately 2 teaspoons of hydrocarbon per square meter of shoreline accumulation. The appearance is described as a stain/film. On that basis, the 10 g/m$^2$ shoreline accumulation threshold has been selected to define the zone of potential “low shoreline accumulation”.

French et al. (1996) and French-McCay (2009) define a shoreline oil accumulation threshold of 100 g/m$^2$, or above, would potentially harm shorebirds and wildlife (furbearing aquatic mammals and marine reptiles on or along the shore) based on studies for sub-lethal and lethal impacts. This threshold has been used in previous environmental risk assessment studies (see French-McCay, 2003; French-McCay et al., 2004, French-McCay et al., 2011; 2012; NOAA, 2013). Additionally, a shoreline concentration of 100 g/m$^2$, or above, is the minimum limit that the oil can be effectively cleaned according to the AMSA (2015) guideline. This threshold equates to approximately ½ a cup of oil per square meter of shoreline accumulation. The appearance is described as a thin oil coat. Therefore, 100 g/m$^2$ has been selected to define the zone of potential “moderate shoreline accumulation”.

Observations by Lin & 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 accumulation”. It equates to approximately 1 litre of hydrocarbon per square meter of shoreline accumulation. The appearance is described as a hydrocarbon cover.

It is worth noting that the shoreline accumulation thresholds derived from extensive literature review (outlined in Table 7.3) agree with the commonly used threshold values for oil spill modelling specified in NOPSEMA (2019).

**Table 7.3 Thresholds used to assess shoreline accumulation.**

| Threshold level | Shoreline loading (g/m$^2$) | Description |
|---|---|---|
| Low (socioeconomic/sublethal) | 10 | Predicts potential for some socio-economic impact |
| Moderate | 100 | Loading predicts area likely to require clean-up effort |
| High | > 1,000 | Loading predicts area likely to require intensive clean-up effort |

### 7.2.3 In-water Exposure Thresholds

Oil is a mixture of thousands of hydrocarbons of varying physical, chemical, and toxicological characteristics, and therefore, demonstrate varying fates and impacts on organisms. As such, for in-water exposure, the SIMAP model provides separate outputs for dissolved and entrained hydrocarbons from oil droplets. The consequences of exposure to dissolved and entrained components will differ because they have different modes and magnitudes of effect.

Entrained hydrocarbon concentrations were calculated based on oil droplets that are suspended in the water column, though not dissolved. The composition of this oil would vary with the state of weathering (oil age) and may contain soluble hydrocarbons when the oil is fresh. Calculations for dissolved hydrocarbons specifically calculates oil components which are dissolved in water, which are known to be the primary source of toxicity exerted by oil.

#### 7.2.3.1 Dissolved Hydrocarbons

Laboratory studies have shown that dissolved hydrocarbons exert most of the toxic effects of oil on aquatic biota (Carls et al., 2008; Nordtug et al., 2011; Redman, 2015). The mode of action is a narcotic effect, which is positively related to the concentration of soluble hydrocarbons in the body tissues of organisms (French-McCay, 2002). Dissolved hydrocarbons are taken up by organisms directly from the water column by absorption through external surfaces and gills, as well as through the digestive tract. Thus, soluble hydrocarbons are termed “bioavailable”.

Hydrocarbon compounds vary in water-solubility and the toxicity exerted by individual compounds is inversely related to solubility, however bioavailability will be modified by the volatility of individual compounds (Nirmalakhandan & Speece, 1988; Blum & Speece, 1990; McCarty, 1986; McCarty et al., 1992a, 1992b; Mackay et al., 1992; McCarty & Mackay, 1993; Verhaar et al., 1992, 1999; Swartz et al., 1995; French-McCay, 2002; McGrath and Di Toro, 2009). Of the soluble compounds, the greatest contributor to toxicity for water-column and benthic organisms are the lower-molecular-weight aromatic compounds, which are both volatile and soluble in water. Although they are not the most water-soluble hydrocarbons within most oil types, the polynuclear aromatic hydrocarbons (PAHs) containing 2-3 aromatic ring structures typically exert the largest narcotic effects because they are semi-soluble and not highly volatile, so they persist in the environment long enough for significant accumulation to occur (Anderson et al., 1974, 1987; Neff & Anderson, 1981; Malins & Hodgins, 1981; McAuliffe, 1987; NRC, 2003). The monoaromatic hydrocarbons (MAHs), including the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), and the soluble alkanes (straight chain hydrocarbons) also contribute to toxicity, but these compounds are highly volatile, so that their contribution will be low when oil is exposed to evaporation and higher when oil is discharged at depth where volatilisation does not occur (French-McCay, 2002).

French-McCay (2002) reviewed available toxicity data, where marine biota was exposed to dissolved hydrocarbons prepared from oil mixtures, finding that 95% of species and life stages exhibited 50% population mortality ($LC_{50}$) between 6 and 400 ppb total PAH concentration after 96 hrs exposure, with an average of 50 ppb. Hence, concentrations lower than 6 ppb total PAH value should be protective of 97.5% of species and life stages even with exposure periods of days (at least 96 hours). Early life-history stages of fish appear to be more sensitive than older fish stages and invertebrates.

Exceedances of 10, 50 or 400 ppb over a 1 hour timestep (see Table 7.4) was applied to indicate increasing potential for sub-lethal to lethal toxic effects (or low to high), based on NOPSEMA (2019).

#### 7.2.3.2 Entrained Hydrocarbons

Entrained hydrocarbons consist of oil droplets that are suspended in the water column and insoluble. As such, insoluble compounds in oil cannot be absorbed from the water column by aquatic organisms, hence are not bioavailable through absorption of compounds from the water. Exposure to these compounds would require routes of uptake other than absorption of soluble compounds. The route of exposure of organisms to whole oil alone include direct contact with tissues of organisms and uptake of oil by direct consumption, with potential for biomagnification through the food chain (NRC, 2005).

The 10 ppb threshold represents the very lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC & ARMCANZ (2000) water quality guidelines. Due to the requirement for relatively long exposure times (>24 hours) for these concentrations to be significant, they are likely to be more meaningful for juvenile fish, larvae and planktonic

organisms that might be entrained (or otherwise moving) within the entrained plumes, or when entrained hydrocarbons adhere to organisms or trapped against a shoreline for periods of several days or more.

This exposure zone is not considered to be of significant biological impact and is therefore outside the adverse exposure zone. This exposure zone represents the area contacted by the spill. This area does not define the area of influence as it is considered that the environment will not be affected by the entrained hydrocarbon at this level.

Thresholds of 10 ppb and 100 ppb were applied over a 1-hour time exposure (Table 7.4), to cover the range of thresholds outlined in ANZECC & ARMCANZ (2000) water quality guidelines, the incremental change for greater potential effect and is per NOPSEMA (2019).

A complicating factor that should be considered when assessing the consequence of dissolved and entrained oil distributions is that there will be some areas where both physically entrained oil droplets and dissolved hydrocarbons co-exist. Higher concentrations of each will tend to occur close to the source where sea conditions can force mixing of relatively unweathered oil into the water column, resulting in more rapid dissolution of soluble compounds.

**Table 7.4 Dissolved and entrained hydrocarbon exposure values assessed over a 1-hour time step, as per NOPSEMA (2019).**

| | Exposure level | In-water threshold (ppb) | Description |
|---|---|---|---|
| Dissolved hydrocarbons | Low | 10 | Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers |
| | Moderate | 50 | Approximates potential toxic effects, particularly sublethal effects to sensitive species |
| | High | 400 | Approximates toxic effects including lethal effects to sensitive species |
| Entrained hydrocarbons | Low | 10 | Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers |
| | High | 100 | As appropriate given oil characteristics for informing risk evaluation |

# 8 HYDROCARBON PROPERTIES

## 8.1 Physical Properties

An exploration well has been drilled within the Annie field with hydrocarbon properties being known for that location. Annie condensate has a higher residuals profile when compared with other offset fields representing a more conservative analogue and therefore Annie condensate was selected for all scenarios modelled in this assessment. While a comprehensive oil assay for Annie-1 condensate was provided by the client (Core Lab RFL 201903231), it should be noted that essential data pertaining to the pour point, dynamic viscosity, and aromatic content for distinct boiling point ranges were absent from the dataset. Consequently, a pragmatic approach was adopted to supplement these missing values by sourcing relevant information from the Minerva condensate assay data. Minerva condensate is found in a nearby reservoir.

Table 8.1 and Table 8.2 present the physical properties and boiling point ranges of the condensate used in this study.

The Annie-1 condensate has an API of 41.0, density of 820.0 kg/m$^3$ (at 16 ºC), with low viscosity (1.063 cP at 20 ºC) classifying it as a Group II (light-persistent) oil according to the International Tankers Owners Pollution Federation (ITOPF, 2020) and US EPA/USCG classifications. The condensate comprises a significant portion of volatiles and semi- to low-volatiles (82.5% total) with 17.5% residual components. This means the condensate will evaporate readily when on the water surface, with the persistent components to remain on the water surface over time.

The boiling points (BP) are dictated by the length of the carbon chains, with the longer and more complex compounds having a higher boiling point, and therefore lower volatility and evaporation rate. Typical evaporation times once the hydrocarbons reach the surface and are exposed to the atmosphere are:

- Up to 12 hours for the $C_4$ to $C_{10}$ compounds (BP <180°C).
- Up to 24 hours for the $C_{11}$ to $C_{15}$ compounds (BP 180-265°C).
- Several days for the $C_{16}$ to $C_{20}$ compounds (BP 265-380°C).
- Not applicable for the residual compounds (BP >380°C), which will resist evaporation, persist in the marine environment for longer periods, and be subject to relatively slow degradation.

**Table 8.1 Physical properties.**

| Characteristic | Annie-1 Condensate |
|---|---|
| Density (kg/m$^3$) | 820.0 (@ 16 °C) |
| API | 41.0 |
| Dynamic viscosity (cP) | 1.063 (@ 20°C)* |
| Pour point (°C) | -30* |
| Wax Content (%) | 10.0 |
| Hydrocarbon property category | Group II |
| Hydrocarbon property classification | Light-Persistent |

**Table 8.2 Boiling point ranges.**

| Oil Type | Component | Volatile (%) | Semi-volatile (%) | Low-volatility (%) | Residual (%) |
|---|---|---|---|---|---|
| | Boiling point (°C) | <180 $C_4$ to $C_{10}$ | 180-265 $C_{11}$ to $C_{15}$ | 265-380 $C_{16}$ to $C_{20}$ | >380 >$C_{20}$ |
| **Annie-1 condensate** | % of total | 8.0 | 46.5 | 28.0 | 17.5 |

** data extracted from Minerva condensate assay*

## 8.2 Weathering Properties

### 8.2.1 Annie-1 Condensate

A series of model weathering tests were conducted to illustrate the potential behaviour of the condensate when exposed to idealised and representative environmental conditions:

- A 50 $m^3$ surface release over 1-hour under calm wind conditions (constant 5 knots), assuming low seasonal water temperature (15 °C) and ambient tidal and drift currents; and
- A 50 $m^3$ surface release over 1-hour under variable wind conditions (1-23 knots, drawn from representative data files), assuming low seasonal water temperature (15°C) and ambient tidal and drift currents.

Note, a surface release is used in the weathering test to solely focus on the weathering and fates of the hydrocarbons when exposed to atmospheric conditions.

The first case is indicative conditions that would not generate entrainment, while the second case represents conditions that would likely cause entrainment. Both scenarios provide examples of potential behaviour during a spill once the oil is on the sea surface.

The mass balance for the condensate under the constant 5 knot wind case (Figure 8.1) shows that 52.4% of the condensate is expected to evaporate within 24 hours. Under calm conditions, the majority of the remaining condensate on the water surface will weather at a slower rate due to being comprised of the less volatile, longer-chain compounds. Evaporation shall cease when only the residual compounds remain, and they will be subject to more gradual decay through biological and photochemical processes.

Under the variable-wind case (Figure 8.2), where the winds are of greater strength on average, entrainment of condensate into the water column is shown to increase. Approximately 24 hours after the spill, 70.1% of the mass is shown to have entrained and a further 23.8% has evaporated, leaving only a small proportion floating on the water surface (<1%).

The increased level of entrainment in the variable-wind case result in a higher percentage decaying at an approximate rate of ~2.5% per day with 17.8% after 7 days, compared to <0.7% per day and a total of 0.1% after 7 days for the constant-wind case. Given the proportion of entrained condensate and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over time scales of several weeks.

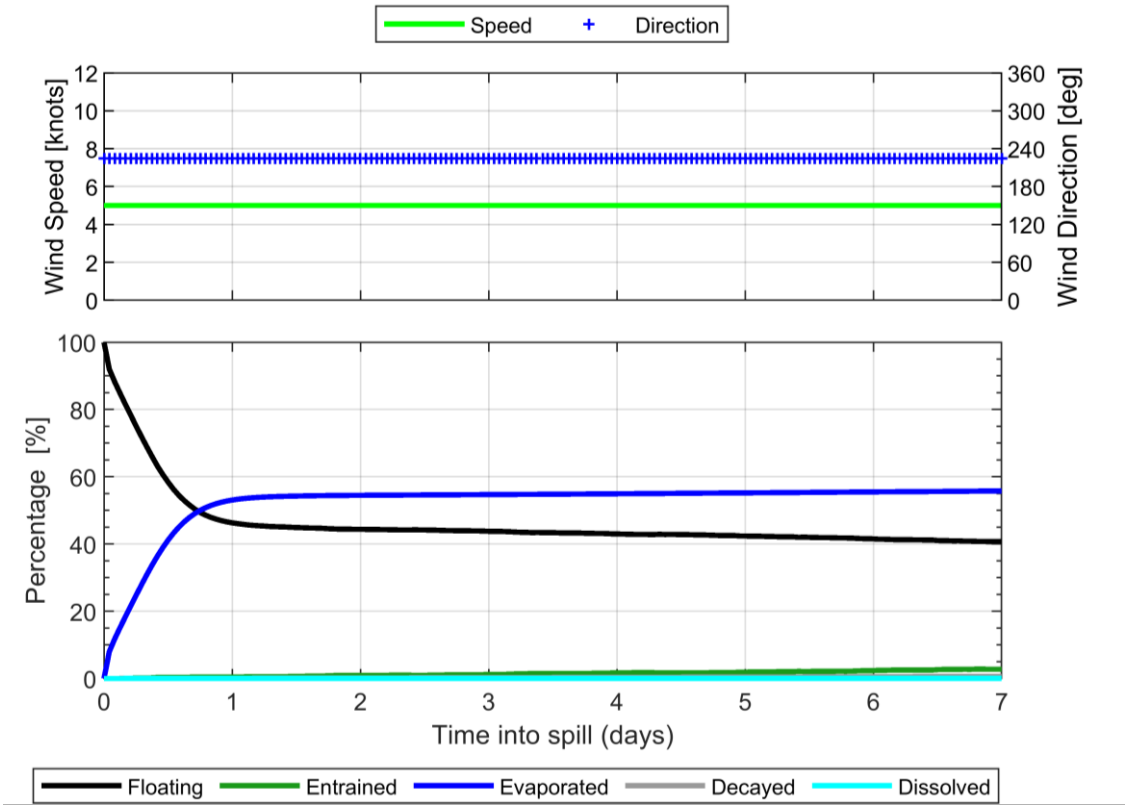



**Figure 8.1 Proportional mass balance plot representing the weathering of Annie-1 condensate spilled onto the water surface over 1-hour and subject to a constant 5 knots wind speed at 15°C water temperature.**

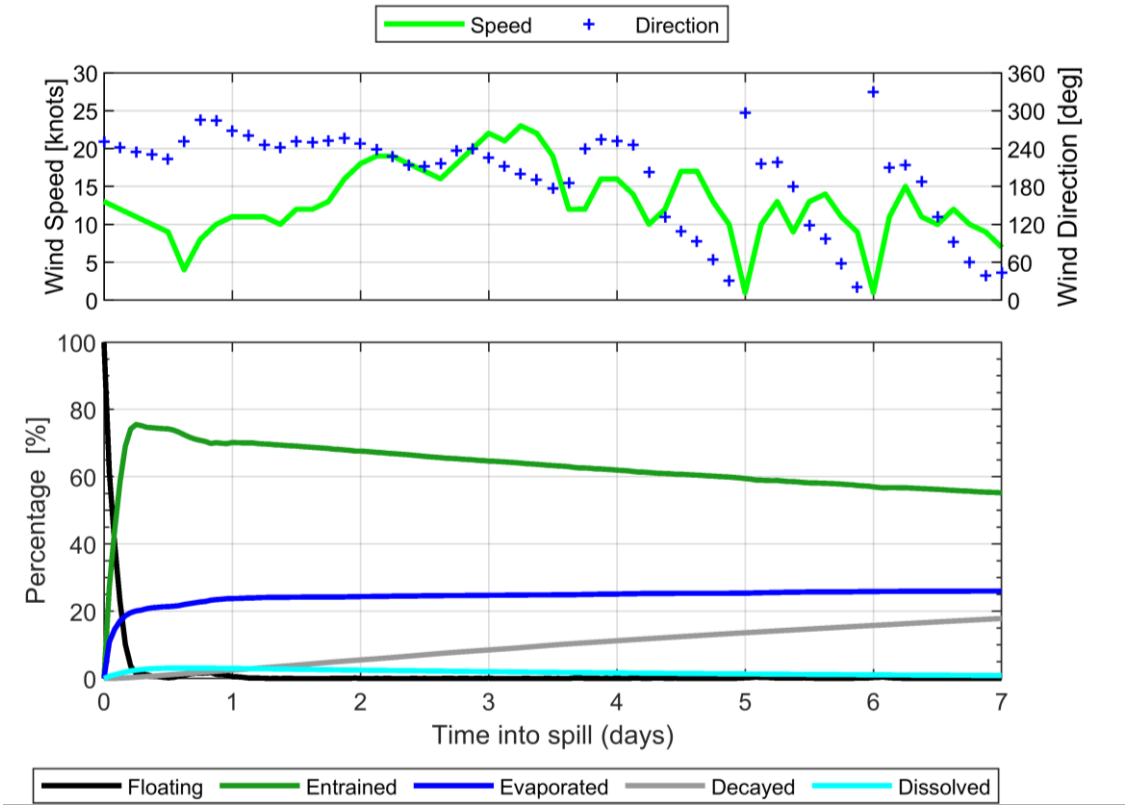



**Figure 8.2 Proportional mass balance plot representing the weathering of Annie-1 condensate spilled onto the water over 1-hour and subject to variable wind speeds (1-23 knots) at 15°C water temperature.**

# 9 MODEL SETTINGS

Table 9.1 provides a summary of the oil spill model settings.

**Table 9.1 Summary of the oil spill model settings and thresholds used in this assessment.**

| Parameter | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| Description | Loss of Well Control at Elanora-1 ST1 (Isabella) | Loss of Well Control at Pecten East-2 | Loss of Well Control at Annie-2 |
| Number of randomly selected spill start times | 100 per season (200 per scenario) | | |
| Model period | Summer (November to April)<br>Winter (May to October) | | |
| Hydrocarbon type for oil spill modelling only | Annie-1 condensate | | |
| Spill volume | 105,289 bbl (16,740 $m^3$) | 83,273 bbl (13,239 $m^3$) | 66,430 bbl (10,562 $m^3$) |
| Release type (subsurface, top of BOP stack (depth (m)) | 54 | 34 | 36 |
| Release duration (days)* | 102 | 102 | 104 |
| Simulation length (days) | 116 | | 118 |
| Surface oil concentration thresholds ($g/m^2$) ^ | 1 (low); 10 (moderate); 50 (high) | | |
| Shoreline oil accumulation thresholds ($g/m^2$) ^ | 10 (low); 100 (moderate); 1,000 (high) | | |
| Dissolved hydrocarbon concentrations (ppb) ^ | 10 (low); 50 (moderate); 400 (high) | | |
| Entrained hydrocarbon concentrations (ppb) ^ | 10 (low); 100 (high) | | |

^Thresholds based on NOPSEMA (2019)

* Note, the 104-day model duration for Scenario 3 relates to slightly more conservative response time for the relief well to kill Annie-2. This duration was carried over from the specifications of the original Annie-2 modelling.

# 10 PRESENTATION AND INTERPRETATION OF MODEL RESULTS

The results from the modelling study are presented in a number of tables and figures, which aim to provide an understanding of potential sea-surface and water column exposure and shoreline accumulation.

## 10.1 Annual Analysis

The statistics are based on the following principles:

- The ***greatest distance travelled by a spill trajectory*** – is determined by a) recording the maximum and b) second greatest distance travelled (or 99$^{th}$ percentile) by a single trajectory, within a scenario, from the release location to the identified exposure thresholds;
- The ***probability of oil exposure to a receptor*** – is determined by recording the number of spill trajectories to reach a specified sea surface or subsea threshold within a receptor polygon, divided by the total number of spill trajectories within that scenario;
- The ***minimum time before oil exposure to a receptor*** – is determined by ranking the elapsed time before sea surface exposure, at a specified threshold, to grid cells within a receptor polygon and recording the minimum value;
- The ***maximum residence time for oil exposure within a receptor*** – is determined by recording the longest continuous length of time a grid cell is exposed to either floating, entrained or dissolved hydrocarbon above each threshold, within a receptor;
- The ***probability of oil accumulation at a receptor*** – is determined by recording the number of spill trajectories to reach a specified shoreline accumulation threshold within a receptor polygon, divided by the total number of spill trajectories within that scenario;
- The ***maximum (total) volume of oil ashore*** – is the total volume of oil stranded on the shorelines throughout the duration of the simulation;
- The ***maximum potential oil loading within a receptor*** – is determined by identifying the maximum loading to any grid cell within a receptor polygon, for a scenario; and
- The ***dissolved and entrained hydrocarbon exposure*** – is determined by recording the maximum instantaneous concentrations at each grid cell.

## 10.2 Deterministic Trajectories

The stochastic modelling results were assessed for each scenario, and the deterministic runs were identified and are presented in the result section based on the following criteria.

a. Largest swept area for surface oil above 10 g/m$^2$;

b. Largest (total) volume of oil ashore;

c. Longest length of shoreline with oil accumulation above 100 g/m$^2$;

d. Largest area of entrained hydrocarbon exposure above 100 ppb; and

e. Largest area of dissolved hydrocarbon exposure above 50 ppb.

## 10.3 Receptors Assessed

A range of environmental receptors and shorelines were assessed for floating oil exposure, shoreline accumulation and water column exposure as part of the study (see Figure 10.1 to Figure 10.11). Receptor categories (see Table 10.1) include sections of shorelines which are defined by local government areas (LGAs), sub-LGAs and offshore islands. All other sensitive receptors other than submerged reefs, shoals and banks (RSB) were sourced from Australian Government Department of Climate Change, Energy, the Environment and Water (https://www.dcceew.gov.au/).

Risks of exposure were separately calculated for each sensitive receptor area and have been tabulated.

Table 10.2 summarises the receptors that the release locations reside within.

*RPS have utilised BIAs for the southern right whale that were delineated within the 2011-2021 Conservation Management Plan for the Southern Right Whale. The NCV Atlas now includes updated BIAs for SRW, though the recently drafted National Recovery Plan for the southern right whale has not been published. The updated BIAs have not been used in this report.*

**Table 10.1 Summary of receptors used to assess floating oil, shoreline and in-water exposure to hydrocarbons.**

| Receptor Category | Acronym | Hydrocarbon Exposure Assessment | | | Figure reference |
|---|---|---|---|---|---|
| | | Water Column | Floating oil | Shoreline | |
| Australian Marine Park | AMP | ✓ | ✓ | × | Figure 10.1 |
| Integrated Marine and Coastal Regionalisation Areas | IMCRA | ✓ | ✓ | × | Figure 10.2 |
| Marine National Park | MNP | ✓ | ✓ | × | Figure 10.3 |
| Marine Park | MP | ✓ | ✓ | × | Figure 10.4 |
| Nature Reserve | NR | ✓ | ✓ | × | Figure 10.5 |
| Ramsar | Ramsar | ✓ | ✓ | ✓ | Figure 10.6 |
| Reefs, Shoals and Banks | RSB | ✓ | ✓ | × | Figure 10.7 |
| Key Ecological Feature | KEF | ✓ | ✓ | × | Figure 10.8 |
| State Waters | State Waters | ✓ | ✓ | × | n/a |
| Local and Sub-Local Government Area | LGA and Sub-LGA | ✓ (Reported as: Nearshore Waters) | ✓ (Reported as: Nearshore Waters) | ✓ (Reported as: Shore) | Figure 10.9 to Figure 10.11 |

**Table 10.2 Summary of the receptors that the release locations reside within for each scenario.**

| Acronym | Receptor Name | Scenario | | |
|---|---|---|---|---|
| | | Scenario 1 | Scenario 2 | Scenario 3 |
| BIA | Antipodean Albatross - Foraging | ✓ | ✓ | ✓ |
| | Black-browed Albatross - Foraging | ✓ | ✓ | ✓ |
| | Bullers Albatross - Foraging | ✓ | ✓ | ✓ |
| | Campbell Albatross - Foraging | ✓ | ✓ | ✓ |
| | Common Diving-petrel - Foraging | ✓ | ✓ | ✓ |
| | Indian Yellow-nosed Albatross - Foraging | ✓ | ✓ | ✓ |
| | Pygmy Blue Whale - Distribution | ✓ | ✓ | ✓ |
| | Pygmy Blue Whale - Foraging | ✓ | ✓ | ✓ |
| | Pygmy Blue Whale - Foraging annual high use area | ✓ | ✓ | ✓ |
| | Shy Albatross - Foraging | ✓ | ✓ | ✓ |
| | Southern Right Whale - Aggregation | × | ✓ | × |
| | Southern Right Whale - Known Core Range | ✓ | ✓ | ✓ |
| | Wandering Albatross - Foraging | ✓ | ✓ | ✓ |
| | Wedge-tailed Shearwater - Foraging | ✓ | ✓ | ✓ |
| | White Shark - Distribution | ✓ | ✓ | ✓ |
| IMCRA | Otway | ✓ | ✓ | ✓ |

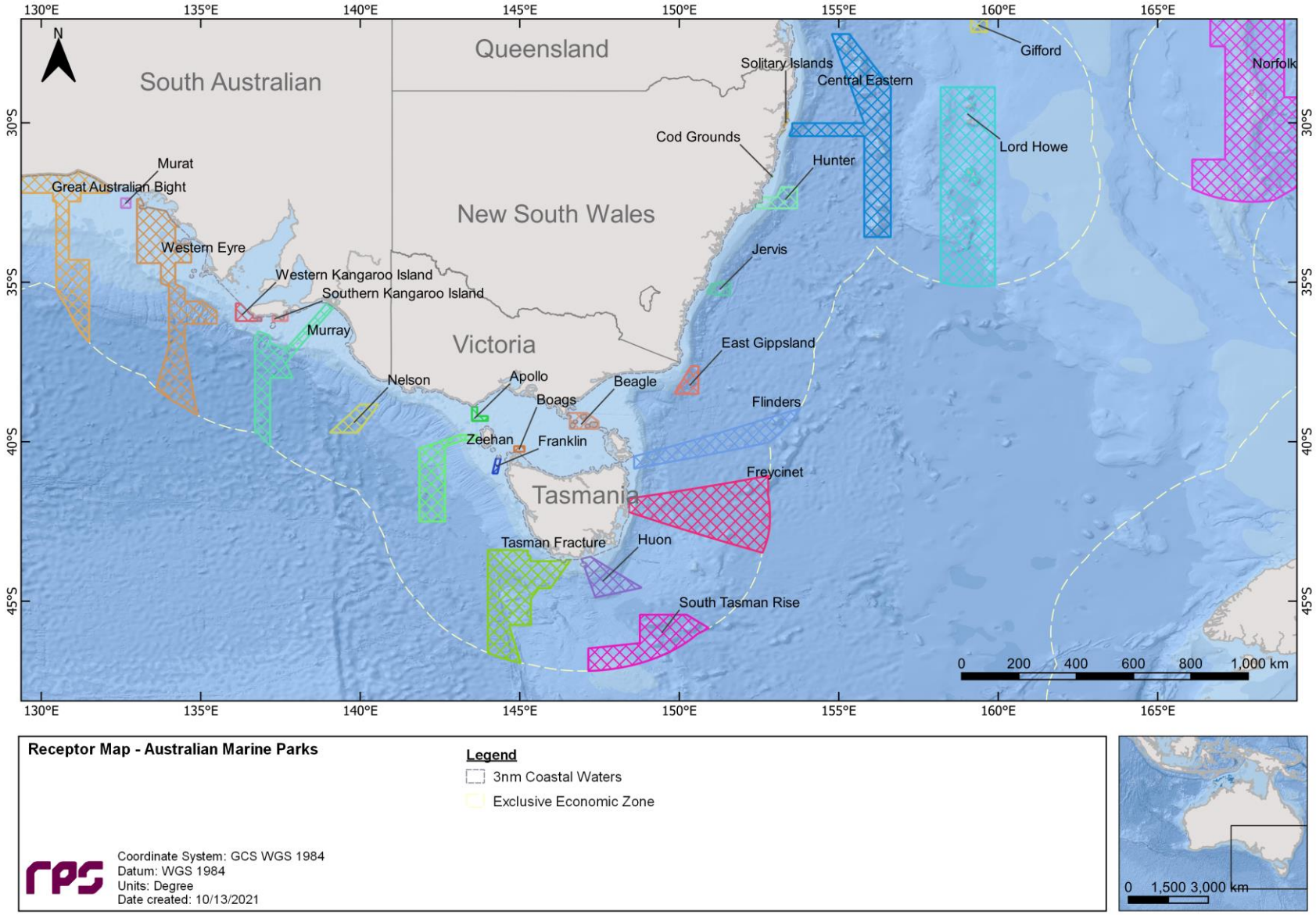



**Figure 10.1 Receptor map for Australian Marine Parks (AMP).**

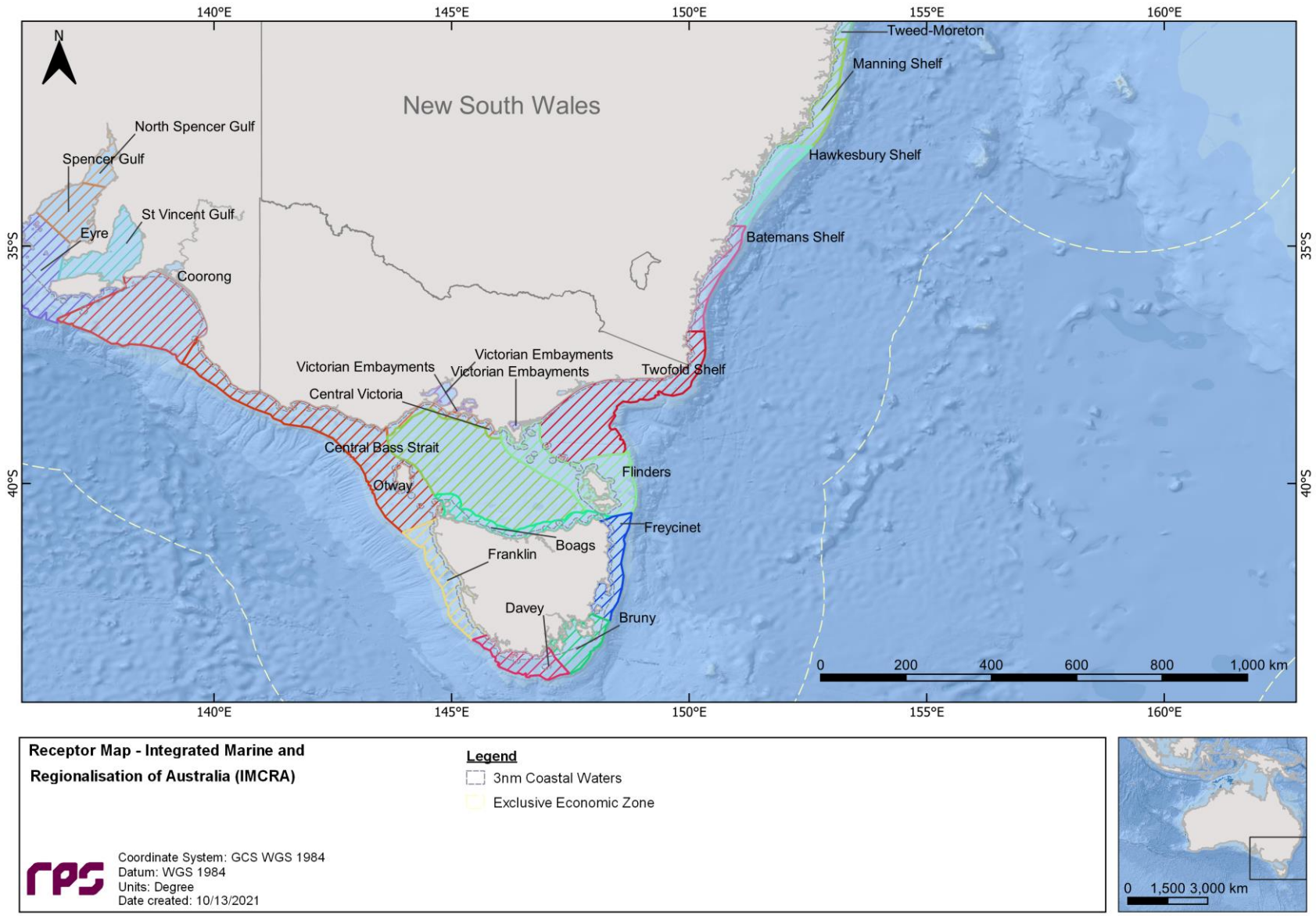



**Figure 10.2 Receptor map for integrated marine and coastal regionalisation (IMCRA) areas.**

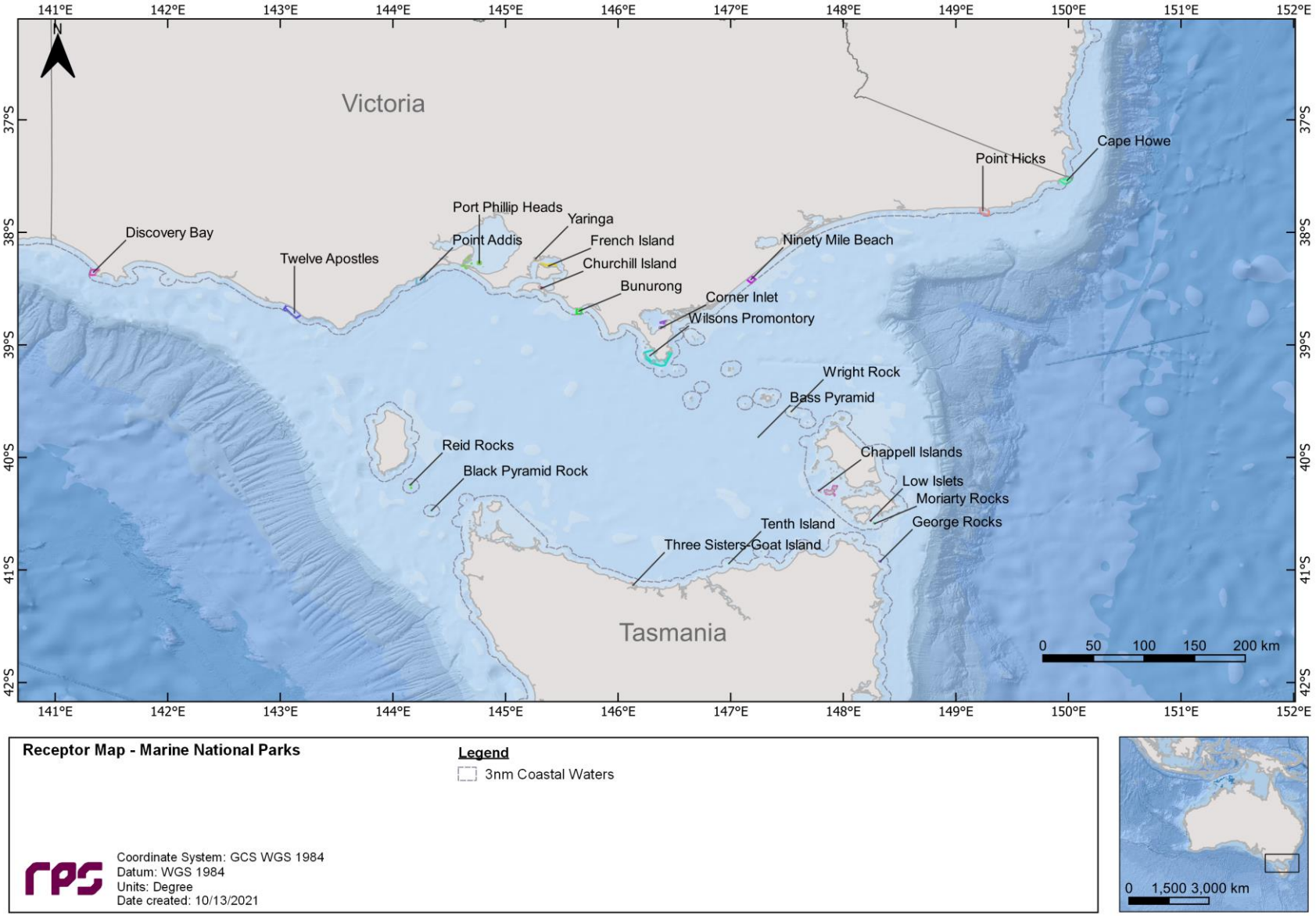



**Figure 10.3 Receptor map for Marine National Parks (MNP).**

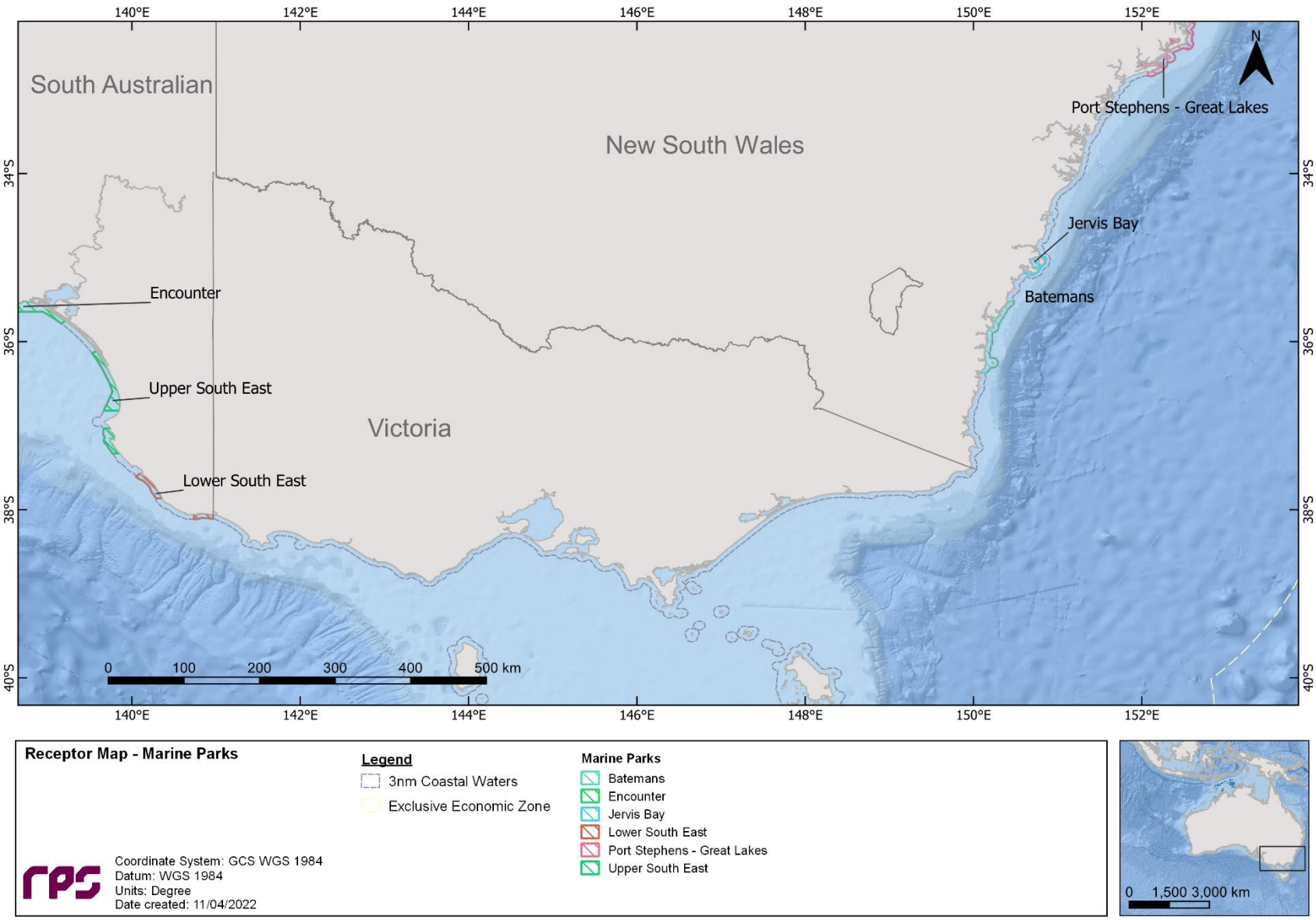



**Figure 10.4 Receptor map for Marine Parks (MP).**

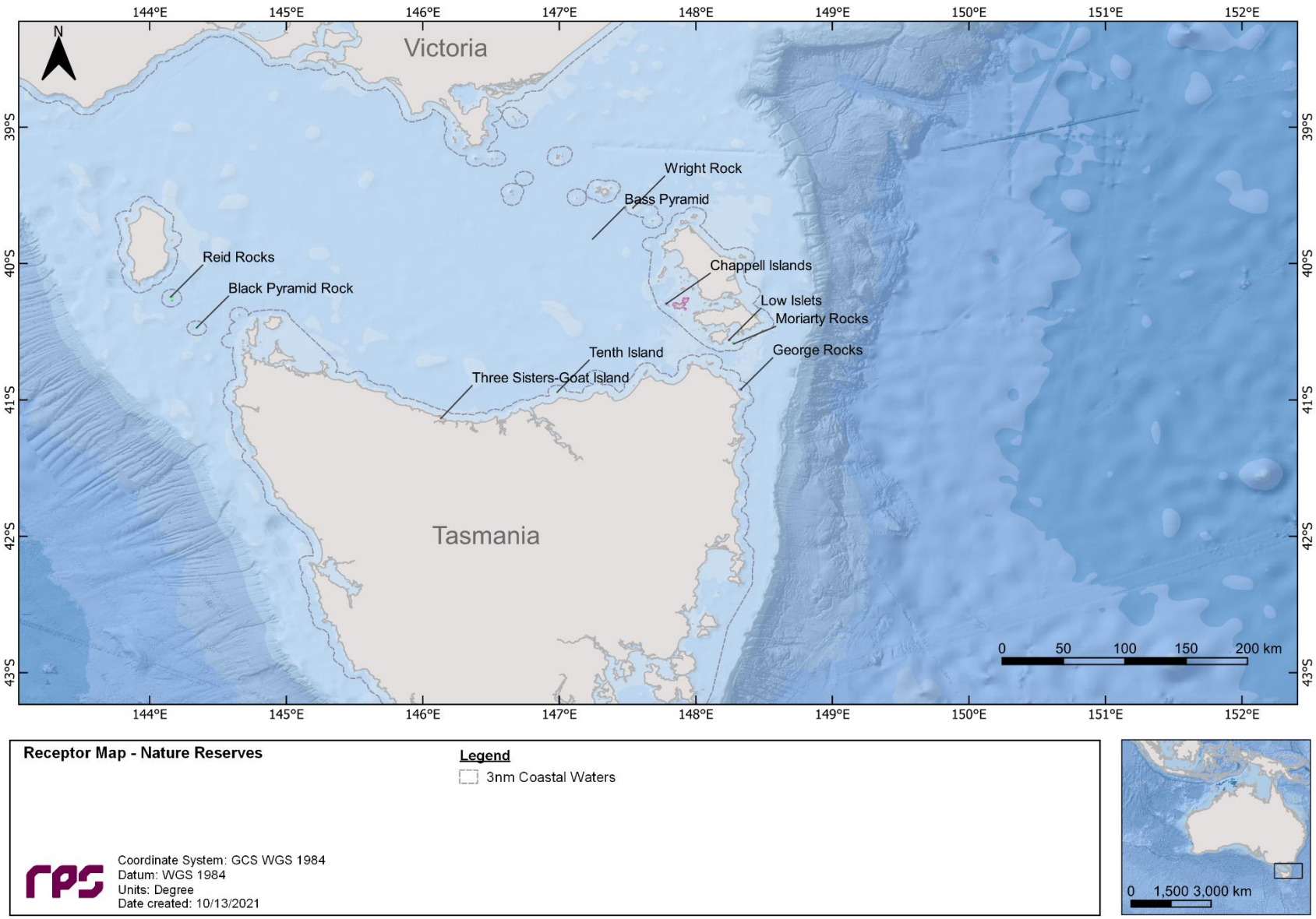



**Figure 10.5 Receptor map for Nature Reserves (NR).**

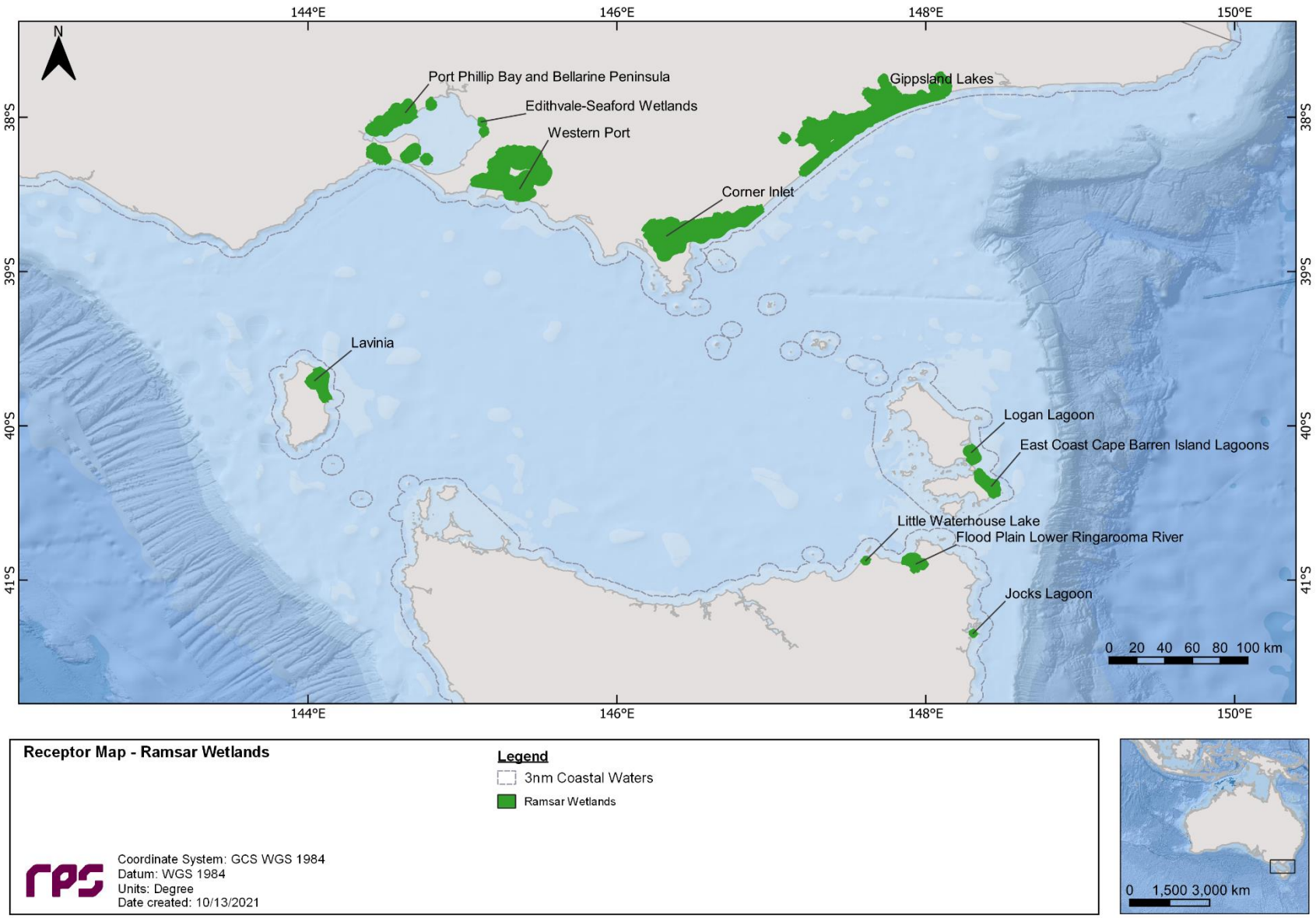



**Figure 10.6 Receptor map for Ramsar Sites (Ramsar).**

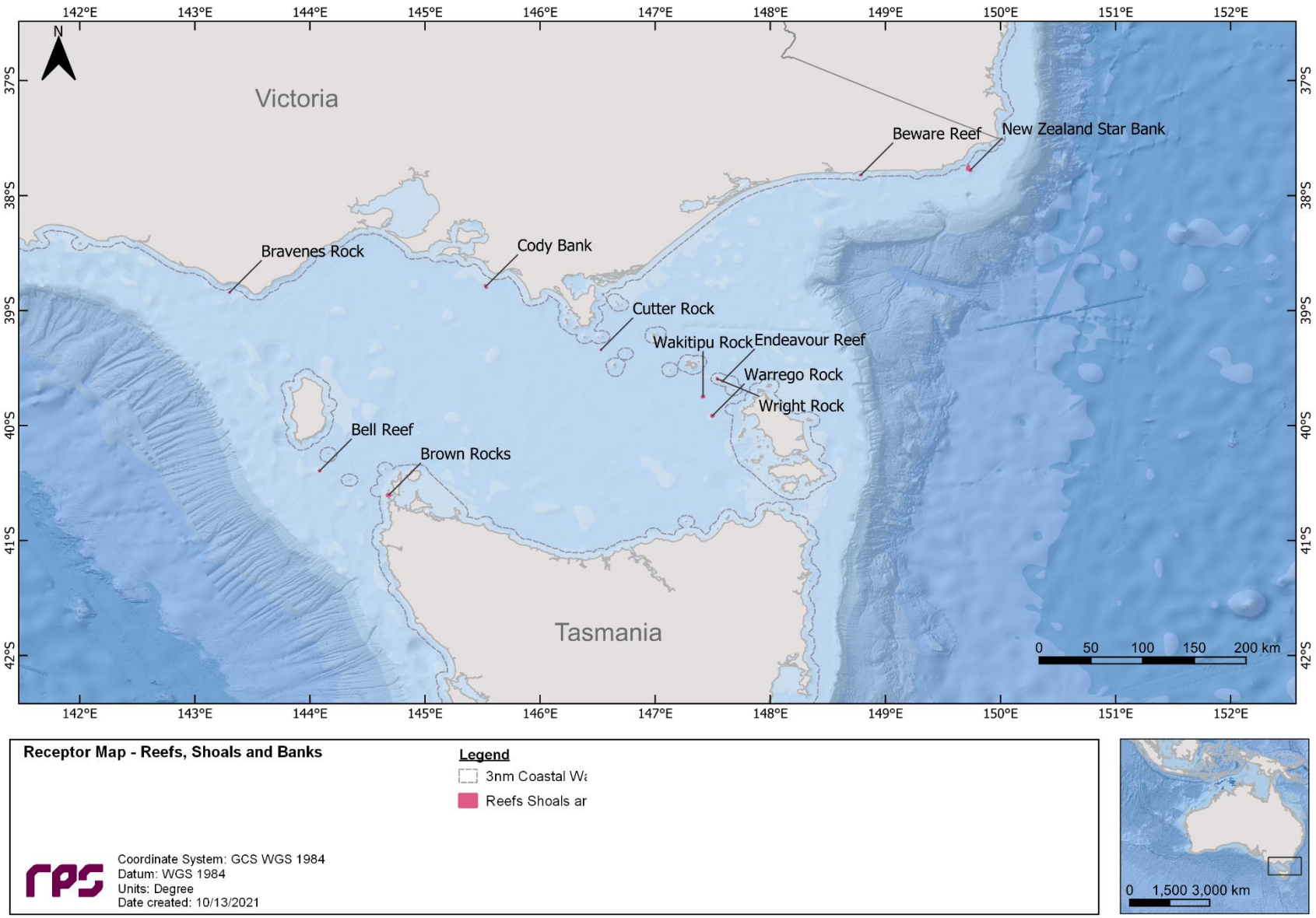



**Figure 10.7 Receptor map for Reefs, Shoals and Banks (RSB).**

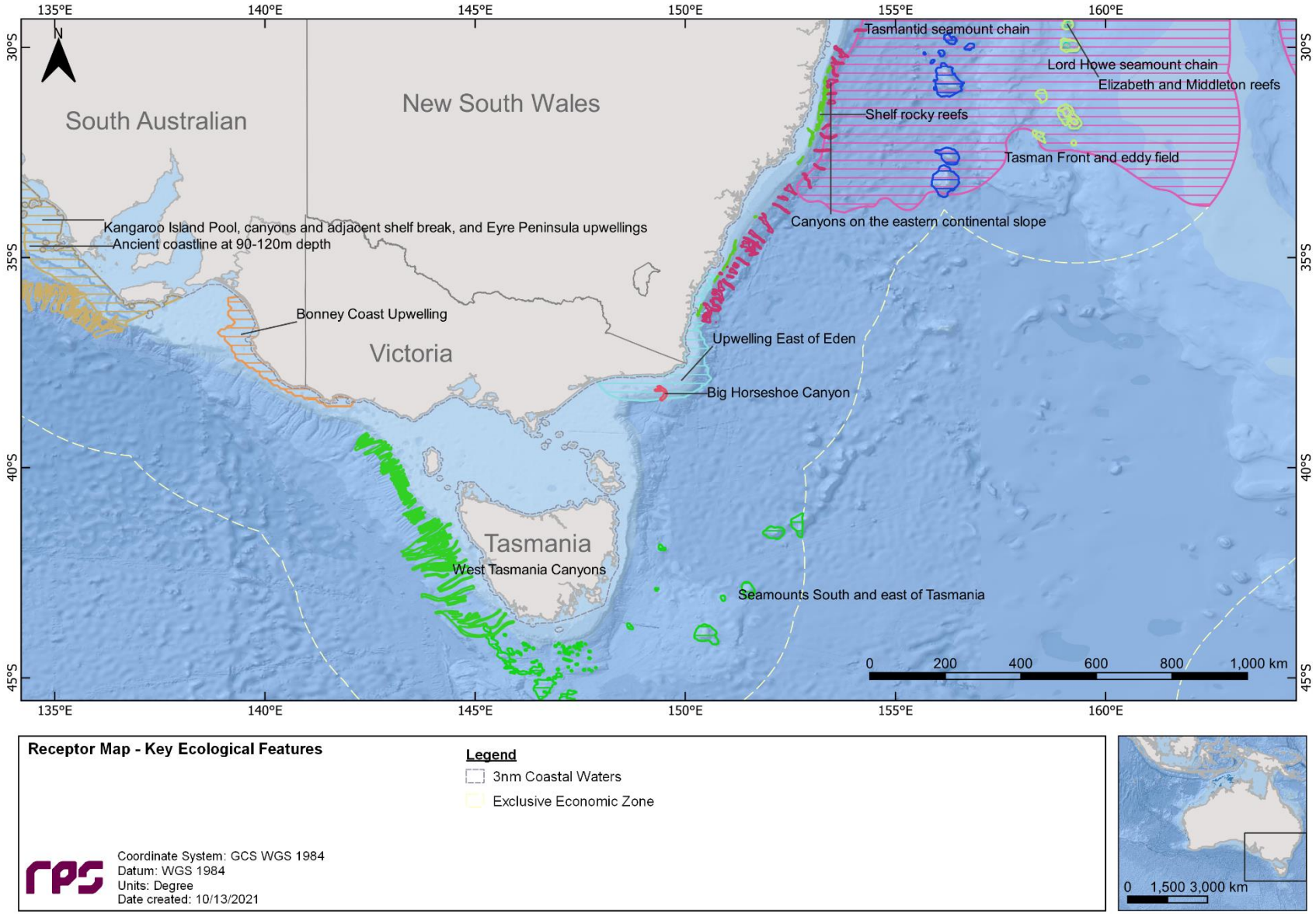



**Figure 10.8 Receptor map for Key Ecological Features (KEF).**

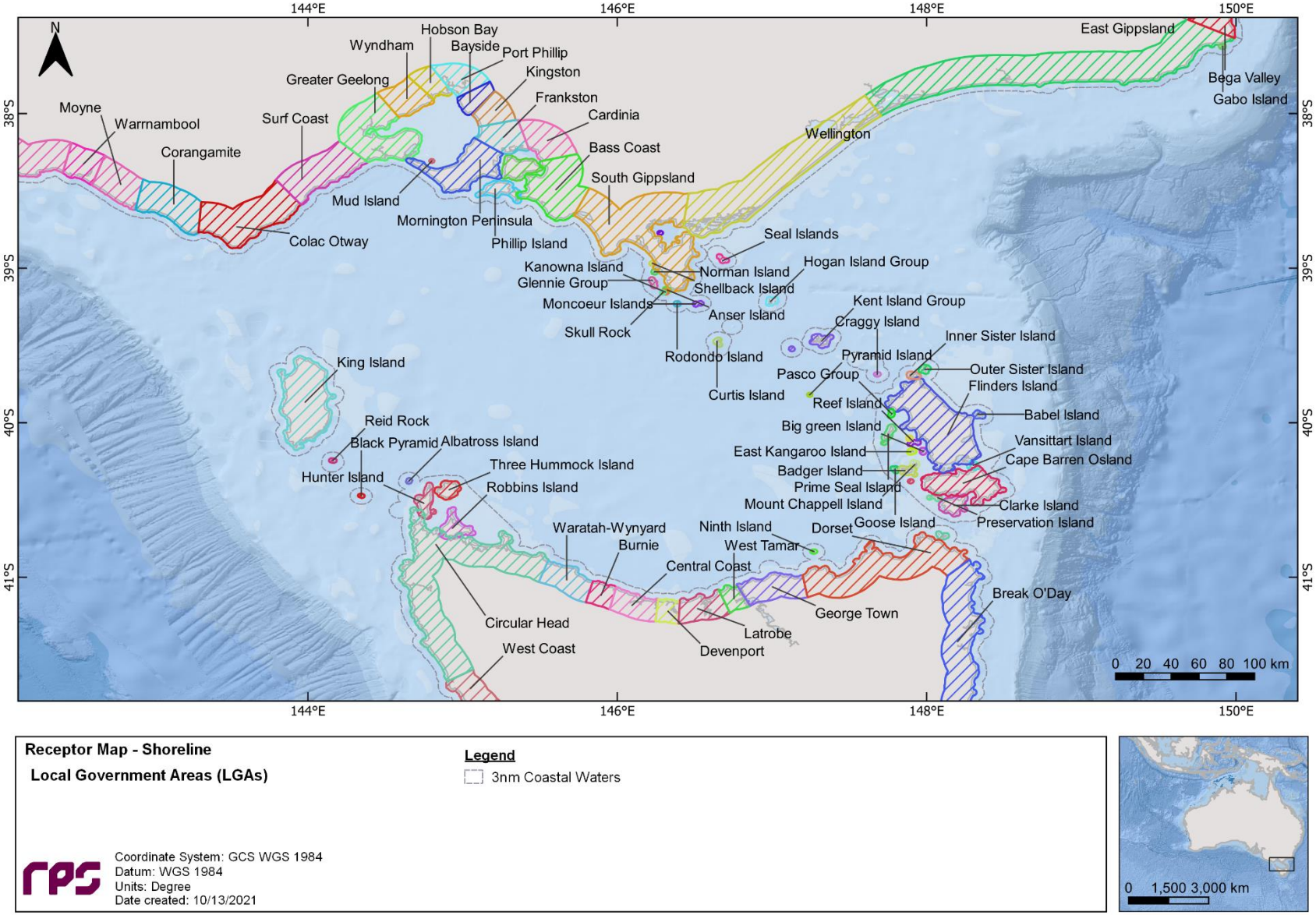



**Figure 10.9 Receptor map for shorelines (1 of 3).**

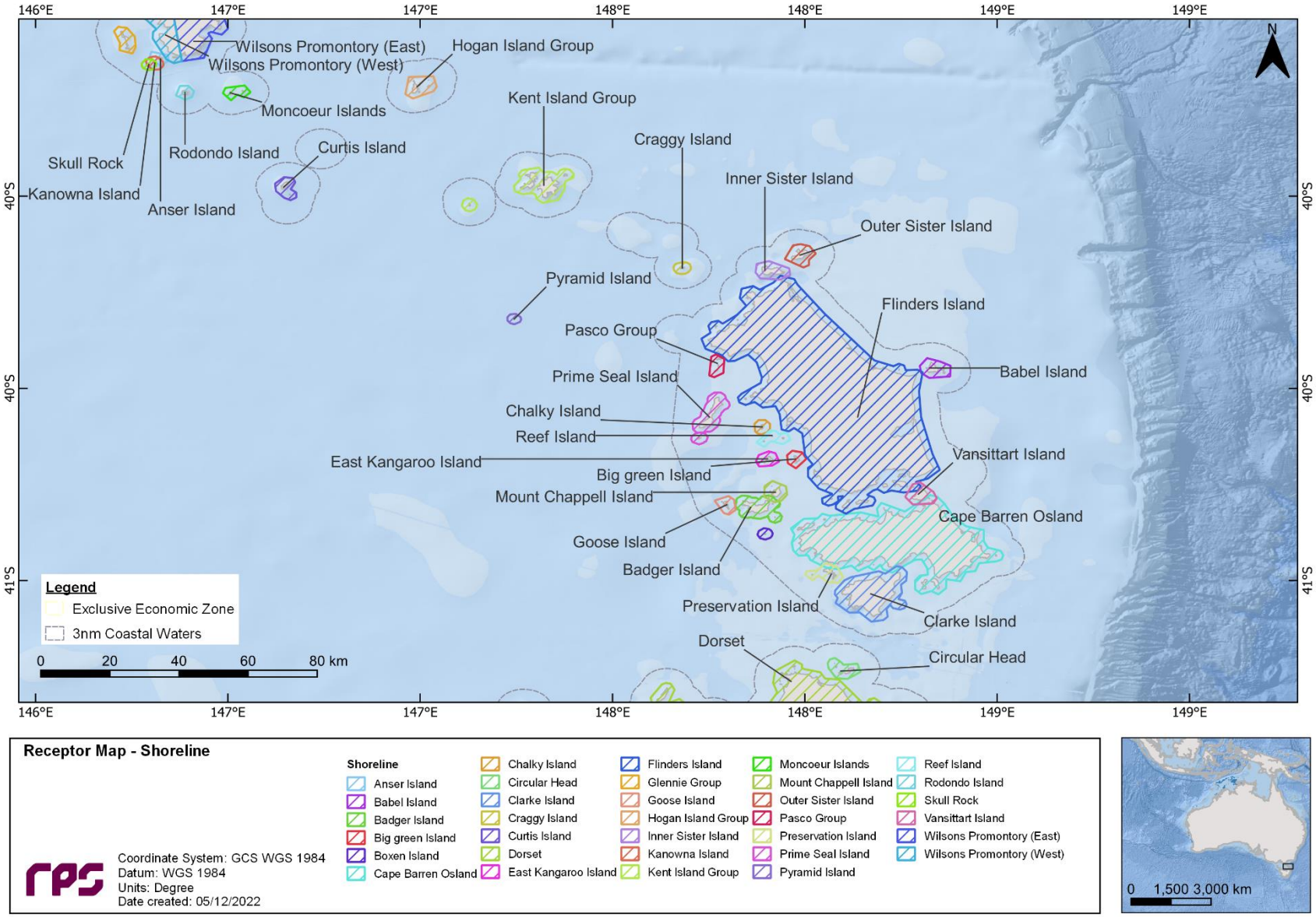



**Figure 10.10 Receptor map for shorelines (2 of 3).**

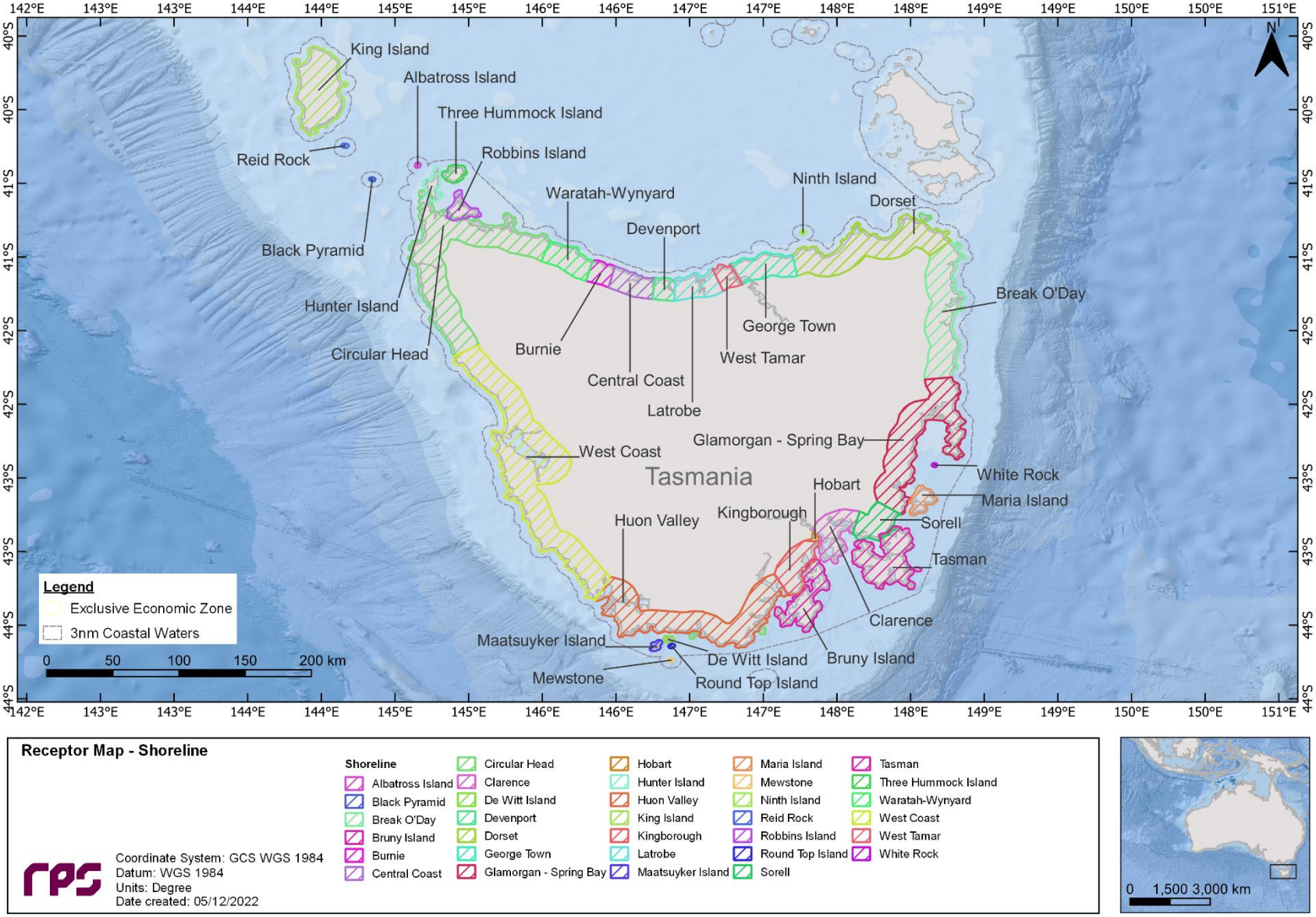



**Figure 10.11 Receptor map for shorelines (3 of 3).**

# 11 RESULTS – SCENARIO 1 – 105,289 BBL (16,740 M$^3$) SUBSURFACE RELEASE FROM A LOSS OF WELL CONTROL AT ELANORA-1 ST1

This scenario examined a 105,289 bbl (16,740 m$^3$) subsurface release of condensate over 102 days to represent a LOWC scenario at Elanora-1 ST1 well. A total of 100 spill simulations were run per season (summer and winter) and each simulation was tracked for 116 days. The results are presented on a seasonal basis.

Sections 11.1 and 11.2 present the seasonal stochastic analysis and deterministic analysis results, respectively.

## 11.1 Stochastic Analysis

### 11.1.1 Floating Oil Exposure

Table 11.1 summarises the maximum distance travelled by floating oil on the sea surface at each threshold. The maximum distance and corresponding direction from the release location to the low (1–10 g/m$^2$) and moderate (10–50 g/m$^2$) exposure zones was 75.7 km (east, winter) and 11.7 km (east-southeast, summer), respectively. No high (>50 g/m$^2$) exposure zones were predicted during either summer or winter conditions.

Table 11.2 summarises the potential floating oil exposure to individual receptors.

During summer, a total of 16 Biologically Important Areas (BIAs) were predicted to be exposed to floating oil at, or above, the low threshold. Excluding the BIAs that the release location resides within (see Section 10.3), the highest probability (40%) of low exposure was predicted at the Southern Right Whale – Aggregation BIA. The minimum time before low exposure to the Southern Right Whale – Aggregation BIA was 3.21 days.

Contrastingly, during winter, excluding the BIAs that the release location resides within (see Section 10.3), the highest probability (54%) of low exposure for any BIA was revealed at the Short-tailed Shearwater - Foraging BIA. Additionally, the minimum time before low exposure to the Southern Right Whale – Aggregation was 1.38 days.

Table 11.3 presents the maximum residence time of floating oil exposure for each individual grid cell within each individual receptor.

Figure 11.1 and Figure 11.2 present the zones of potential floating oil exposure per season whilst Figure 11.3 to Figure 11.6 present the maximum residence time of floating oil exposure for the NOPSEMA thresholds.

**Table 11.1 Maximum distance and direction from the release location to the edge of floating oil exposure. Results are based on a 105,289 bbl (16,740 m$^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations per season.**

| Distance and direction travelled | Zones of potential floating oil exposure | | | | | |
|---|---|---|---|---|---|---|
| | Summer | | | Winter | | |
| | Low | Moderate | High | Low | Moderate | High |
| Maximum distance (km) from release location | 74.0 | 11.7 | - | 75.7 | 9.8 | - |
| Maximum distance (km) from release location (99$^{th}$ percentile) | 48.0 | 11.3 | - | 68.4 | 9.3 | - |
| Direction | E | ESE | - | E | NW | - |

**Table 11.2 Summary of the potential floating oil exposure to individual receptors. Results are based on a 105,289 bbl (16,740 $m^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | |
| | | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High |
| BIA | Antipodean Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Black-browed Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Bullers Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Campbell Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Common Diving-petrel - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Pygmy Blue Whale - Distribution* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Pygmy Blue Whale - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Short-tailed Shearwater - Foraging | 21 | - | - | 4.54 | - | - | 54 | - | - | 6.71 | - | - |
| | Shy Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Southern Right Whale – Aggregation | 40 | - | - | 3.21 | - | - | 47 | - | - | 1.38 | - | - |
| | Southern Right Whale - Known Core Range* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Wandering Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Wedge-tailed Shearwater - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | White Shark - Distribution* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| IBRA | Otway Plain | 21 | - | - | 4.54 | - | - | 53 | - | - | 6.71 | - | - |
| | Otway Ranges | 1 | - | - | 25.21 | - | - | 8 | - | - | 12.25 | - | - |
| | Warrnambool Plain | 12 | - | - | 7.75 | - | - | 16 | - | - | 6.92 | - | - |
| IMCRA | Otway* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| MNP | Twelve Apostles | 8 | - | - | 32.92 | - | - | 8 | - | - | 6.92 | - | - |

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | |
| | | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High |
| Nearshore Waters | Colac Otway | 21 | - | - | 4.54 | - | - | 54 | - | - | 6.71 | - | - |
| | Corangamite | 12 | - | - | 7.75 | - | - | 16 | - | - | 6.92 | - | - |
| | Moyne | - | - | - | - | - | - | 3 | - | - | 11.13 | - | - |
| | Warrnambool | - | - | - | - | - | - | 1 | - | - | 12.25 | - | - |
| State Waters | Victoria State Waters* | 30 | - | - | 4.54 | - | - | 56 | - | - | 6.71 | - | - |
| Nearshore Waters (Sub-LGA) | Bay of Islands | - | - | - | - | - | - | 3 | - | - | 11.13 | - | - |
| | Cape Otway West | 21 | - | - | 4.54 | - | - | 54 | - | - | 6.71 | - | - |
| | Childers Cove | - | - | - | - | - | - | 1 | - | - | 12.25 | - | - |
| | Moonlight Head | 8 | - | - | 27.92 | - | - | 11 | - | - | 6.92 | - | - |
| | Port Campbell | 4 | - | - | 7.75 | - | - | 7 | - | - | 11.17 | - | - |

*The release location resides within the receptor boundaries.

**Table 11.3 Summary of the maximum residence time of floating oil exposure for each individual grid cell within each individual receptor. Results are based on a 105,289 bbl (16,740 $m^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum residence time of floating oil exposure (days) | | | Maximum residence time of floating oil exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High |
| BIA | Antipodean Albatross - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Black-browed Albatross - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Bullers Albatross - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Campbell Albatross - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Common Diving-petrel - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Pygmy Blue Whale - Distribution* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Pygmy Blue Whale - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Short-tailed Shearwater - Foraging | 0.58 | - | - | 0.83 | - | - |
| | Shy Albatross - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Southern Right Whale – Aggregation | 0.54 | - | - | 0.71 | - | - |
| | Southern Right Whale - Known Core Range* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Wandering Albatross - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | Wedge-tailed Shearwater - Foraging* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| | White Shark - Distribution* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| IBRA | Otway Plain | 0.58 | - | - | 0.83 | - | - |
| | Otway Ranges | 0.13 | - | - | 0.21 | - | - |
| | Warrnambool Plain | 0.46 | - | - | 0.63 | - | - |
| IMCRA | Otway* | 16.21 | 1.21 | - | 17.29 | 1.21 | - |
| MNP | Twelve Apostles | 0.25 | - | - | 0.5 | - | - |
| Nearshore Waters | Colac Otway | 0.58 | - | - | 0.83 | - | - |
| | Corangamite | 0.46 | - | - | 0.63 | - | - |
| | Moyne | - | - | - | 0.46 | - | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum residence time of floating oil exposure (days) | | | Maximum residence time of floating oil exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High |
| | Warrnambool | - | - | - | 0.04 | - | - |
| State Waters | Victoria State Waters* | 0.58 | - | - | 0.83 | - | - |
| Nearshore Waters (Sub-LGA) | Bay of Islands | - | - | - | 0.46 | - | - |
| | Cape Otway West | 0.58 | - | - | 0.83 | - | - |
| | Childers Cove | - | - | - | 0.04 | - | - |
| | Moonlight Head | 0.21 | - | - | 0.5 | - | - |
| | Port Campbell | 0.46 | - | - | 0.63 | - | - |

*The release location resides within the receptor boundaries.

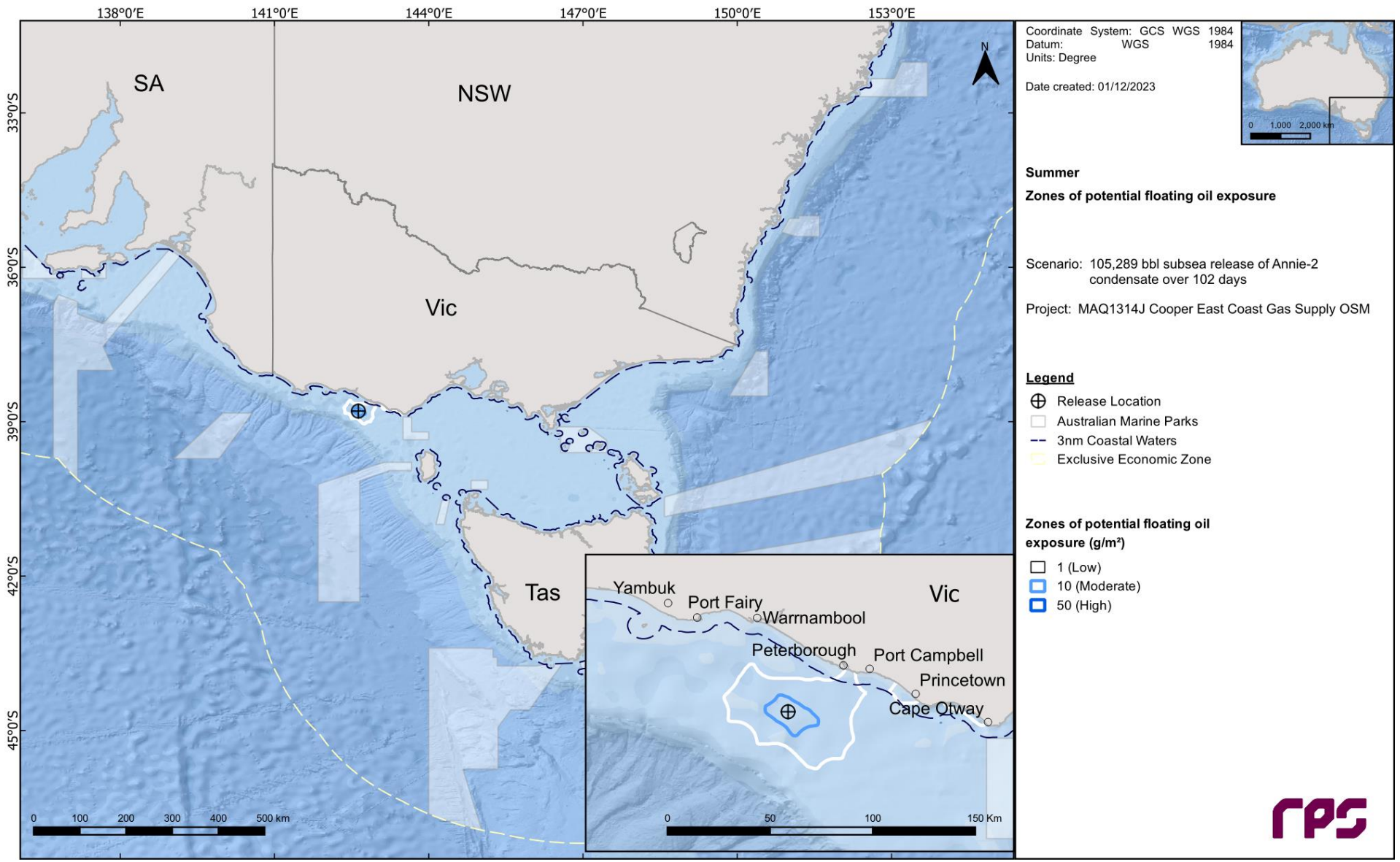



**Figure 11.1 Zones of potential floating oil exposure in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

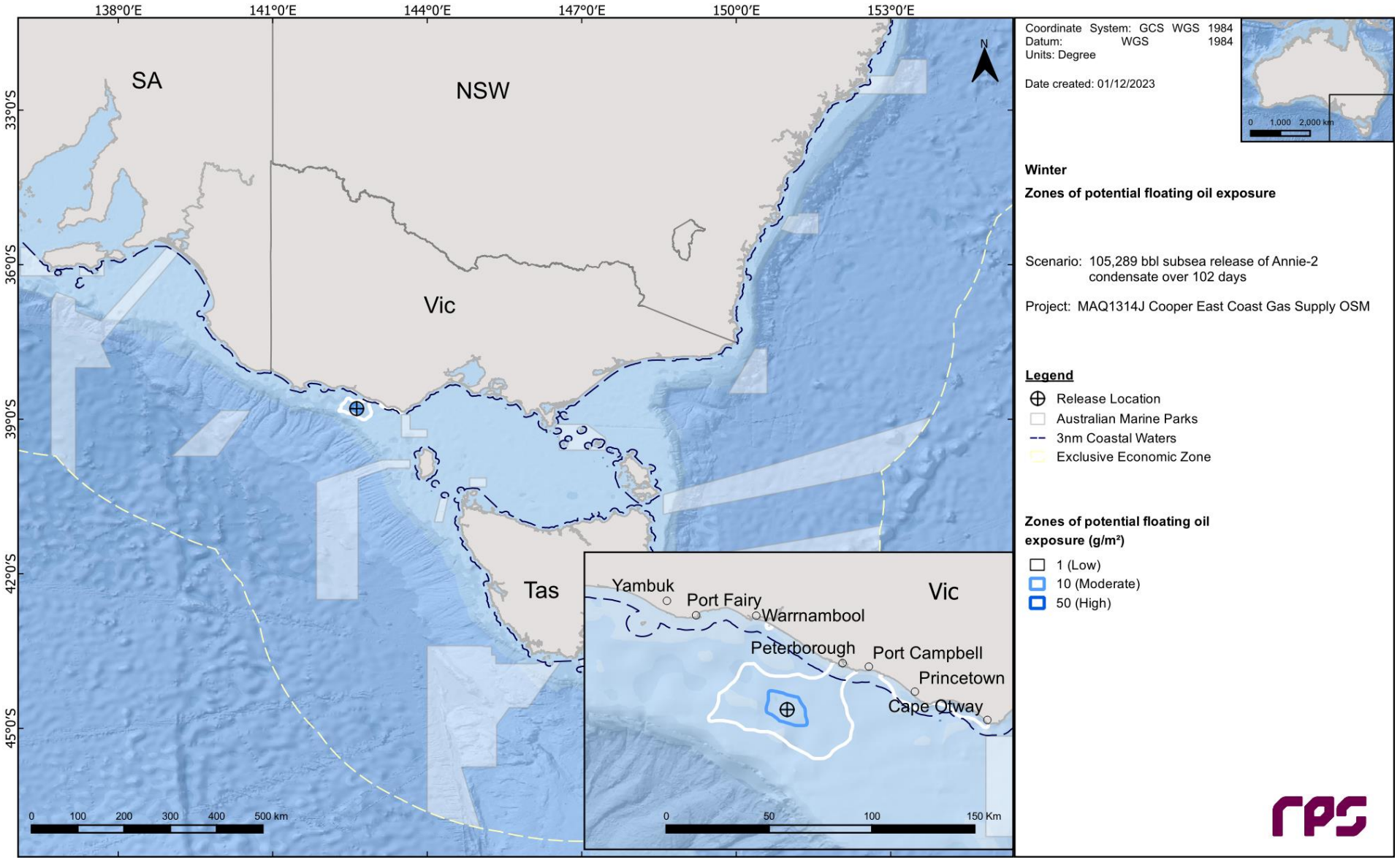



**Figure 11.2 Zones of potential floating oil exposure in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

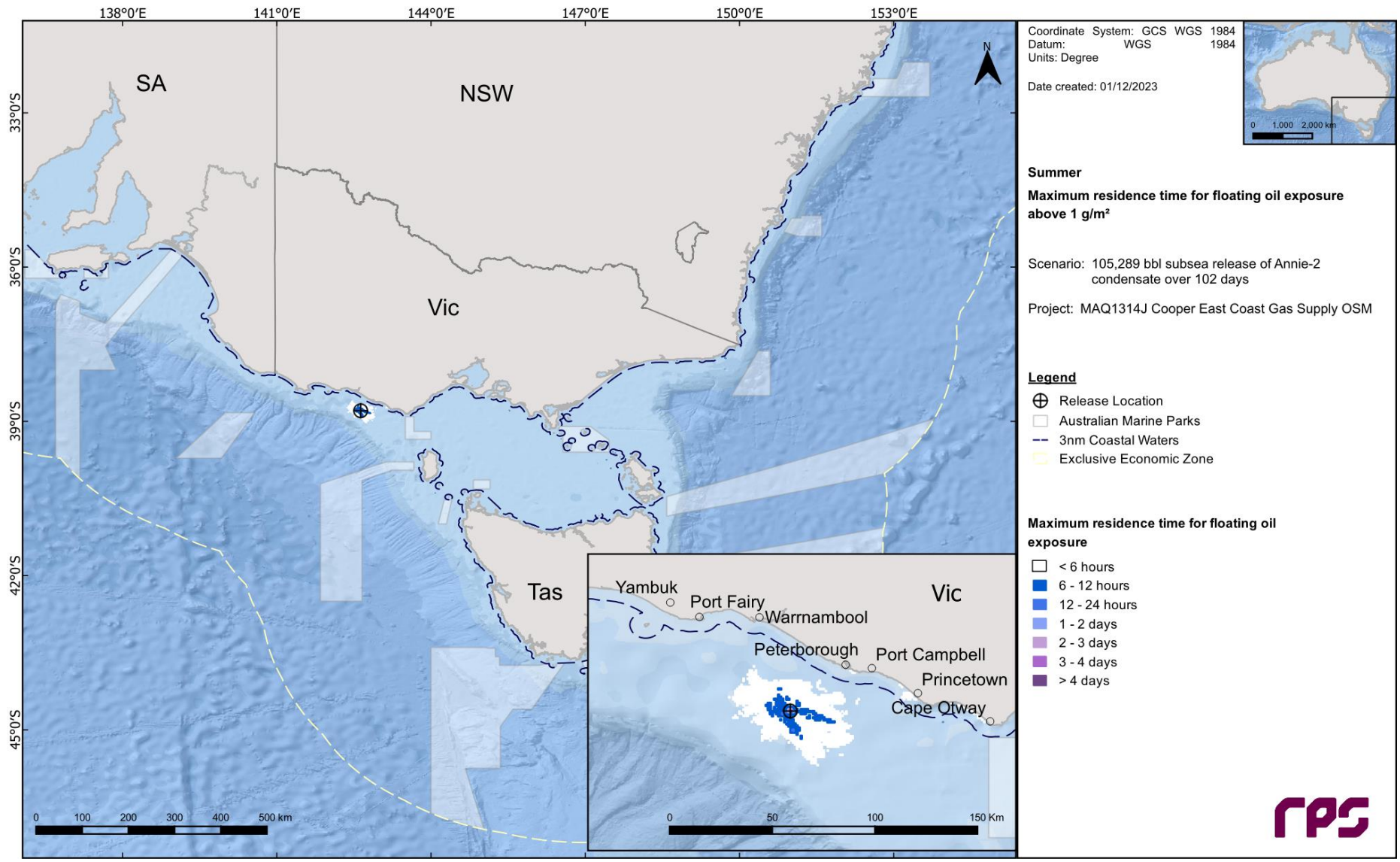



**Figure 11.3 Maximum residence time of floating oil exposure above 1 g/m$^2$, in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

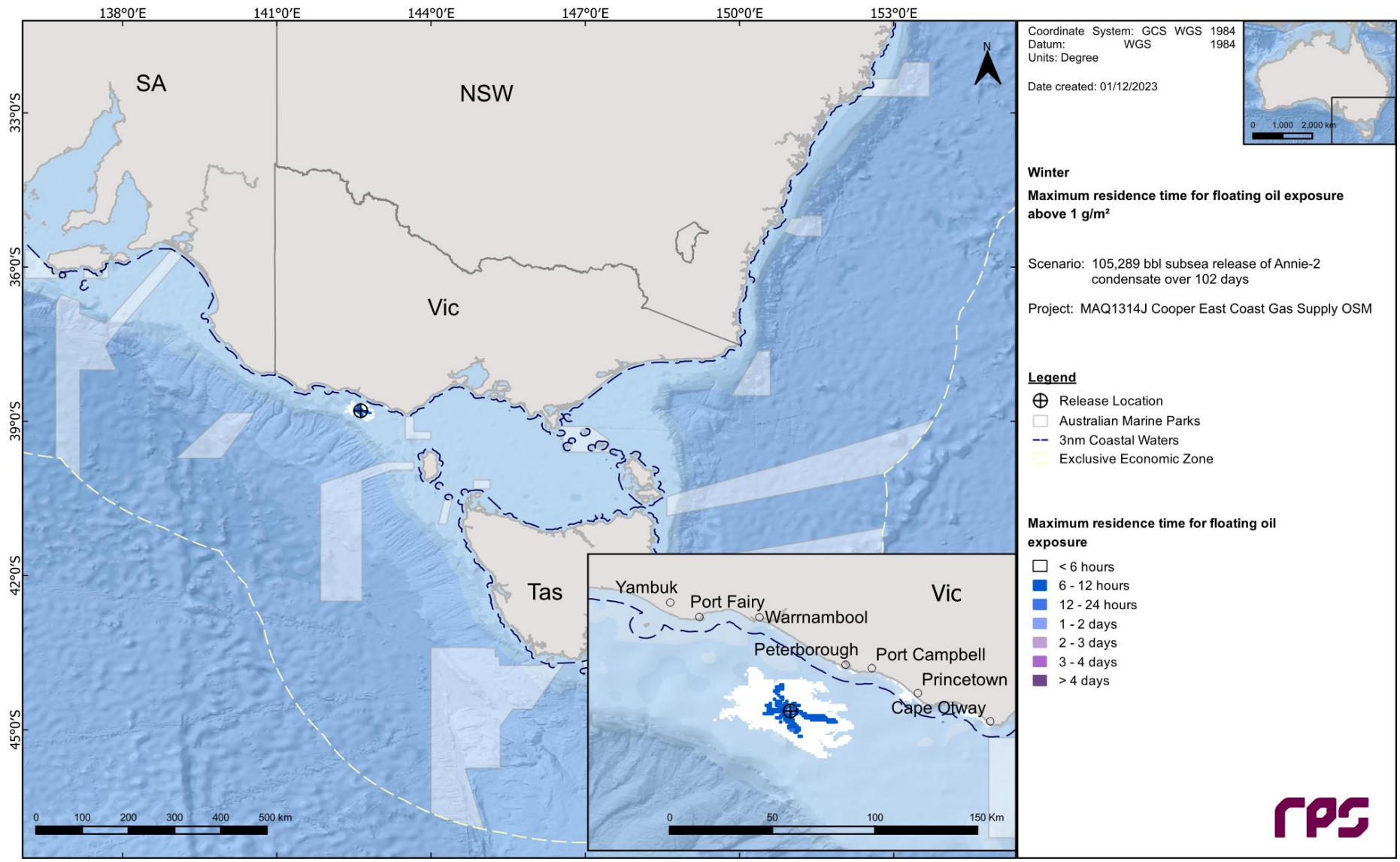



**Figure 11.4 Maximum residence time of floating oil exposure above 1 g/m$^2$, in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

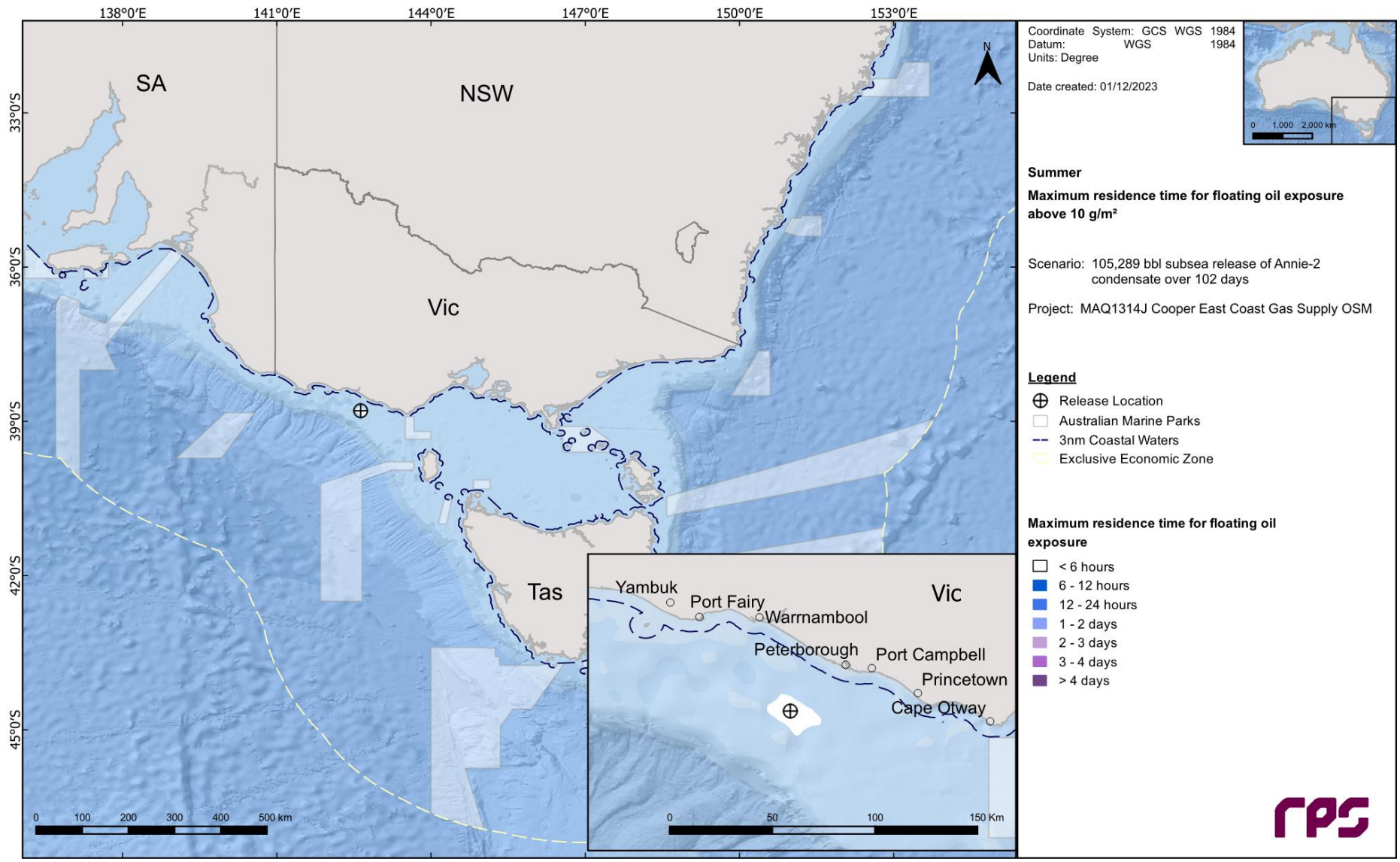



**Figure 11.5 Maximum residence time of floating oil exposure above 10 g/m$^2$, in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

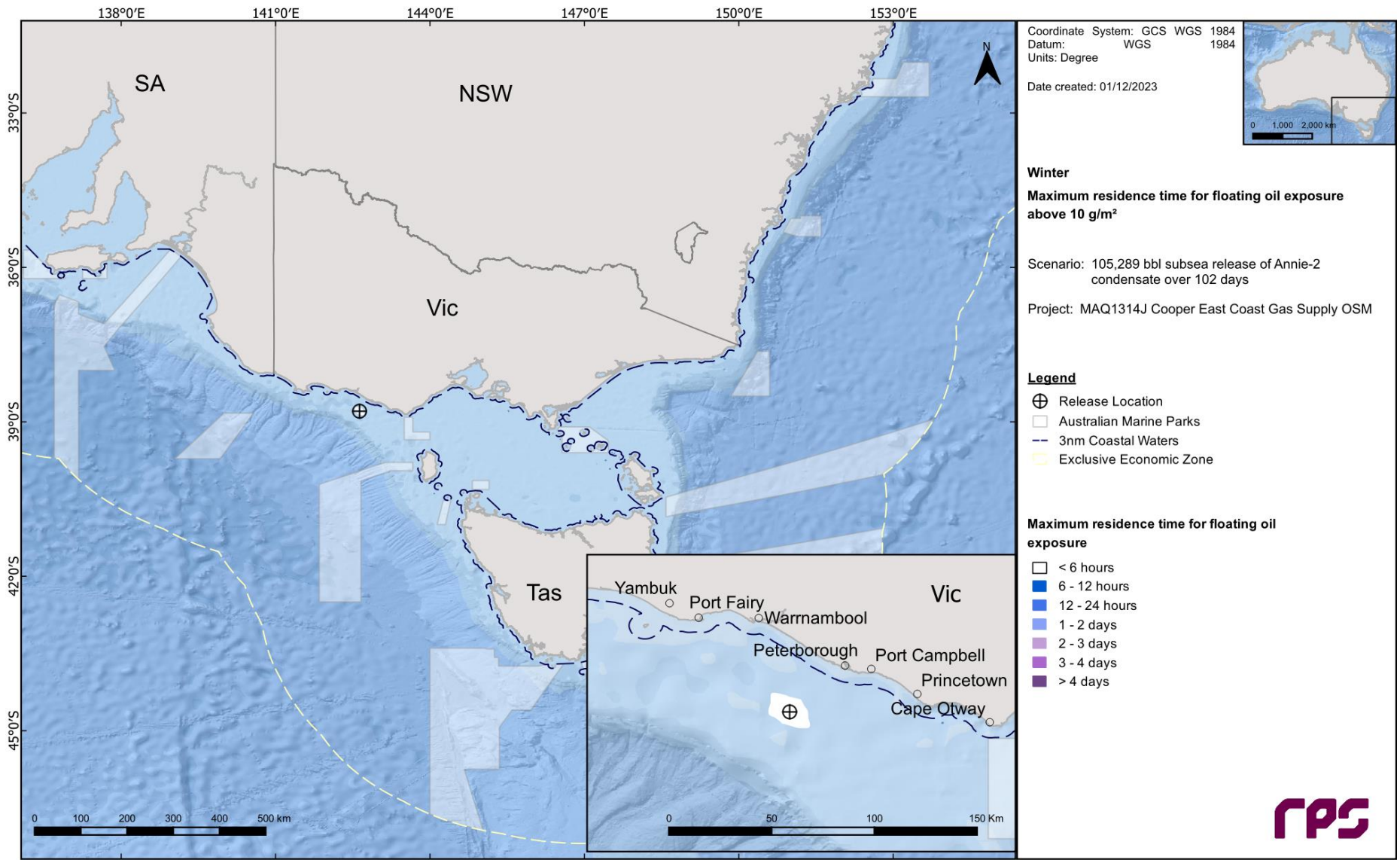



**Figure 11.6 Maximum residence time of floating oil exposure above 10 g/m$^2$, in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

### 11.1.2 Shoreline Accumulation

Table 11.4 presents a summary of the potential shoreline accumulation. The probability of accumulation to any shoreline at, or above, the low (10 g/m$^2$) threshold was 100% throughout the year. The minimum time before oil accumulation at, or above, the low threshold was 1.83 days (winter). The maximum total volume ashore for a single spill trajectory was 251.0 m$^3$, and the maximum length of shoreline with accumulation above the low, moderate and high thresholds were 295.0 km, 48.0 km and 1.0 km, respectively, all occurring during winter.

Table 11.5 and Table 11.6 summarises the shoreline accumulation on individual receptors during summer and winter, respectively.

During summer, the shoreline segment of Colac Otway LGA as well as the Cape Otway West sub-LGA had the highest probability of accumulation above the low (99%) and moderate (69%) thresholds. Bay of Islands and Moyne also revealed a 1% probability of accumulation above the high threshold. The minimum time for low threshold shoreline accumulation was 3.38 days for the Corangamite shoreline segment.

Through winter, the shoreline segment of Colac Otway as well as the Cape Otway West sub-LGA had the highest probability of accumulation above the low and moderate thresholds (100% and 85%, respectively). Again, only few receptors revealed a 1% probability of accumulation above the high threshold. The minimum time for low threshold shoreline accumulation was 1.83 days for the Bay of Islands and Moyne shoreline segments.

The maximum potential shoreline loadings above each shoreline thresholds are presented in Figure 11.7 and Figure 11.8 for summer and winter, respectively.

**Table 11.4 Summary of oil accumulation across all shorelines. Results are based on a 105,289 bbl (16,740 m$^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations per season.**

| Shoreline Statistics | Summer | Winter |
|---|---|---|
| Probability of accumulation on any shoreline (%) | 100 | 100 |
| Absolute minimum time for visible oil to shore (days) | 3.38 | 1.83 |
| Maximum total volume of hydrocarbons ashore (m$^3$) | 189.6 | 251.0 |
| Average total volume of hydrocarbons ashore (m$^3$) | 68.0 | 98.8 |
| Maximum length of the shoreline at **10 g/m$^2$** (km) | 264.0 | 295.0 |
| Average shoreline length (km) at **10 g/m$^2$** (km) | 109.8 | 142.2 |
| Maximum length of the shoreline at **100 g/m$^2$** (km) | 37.0 | 48.0 |
| Average shoreline length (km) at **100 g/m$^2$** (km) | 12.4 | 18.3 |
| Maximum length of the shoreline at **1,000 g/m$^2$** (km) | 1.0 | 1.0 |
| Average shoreline length (km) at **1,000 g/m$^2$** (km) | 1.0 | 1.0 |

**Table 11.5 Summary of oil accumulation on individual shoreline receptors. Results are based on a 105,289 bbl (16,740 $m^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

| Shoreline Receptor | | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| LGA Shoreline | Anglesea | 22 | 1 | - | 16.88 | 67.13 | - | 5 | 100 | 1.4 | 12.3 | 5.9 | 0.9 | - | 19.1 | 0.9 | - |
| | Anser Island | 20 | - | - | 18.75 | - | - | 6 | 68 | 0.5 | 1.8 | 2.6 | - | - | 3.6 | - | - |
| | Apollo Bay | 90 | 11 | - | 5.13 | 52.54 | - | 13 | 167 | 4.6 | 18.5 | 10.7 | 2.3 | - | 23.6 | 4.5 | - |
| | Bass Coast | 3 | - | - | 92.71 | - | - | 2 | 22 | 0.3 | 1.1 | 1.2 | - | - | 1.8 | - | - |
| | Bay of Islands | 81 | 30 | 1 | 5.54 | 17.88 | 106.67 | 19 | 1,068 | 6.7 | 69.5 | 12.9 | 3 | 0.9 | 28.2 | 10.9 | 0.9 |
| | Bega Valley | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Colac Otway | 99 | 69 | - | 3.58 | 6.58 | - | 24 | 686 | 26.8 | 78.6 | 35.5 | 7.1 | - | 72.7 | 20 | - |
| | Corangamite | 95 | 55 | - | 3.38 | 6.79 | - | 23 | 415 | 16.6 | 54.5 | 24.5 | 5.6 | - | 49.1 | 15.4 | - |
| | Curtis Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | East Gippsland | 23 | - | - | 16.29 | - | - | 3 | 55 | 1.3 | 3.9 | 3.9 | - | - | 7.3 | - | - |
| | French Island | 10 | - | - | 19.08 | - | - | 2 | 36 | 0.2 | 0.8 | 1.2 | - | - | 1.8 | - | - |
| | Gabo Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Glenelg | 41 | - | - | 8.08 | - | - | 5 | 83 | 3.9 | 12.8 | 10.7 | - | - | 27.3 | - | - |
| | Glennie Group | 25 | - | - | 16.96 | - | - | 5 | 55 | 0.7 | 3.4 | 3.4 | - | - | 9.1 | - | - |
| | Grant | 7 | - | - | 27.83 | - | - | 2 | 18 | 0.6 | 1.3 | 1.2 | - | - | 1.8 | - | - |
| | Greater Geelong | 16 | - | - | 19.5 | - | - | 3 | 80 | 0.9 | 4.8 | 5.6 | - | - | 15.4 | - | - |
| | Hogan Island Group | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Kanowna Island | 13 | - | - | 18.75 | - | - | 4 | 37 | 0.3 | 1.7 | 2.9 | - | - | 4.5 | - | - |
| | Kent Island Group | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | King Island | 29 | - | - | 17.79 | - | - | 2 | 64 | 1.4 | 6.9 | 4.4 | - | - | 17.3 | - | - |
| | Lady Julia Percy Island | 45 | 1 | - | 13.13 | 14.96 | - | 12 | 136 | 1 | 5.2 | 3 | 1.8 | - | 5.5 | 1.8 | - |
| | Laurence Rocks | 23 | - | - | 17.67 | - | - | 8 | 38 | 0.3 | 0.8 | 1.9 | - | - | 2.7 | - | - |
| | Moncoeur Islands | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Montague Island | 2 | - | - | 114.75 | - | - | 3 | 14 | 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| | Mornington Peninsula | 25 | - | - | 16.17 | - | - | 4 | 77 | 2.4 | 12.8 | 12.1 | - | - | 29.1 | - | - |
| | Moyne | 85 | 30 | 1 | 5.54 | 17.88 | 106.67 | 12 | 1,068 | 9.3 | 73 | 18 | 3.3 | 0.9 | 52.7 | 10.9 | 0.9 |
| | Norman Island | 14 | - | - | 20.38 | - | - | 4 | 31 | 0.2 | 0.7 | 1.4 | - | - | 1.8 | - | - |
| | Phillip Island | 25 | - | - | 16.25 | - | - | 3 | 67 | 1 | 5.6 | 4.1 | - | - | 10.9 | - | - |
| | Rodondo Island | 14 | - | - | 62.33 | - | - | 5 | 48 | 0.2 | 1 | 1.4 | - | - | 1.8 | - | - |
| | Seal Islands | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Shellback Island | 4 | - | - | 59.17 | - | - | 4 | 16 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| | Skull Rock | 10 | - | - | 19.29 | - | - | 4 | 37 | 0.2 | 0.9 | 1.3 | - | - | 1.8 | - | - |
| | South Gippsland | 31 | 6 | - | 16.63 | 71.25 | - | 4 | 121 | 2.9 | 15.5 | 11.4 | 1.1 | - | 28.2 | 1.8 | - |
| | Surf Coast | 30 | 5 | - | 9.96 | 60.79 | - | 5 | 136 | 3.2 | 30.9 | 11.1 | 2.2 | - | 40.9 | 4.5 | - |
| | Warrnambool | 47 | 8 | - | 8.83 | 41.54 | - | 9 | 160 | 2.7 | 14.8 | 8.1 | 1.7 | - | 23.6 | 2.7 | - |
| | Wellington | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Sub-LGA Shoreline | Bega Valley | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Cape Conran | 6 | - | - | 53.75 | - | - | 3 | 15 | 0.2 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | Cape Howe / Mallacoota | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Cape Liptrap (NW) | 22 | - | - | 16.63 | - | - | 3 | 72 | 0.6 | 3.8 | 2.8 | - | - | 6.4 | - | - |
| | Cape Nelson | 41 | - | - | 8.08 | - | - | 6 | 83 | 3.3 | 10 | 10 | - | - | 24.5 | - | - |
| | Cape Otway West | 99 | 69 | - | 3.58 | 6.58 | - | 42 | 686 | 20.4 | 51.8 | 21.9 | 6.7 | - | 35.4 | 15.4 | - |
| | Cape Patton | 51 | - | - | 8.33 | - | - | 6 | 91 | 1.7 | 10.1 | 6.6 | - | - | 20.9 | - | - |

| Shoreline Receptor | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| Childers Cove | 61 | 9 | - | 8.83 | 41.54 | - | 10 | 160 | 3.1 | 16.4 | 7.8 | 1.9 | - | 20 | 3.6 | - |
| Clonmel Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Croajingolong (West) | 14 | - | - | 16.29 | - | - | 3 | 55 | 0.4 | 1.5 | 1.9 | - | - | 3.6 | - | - |
| Discovery Bay (East) | 5 | - | - | 36.42 | - | - | 2 | 15 | 0.3 | 1 | 0.9 | - | - | 0.9 | - | - |
| Discovery Bay (West) | 2 | - | - | 63.04 | - | - | 2 | 11 | 0.3 | 0.9 | 0.9 | - | - | 0.9 | - | - |
| French Island / Crib Point | 11 | - | - | 17.63 | - | - | 3 | 43 | 0.2 | 0.7 | 1.2 | - | - | 1.8 | - | - |
| Kilcunda | 2 | - | - | 92.71 | - | - | 2 | 17 | 0.2 | 0.7 | 0.9 | - | - | 0.9 | - | - |
| Lake Tyers Beach | 2 | - | - | 103.79 | - | - | 2 | 25 | 0.3 | 1 | 1.4 | - | - | 1.8 | - | - |
| Lorne | 25 | - | - | 9.96 | - | - | 4 | 58 | 1.1 | 5.1 | 6 | - | - | 12.7 | - | - |
| Marlo | 1 | - | - | 105.54 | - | - | 2 | 23 | 0.1 | 0.6 | 0.9 | - | - | 0.9 | - | - |
| Moonlight Head | 92 | 53 | - | 3.38 | 6.79 | - | 27 | 341 | 10.8 | 39 | 13.5 | 4.8 | - | 24.5 | 12.7 | - |
| Mornington Peninsula (S) | 16 | - | - | 16.46 | - | - | 4 | 77 | 0.8 | 3.8 | 4.4 | - | - | 8.2 | - | - |
| Mornington Peninsula (SW) | 25 | - | - | 16.17 | - | - | 5 | 59 | 1.4 | 7 | 7.5 | - | - | 14.5 | - | - |
| New South Wales | 2 | - | - | 114.75 | - | - | 2 | 14 | 0.3 | 1.3 | 0.9 | - | - | 0.9 | - | - |
| Point Hicks | 21 | - | - | 50.79 | - | - | 4 | 44 | 0.6 | 1.7 | 2.6 | - | - | 3.6 | - | - |
| Port Campbell | 81 | 24 | - | 4.21 | 8.04 | - | 18 | 415 | 5.9 | 27.6 | 13.2 | 2.2 | - | 26.4 | 6.4 | - |
| Port Fairy | 42 | 3 | - | 7.13 | 25.25 | - | 5 | 124 | 1.4 | 6 | 4.2 | 0.9 | - | 13.6 | 0.9 | - |
| Port Phillip (Queenscliff) | 16 | - | - | 19.5 | - | - | 3 | 30 | 0.5 | 2.5 | 2.6 | - | - | 9.1 | - | - |
| Port Phillip (Sorrento Shore) | 8 | - | - | 16.58 | - | - | 3 | 15 | 0.3 | 0.7 | 1.4 | - | - | 2.7 | - | - |
| Port Welshpool | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Portland Bay (East) | 2 | - | - | 24.54 | - | - | 2 | 22 | 0.2 | 2.4 | 5 | - | - | 9.1 | - | - |
| Portland Bay (West) | 6 | - | - | 15 | - | - | 2 | 19 | 0.3 | 1.6 | 2 | - | - | 3.6 | - | - |
| Snake Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| South Australia State Waters | 7 | - | - | 27.83 | - | - | 2 | 18 | 0.6 | 1.6 | 1.2 | - | - | 1.8 | - | - |
| Tasmania State Waters | 29 | - | - | 17.79 | - | - | 2 | 64 | 1.8 | 8.2 | 4.4 | - | - | 17.3 | - | - |
| Torquay | 15 | 5 | - | 16.33 | 60.79 | - | 6 | 136 | 2 | 19.8 | 9.8 | 2 | - | 24.5 | 3.6 | - |
| Venus Bay | 2 | - | - | 104.5 | - | - | 2 | 22 | 0.2 | 0.9 | 0.9 | - | - | 0.9 | - | - |
| Victoria State Waters | 100 | 82 | 1 | 3.38 | 6.58 | 106.67 | 14 | 1,068 | 66.1 | 186.8 | 98.4 | 11.3 | 0.9 | 239.9 | 33.6 | 0.9 |
| Waratah Bay | 4 | - | - | 16.88 | - | - | 2 | 19 | 0.1 | 0.5 | 0.9 | - | - | 0.9 | - | - |
| Warrnambool | 39 | 1 | - | 15 | 49.54 | - | 6 | 117 | 1.5 | 7.4 | 5.3 | 0.9 | - | 15.4 | 0.9 | - |
| Westernport | 8 | - | - | 17.38 | - | - | 2 | 24 | 0.3 | 1.3 | 2.5 | - | - | 3.6 | - | - |
| Wilsons Promontory (East) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Wilsons Promontory (West) | 30 | 6 | - | 16.88 | 71.25 | - | 6 | 121 | 2.3 | 12.7 | 9.6 | 1.1 | - | 23.6 | 1.8 | - |

**Table 11.6 Summary of oil accumulation on individual shoreline receptors. Results are based on a 105,289 bbl (16,740 $m^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

| Shoreline Receptor | | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| LGA Shoreline | Anglesea | 31 | - | - | 13.79 | - | - | 4 | 68 | 0.9 | 6.7 | 4.3 | - | - | 13.6 | - | - |
| | Anser Island | 57 | - | - | 16.42 | - | - | 10 | 76 | 0.8 | 2.6 | 2.3 | - | - | 4.5 | - | - |
| | Apollo Bay | 100 | 20 | - | 4.17 | 15.42 | - | 14 | 265 | 5.3 | 18.3 | 11 | 1.4 | - | 21.8 | 3.6 | - |
| | Bass Coast | 17 | - | - | 13.42 | - | - | 2 | 33 | 0.6 | 2.6 | 2 | - | - | 5.5 | - | - |
| | Bay of Islands | 87 | 25 | - | 1.83 | 11.38 | - | 20 | 398 | 6.8 | 23.1 | 11.8 | 3.2 | - | 25.4 | 5.5 | - |
| | Bega Valley | 30 | - | - | 32.96 | - | - | 3 | 58 | 0.8 | 3.3 | 1.9 | - | - | 4.5 | - | - |
| | Colac Otway | 100 | 85 | - | 3.75 | 6.63 | - | 35 | 912 | 42 | 88 | 44.1 | 10.2 | - | 65.4 | 20 | - |
| | Corangamite | 98 | 69 | 1 | 1.88 | 9.46 | 82.29 | 33 | 1,008 | 25.3 | 130.1 | 30.4 | 6.4 | 0.9 | 57.2 | 22.7 | 0.9 |
| | Curtis Island | 1 | - | - | 52.08 | - | - | 2 | 12 | 0.1 | 0.5 | 1.8 | - | - | 1.8 | - | - |
| | East Gippsland | 60 | 5 | - | 32.04 | 56.96 | - | 4 | 125 | 2.6 | 8.5 | 4.2 | 1.1 | - | 10.9 | 1.8 | - |
| | French Island | 7 | - | - | 13.71 | - | - | 2 | 15 | 0.1 | 0.5 | 1.2 | - | - | 1.8 | - | - |
| | Gabo Island | 13 | - | - | 49.83 | - | - | 5 | 35 | 0.2 | 1 | 2.1 | - | - | 3.6 | - | - |
| | Glenelg | 24 | 3 | - | 11.92 | 29.25 | - | 5 | 181 | 4.3 | 24.5 | 13.1 | 1.5 | - | 45.4 | 1.8 | - |
| | Glennie Group | 59 | - | - | 13.63 | - | - | 9 | 87 | 1.4 | 5.2 | 4.5 | - | - | 10.9 | - | - |
| | Grant | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Greater Geelong | 12 | - | - | 14.38 | - | - | 3 | 88 | 0.6 | 4.1 | 5.2 | - | - | 14.5 | - | - |
| | Hogan Island Group | 4 | - | - | 45.75 | - | - | 2 | 16 | 0.2 | 0.6 | 0.9 | - | - | 0.9 | - | - |
| | Kanowna Island | 43 | - | - | 19.46 | - | - | 6 | 50 | 0.5 | 1.6 | 2.3 | - | - | 4.5 | - | - |
| | Kent Island Group | 3 | - | - | 62.33 | - | - | 2 | 27 | 0.2 | 1.2 | 1.8 | - | - | 2.7 | - | - |
| | King Island | 22 | - | - | 23.71 | - | - | 2 | 74 | 1.4 | 8.4 | 6.4 | - | - | 20.9 | - | - |
| | Lady Julia Percy Island | 31 | 7 | - | 15.42 | 29.54 | - | 16 | 199 | 1.4 | 6.4 | 3.3 | 2.1 | - | 6.4 | 2.7 | - |
| | Laurence Rocks | 17 | - | - | 11.5 | - | - | 9 | 33 | 0.3 | 1 | 1.5 | - | - | 2.7 | - | - |
| | Moncoeur Islands | 6 | - | - | 27.5 | - | - | 3 | 14 | 0.2 | 0.6 | 0.9 | - | - | 0.9 | - | - |
| | Montague Island | 11 | - | - | 43.04 | - | - | 6 | 37 | 0.3 | 1.4 | 2.8 | - | - | 3.6 | - | - |
| | Mornington Peninsula | 38 | - | - | 11.58 | - | - | 3 | 59 | 2 | 11.6 | 7.2 | - | - | 24.5 | - | - |
| | Moyne | 87 | 30 | - | 1.83 | 11.38 | - | 14 | 398 | 9.6 | 42.6 | 18.4 | 3 | - | 77.2 | 6.4 | - |
| | Norman Island | 38 | - | - | 13.00 | - | - | 6 | 29 | 0.3 | 1 | 2 | - | - | 4.5 | - | - |
| | Phillip Island | 55 | - | - | 11.63 | - | - | 4 | 67 | 1.7 | 7 | 5.7 | - | - | 16.4 | - | - |
| | Rodondo Island | 47 | - | - | 18.13 | - | - | 8 | 94 | 0.4 | 2 | 1.7 | - | - | 2.7 | - | - |
| | Seal Islands | 2 | - | - | 46.46 | - | - | 2 | 13 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| | Shellback Island | 16 | - | - | 22.17 | - | - | 5 | 34 | 0.1 | 0.6 | 1.1 | - | - | 1.8 | - | - |
| | Skull Rock | 38 | - | - | 19.46 | - | - | 7 | 31 | 0.3 | 0.7 | 1.3 | - | - | 1.8 | - | - |
| | South Gippsland | 64 | 17 | - | 11.88 | 41.63 | - | 8 | 204 | 6 | 18.9 | 14 | 1.6 | - | 30 | 1.8 | - |
| | Surf Coast | 51 | 1 | - | 12.79 | 16.88 | - | 4 | 110 | 2.3 | 21.6 | 7.4 | 1.8 | - | 34.5 | 1.8 | - |
| | Warrnambool | 44 | 5 | - | 4.25 | 5.92 | - | 11 | 207 | 3.2 | 11.2 | 8.2 | 1.6 | - | 20.9 | 3.6 | - |
| | Wellington | 3 | - | - | 47.63 | - | - | 2 | 27 | 0.4 | 4 | 2.1 | - | - | 2.7 | - | - |
| Sub-LGA Shoreline | Bega Valley | 30 | - | - | 32.96 | - | - | 3 | 58 | 0.8 | 3.3 | 1.9 | - | - | 4.5 | - | - |
| | Cape Conran | 3 | - | - | 55.38 | - | - | 2 | 14 | 0.1 | 0.7 | 0.9 | - | - | 0.9 | - | - |
| | Cape Howe / Mallacoota | 15 | - | - | 46.63 | - | - | 3 | 38 | 0.2 | 1.6 | 1.6 | - | - | 4.5 | - | - |
| | Cape Liptrap (NW) | 52 | - | - | 12.21 | - | - | 6 | 76 | 1.1 | 4 | 3.3 | - | - | 7.3 | - | - |
| | Cape Nelson | 24 | 3 | - | 11.92 | 29.25 | - | 6 | 181 | 2.9 | 16.1 | 8.5 | 1.5 | - | 26.4 | 1.8 | - |
| | Cape Otway West | 100 | 85 | - | 3.75 | 6.63 | - | 68 | 912 | 33.9 | 80.5 | 26.2 | 9.9 | - | 35.4 | 20 | - |
| | Cape Patton | 80 | - | - | 8.13 | - | - | 7 | 99 | 2.6 | 8.4 | 7.6 | - | - | 19.1 | - | - |

| Shoreline Receptor | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| Childers Cove | 48 | 4 | - | 4.67 | 5.92 | - | 12 | 207 | 3.6 | 14.7 | 10.2 | 1.8 | - | 18.2 | 4.5 | - |
| Clonmel Island | 2 | - | - | 53.71 | - | - | 2 | 26 | 0.2 | 1.3 | 1.4 | - | - | 1.8 | - | - |
| Croajingolong (West) | 35 | - | - | 37.83 | - | - | 4 | 67 | 0.5 | 2 | 1.7 | - | - | 4.5 | - | - |
| Discovery Bay (East) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Discovery Bay (West) | 1 | - | - | 104.75 | - | - | 2 | 15 | 0.2 | 0.7 | 0.9 | - | - | 0.9 | - | - |
| French Island / Crib Point | 9 | - | - | 12.83 | - | - | 2 | 25 | 0.1 | 0.6 | 1.1 | - | - | 1.8 | - | - |
| Kilcunda | 14 | - | - | 13.42 | - | - | 3 | 24 | 0.3 | 1.3 | 1.6 | - | - | 2.7 | - | - |
| Lake Tyers Beach | 1 | - | - | 59.88 | - | - | 2 | 10 | 0.2 | 0.9 | 0.9 | - | - | 0.9 | - | - |
| Lorne | 48 | - | - | 12.79 | - | - | 4 | 49 | 1.1 | 3.8 | 4.4 | - | - | 11.8 | - | - |
| Marlo | 14 | - | - | 46.58 | - | - | 2 | 51 | 0.2 | 1.2 | 1.1 | - | - | 1.8 | - | - |
| Moonlight Head | 98 | 62 | 1 | 3.54 | 9.46 | 82.29 | 43 | 1,008 | 17.4 | 97.5 | 17.4 | 5.6 | 0.9 | 30 | 15.4 | 0.9 |
| Mornington Peninsula (S) | 29 | - | - | 11.71 | - | - | 4 | 59 | 0.6 | 3.9 | 2.8 | - | - | 9.1 | - | - |
| Mornington Peninsula (SW) | 26 | - | - | 11.58 | - | - | 4 | 57 | 0.9 | 5.5 | 5 | - | - | 13.6 | - | - |
| New South Wales | 31 | - | - | 32.96 | - | - | 3 | 58 | 1 | 4.1 | 2.8 | - | - | 7.3 | - | - |
| Point Hicks | 56 | 5 | - | 32.04 | 56.96 | - | 10 | 125 | 1.3 | 4.9 | 2.7 | 1.1 | - | 5.5 | 1.8 | - |
| Port Campbell | 89 | 31 | - | 1.88 | 9.5 | - | 23 | 305 | 8.1 | 33.7 | 13.8 | 3.1 | - | 26.4 | 8.2 | - |
| Port Fairy | 32 | 5 | - | 15.50 | 17.29 | - | 6 | 122 | 1.8 | 9.1 | 5.3 | 0.9 | - | 23.6 | 0.9 | - |
| Port Phillip (Queenscliff) | 10 | - | - | 34.46 | - | - | 3 | 28 | 0.3 | 2.4 | 3.2 | - | - | 7.3 | - | - |
| Port Phillip (Sorrento Shore) | 14 | - | - | 12.13 | - | - | 3 | 40 | 0.3 | 1.7 | 2.3 | - | - | 4.5 | - | - |
| Port Welshpool | 3 | - | - | 69.00 | - | - | 2 | 14 | 0.1 | 0.6 | 1.2 | - | - | 1.8 | - | - |
| Portland Bay (East) | 7 | - | - | 18.13 | - | - | 3 | 28 | 0.7 | 3.9 | 6.5 | - | - | 11.8 | - | - |
| Portland Bay (West) | 7 | - | - | 26.25 | - | - | 6 | 70 | 2.1 | 8 | 14.9 | - | - | 18.2 | - | - |
| Snake Island | 3 | - | - | 47.63 | - | - | 2 | 27 | 0.1 | 1.2 | 1.2 | - | - | 1.8 | - | - |
| South Australia State Waters | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Tasmania State Waters | 24 | - | - | 23.71 | - | - | 2 | 74 | 1.6 | 8.9 | 6.3 | - | - | 20.9 | - | - |
| Torquay | 28 | 1 | - | 13.75 | 16.88 | - | 4 | 110 | 1 | 16.9 | 5.4 | 1.8 | - | 23.6 | 1.8 | - |
| Venus Bay | 12 | - | - | 13.67 | - | - | 2 | 33 | 0.3 | 1.3 | 1.1 | - | - | 2.7 | - | - |
| Victoria State Waters | 100 | 88 | 1 | 1.83 | 5.92 | 82.29 | 17 | 1,008 | 96.6 | 248.8 | 126.8 | 16.6 | 0.9 | 268.1 | 43.6 | 0.9 |
| Waratah Bay | 6 | - | - | 31.75 | - | - | 2 | 29 | 0.2 | 2.2 | 1.8 | - | - | 4.5 | - | - |
| Warrnambool | 31 | 5 | - | 4.25 | 8.63 | - | 7 | 161 | 2 | 12.5 | 7.7 | 1.1 | - | 23.6 | 1.8 | - |
| Westernport | 11 | - | - | 12.54 | - | - | 2 | 24 | 0.3 | 1.4 | 1.9 | - | - | 3.6 | - | - |
| Wilsons Promontory (East) | 2 | - | - | 40.08 | - | - | 2 | 14 | 0.2 | 1.7 | 1.4 | - | - | 1.8 | - | - |
| Wilsons Promontory (West) | 63 | 17 | - | 11.88 | 41.63 | - | 11 | 204 | 4.6 | 14.3 | 11.2 | 1.6 | - | 21.8 | 1.8 | - |

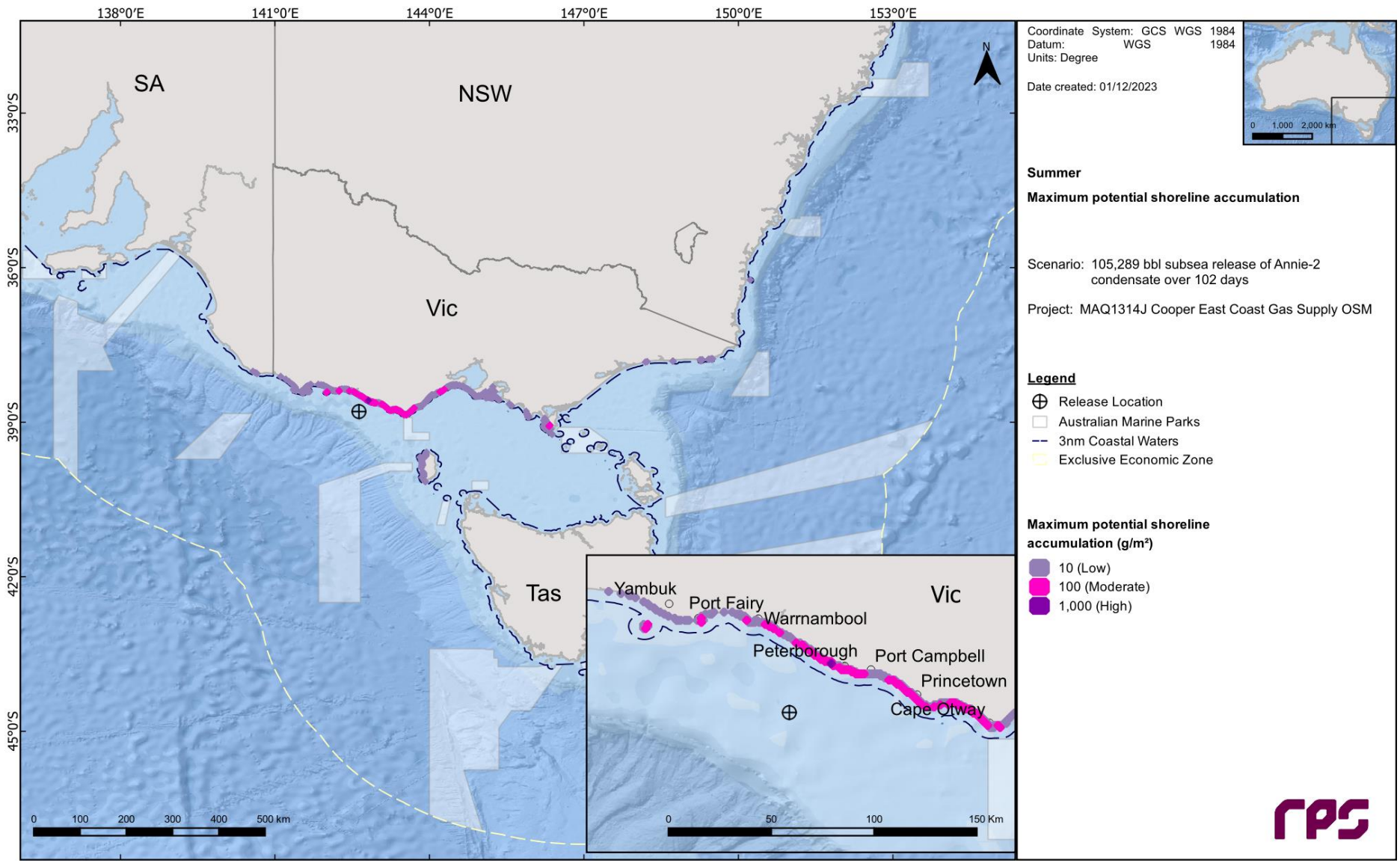



**Figure 11.7 Maximum potential shoreline accumulation in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

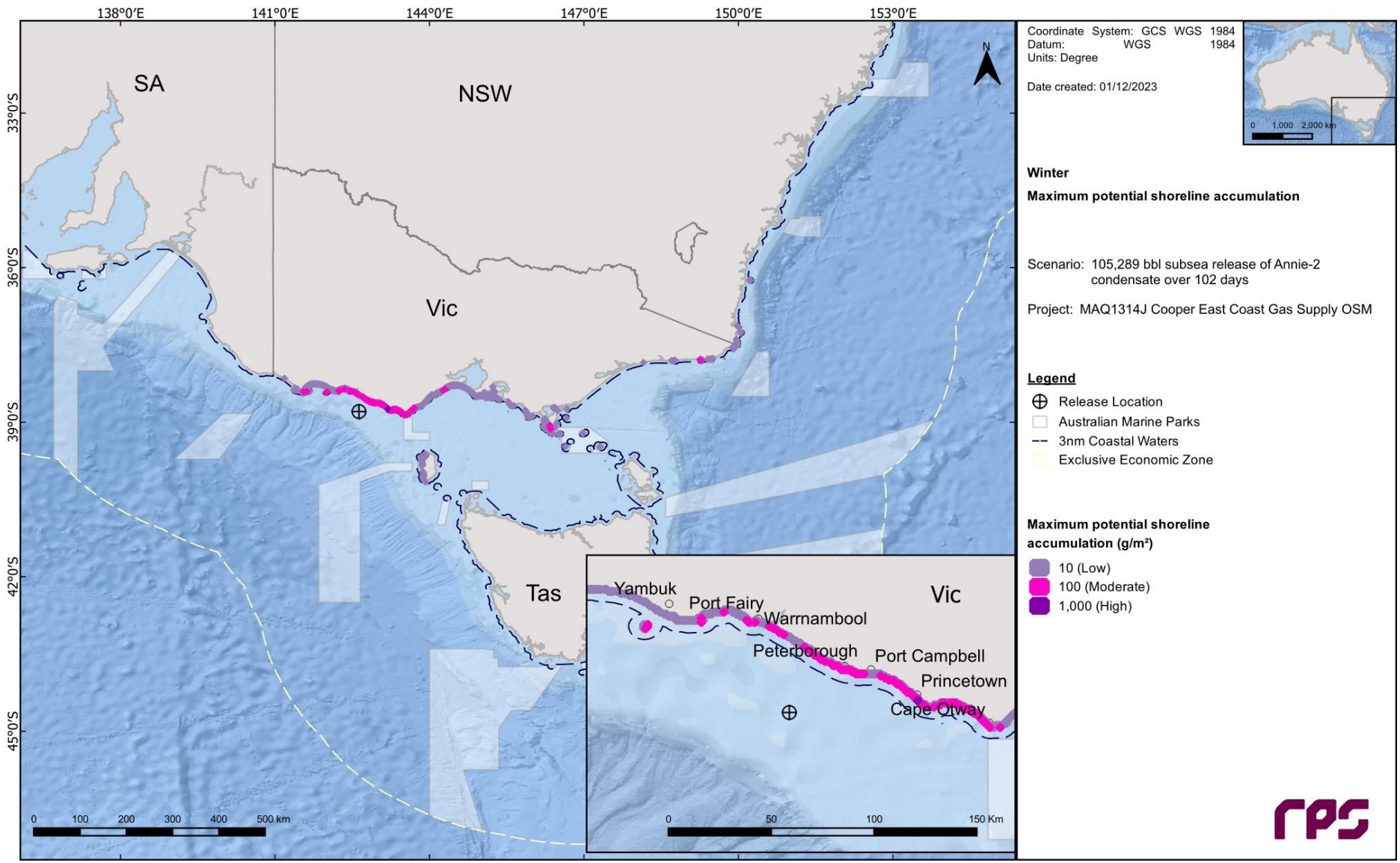



**Figure 11.8 Maximum potential shoreline accumulation in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

### 11.1.3 In-water exposure

#### 11.1.3.1 Dissolved Hydrocarbons

Table 11.7 summarises the potential in-water exposure to individual receptors from dissolved hydrocarbons in the 0-10 m layer.

During summer conditions, a total of 20 BIAs were predicted to be exposed to dissolved hydrocarbon at, or above, the low threshold. Excluding the BIAs that the release location resides within (see Section 10.3), the highest probability of low exposure ranged between 2% (Australasian Gannet - Foraging) and 15% (Southern Right Whale - Aggregation).

Alternatively, during winter, excluding the BIAs that the release location resides within (see Section 10.3), the probability of low exposure ranged between 1% (Australasian Gannet - Foraging) and 21% (Short-tailed Shearwater - Foraging).

The maximum dissolved hydrocarbon concentration at any given receptor(s) was shown to be 51.8 ppb and 60.2 ppb for summer and winter conditions, respectively.

Table 11.8 presents the predicted minimum time to dissolved hydrocarbon exposure and maximum residence time for dissolved hydrocarbon exposure to individual receptors, in the 0-10 m depth layer, for all thresholds assessed.

Figure 11.9 and Figure 11.10 present the zones of potential dissolved hydrocarbon exposure for the 0-10 m depth layer for each season whilst Figure 11.11  Figure 11.12 present the maximum residence time of dissolved hydrocarbon exposure for the NOPSEMA thresholds.

**Table 11.7 Probability of dissolved hydrocarbons exposure to marine based receptors in the 0–10 m depth. Results are based on a 105,289 bbl (16,740 $m^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | |
| | | | Low | Moderate | High | | Low | Moderate | High |
| AMP | Apollo | 19.1 | 5 | - | - | 44.3 | 10 | - | - |
| BIA | Antipodean Albatross - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Australasian Gannet - Foraging | 17.9 | 2 | - | - | 14.3 | 1 | - | - |
| | Black-browed Albatross - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Bullers Albatross - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Campbell Albatross - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Common Diving-petrel - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Pygmy Blue Whale - Distribution* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Pygmy Blue Whale - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Pygmy Blue Whale - Known Foraging Area | 26.8 | 4 | - | - | 44.3 | 8 | - | - |
| | Short-tailed Shearwater - Foraging | 36.5 | 11 | - | - | 49.6 | 21 | - | - |
| | Shy Albatross - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Southern Right Whale – Aggregation | 34.9 | 15 | - | - | 30 | 17 | - | - |
| | Southern Right Whale - Known Core Range* ^ | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Wandering Albatross - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | Wedge-tailed Shearwater - Foraging* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | White Shark - Distribution* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| | White Shark - Foraging | 18.8 | 3 | - | - | 25.4 | 4 | - | - |
| | White-faced Storm-petrel - Foraging | 26.8 | 4 | - | - | 33.9 | 7 | - | - |
| IBRA | Otway Plain | 23.3 | 4 | - | - | 34.4 | 16 | - | - |
| | Otway Ranges | 18.9 | 2 | - | - | 23.9 | 3 | - | - |
| | Warrnambool Plain | 30.7 | 5 | - | - | 25.1 | 5 | - | - |
| IMCRA | Central Bass Strait | 26.8 | 4 | - | - | 33.9 | 7 | - | - |
| | Central Victoria | 26.6 | 4 | - | - | 44.3 | 10 | - | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | |
| | | | Low | Moderate | High | | Low | Moderate | High |
| | Otway* | 51.8 | 40 | 1 | - | 60.2 | 66 | 1 | - |
| KEF | Bonney Coast Upwelling | 8.6 | - | - | - | 14.3 | 1 | - | - |
| | West Tasmania Canyons | 13.4 | 1 | - | - | 13.1 | 1 | - | - |
| MNP | Twelve Apostles | 30.7 | 6 | - | - | 21.5 | 6 | - | - |
| RSB | Bravenes Rock | 9.8 | - | - | - | 14.9 | 4 | - | - |
| Nearshore Waters | Colac Otway | 23.3 | 4 | - | - | 34.4 | 16 | - | - |
| | Corangamite | 30.7 | 5 | - | - | 25.1 | 5 | - | - |
| | Moyne | 23.8 | 1 | - | - | 15.6 | 3 | - | - |
| | Warrnambool | 3.9 | - | - | - | 16.3 | 1 | - | - |
| State Waters | Victoria State Waters* | 34.9 | 10 | - | - | 34.4 | 21 | - | - |
| Nearshore Waters (Sub-LGA) | Apollo Bay | 12.1 | 1 | - | - | 23.9 | 2 | - | - |
| | Bay of Islands | 23.8 | 1 | - | - | 15.6 | 3 | - | - |
| | Cape Otway West | 24.8 | 4 | - | - | 34.4 | 16 | - | - |
| | Cape Patton | 10.3 | 1 | - | - | 11.4 | 1 | - | - |
| | Childers Cove | 7.4 | - | - | - | 16.3 | 1 | - | - |
| | Moonlight Head | 30.7 | 5 | - | - | 25.1 | 5 | - | - |
| | Port Campbell | 11.6 | 1 | - | - | 12.6 | 2 | - | - |
| | Warrnambool | 3.8 | - | - | - | 11.5 | 1 | - | - |

*The release location resides within the receptor boundaries.

^ RPS have utilised BIA's for the southern right whale that were delineated within the 2011-2021 Southern Right Whale. The NCV Atlas now includes updated BIA's for SRW, though the recently drafted National Recovery Plan for the southern right whale has not been published. The updated BIA's have not been used in this report.

**Table 11.8 Predicted minimum time to dissolved hydrocarbon exposure and maximum residence time for dissolved hydrocarbon exposure to individual receptors in the 0-10 m depth layer. Results are based on a 105,289 bbl (16,740 $m^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High |
| AMP | Apollo | 3.50 | - | - | 0.13 | - | - | 2.54 | - | - | 0.13 | - | - |
| BIA | Antipodean Albatross - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Australasian Gannet - Foraging | 7.29 | - | - | 0.08 | - | - | 11.25 | - | - | 0.04 | - | - |
| | Black-browed Albatross - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Bullers Albatross - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Campbell Albatross - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Common Diving-petrel - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Indian Yellow-nosed Albatross - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Pygmy Blue Whale - Distribution* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Pygmy Blue Whale - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Pygmy Blue Whale - Known Foraging Area | 3.54 | - | - | 0.13 | - | - | 3.04 | - | - | 0.13 | - | - |
| | Short-tailed Shearwater - Foraging | 2.08 | - | - | 0.17 | - | - | 1.88 | 15.79 | - | 0.21 | - | - |
| | Shy Albatross - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Southern Right Whale – Aggregation | 1.25 | - | - | 0.13 | - | - | 1.88 | - | - | 0.17 | - | - |
| | Southern Right Whale - Known Core Range* ^ | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Wandering Albatross - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | Wedge-tailed Shearwater - Foraging* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | White Shark - Distribution* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| | White Shark - Foraging | 6.46 | - | - | 0.08 | - | - | 6.13 | - | - | 0.08 | - | - |
| | White-faced Storm-petrel - Foraging | 3.58 | - | - | 0.13 | - | - | 3.04 | - | - | 0.13 | - | - |
| IBRA | Otway Plain | 7.38 | - | - | 0.17 | - | - | 5.92 | - | - | 0.13 | - | - |

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High |
| | Otway Ranges | 6.46 | - | - | 0.04 | - | - | 4.88 | - | - | 0.08 | - | - |
| | Warrnambool Plain | 15.88 | - | - | 0.13 | - | - | 9.71 | - | - | 0.08 | - | - |
| IMCRA | Central Bass Strait | 6.67 | - | - | 0.13 | - | - | 3.04 | - | - | 0.13 | - | - |
| | Central Victoria | 3.58 | - | - | 0.13 | - | - | 3.96 | - | - | 0.13 | - | - |
| | Otway* | 0.71 | 31.92 | - | 0.29 | - | - | 0.42 | 5.79 | - | 0.33 | - | - |
| KEF | Bonney Coast Upwelling | - | - | - | - | - | - | 18.54 | - | - | 0.04 | - | - |
| KEF | West Tasmania Canyons | 13.50 | - | - | 0.08 | - | - | 21.96 | - | - | 0.04 | - | - |
| MNP | Twelve Apostles | 7.71 | - | - | 0.13 | - | - | 4.96 | - | - | 0.08 | - | - |
| RSB | Bravenes Rock | 24.25 | - | - | 0.04 | - | - | 10.25 | - | - | 0.04 | - | - |
| Nearshore Waters | Colac Otway | 6.46 | - | - | 0.17 | - | - | 4.88 | - | - | 0.13 | - | - |
| | Corangamite | 16.33 | - | - | 0.13 | - | - | 9.71 | - | - | 0.08 | - | - |
| | Moyne | 21.79 | - | - | 0.08 | - | - | 10.25 | - | - | 0.08 | - | - |
| | Warrnambool | - | - | - | - | - | - | 10.71 | - | - | 0.04 | - | - |
| State Waters | Victoria State Waters* | 3.08 | - | - | 0.17 | - | - | 3.83 | - | - | 0.21 | - | - |
| Nearshore Waters (Sub-LGA) | Apollo Bay | 6.46 | - | - | 0.04 | - | - | 4.88 | - | - | 0.08 | - | - |
| | Bay of Islands | 21.79 | - | - | 0.08 | - | - | 10.25 | - | - | 0.08 | - | - |
| | Cape Otway West | 5.04 | - | - | 0.17 | - | - | 5.75 | - | - | 0.13 | - | - |
| | Cape Patton | 8.58 | - | - | 0.04 | - | - | 25.79 | - | - | 0.04 | - | - |
| | Childers Cove | - | - | - | - | - | - | 10.96 | - | - | 0.04 | - | - |
| | Moonlight Head | 15.88 | - | - | 0.13 | - | - | 9.71 | - | - | 0.08 | - | - |
| | Port Campbell | 18.42 | - | - | 0.04 | - | - | 9.83 | - | - | 0.04 | - | - |
| | Warrnambool | - | - | - | - | - | - | 10.71 | - | - | 0.04 | - | - |

*The release location resides within the receptor boundaries.

^ RPS have utilised BIA's for the southern right whale that were delineated within the 2011-2021 Southern Right Whale. The NCV Atlas now includes updated BIA's for SRW, though the recently drafted National Recovery Plan for the southern right whale has not been published. The updated BIA's have not been used in this report.

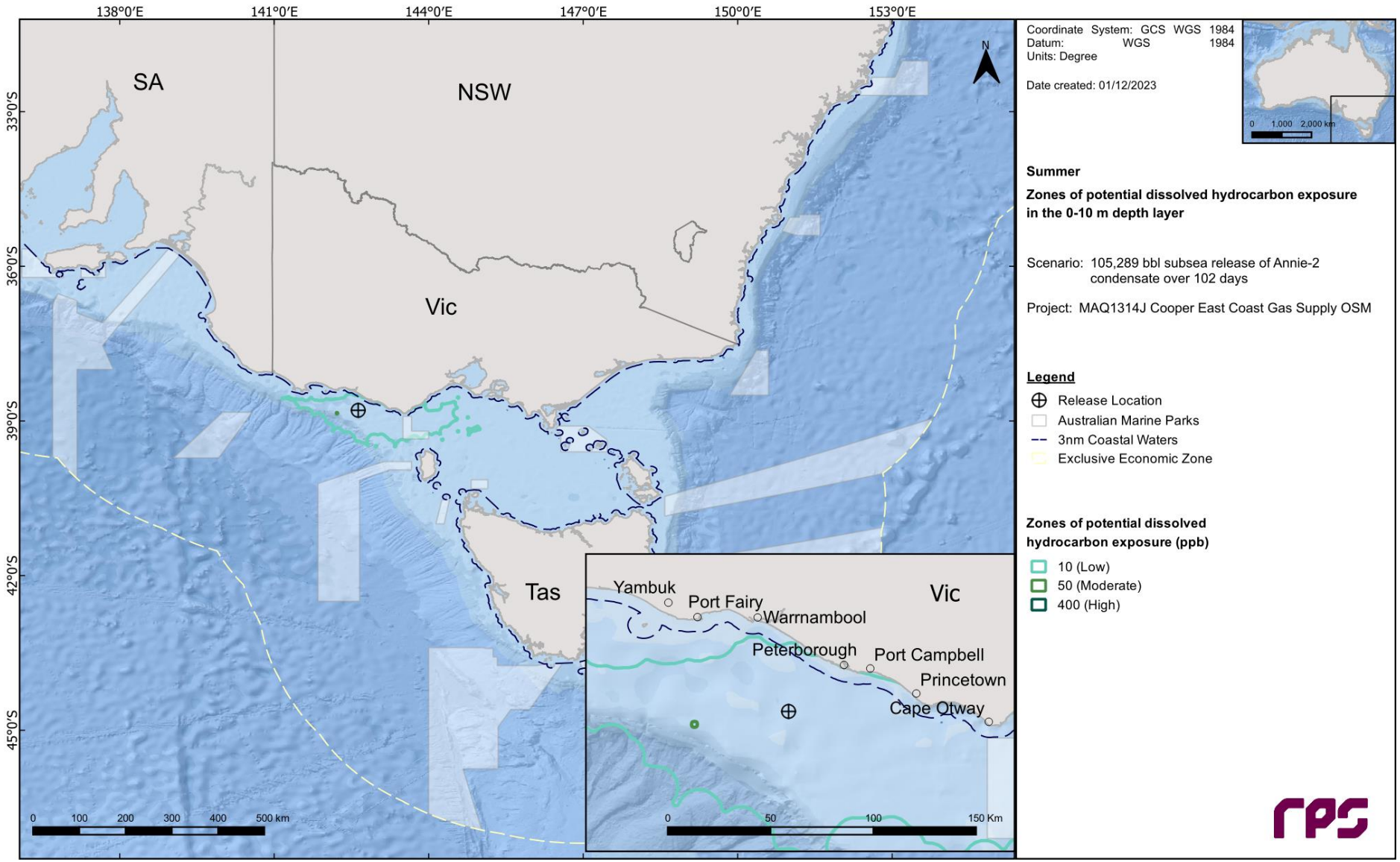



**Figure 11.9 Zones of potential dissolved hydrocarbon exposure at 0-10 m below the sea in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

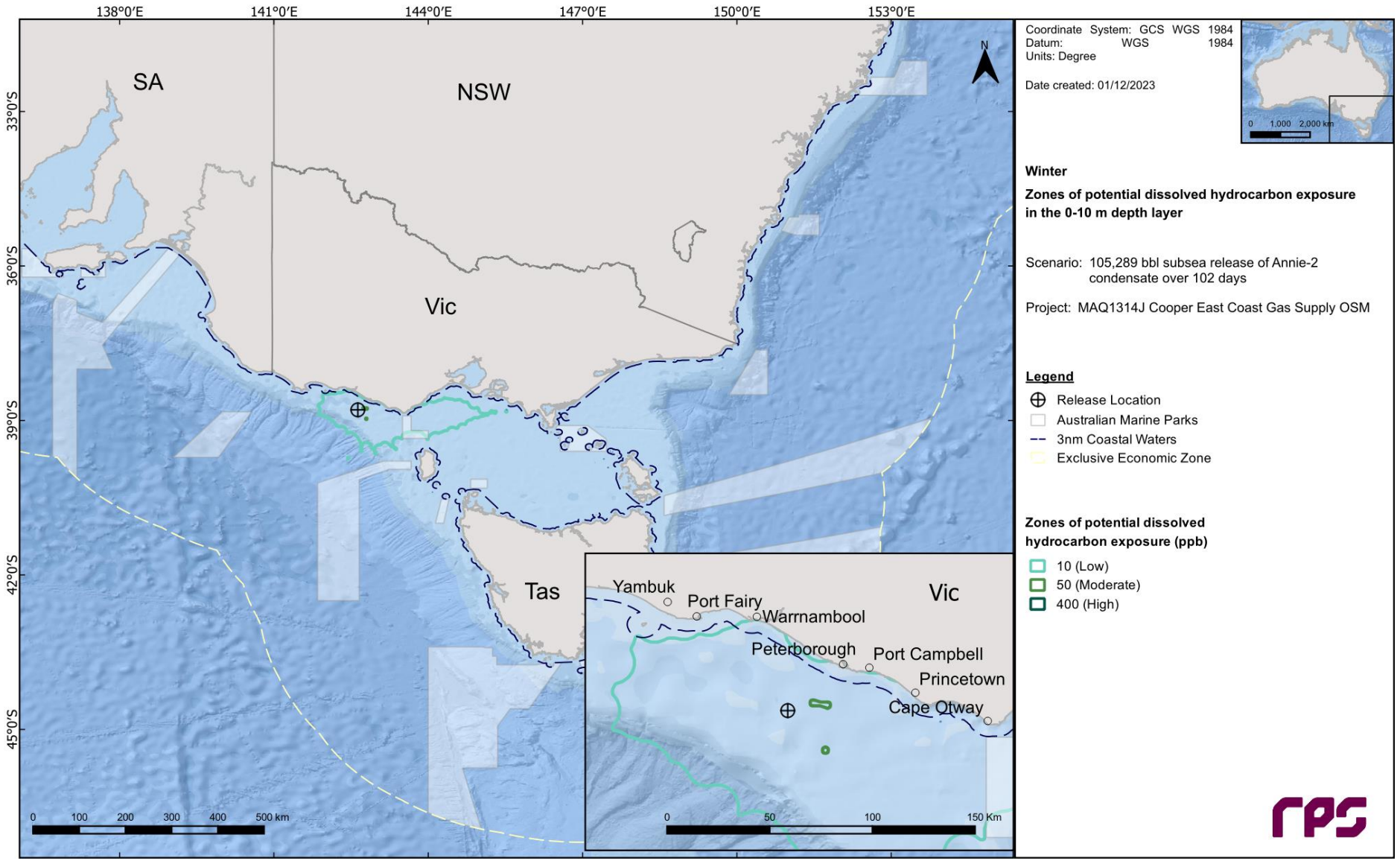



**Figure 11.10 Zones of potential dissolved hydrocarbon exposure at 0-10 m below the sea in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

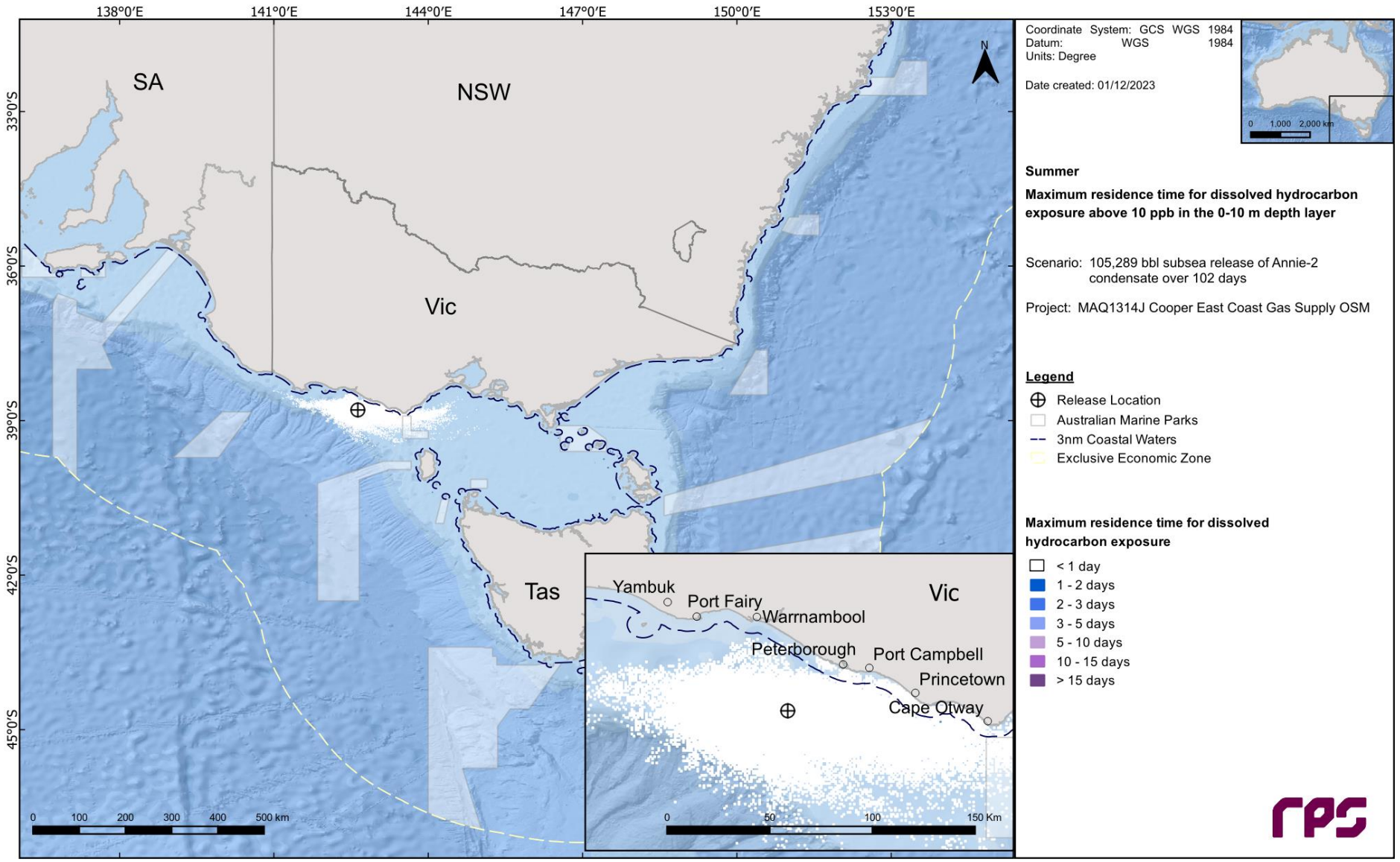



**Figure 11.11 Maximum residence time for dissolved hydrocarbon exposure above 10 ppb, at 0-10 m below the sea surface in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

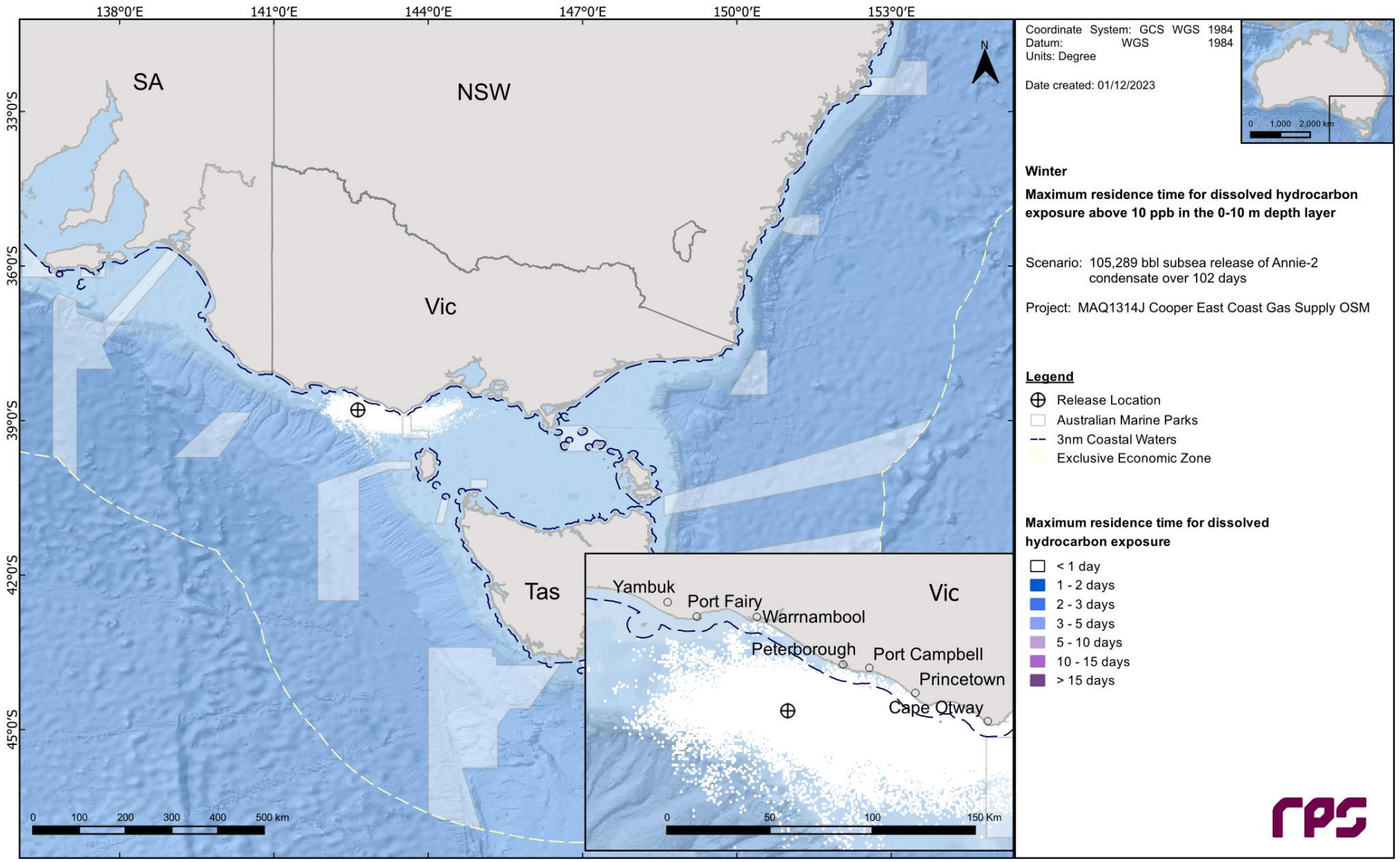



**Figure 11.12 Maximum residence time for dissolved hydrocarbon exposure above 10 ppb, at 0-10 m below the sea surface in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

### 11.1.3.2 Entrained Hydrocarbons

Table 11.9 summarises the potential in-water exposure to individual receptors from entrained hydrocarbons in the 0-10 m depth layer.

Except for the receptors the release location is within, during summer the highest probability of low entrained hydrocarbon exposure was 100% recorded for Southern Right Whale - Aggregation. Additional receptors including LGAs, sub-LGAs, and AMPs were predicted with entrained hydrocarbon exposure (refer to Table 11.9).

During winter, several receptors, including the Apollo AMP, Southern Right Whale – Aggregation and White-faced Storm-petrel - Foraging BIAs revealed a 100% probability of low entrained hydrocarbon exposure.

Table 11.10 presents the predicted minimum time to entrained hydrocarbon exposure and maximum residence time for entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer, for all thresholds assessed.

Figure 11.13 and Figure 11.14 present the zones of potential entrained hydrocarbon exposure for the 0-10 m depth layer for each season whilst Figure 11.15 and Figure 11.18 present the maximum residence time of entrained hydrocarbon exposure for the NOPSEMA thresholds.

**Table 11.9 Probability of entrained hydrocarbons exposure to marine based receptors in the 0–10 m depth layer. Results are based on a 105,289 bbl (16,740 $m^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| AMP | Apollo | 281.5 | 98 | 36 | 237.4 | 100 | 61 |
| | Beagle | 38.4 | 44 | - | 45.8 | 63 | - |
| | East Gippsland | 16.7 | 8 | - | 17.9 | 5 | - |
| | Franklin | 45.4 | 16 | - | 44.8 | 2 | - |
| | Murray | 14.8 | 3 | - | 7.2 | - | - |
| | Nelson | 22.3 | 11 | - | 14.4 | 2 | - |
| | Zeehan | 91.2 | 61 | - | 91.9 | 23 | - |
| BIA | Antipodean Albatross - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Australasian Gannet - Foraging | 132.1 | 69 | 4 | 92.2 | 90 | - |
| | Australian Sea Lion - Foraging | 32 | 14 | - | 11.2 | 1 | - |
| | Black Petrel - Foraging | 28.2 | 7 | - | 22.8 | 10 | - |
| | Black-browed Albatross - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Black-faced Cormorant - Foraging | 45.2 | 42 | - | 39.6 | 31 | - |
| | Bullers Albatross - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Campbell Albatross - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Common Diving-petrel - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Crested Tern - Breeding | 19.9 | 6 | - | 20.9 | 10 | - |
| | Crested Tern - Foraging | 20.9 | 7 | - | 22.8 | 10 | - |
| | Flesh-footed Shearwater - Foraging | 28.2 | 7 | - | 22.8 | 10 | - |
| | Great-winged Petrel - Foraging | 28.2 | 7 | - | 17.7 | 10 | - |
| | Grey Nurse Shark - Foraging | 27.4 | 21 | - | 23.3 | 32 | - |
| | Grey Nurse Shark - Migration | 45.1 | 27 | - | 22.8 | 36 | - |
| | Humpback Whale - Foraging | 45.1 | 27 | - | 23.8 | 36 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Indo-Pacific/Spotted Bottlenose Dolphin - Breeding | 23.9 | 13 | - | 24.5 | 22 | - |
| | Little Penguin - Breeding | 20.7 | 6 | - | 22.8 | 10 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Little Penguin - Foraging | 42.1 | 54 | - | 61.6 | 79 | - |
| | Northern Giant Petrel - Foraging | 28.2 | 7 | - | 17.7 | 10 | - |
| | Pygmy Blue Whale - Distribution* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Pygmy Blue Whale - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Pygmy Blue Whale - Foraging annual high use area* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Pygmy Blue Whale - Known Foraging Area | 269.7 | 98 | 35 | 210.4 | 100 | 60 |
| | Short-tailed Shearwater - Foraging | 439.8 | 100 | 85 | 450.3 | 100 | 90 |
| | Shy Albatross - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Soft-plumaged Petrel - Foraging | 25.6 | 5 | - | 13.4 | 1 | - |
| | Sooty Shearwater - Foraging | 38.7 | 19 | - | 22.8 | 33 | - |
| | Southern Giant Petrel - Foraging | 28.2 | 7 | - | 17.7 | 10 | - |
| | Southern Right Whale – Aggregation | 379 | 100 | 87 | 427.8 | 100 | 88 |
| | Southern Right Whale - Connecting Habitat | 30.8 | 31 | - | 33.6 | 18 | - |
| | Southern Right Whale - Known Core Range*^ | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Wandering Albatross - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Wedge-tailed Shearwater - Foraging* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | White Shark - Breeding | 33.6 | 41 | - | 34.6 | 60 | - |
| | White Shark - Distribution* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | White Shark - Foraging | 176.6 | 78 | 26 | 191.6 | 81 | 11 |
| | White-capped Albatross - Foraging | 28.2 | 7 | - | 17.7 | 10 | - |
| | White-faced Storm-petrel - Breeding | 29.9 | 12 | - | 22.8 | 16 | - |
| | White-faced Storm-petrel - Foraging | 269.7 | 97 | 28 | 206.6 | 100 | 46 |
| | Wilsons Storm Petrel - Migration | 28.2 | 7 | - | 17.7 | 10 | - |
| IBRA | Bateman | 15.9 | 6 | - | 18 | 10 | - |
| | Bridgewater | 76.1 | 45 | - | 65.9 | 23 | - |
| | East Gippsland Lowlands | 23.8 | 13 | - | 24 | 32 | - |
| | Flinders | 37.2 | 25 | - | 35.8 | 35 | - |
| | Gippsland Plain | 66.6 | 57 | - | 83.2 | 70 | - |
| | Glenelg Plain | 77.2 | 56 | - | 72.3 | 28 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | King Island | 30.8 | 31 | - | 31.6 | 16 | - |
| | Otway Plain | 439.8 | 99 | 74 | 450.3 | 100 | 83 |
| | Otway Ranges | 355.2 | 99 | 48 | 366.6 | 100 | 69 |
| | South East Coastal Ranges | 10.1 | 1 | - | 9 | - | - |
| | Strzelecki Ranges | 37.8 | 52 | - | 51.8 | 70 | - |
| | Tasmanian West | 12.6 | 3 | - | 12.5 | 1 | - |
| | Warrnambool Plain | 460.3 | 99 | 62 | 350.5 | 100 | 60 |
| | Wilsons Promontory | 101 | 62 | 1 | 90.6 | 76 | - |
| IMCRA | Batemans Shelf | 22.3 | 9 | - | 22.8 | 13 | - |
| | Central Bass Strait | 272.4 | 96 | 29 | 218 | 100 | 43 |
| | Central Victoria | 265.5 | 98 | 35 | 201.1 | 100 | 55 |
| | Coorong | 25.9 | 8 | - | 12 | 1 | - |
| | Davey | 10.9 | 1 | - | 2.3 | - | - |
| | Flinders | 106.9 | 62 | 2 | 97.4 | 77 | - |
| | Franklin | 25.6 | 10 | - | 14.1 | 2 | - |
| | Otway* | 1,334.9 | 100 | 100 | 1,332.9 | 100 | 100 |
| | Twofold Shelf | 45.1 | 33 | - | 34.2 | 50 | - |
| | Victorian Embayments | 41.5 | 46 | - | 63.5 | 58 | - |
| | Victorian Embayments | 12.2 | 6 | - | 10.7 | 3 | - |
| KEF | Big Horseshoe Canyon | 16.1 | 6 | - | 15.5 | 11 | - |
| | Bonney Coast Upwelling | 107.2 | 64 | 1 | 92 | 53 | - |
| | Canyons on the Eastern Continental Slope | 28.2 | 6 | - | 11 | 3 | - |
| | Shelf rocky reefs | 18.8 | 6 | - | 19.7 | 10 | - |
| | Upwelling East of Eden | 45.1 | 27 | - | 27.6 | 38 | - |
| | West Tasmania Canyons | 108.1 | 77 | 2 | 119 | 44 | 1 |
| MNP | Bunurong | 32.2 | 45 | - | 46.1 | 64 | - |
| | Cape Howe | 25.3 | 14 | - | 26.2 | 24 | - |
| | Churchill Island | 21.2 | 20 | - | 29.9 | 31 | - |
| | Discovery Bay | 51.1 | 34 | - | 24.9 | 18 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Point Addis | 74.6 | 30 | - | 55.8 | 68 | - |
| | Point Hicks | 18.1 | 14 | - | 21.1 | 33 | - |
| | Port Phillip Heads | 41.5 | 27 | - | 61.3 | 56 | - |
| | Twelve Apostles | 376.6 | 100 | 65 | 317.3 | 100 | 64 |
| | Wilsons Promontory | 106.9 | 60 | 2 | 97.4 | 75 | - |
| MP | Batemans | 19.9 | 6 | - | 20.9 | 10 | - |
| | Lower South East | 19.6 | 19 | - | 9.5 | - | - |
| MS | Beware Reef | 9.5 | - | - | 10.9 | 1 | - |
| | Mushroom Reef | 31.2 | 44 | - | 31.2 | 50 | - |
| NP | Kent Group | 17.3 | 6 | - | 13.7 | 2 | - |
| NPS4 | Bunurong Marine Park | 32.6 | 46 | - | 58.1 | 59 | - |
| | Corner Inlet Marine and Coastal Park | 12.2 | 6 | - | 10.7 | 3 | - |
| | Shallow Inlet Marine and Coastal Park | 12.1 | 3 | - | 8.5 | - | - |
| | Wilsons Promontory Marine Park | 68.7 | 57 | - | 63.2 | 70 | - |
| RAMSAR | Corner Inlet | 12.2 | 6 | - | 10.7 | 3 | - |
| | Port Phillip Bay Western Shoreline and Bellarine Peninsula | 26.6 | 14 | - | 26.7 | 37 | - |
| | Western Port | 24.5 | 20 | - | 29.9 | 31 | - |
| RSB | Bell Reef | 11.8 | 8 | - | 11.5 | 4 | - |
| | Beware Reef | 9.6 | - | - | 10.9 | 1 | - |
| | Bravenes Rock | 228.6 | 99 | 37 | 208.5 | 100 | 51 |
| | Cody Bank | 30.7 | 63 | - | 41.3 | 67 | - |
| | Cutter Rock | 29.3 | 31 | - | 30.5 | 45 | - |
| | New Zealand Star Bank | 21 | 22 | - | 22.5 | 33 | - |
| Nearshore Waters | Anser Island | 101 | 59 | 1 | 90.6 | 72 | - |
| | Bass Coast | 38.7 | 47 | - | 66.8 | 64 | - |
| | Bega Valley | 21.4 | 8 | - | 24 | 11 | - |
| | Black Pyramid | 28 | 8 | - | 29.3 | 2 | - |
| | Circular Head | 8.7 | - | - | 11.2 | 1 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Colac Otway | 439.8 | 99 | 74 | 450.3 | 100 | 83 |
| | Corangamite | 365.7 | 99 | 62 | 350.5 | 100 | 59 |
| | Curtis Island | 37.2 | 21 | - | 35.8 | 30 | - |
| | East Gippsland | 21.4 | 13 | - | 23.8 | 32 | - |
| | Eurobodalla | 9.3 | - | - | 13 | 7 | - |
| | French Island | 16.9 | 13 | - | 19.4 | 11 | - |
| | Gabo Island | 23.8 | 13 | - | 23.3 | 25 | - |
| | Glenelg | 76.7 | 56 | - | 72.3 | 28 | - |
| | Glennie Group | 96.5 | 62 | - | 87.6 | 76 | - |
| | Grant | 27.5 | 16 | - | 9 | - | - |
| | Greater Geelong | 61.3 | 26 | - | 55.5 | 53 | - |
| | Hogan Island Group | 28 | 25 | - | 33.7 | 35 | - |
| | Kanowna Island | 101 | 59 | 1 | 87.4 | 71 | - |
| | Kent Island Group | 20.3 | 6 | - | 13.7 | 2 | - |
| | King Island | 30.8 | 32 | - | 33.9 | 16 | - |
| | Lady Julia Percy Island | 72.9 | 61 | - | 70.3 | 36 | - |
| | Laurence Rocks | 65.3 | 56 | - | 64.2 | 28 | - |
| | Moncoeur Islands | 34.3 | 43 | - | 42.8 | 58 | - |
| | Montague Island | 15.9 | 6 | - | 18 | 10 | - |
| | Mornington Peninsula | 63.3 | 53 | - | 83.2 | 69 | - |
| | Moyne | 460.3 | 96 | 36 | 310.1 | 94 | 40 |
| | Mud Island | 19.5 | 10 | - | 33.8 | 31 | - |
| | Norman Island | 83.6 | 59 | - | 76.9 | 75 | - |
| | Phillip Island | 40.3 | 49 | - | 49.6 | 62 | - |
| | Reid Rock | 13.3 | 4 | - | 13.1 | 3 | - |
| | Rodondo Island | 49.9 | 47 | - | 50.9 | 65 | - |
| | Seal Islands | 17.9 | 9 | - | 18.5 | 30 | - |
| | Shellback Island | 51 | 54 | - | 49.5 | 72 | - |
| | Skull Rock | 97.1 | 59 | - | 87.4 | 70 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | South Gippsland | 99.9 | 58 | - | 88.8 | 74 | - |
| | Surf Coast | 69.7 | 44 | - | 56.3 | 67 | - |
| | Warrnambool | 150.6 | 67 | 6 | 171.5 | 47 | 11 |
| | West Coast | 12.6 | 3 | - | 12.5 | 1 | - |
| State Waters | New South Wales | 23.9 | 13 | - | 24 | 22 | - |
| | South Australia State Waters | 29 | 19 | - | 10.6 | 2 | - |
| | Tasmania State Waters | 44.1 | 42 | - | 39.6 | 42 | - |
| | Victoria State Waters* | 460.3 | 100 | 77 | 450.3 | 100 | 85 |
| Nearshore Waters (Sub-LGA) | Anglesea | 69.7 | 34 | - | 44.9 | 59 | - |
| | Apollo Bay | 161.9 | 95 | 18 | 159.4 | 100 | 25 |
| | Bay of Islands | 460.3 | 96 | 36 | 310.1 | 94 | 40 |
| | Bega Valley | 21.4 | 8 | - | 24 | 11 | - |
| | Cape Conran | 10.8 | 1 | - | 12.6 | 5 | - |
| | Cape Howe / Mallacoota | 21.4 | 8 | - | 23.8 | 20 | - |
| | Cape Liptrap - Northwest | 37.3 | 55 | - | 53.7 | 70 | - |
| | Cape Nelson | 76.7 | 56 | - | 72.3 | 28 | - |
| | Cape Otway West | 439.8 | 99 | 76 | 450.3 | 100 | 84 |
| | Cape Patton | 106.2 | 84 | 1 | 117.4 | 92 | 5 |
| | Childers Cove | 150.6 | 77 | 6 | 171.5 | 51 | 11 |
| | Corner Inlet | 12.2 | 6 | - | 10.7 | 3 | - |
| | Corringle | 10.5 | 2 | - | 8.1 | - | - |
| | Croajingolong - East | 12.3 | 5 | - | 14.4 | 12 | - |
| | Croajingolong - West | 12.4 | 9 | - | 14.1 | 17 | - |
| | Discovery Bay - East | 47.1 | 30 | - | 18.5 | 13 | - |
| | Discovery Bay - West | 24.1 | 25 | - | 11.2 | 3 | - |
| | Eurobodalla | 9.3 | - | - | 13 | 7 | - |
| | French Island - East | 10.9 | 4 | - | 14.1 | 2 | - |
| | French Island / Crib Point | 17 | 14 | - | 19.2 | 12 | - |
| | French Island / San Remo | 22.2 | 32 | - | 34.5 | 42 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Kilcunda | 38.1 | 44 | - | 66.8 | 57 | - |
| | Lorne | 51.4 | 44 | - | 55.8 | 71 | - |
| | Marlo | 9.7 | - | - | 10.8 | 1 | - |
| | Moonlight Head | 365.7 | 99 | 62 | 350.5 | 100 | 60 |
| | Mornington Peninsula - South | 40.8 | 52 | - | 52.1 | 64 | - |
| | Mornington Peninsula - Southwest | 63.3 | 53 | - | 83.2 | 68 | - |
| | Point Hicks | 15.6 | 13 | - | 19.7 | 32 | - |
| | Port Campbell | 358.7 | 97 | 43 | 301.1 | 95 | 39 |
| | Port Fairy | 95.3 | 49 | - | 94.5 | 40 | - |
| | Port Phillip - Mornington | 12.3 | 5 | - | 16.8 | 16 | - |
| | Port Phillip - Queenscliff | 48.5 | 26 | - | 52.9 | 53 | - |
| | Port Phillip - Sorrento Shore | 40.4 | 40 | - | 79.3 | 69 | - |
| | Port Phillip Heads | 34.6 | 20 | - | 39.9 | 41 | - |
| | Portland Bay - East | 40.5 | 38 | - | 57.1 | 22 | - |
| | Portland Bay - West | 63.7 | 37 | - | 61.1 | 17 | - |
| | Sydenham Inlet | 14.1 | 7 | - | 16.1 | 15 | - |
| | Torquay | 66.3 | 25 | - | 55.5 | 57 | - |
| | Venus Bay | 38.7 | 47 | - | 63.7 | 64 | - |
| | Waratah Bay | 37.8 | 52 | - | 51.8 | 70 | - |
| | Warrnambool | 105.4 | 59 | 1 | 110.4 | 47 | 1 |
| | Westernport | 29.4 | 41 | - | 33.4 | 50 | - |
| | Wilsons Promontory - East | 68.3 | 52 | - | 59.2 | 69 | - |
| | Wilsons Promontory - West | 99.9 | 58 | - | 88.8 | 74 | - |

*The release location resides within the receptor boundaries.^ RPS have utilised BIA's for the southern right whale that were delineated within the 2011-2021 Southern Right Whale. The NCV Atlas now includes updated BIA's for SRW, though the recently drafted National Recovery Plan for the southern right whale has not been published. The updated BIA's have not been used in this report.

**Table 11.10 Predicted minimum time to entrained hydrocarbon exposure and maximum residence time for entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer. Results are based on a 105,289 bbl (16,740 $m^3$) subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| AMP | Apollo | 2.42 | 3.13 | 34.25 | 1.04 | 1.58 | 5.33 | 25.54 | 1 |
| | Beagle | 11.42 | - | 13.63 | - | 9.67 | - | 15.75 | - |
| | East Gippsland | 70.88 | - | 0.46 | - | 39.67 | - | 0.5 | - |
| | Franklin | 32.21 | - | 2.13 | - | 18.5 | - | 2.17 | - |
| | Murray | 37.21 | - | 0.5 | - | - | - | - | - |
| | Nelson | 13.67 | - | 2.92 | - | 100.92 | - | 0.63 | - |
| | Zeehan | 8.54 | - | 9.38 | - | 7.42 | - | 7.33 | - |
| BIA | Antipodean Albatross - Foraging* | 0.04 | 0.04 | 85.58 | 17.54 | 0.04 | 0.04 | 90.96 | 17.67 |
| | Australasian Gannet - Foraging | 2.92 | 14.29 | 72.04 | 0.25 | 6.71 | - | 90.96 | - |
| | Australian Sea Lion - Foraging | 14.08 | - | 4.46 | - | 24.13 | - | 0.04 | - |
| | Black Petrel - Foraging | 46.92 | - | 2.83 | - | 41.21 | - | 2.96 | - |
| | Black-browed Albatross - Foraging* | 0.04 | 0.04 | 85.58 | 17.54 | 0.04 | 0.04 | 90.96 | 17.67 |
| | Black-faced Cormorant - Foraging | 13.79 | - | 7.33 | - | 7.63 | - | 8.96 | - |
| | Bullers Albatross - Foraging* | 0.04 | 0.04 | 85.58 | 19.83 | 0.04 | 0.04 | 90.96 | 17.67 |
| | Campbell Albatross - Foraging* | 0.04 | 0.04 | 85.58 | 17.54 | 0.04 | 0.04 | 90.96 | 17.67 |
| | Common Diving-petrel - Foraging* | 0.04 | 0.04 | 85.83 | 22.08 | 0.04 | 0.04 | 92.75 | 22.13 |
| | Crested Tern - Breeding | 88.33 | - | 2.25 | - | 41.83 | - | 2.96 | - |
| | Crested Tern - Foraging | 47.88 | - | 2.83 | - | 41.33 | - | 2.96 | - |
| | Flesh-footed Shearwater - Foraging | 46.92 | - | 2.83 | - | 41.21 | - | 2.96 | - |
| | Great-winged Petrel - Foraging | 46.92 | - | 2.04 | - | 42.79 | - | 1.58 | - |
| | Grey Nurse Shark - Foraging | 44.29 | - | 2.75 | - | 39.92 | - | 2.54 | - |
| | Grey Nurse Shark - Migration | 44.21 | - | 2.83 | - | 39.88 | - | 3.04 | - |
| | Humpback Whale - Foraging | 33.04 | - | 2.83 | - | 39.63 | - | 3.04 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 0.04 | 0.04 | 85.58 | 17.54 | 0.04 | 0.04 | 90.96 | 17.67 |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Indo-Pacific/Spotted Bottlenose Dolphin - Breeding | 44.00 | - | 2.96 | - | 40.46 | - | 2.96 | - |
| | Little Penguin - Breeding | 88.25 | - | 2.38 | - | 41.75 | - | 2.96 | - |
| | Little Penguin - Foraging | 14.33 | - | 18.38 | - | 7.71 | - | 39.88 | - |
| | Northern Giant Petrel - Foraging | 46.92 | - | 2.04 | - | 42.79 | - | 1.58 | - |
| | Pygmy Blue Whale - Distribution* | 0.04 | 0.04 | 85.83 | 22.08 | 0.04 | 0.04 | 92.75 | 22.13 |
| | Pygmy Blue Whale - Foraging* | 0.04 | 0.04 | 85.83 | 22.08 | 0.04 | 0.04 | 92.75 | 22.13 |
| | Pygmy Blue Whale - Foraging annual high use area* | 0.04 | 0.04 | 85.83 | 22.08 | 0.04 | 0.04 | 92.75 | 22.13 |
| | Pygmy Blue Whale - Known Foraging Area | 2.58 | 3.38 | 59.42 | 1.88 | 1.67 | 3.38 | 65.92 | 3.17 |
| | Short-tailed Shearwater - Foraging | 1.46 | 1.58 | 83.92 | 22.08 | 0.75 | 1.33 | 92.75 | 22.13 |
| | Shy Albatross - Foraging* | 0.04 | 0.04 | 85.83 | 22.08 | 0.04 | 0.04 | 92.75 | 22.13 |
| | Soft-plumaged Petrel - Foraging | 28.71 | - | 3.79 | - | 103.92 | - | 0.29 | - |
| | Sooty Shearwater - Foraging | 39.54 | - | 2.83 | - | 40.08 | - | 3.04 | - |
| | Southern Giant Petrel - Foraging | 46.92 | - | 2.04 | - | 42.79 | - | 1.58 | - |
| | Southern Right Whale – Aggregation | 0.54 | 1.04 | 72.04 | 2.92 | 0.46 | 0.58 | 90.96 | 3.46 |
| | Southern Right Whale - Connecting Habitat | 15.67 | - | 16.88 | - | 11.21 | - | 11.38 | - |
| | Southern Right Whale - Known Core Range*^ | 0.04 | 0.04 | 85.83 | 22.08 | 0.04 | 0.04 | 92.75 | 22.13 |
| | Wandering Albatross - Foraging* | 0.04 | 0.04 | 85.58 | 17.54 | 0.04 | 0.04 | 90.96 | 17.67 |
| | Wedge-tailed Shearwater - Foraging* | 0.04 | 0.04 | 85.83 | 22.08 | 0.04 | 0.04 | 92.75 | 22.13 |
| | White Shark - Breeding | 12.04 | - | 19.5 | - | 22.13 | - | 43.42 | - |
| | White Shark - Distribution* | 0.04 | 0.04 | 85.58 | 17.54 | 0.04 | 0.04 | 90.96 | 17.67 |
| | White Shark - Foraging | 2.33 | 2.46 | 72.04 | 1.29 | 2.67 | 5.63 | 90.96 | 1.08 |
| | White-capped Albatross - Foraging | 46.92 | - | 2.04 | - | 42.79 | - | 1.58 | - |
| | White-faced Storm-petrel - Breeding | 46.29 | - | 2.83 | - | 40.58 | - | 2.96 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | White-faced Storm-petrel - Foraging | 2.83 | 3.42 | 58.33 | 1.88 | 1.75 | 5.71 | 65.92 | 3.17 |
| | Wilsons Storm Petrel - Migration | 46.92 | - | 2.04 | - | 42.79 | - | 1.58 | - |
| IBRA | Bateman | 88.50 | - | 1.71 | - | 42.08 | - | 1.79 | - |
| | Bridgewater | 12.33 | - | 57.71 | - | 15.88 | - | 24.83 | - |
| | East Gippsland Lowlands | 48.17 | - | 3.17 | - | 34.38 | - | 9.58 | - |
| | Flinders | 30.92 | - | 5.25 | - | 22.67 | - | 5.29 | - |
| | Gippsland Plain | 12.42 | - | 40.83 | - | 7.92 | - | 53.88 | - |
| | Glenelg Plain | 5.46 | - | 60.63 | - | 11.21 | - | 27.08 | - |
| | King Island | 15.75 | - | 16.88 | - | 11.29 | - | 11.04 | - |
| | Otway Plain | 2.50 | 2.96 | 83.33 | 19.5 | 1.79 | 3.21 | 77.75 | 22.04 |
| | Otway Ranges | 2.38 | 5.33 | 76.04 | 10.67 | 1.50 | 4.13 | 91.29 | 12 |
| | South East Coastal Ranges | 99.63 | - | 0.04 | - | - | - | - | - |
| | Strzelecki Ranges | 12.00 | - | 13.96 | - | 12.96 | - | 17.67 | - |
| | Tasmanian West | 85.83 | - | 0.13 | - | 103.92 | - | 0.21 | - |
| | Warrnambool Plain | 2.33 | 6.21 | 85.21 | 11.83 | 1.21 | 4.21 | 86.17 | 17.17 |
| | Wilsons Promontory | 11.29 | 88.71 | 45.79 | 0.08 | 7.58 | - | 73.17 | - |
| IMCRA | Batemans Shelf | 46.38 | - | 2.83 | - | 40.58 | - | 2.96 | - |
| | Central Bass Strait | 2.58 | 6.67 | 27.17 | 1.42 | 1.79 | 5.83 | 38.58 | 3.17 |
| | Central Victoria | 2.54 | 3.42 | 57.00 | 1.88 | 1.67 | 5.67 | 65.92 | 1.79 |
| | Coorong | 16.5 | - | 4.46 | - | 24.13 | - | 0.08 | - |
| | Davey | 40.17 | - | 0.08 | - | - | - | - | - |
| | Flinders | 10.75 | 56.67 | 47.33 | 0.08 | 6.83 | - | 73.17 | - |
| | Franklin | 26.96 | - | 3.79 | - | 19.04 | - | 0.33 | - |
| | Otway* | 0.04 | 0.04 | 85.83 | 22.08 | 0.04 | 0.04 | 92.75 | 22.13 |
| | Twofold Shelf | 12.33 | - | 5.33 | - | 19.42 | - | 14.54 | - |
| | Victorian Embayments | 14.71 | - | 12.33 | - | 9.92 | - | 28.92 | - |
| | Victorian Embayments | 50.17 | - | 0.13 | - | 58.25 | - | 0.04 | - |
| KEF | Big Horseshoe Canyon | 42.58 | - | 0.67 | - | 64.00 | - | 0.67 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Bonney Coast Upwelling | 3.29 | 9.42 | 72.04 | 0.04 | 7.00 | - | 90.96 | - |
| | Canyons on the Eastern Continental Slope | 46.96 | - | 2.04 | - | 51.67 | - | 0.04 | - |
| | Shelf rocky reefs | 88.21 | - | 2.17 | - | 42.08 | - | 2.08 | - |
| | Upwelling East of Eden | 15.29 | - | 5.33 | - | 27.88 | - | 14.54 | - |
| | West Tasmania Canyons | 3.04 | 11.79 | 12.17 | 0.17 | 9.13 | 12.83 | 8.17 | 0.21 |
| MNP | Bunurong | 36.38 | - | 10.83 | - | 13.00 | - | 11.13 | - |
| | Cape Howe | 43.96 | - | 3.25 | - | 41.5 | - | 3.25 | - |
| | Churchill Island | 37.00 | - | 5.92 | - | 29.63 | - | 18.21 | - |
| | Discovery Bay | 14.29 | - | 22.38 | - | 15.88 | - | 10.04 | - |
| | Point Addis | 13.46 | - | 46.25 | - | 12.29 | - | 35.54 | - |
| | Point Hicks | 65.92 | - | 2.67 | - | 34.04 | - | 14.54 | - |
| | Port Phillip Heads | 18.63 | - | 6.17 | - | 20.67 | - | 26.25 | - |
| | Twelve Apostles | 2.13 | 4.08 | 85.83 | 11.83 | 1.33 | 4.08 | 78.54 | 17.46 |
| | Wilsons Promontory | 11.29 | 56.67 | 47.33 | 0.08 | 7.71 | - | 73.17 | - |
| MP | Batemans | 88.33 | - | 2.25 | - | 41.83 | - | 2.96 | - |
| | Lower South East | 26.88 | - | 4.08 | - | - | - | - | - |
| MS | Beware Reef | - | - | - | - | 91.75 | - | 0.04 | - |
| | Mushroom Reef | 14.75 | - | 11.58 | - | 10.00 | - | 7.88 | - |
| NP | Kent Group | 32.67 | - | 0.88 | - | 41.96 | - | 0.13 | - |
| NPS4 | Bunurong Marine Park | 41.08 | - | 11.25 | - | 12.13 | - | 14.00 | - |
| | Corner Inlet Marine and Coastal Park | 50.17 | - | 0.13 | - | 58.25 | - | 0.04 | - |
| | Shallow Inlet Marine and Coastal Park | 40.04 | - | 0.17 | - | - | - | - | - |
| | Wilsons Promontory Marine Park | 12.54 | - | 41.79 | - | 8.33 | - | 54 | - |
| RAMSAR | Corner Inlet | 50.17 | - | 0.13 | - | 58.25 | - | 0.04 | - |
| | Port Phillip Bay Western Shoreline and Bellarine Peninsula | 24.21 | - | 6.83 | - | 20.83 | - | 14.79 | - |
| | Western Port | 30.58 | - | 9.08 | - | 29.63 | - | 18.21 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| RSB | Bell Reef | 33.33 | - | 0.17 | - | 19.96 | - | 0.08 | - |
| | Beware Reef | - | - | - | - | 89.00 | - | 0.04 | - |
| | Bravenes Rock | 1.96 | 5.17 | 75.96 | 3.88 | 1.25 | 6.38 | 78.79 | 3.54 |
| | Cody Bank | 11.54 | - | 9.75 | - | 6.88 | - | 6.29 | - |
| | Cutter Rock | 31.54 | - | 5.63 | - | 19.00 | - | 4.67 | - |
| | New Zealand Star Bank | 39.75 | - | 3.38 | - | 36.63 | - | 4.13 | - |
| Nearshore Waters | Anser Island | 11.67 | 88.71 | 43.5 | 0.08 | 7.88 | - | 73.17 | - |
| | Bass Coast | 33.33 | - | 11.67 | - | 11.71 | - | 17.96 | - |
| | Bega Valley | 74.83 | - | 2.54 | - | 44.54 | - | 2.42 | - |
| | Black Pyramid | 33.75 | - | 1.58 | - | 20 | - | 1.58 | - |
| | Circular Head | - | - | - | - | 108.38 | - | 0.04 | - |
| | Colac Otway | 2.5 | 2.96 | 83.33 | 19.5 | 1.79 | 3.21 | 91.13 | 22.04 |
| | Corangamite | 2.25 | 6.21 | 85.21 | 11.83 | 1.21 | 4.21 | 91.29 | 17.17 |
| | Curtis Island | 30.92 | - | 2.71 | - | 22.67 | - | 3.42 | - |
| | East Gippsland | 64.63 | - | 2.67 | - | 34.38 | - | 9.58 | - |
| | Eurobodalla | - | - | - | - | 46.79 | - | 0.25 | - |
| | French Island | 38.42 | - | 0.33 | - | 55.54 | - | 6.21 | - |
| | Gabo Island | 48.17 | - | 3.42 | - | 41.71 | - | 3.17 | - |
| | Glenelg | 5.46 | - | 60.63 | - | 11.21 | - | 72.75 | - |
| | Glennie Group | 11.54 | - | 45.79 | - | 7.63 | - | 71.92 | - |
| | Grant | 22.38 | - | 6.38 | - | - | - | - | - |
| | Greater Geelong | 17.58 | - | 19.17 | - | 14.00 | - | 44.04 | - |
| | Hogan Island Group | 31.83 | - | 5.25 | - | 23.42 | - | 5.29 | - |
| | Kanowna Island | 11.38 | 88.71 | 43.25 | 0.04 | 7.88 | - | 70.71 | - |
| | Kent Island Group | 32.38 | - | 1.17 | - | 41.96 | - | 0.13 | - |
| | King Island | 15.75 | - | 16.88 | - | 11.29 | - | 11.04 | - |
| | Lady Julia Percy Island | 8.00 | - | 53.25 | - | 9.33 | - | 84.88 | - |
| | Laurence Rocks | 8.71 | - | 60.75 | - | 10.46 | - | 27.29 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Moncoeur Islands | 11.58 | - | 13.04 | - | 9.75 | - | 7.83 | - |
| | Montague Island | 88.5 | - | 1.71 | - | 42.08 | - | 1.79 | - |
| | Mornington Peninsula | 14.33 | - | 20 | - | 9.50 | - | 36.54 | - |
| | Moyne | 2.38 | 6.25 | 50.21 | 10.79 | 1.46 | 6.67 | 68.63 | 7.92 |
| | Mud Island | 42.17 | - | 5.71 | - | 41.17 | - | 13.25 | - |
| | Norman Island | 12.00 | - | 41.83 | - | 7.58 | - | 67.71 | - |
| | Phillip Island | 14.67 | - | 15.13 | - | 9.88 | - | 33.58 | - |
| | Reid Rock | 30.00 | - | 0.42 | - | 24.33 | - | 0.13 | - |
| | Rodondo Island | 11.33 | - | 19.58 | - | 9.46 | - | 28.04 | - |
| | Seal Islands | 48.29 | - | 0.54 | - | 28.25 | - | 1.33 | - |
| | Shellback Island | 12.29 | - | 36.42 | - | 9.79 | - | 52.04 | - |
| | Skull Rock | 11.29 | - | 43.25 | - | 7.88 | - | 70.71 | - |
| | South Gippsland | 11.63 | - | 44.21 | - | 7.92 | - | 73.17 | - |
| | Surf Coast | 8.92 | - | 55.38 | - | 12.13 | - | 39.83 | - |
| | Warrnambool | 8.33 | 49 | 56.42 | 1.13 | 4.00 | 6.54 | 86.17 | 1.5 |
| | West Coast | 85.83 | - | 0.13 | - | 103.92 | - | 0.21 | - |
| State Waters | New South Wales | 44.42 | - | 2.75 | - | 41.83 | - | 2.96 | - |
| | South Australia State Waters | 20.42 | - | 6.38 | - | 19.63 | - | 0.04 | - |
| | Tasmania State Waters | 14.79 | - | 17.63 | - | 7.71 | - | 11.71 | - |
| | Victoria State Waters* | 1.50 | 2.58 | 85.83 | 22.08 | 0.83 | 3 | 92.75 | 22.13 |
| Nearshore Waters (Sub-LGA) | Anglesea | 15.00 | - | 40.5 | - | 12.46 | - | 39.83 | - |
| | Apollo Bay | 3.42 | 3.92 | 59.79 | 1.25 | 2.25 | 20 | 65.92 | 0.88 |
| | Bay of Islands | 2.38 | 6.25 | 39.25 | 10.79 | 1.46 | 6.67 | 39.29 | 7.92 |
| | Bega Valley | 74.83 | - | 2.54 | - | 44.54 | - | 2.42 | - |
| | Cape Conran | 114.29 | - | 0.04 | - | 48.63 | - | 0.13 | - |
| | Cape Howe / Mallacoota | 70.29 | - | 2.67 | - | 41.75 | - | 2.75 | - |
| | Cape Liptrap - Northwest | 16.29 | - | 13.38 | - | 12.75 | - | 22.33 | - |
| | Cape Nelson | 5.46 | - | 60.63 | - | 11.13 | - | 27.13 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Cape Otway West | 2.46 | 2.96 | 83.54 | 22.04 | 1.79 | 3.21 | 91.13 | 22.08 |
| | Cape Patton | 4.83 | 48.21 | 46 | 0.04 | 5.25 | 21.79 | 63.04 | 0.08 |
| | Childers Cove | 8.33 | 48.96 | 46.96 | 1.13 | 4.33 | 5 | 46.92 | 1.5 |
| | Corner Inlet | 50.17 | - | 0.13 | - | 58.25 | - | 0.04 | - |
| | Corringle | 64.63 | - | 0.04 | - | - | - | - | - |
| | Croajingolong - East | 81.83 | - | 0.17 | - | 48.5 | - | 0.63 | - |
| | Croajingolong - West | 67.00 | - | 0.25 | - | 45.17 | - | 0.46 | - |
| | Discovery Bay - East | 16.88 | - | 24.29 | - | 18.42 | - | 6.17 | - |
| | Discovery Bay - West | 21.79 | - | 4.38 | - | 95.96 | - | 0.04 | - |
| | Eurobodalla | - | - | - | - | 46.79 | - | 0.25 | - |
| | French Island - East | 76.5 | - | 0.04 | - | 64.96 | - | 0.54 | - |
| | French Island / Crib Point | 38.38 | - | 0.29 | - | 55.54 | - | 2 | - |
| | French Island / San Remo | 33.38 | - | 8.54 | - | 11.79 | - | 16.38 | - |
| | Kilcunda | 33.33 | - | 11.04 | - | 11.71 | - | 17.96 | - |
| | Lorne | 8.38 | - | 22.92 | - | 10.42 | - | 37.25 | - |
| | Marlo | - | - | - | - | 81.08 | - | 0.04 | - |
| | Moonlight Head | 2.33 | 6.21 | 76.5 | 10.29 | 1.46 | 4.21 | 91.29 | 17.17 |
| | Mornington Peninsula - South | 14.33 | - | 18.83 | - | 9.5 | - | 23.58 | - |
| | Mornington Peninsula - Southwest | 14.33 | - | 20 | - | 9.5 | - | 30.42 | - |
| | Point Hicks | 66.08 | - | 2.25 | - | 34.25 | - | 9.58 | - |
| | Port Campbell | 2.25 | 6.38 | 85.21 | 11.83 | 1.21 | 7.08 | 76.08 | 7.67 |
| | Port Fairy | 7.83 | - | 49.67 | - | 14.00 | - | 68.63 | - |
| | Port Phillip - Mornington | 55.21 | - | 0.54 | - | 47.29 | - | 3.63 | - |
| | Port Phillip - Queenscliff | 18.08 | - | 16 | - | 19.63 | - | 26.38 | - |
| | Port Phillip - Sorrento Shore | 15.96 | - | 9.29 | - | 11.17 | - | 37.13 | - |
| | Port Phillip Heads | 18.75 | - | 4.92 | - | 20.71 | - | 20.96 | - |
| | Portland Bay - East | 11.67 | - | 40.33 | - | 15.25 | - | 68.58 | - |
| | Portland Bay - West | 12.21 | - | 50.92 | - | 19.71 | - | 72.75 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Sydenham Inlet | 66.46 | - | 0.42 | - | 46.83 | - | 1.75 | - |
| | Torquay | 15.04 | - | 55.38 | - | 13.00 | - | 36.21 | - |
| | Venus Bay | 34.38 | - | 11.67 | - | 11.88 | - | 17.42 | - |
| | Waratah Bay | 12.00 | - | 25.63 | - | 12.96 | - | 17.67 | - |
| | Warrnambool | 8.42 | 64.13 | 56.42 | 0.04 | 4.00 | 10.42 | 86.17 | 0.13 |
| | Westernport | 14.75 | - | 11.42 | - | 9.96 | - | 7.88 | - |
| | Wilsons Promontory - East | 11.79 | - | 35.5 | - | 11.50 | - | 57.46 | - |
| | Wilsons Promontory - West | 11.63 | - | 44.21 | - | 7.92 | - | 73.17 | - |

*The release location resides within the receptor boundaries. ^ RPS have utilised BIA's for the southern right whale that were delineated within the 2011-2021 Southern Right Whale. The NCV Atlas now includes updated BIA's for SRW, though the recently drafted National Recovery Plan for the southern right whale has not been published. The updated BIA's have not been used in this report.

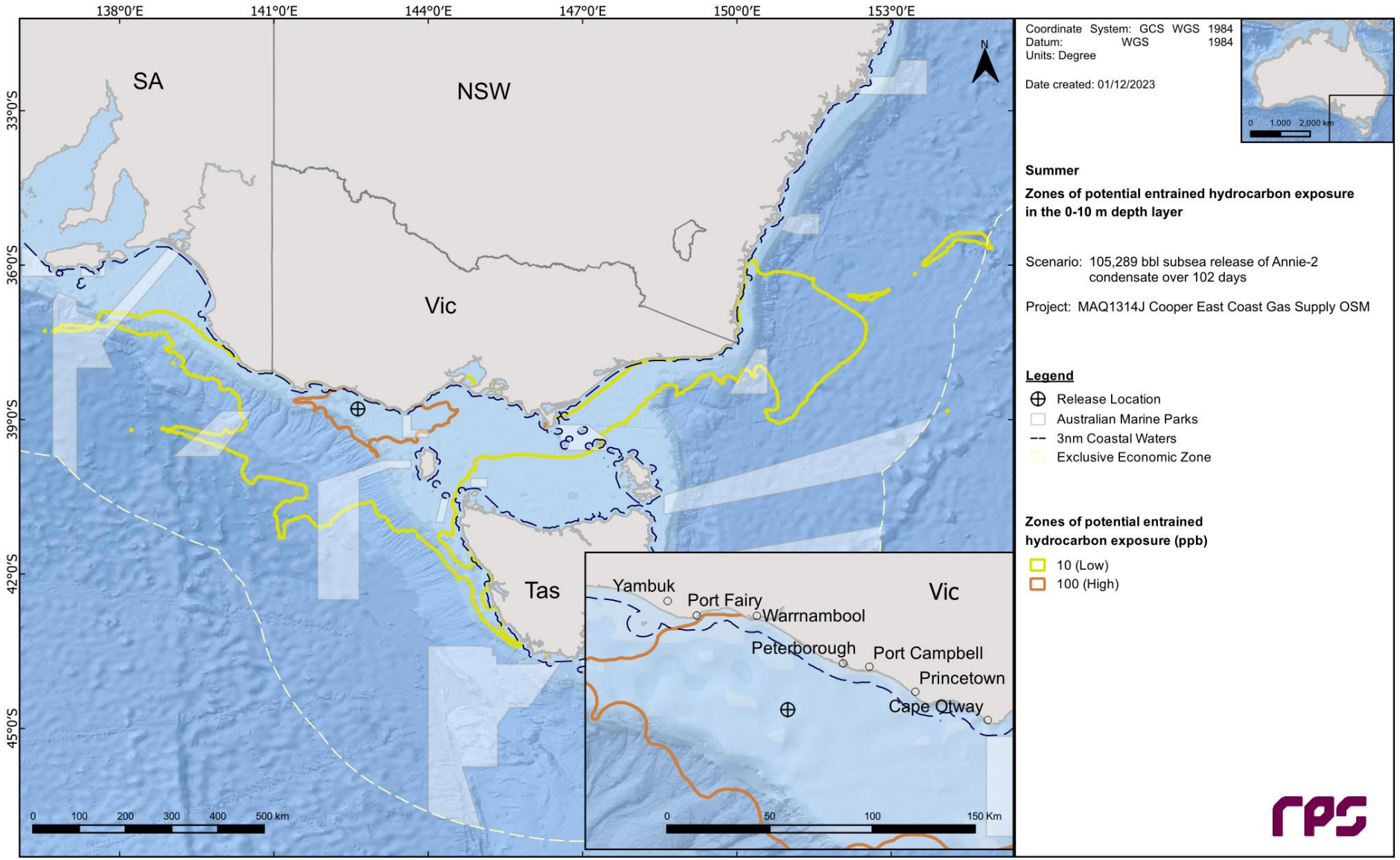



**Figure 11.13 Zones of potential entrained hydrocarbon exposure at 0-10 m below the sea surface in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

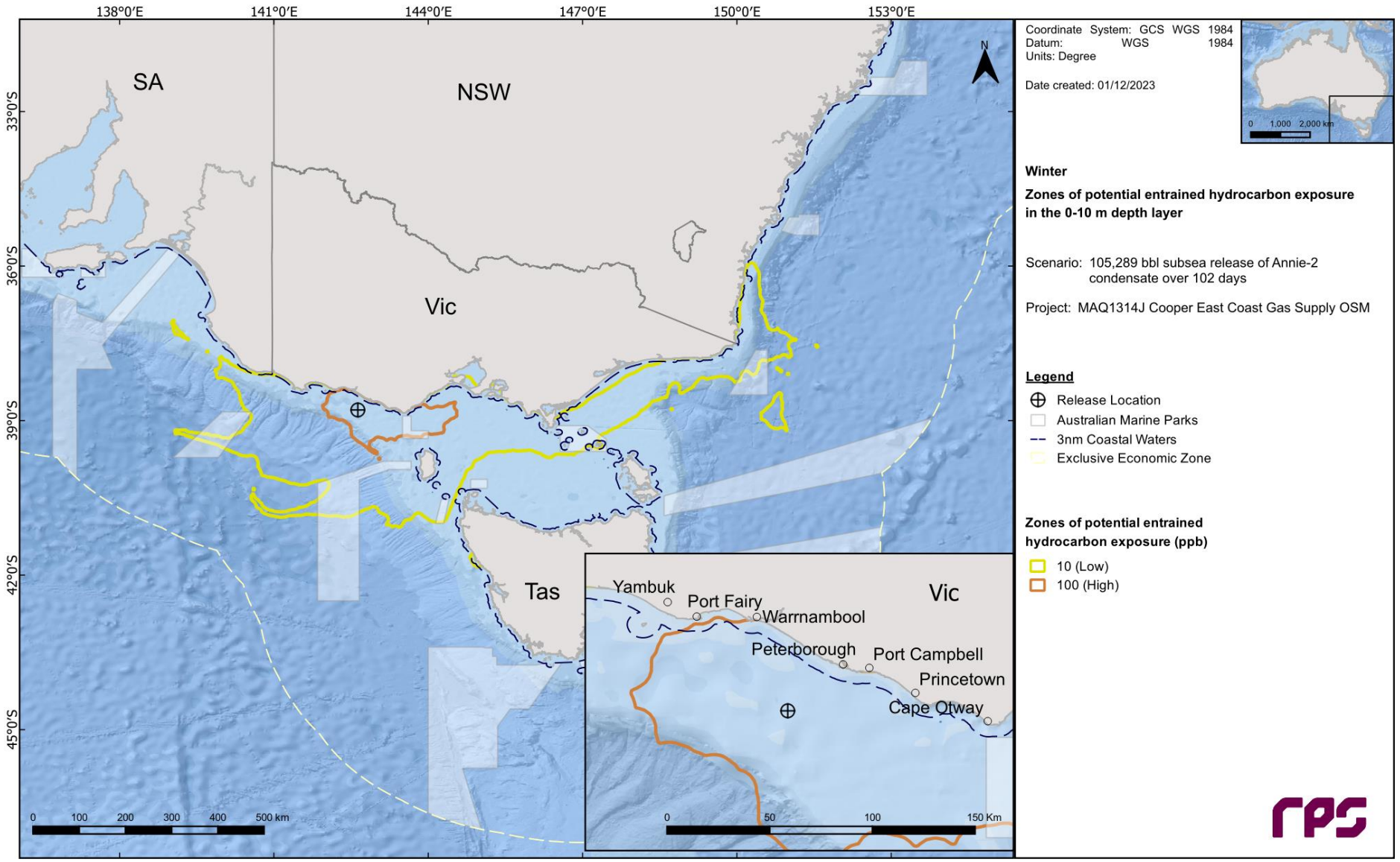



**Figure 11.14 Zones of potential entrained hydrocarbon exposure at 0-10 m below the sea surface in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

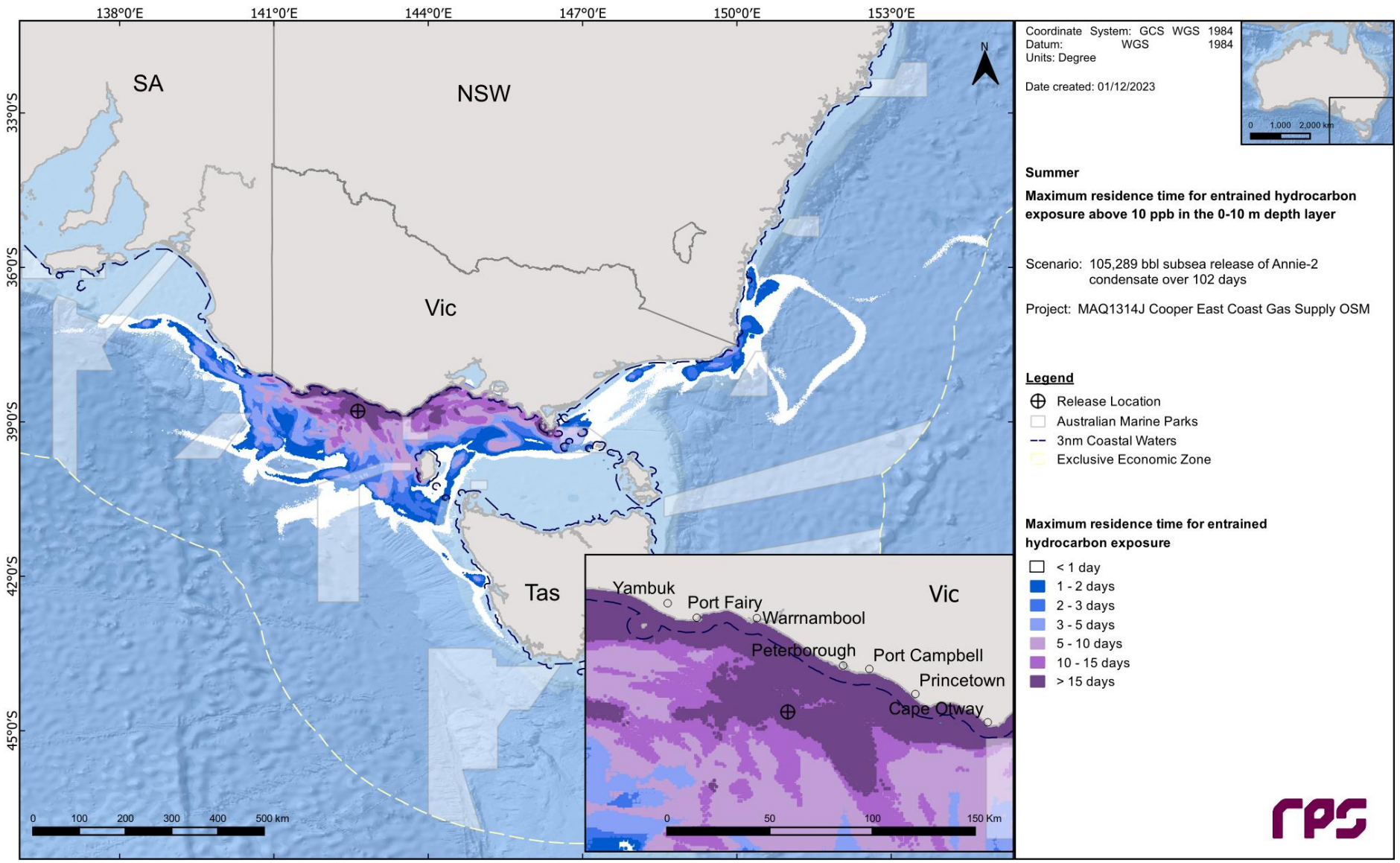



**Figure 11.15 Maximum residence time for entrained hydrocarbon exposure above 10 ppb, at 0-10 m below the sea in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

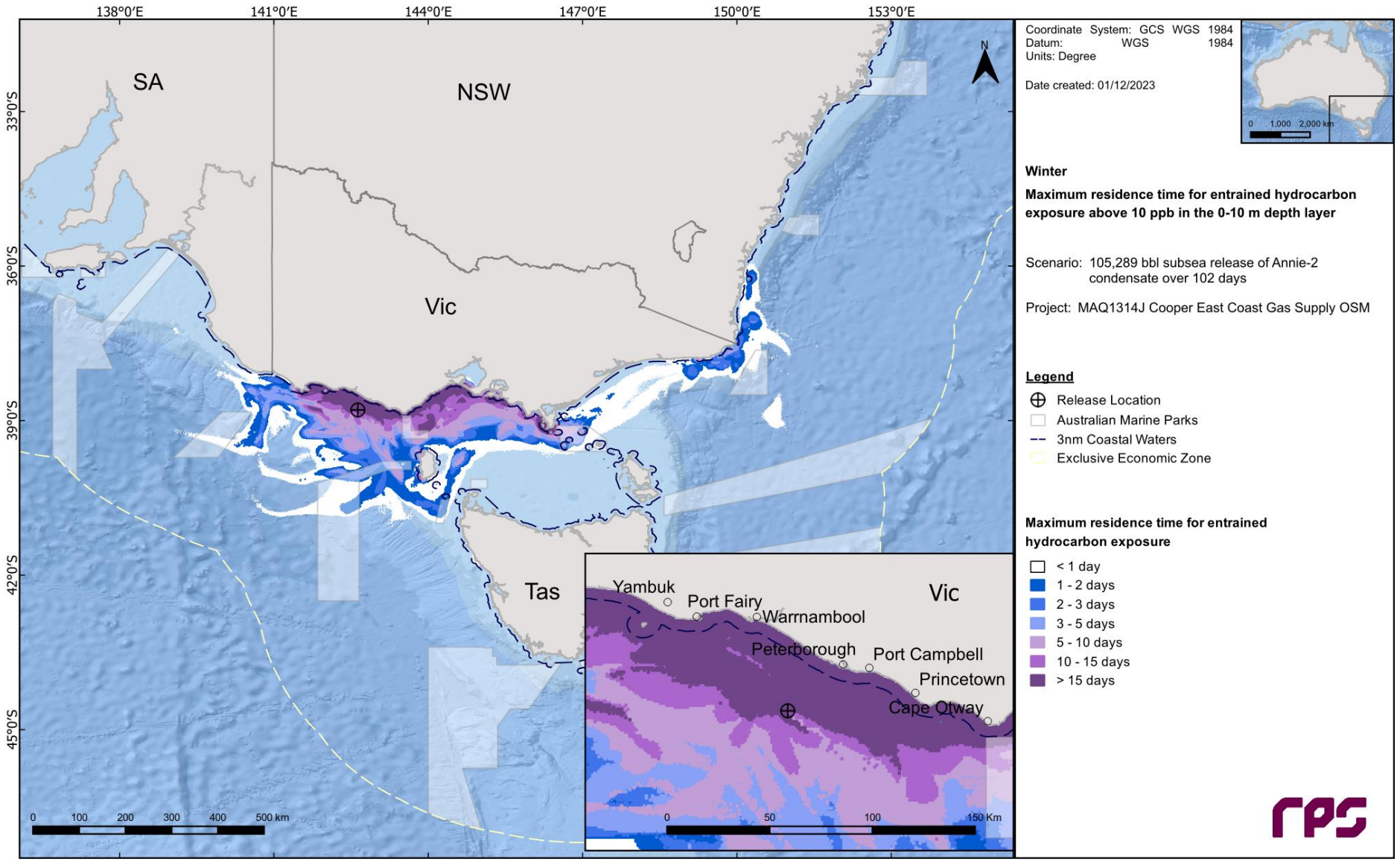



**Figure 11.16 Maximum residence time for entrained hydrocarbon exposure above 10 ppb, at 0-10 m below the sea in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

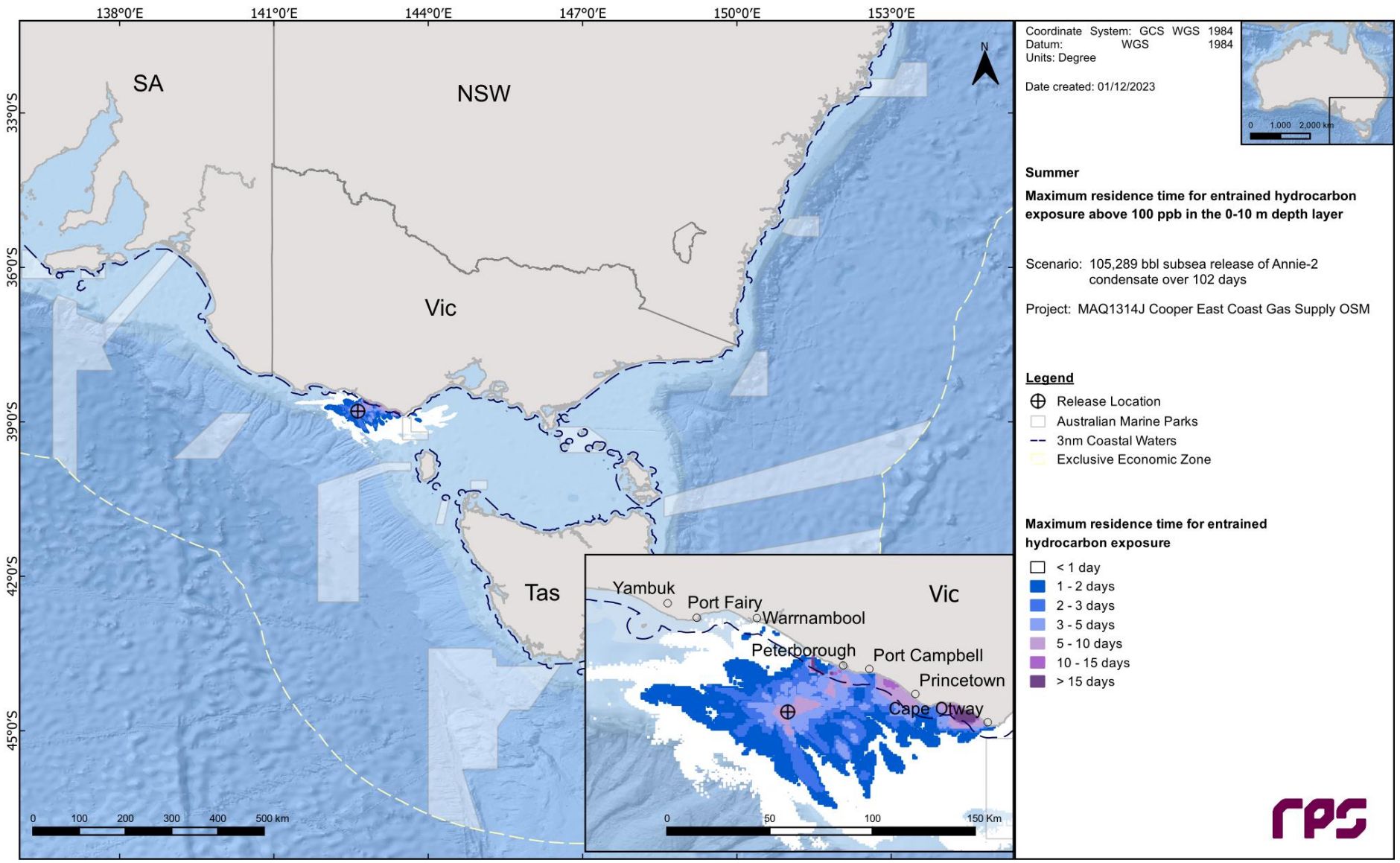



**Figure 11.17 Maximum residence time for entrained hydrocarbon exposure above 100 ppb, at 0-10 m below the sea in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

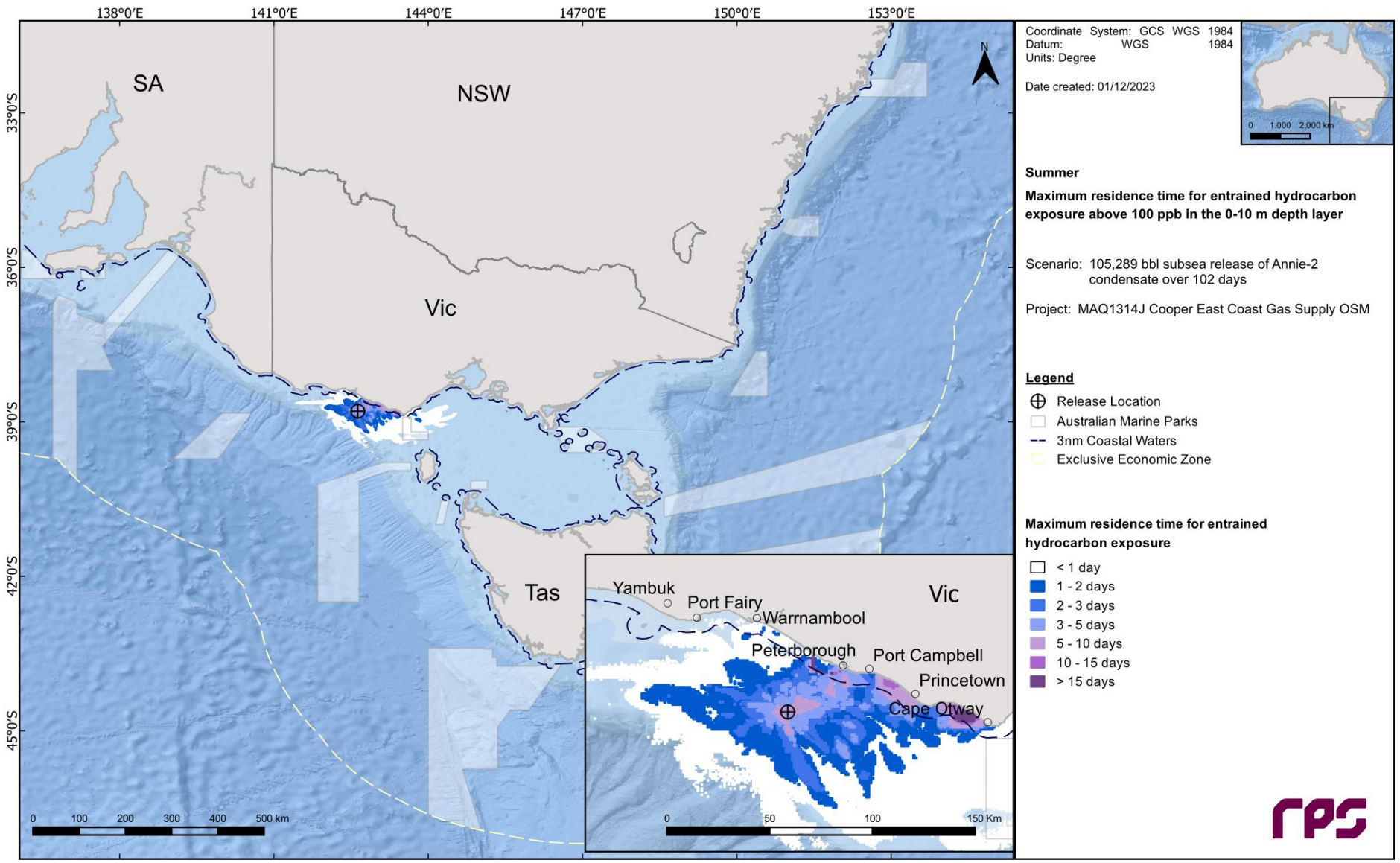



**Figure 11.18 Maximum residence time for entrained hydrocarbon exposure above 100 ppb, at 0-10 m below the sea in the event of a 105,289 bbl subsurface release from a loss of well control at Elanora-1 ST1 (Isabella) over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

## 11.2 Deterministic Analysis

The stochastic modelling results were assessed, and the “worst case” deterministic runs were identified and are presented below for the following criteria:

a. Largest swept area for surface oil above 10 g/m$^2$;
b. Largest (total) volume of oil ashore;
c. Longest length of shoreline with oil accumulation above 100 g/m$^{2;}$
d. Largest area of entrained hydrocarbon exposure above 100 ppb; and
e. Largest area of dissolved hydrocarbon exposure above 50 ppb.

Table 11.11 presents a summary of sea surface and in-water exposure and shoreline accumulation at the assessed thresholds for the identified deterministic simulations.

**Table 11.11 Summary of the worst-case deterministic analysis based on the scenario presented in the stochastic analysis section.**

| Variable | Threshold | Deterministic Analysis Criteria | | | | |
|---|---|---|---|---|---|---|
| | | Largest swept area of floating oil >10 g/m² | Largest volume of oil ashore | Longest length of shoreline with accumulation >100 g/m² | Largest area of entrained hydrocarbon exposure >100 ppb | Largest area of dissolved hydrocarbon exposure >50 ppb |
| **Season** | | Summer | Winter | Winter | Summer | Summer |
| **Run Number** | | 5 | 92 | 17 | 44 | 29 |
| **Total area of floating Oil exposure (km²)** | 1 g/m² | 360 | 251 | 293 | 276 | 341 |
| | 10 g/m² | **40** | 7 | 5 | 16 | 9 |
| | 50 g/m² | - | - | - | - | - |
| **Total length of shoreline accumulation (km)** | 10 g/m² | 166 | 189 | 268 | 34 | 158 |
| | 100 g/m² | 15 | 43 | **44** | 5 | 12 |
| | 1,000 g/m² | - | 0 | **-** | - | - |
| **Minimum time before accumulation on any shoreline (hours)** | 10 g/m² | 335 | 44 | 269 | 1035 | 366 |
| | 100 g/m² | 994 | 296 | 619 | 1073 | 436 |
| | 1,000 g/m² | - | - | **-** | - | **-** |
| **Total volume of oil ashore (m³)** | | 82 | **212** | 189 | 22 | 74 |
| **Total area of entrained hydrocarbon exposure (km²)** | 10 ppb | 49,508 | 24,945 | 24,641 | 60,183 | 48,694 |
| | 100 ppb | 5,196 | 5,084 | 3,596 | **6,272** | 5,835 |
| **Total area of dissolved hydrocarbon exposure (km²)** | 10 ppb | 141 | 413 | 400 | 273 | 319 |
| | 50 ppb | - | - | - | - | **1** |
| | 400 ppb | - | - | - | - | - |
| **Start Date** | | 3rd April 2018 5 am | 1st August 2010 1 am | 24th September 2013 7 pm | 4th January 2018 10 am | 12th March 2015 2 pm |

NC = No contact at, or above the specified shoreline accumulation threshold.

### 11.2.1 Deterministic Case: Largest swept area of floating oil above 10 g/m$^2$

The deterministic trajectory that resulted in the largest swept area of floating oil above 10 g/m$^2$ was identified as summer run number 5, which started on 3rd April 2018.

Figure 11.19 illustrates the floating oil exposure and shoreline accumulation over the 116-day simulation.

Figure 11.20 displays the time series of the area of sea surface exposure above the low (1 g/m$^2$), moderate (10 g/m$^2$) and high (50 g/m$^2$) thresholds over the 116-day simulation.

Figure 11.21 presents the fates and weathering graph for the corresponding single spill trajectory and Table 11.12 summarises the mass balance peaks and at the end of the simulation.

**Table 11.12 Summary of the mass balance for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface (m$^3$) | 260.3 | 26.8 | 6.4 |
| Entrained (m$^3$) | 2,515.2 | 96.7 | 2,002.1 |
| Dissolved (m$^3$) | 8.9 | 33.8 | 0.5 |
| Evaporation (m$^3$) | 9,881.7 | 116.0 | 9,881.7 |
| Decay (m$^3$) | 4,047.6 | 116.0 | 4,047.6 |
| Ashore (m$^3$) | 84.7 | 101.0 | 82.0 |

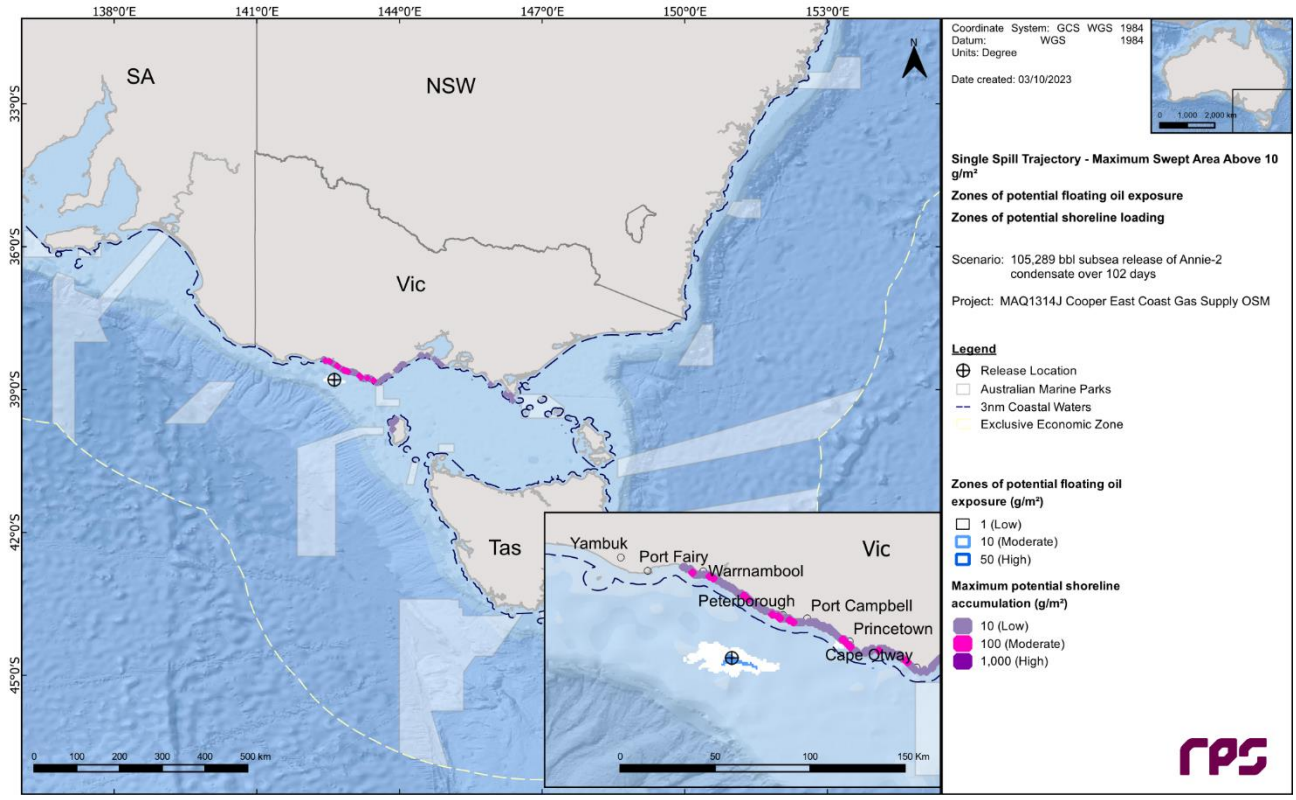



**Figure 11.19 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

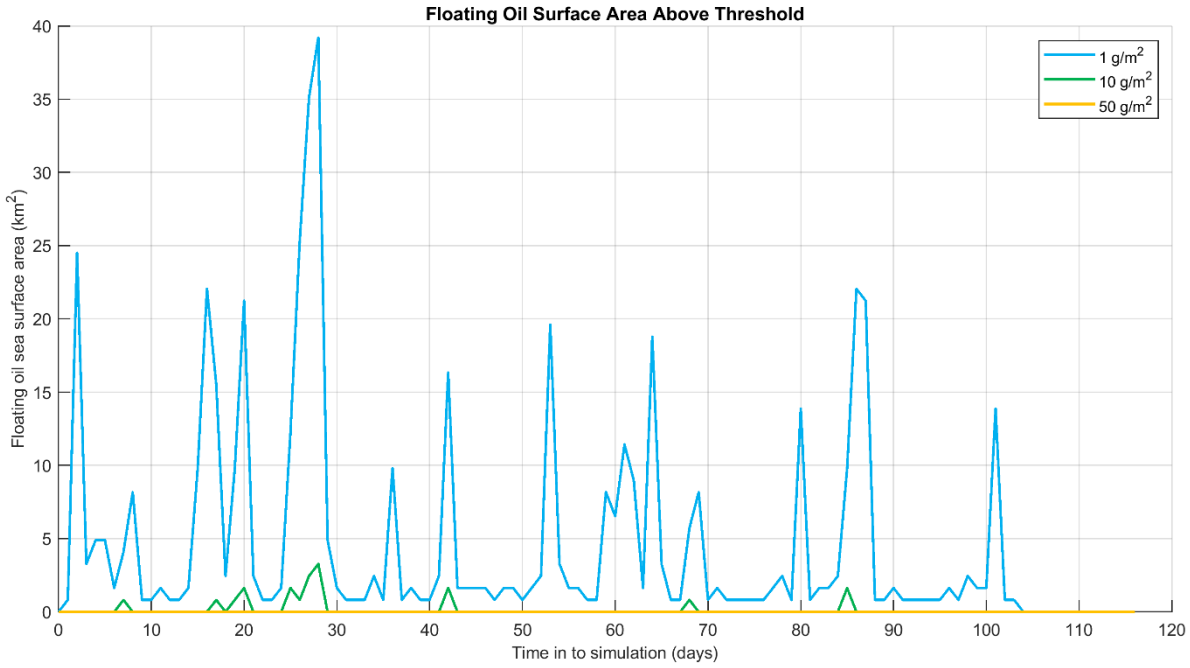



**Figure 11.20 Time series of the sea surface exposure above each threshold for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

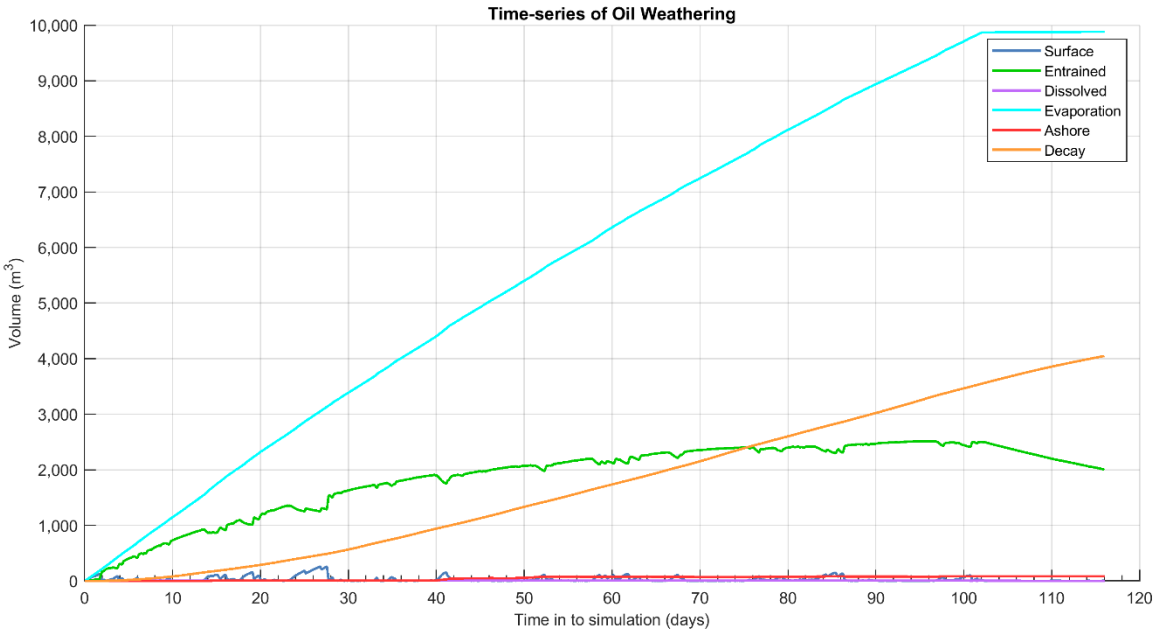



**Figure 11.21 Predicted weathering and fates graph for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

## 11.2.2 Deterministic Case: Largest volume of oil ashore

The deterministic trajectory that resulted in the largest volume of oil ashore was identified as winter run number 92, which started on 1st August 2010.

Figure 11.22 illustrates the floating oil exposure and shoreline accumulation over the 116-day simulation.

Figure 11.23 displays the time series of the shoreline accumulation above the low (10 g/m$^2$), moderate (100 g/m$^2$) and high (1,000 g/m$^2$) thresholds over the 116-day simulation.

Figure 11.24 presents the fates and weathering graph for the corresponding single spill trajectory and Table 11.13 summarises the mass balance peaks and at the end of the simulation.

**Table 11.13 Summary of the mass balance for the trajectory with the largest volume of oil ashore.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface (m$^3$) | 194.2 | 28.4 | 0.8 |
| Entrained (m$^3$) | 2,506.9 | 99.3 | 1,990.3 |
| Dissolved (m$^3$) | 10.1 | 24.8 | 0.7 |
| Evaporation (m$^3$) | 9,748.3 | 116.0 | 9,748.3 |
| Decay (m$^3$) | 4,070.4 | 116.0 | 4,070.4 |
| Ashore (m$^3$) | 211.7 | 111.1 | 209.8 |

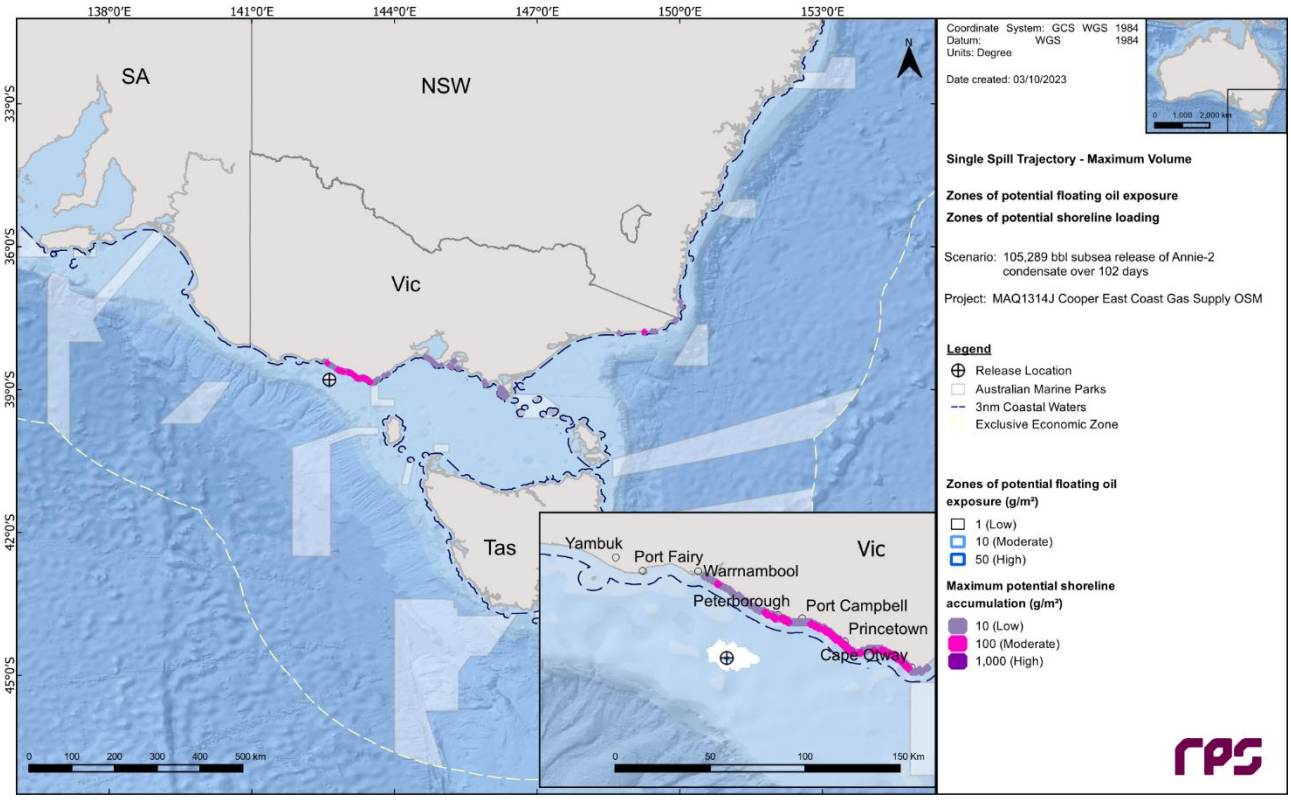



**Figure 11.22 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest volume of oil ashore.**

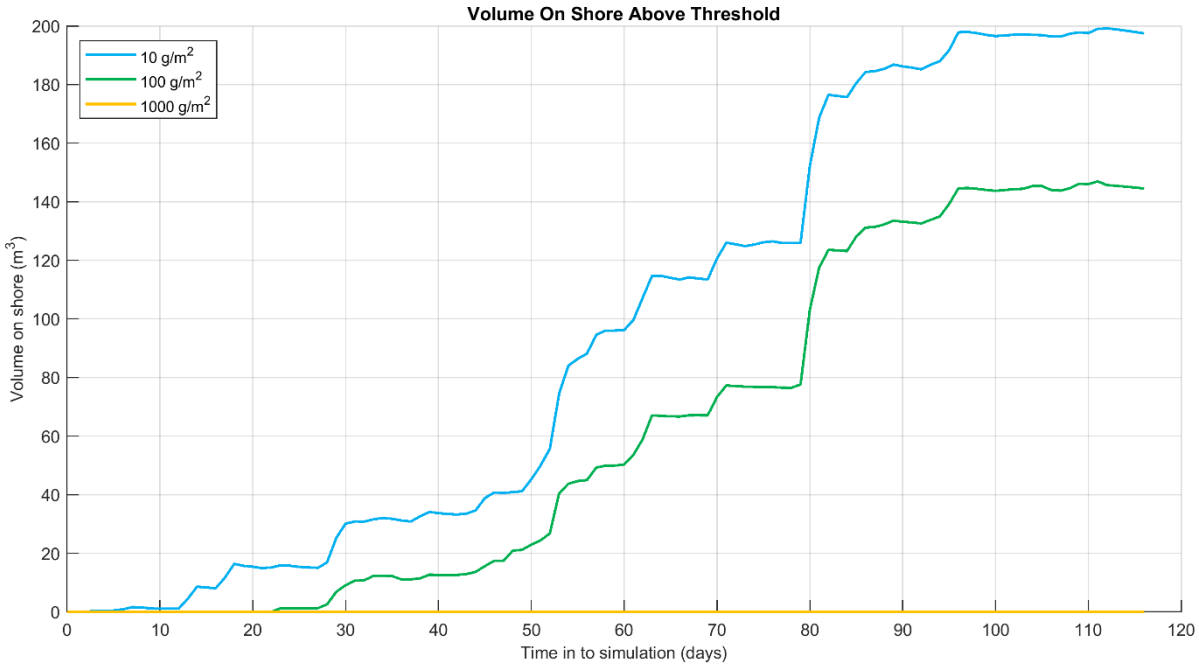



**Figure 11.23 Time series of oil accumulation on the shoreline above each threshold for the trajectory with the largest volume of oil ashore.**

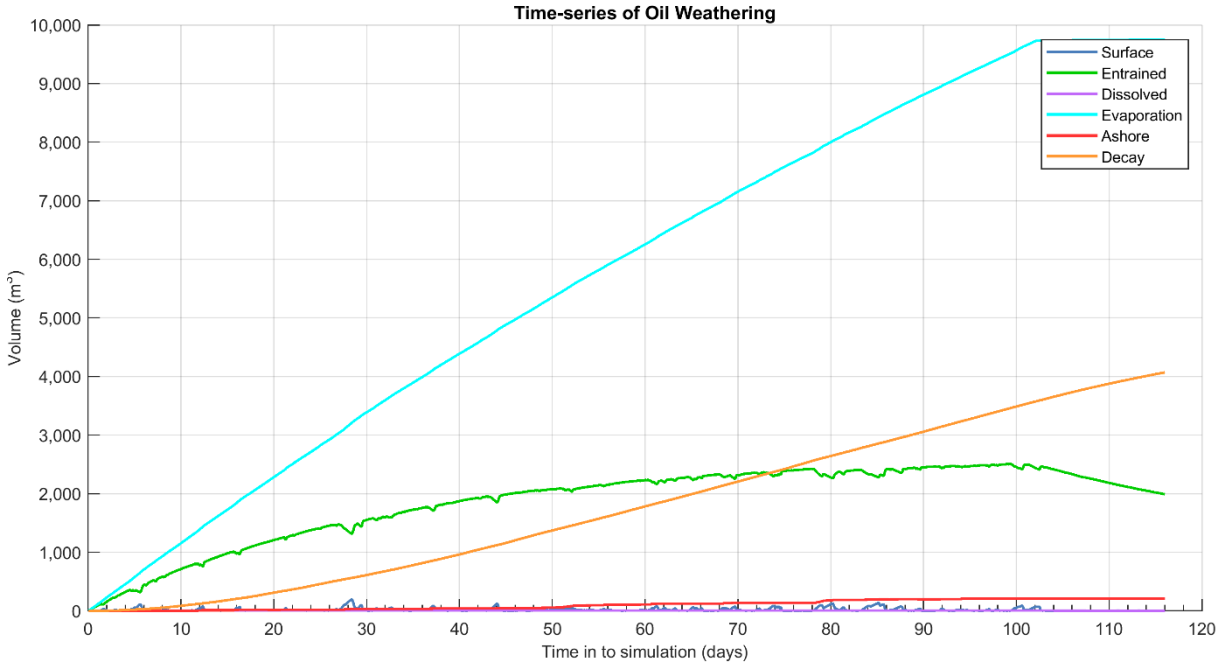



**Figure 11.24 Predicted weathering and fates graph for the trajectory with the largest volume of oil ashore.**

### 11.2.3 Deterministic Case: Longest length of shoreline with accumulation above 100 g/m$^2$

The deterministic trajectory that resulted in the longest length of shoreline with accumulation above 100 g/m$^2$ was identified as winter run number 17, which started on 24$^{th}$ September 2013.

Figure 11.25 illustrates the floating oil exposure and shoreline accumulation over the 116-day simulation.

Figure 11.26 displays the time series of the length of shoreline with accumulation at the low (10 g/m$^2$), moderate (100 g/m$^2$) and high (1,000 g/m$^2$) thresholds over the 116-day simulation.

Figure 11.27 presents the fates and weathering graph for the corresponding single spill trajectory and Table 11.14 summarises the mass balance peaks and at the end of the simulation.

**Table 11.14 Summary of the mass balance for the trajectory with the longest length of shoreline with accumulation above 100 g/m$^2$.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface (m$^3$) | 192.1 | 37.9 | 0.1 |
| Entrained (m$^3$) | 2,556.1 | 102.0 | 2,026.8 |
| Dissolved (m$^3$) | 10.2 | 21.7 | 0.5 |
| Evaporation (m$^3$) | 9,776.3 | 116.0 | 9,776.3 |
| Decay (m$^3$) | 4,027.9 | 116.0 | 4,027.9 |
| Ashore (m$^3$) | 190.0 | 112.7 | 188.6 |

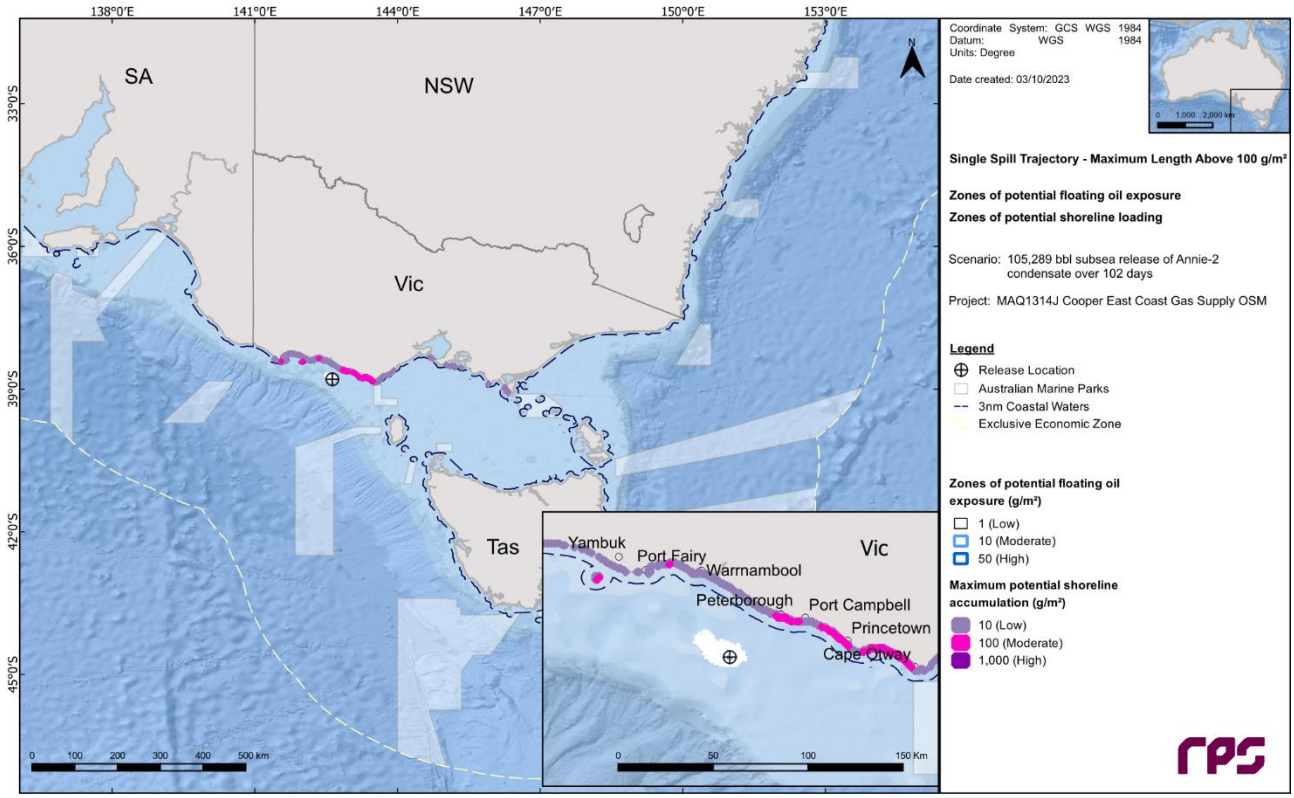



**Figure 11.25 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the longest length of shoreline with accumulation above 100 g/m$^2$.**

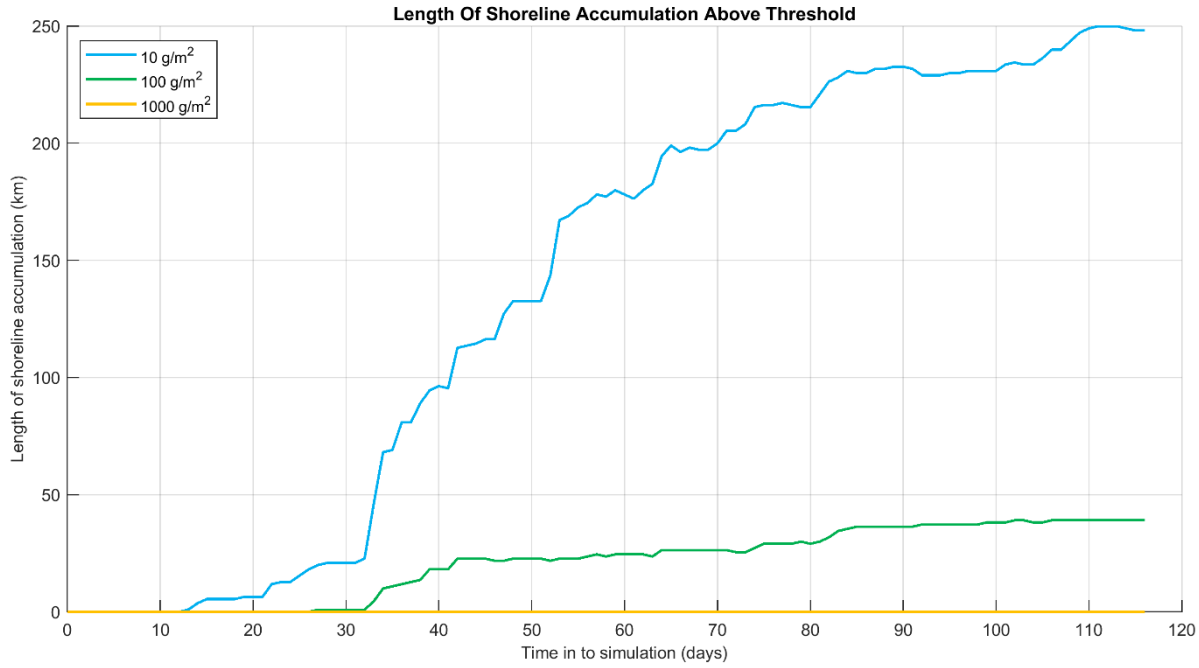



**Figure 11.26 Time series of the length of shoreline with accumulation above each threshold for the trajectory with the longest length of shoreline with accumulation above 100 g/m².**

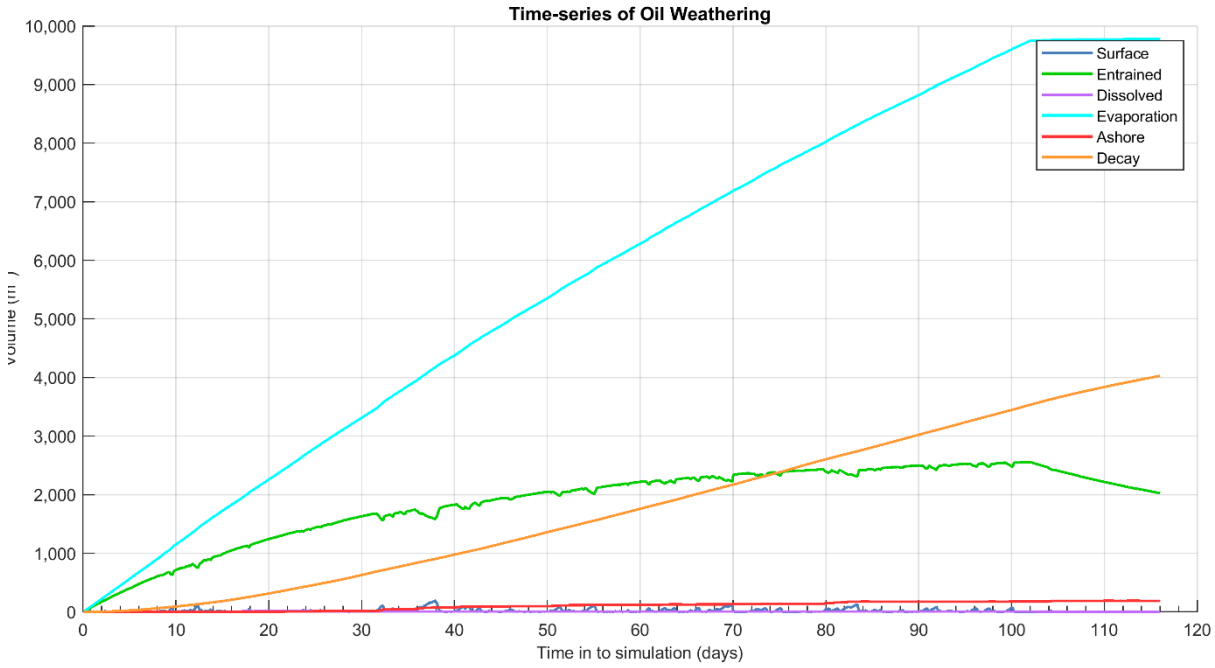



**Figure 11.27 Predicted weathering and fates graph for the trajectory with the longest length of shoreline with accumulation above 100 g/m².**

### 11.2.4 Deterministic Case: Largest area of entrained hydrocarbon exposure above 100 ppb

The deterministic trajectory that resulted in the largest area of entrained hydrocarbon exposure above 100 ppb was identified as summer run number 44, which started on 4th January 2018.

Figure 11.28 illustrates the zones of potential entrained hydrocarbon exposure over the 116-day simulation.

Figure 11.29 displays the time series of the area of entrained hydrocarbon exposure at the low (10 ppb) and high (100 ppb) thresholds over the 116-day simulation.

Figure 11.30 presents the fates and weathering graph for the corresponding single spill trajectory and Table 11.15 summarises the mass balance peaks and at the end of the simulation.

**Table 11.15 Summary of the mass balance for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface ($m^3$) | 183.0 | 19.8 | 2.2 |
| Entrained ($m^3$) | 2,654.6 | 100.1 | 2,087.2 |
| Dissolved ($m^3$) | 9.7 | 29.7 | 0.5 |
| Evaporation ($m^3$) | 9,778.9 | 116.0 | 9,778.9 |
| Decay ($m^3$) | 4,130.0 | 116.0 | 4,130.0 |
| Ashore ($m^3$) | 21.8 | 105.5 | 21.5 |

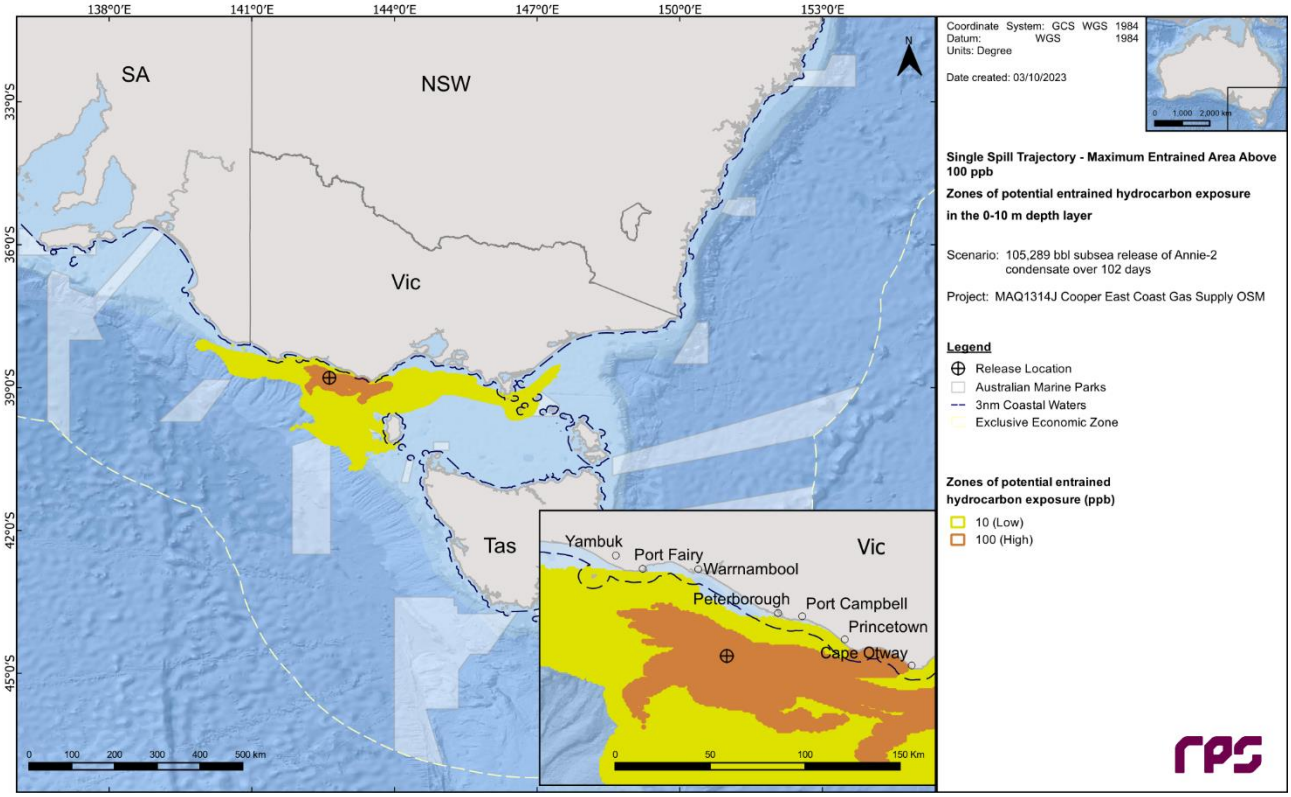



**Figure 11.28 Zones of potential entrained hydrocarbon exposure, for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

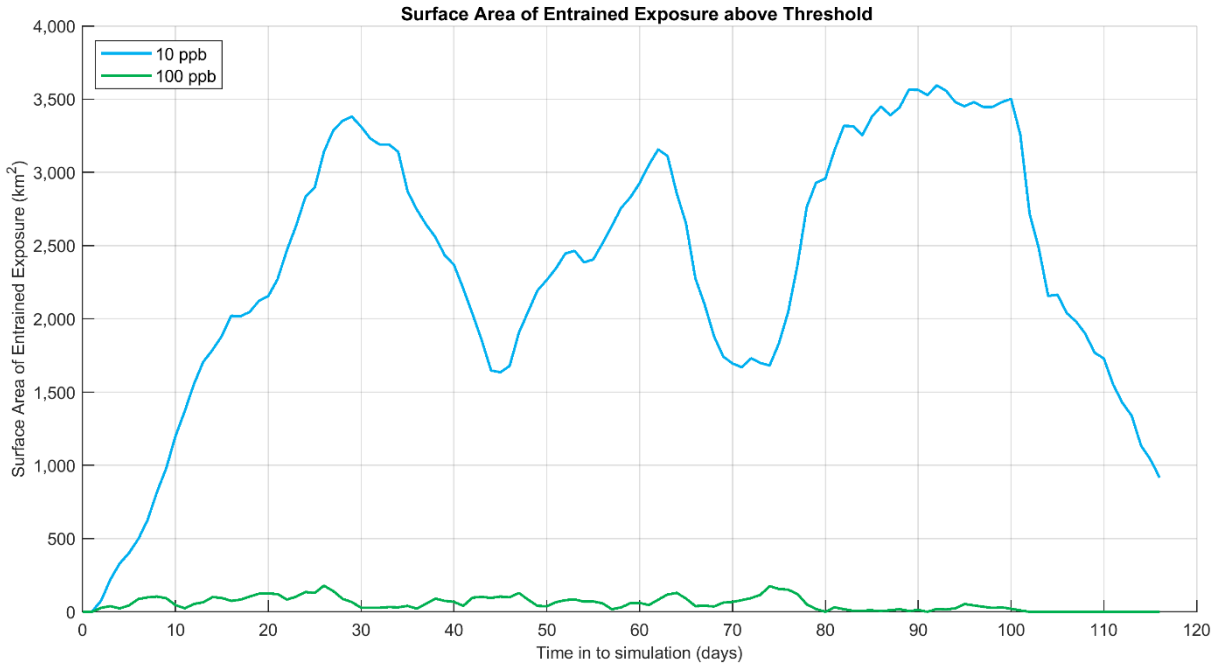



**Figure 11.29 Time series of the entrained hydrocarbon exposure area above each threshold for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

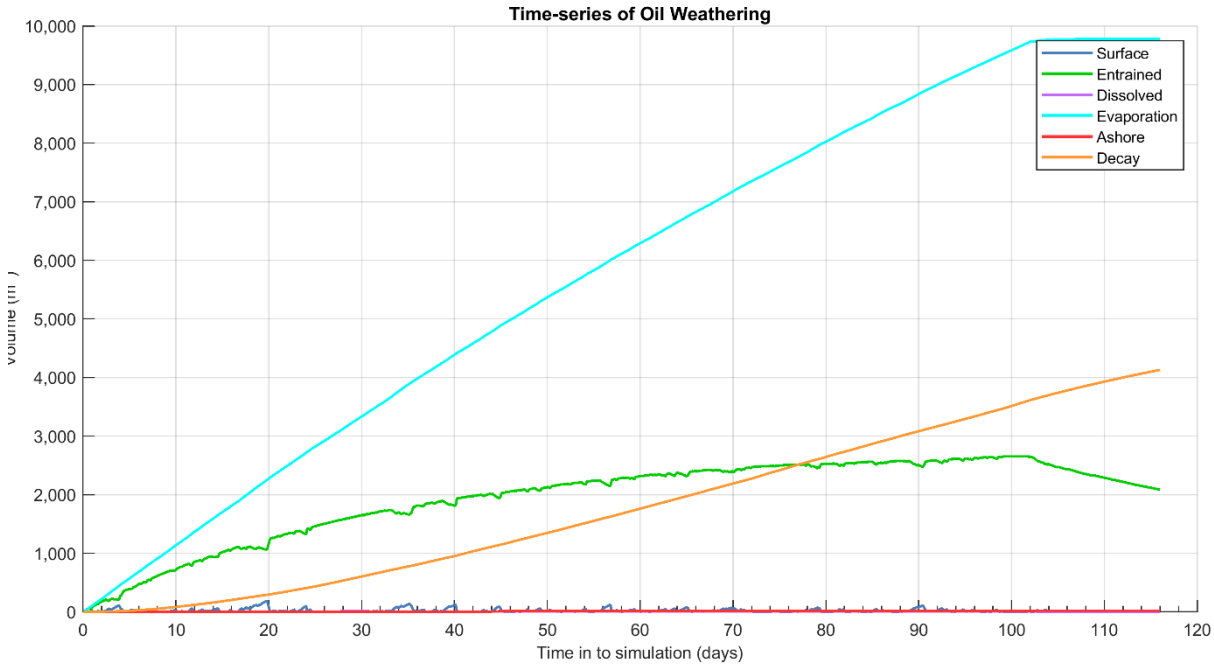



**Figure 11.30 Predicted weathering and fates graph for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

## 11.2.5 Deterministic Case: Largest area of dissolved hydrocarbon exposure above 50 ppb

The deterministic trajectory that resulted in the largest area of dissolved hydrocarbon exposure above 50 ppb was identified as summer run number 29, which started on 12th March 2015.

Figure 11.31 illustrates the zones of potential dissolved hydrocarbon exposure over the 116-day simulation.

Figure 11.32 displays the time series of the area of dissolved hydrocarbon exposure at the low (10 ppb), moderate (50 ppb) and high (400 ppb) thresholds over the 116-day simulation.

Figure 11.33 presents the fates and weathering graph for the corresponding single spill trajectory and Table 11.16 summarises the mass balance peaks and at the end of the simulation.

**Table 11.16 Summary of the mass balance for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface ($m^3$) | 155.8 | 65.1 | 0.4 |
| Entrained ($m^3$) | 2,557.9 | 102.0 | 2,041.7 |
| Dissolved ($m^3$) | 9.0 | 22.1 | 0.6 |
| Evaporation ($m^3$) | 9,827.6 | 116.0 | 9,827.6 |
| Decay ($m^3$) | 4,076.3 | 116.0 | 4,076.3 |
| Ashore ($m^3$) | 76.6 | 93.8 | 73.8 |

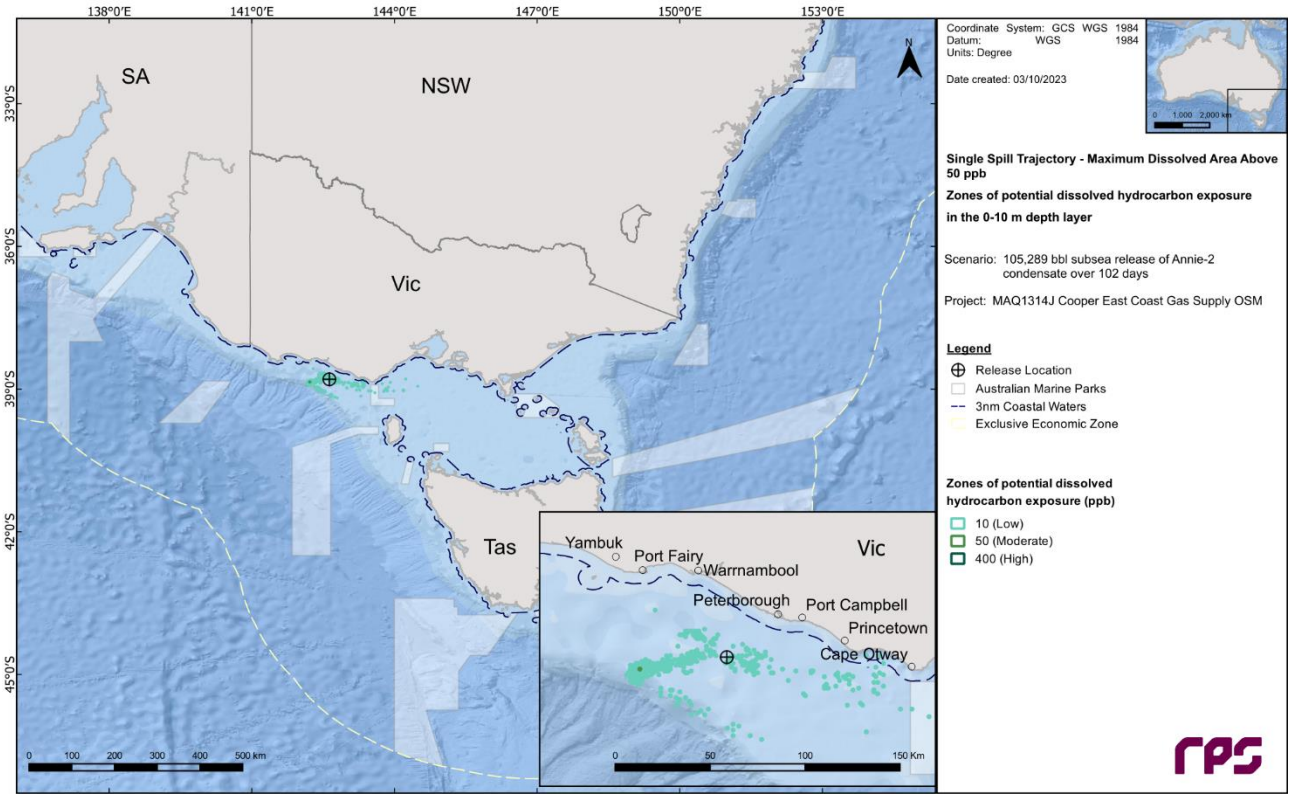



**Figure 11.31 Zones of potential dissolved hydrocarbon exposure, for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb.**

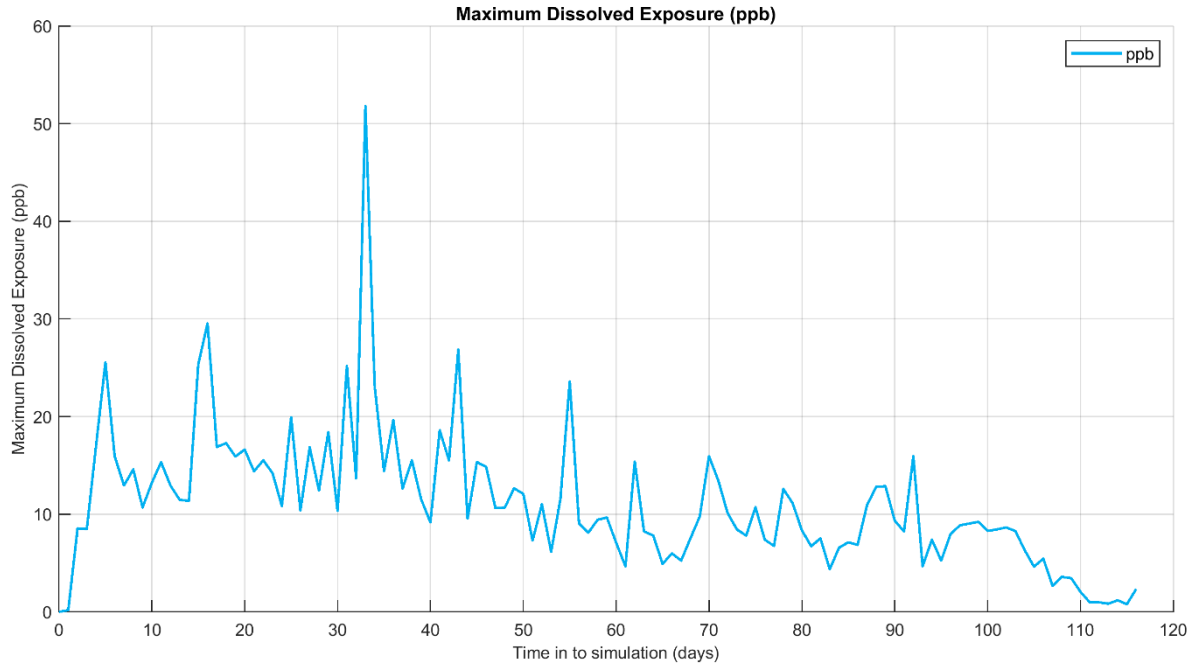



**Figure 11.32 Time series of the dissolved hydrocarbon exposure area above each threshold for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb.**

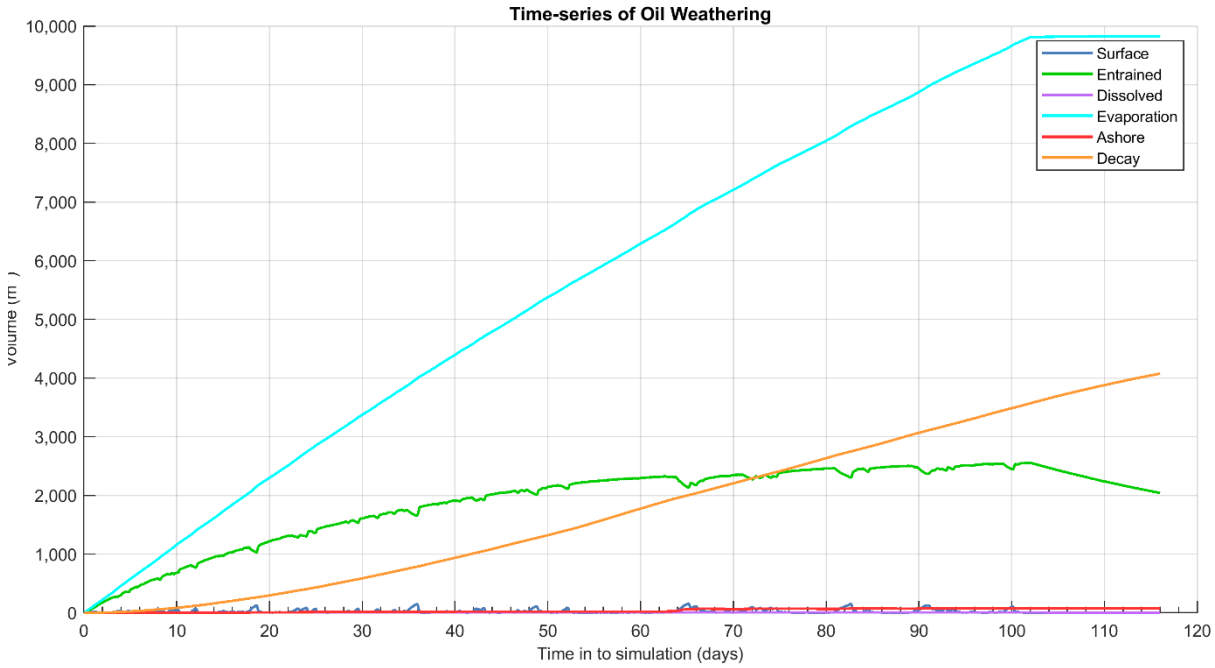



**Figure 11.33 Predicted weathering and fates graph for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb.**

# 12 RESULTS – SCENARIO 2 – 83,273 BBL (13,239 M$^3$) SUBSURFACE RELEASE FROM A LOSS OF WELL CONTROL AT PECTEN EAST-2

This scenario examined an 83,273 bbl (13,239 m$^3$) subsurface release of condensate over 102 days to represent a LOWC scenario at Pecten East-2 well. A total of 100 spill simulations were run per season (summer and winter) and each simulation was tracked for 116 days. The results are presented on a seasonal basis.

Sections 12.1 and 12.1.1 present the seasonal stochastic analysis and deterministic analysis results, respectively.

## 12.1 Stochastic Analysis

### 12.1.1 Floating Oil Exposure

Table 12.1 summarises the maximum distance travelled by floating oil on the sea surface at each threshold. The maximum distance and corresponding direction from the release location to the low (1–10 g/m$^2$) and moderate (10–50 g/m$^2$) exposure zones was 74.4 km (east-southeast, winter) and 15.2 km (east-southeast, winter), respectively. No high (>50 g/m$^2$) exposure zones were predicted during either summer or winter conditions.

Table 12.2 summarises the potential floating oil exposure to individual receptors.

In summer conditions, a total of 18 BIAs were predicted to be exposed to floating oil at, or above, the low threshold. Excluding the BIAs that the release location resides within (see Section 10.3), the highest probability (8%) of low exposure was predicted at the Short-tailed Shearwater – Foraging BIA. The minimum time before low exposure to the Short-tailed Shearwater – Foraging BIA was 11.63 days.

Additionally, during winter, a total of 18 BIAs were predicted to be exposed to floating oil at, or above, the low threshold. Again, the highest probability (20%) of low exposure for any BIA was predicted at the Short-tailed Shearwater – Foraging BIA. The minimum time before low exposure to the Short-tailed Shearwater – Foraging BIA was 8.46 days.

Table 12.3 presents the maximum residence time of floating oil exposure for each individual grid cell within each individual receptor.

Figure 12.1 and Figure 12.2 present the zones of potential floating oil exposure for each season whilst Figure 12.3 to Figure 12.6 present the maximum residence time of floating oil exposure for the NOPSEMA thresholds.

**Table 12.1 Maximum distance and direction from the release location to the edge of floating oil exposure. Results are based on an 83,273 bbl (13,239 m$^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations per season.**

| Distance and direction travelled | Zones of potential floating oil exposure | | | | | |
|---|---|---|---|---|---|---|
| | Summer | | | Winter | | |
| | Low | Moderate | High | Low | Moderate | High |
| Maximum distance (km) from release location | 67.4 | 12.7 | - | 74.4 | 15.2 | - |
| Maximum distance (km) from release location (99$^{th}$ percentile) | 45.5 | 12.4 | - | 49.7 | 14.9 | - |
| Direction | ESE | ESE | - | ESE | ESE | - |

**Table 12.2 Summary of the potential floating oil exposure to individual receptors. Results are based on an 83,273 bbl (13,239 $m^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | |
| | | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High |
| BIA | Antipodean Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Australasian Gannet - Foraging | - | - | - | - | - | - | 2 | - | - | 10.29 | - | - |
| | Black-browed Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Bullers Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Campbell Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Common Diving-petrel - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Pygmy Blue Whale - Distribution* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Pygmy Blue Whale - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Short-tailed Shearwater - Foraging | 8 | - | - | 11.63 | - | - | 20 | - | - | 8.46 | - | - |
| | Shy Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Southern Right Whale - Aggregation | 100 | 78 | - | 0.04 | 0.75 | - | 100 | 62 | - | 0.13 | 0.58 | - |
| | Southern Right Whale - Known Core Range* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Wandering Albatross - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | Wedge-tailed Shearwater - Foraging* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | White Shark - Distribution* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| | White Shark - Foraging | - | - | - | - | - | - | 2 | - | - | 10.29 | - | - |
| IBRA | Otway Plain | 8 | - | - | 11.63 | - | - | 11 | - | - | 8.96 | - | - |
| | Otway Ranges | - | - | - | - | - | - | 8 | - | - | 8.46 | - | - |
| | Warrnambool Plain | 87 | - | - | 1.71 | - | - | 90 | - | - | 2.04 | - | - |
| IMCRA | Otway* | 100 | 100 | - | 0.04 | 0.08 | - | 100 | 100 | - | 0.04 | 0.08 | - |
| KEF | Bonney Coast Upwelling | - | - | - | - | - | - | 2 | - | - | 10.29 | - | - |

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | |
| | | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High |
| MNP | Twelve Apostles | 51 | - | - | 4.38 | - | - | 65 | - | - | 2.54 | - | - |
| Nearshore Waters | Colac Otway | 8 | - | - | 11.63 | - | - | 16 | - | - | 8.46 | - | - |
| | Corangamite | 67 | - | - | 2.75 | - | - | 81 | - | - | 2.54 | - | - |
| | Lady Julia Percy Island | - | - | - | - | - | - | 2 | - | - | 10.29 | - | - |
| | Moyne | 64 | - | - | 1.71 | - | - | 59 | - | - | 2.04 | - | - |
| | Warrnambool | 2 | - | - | 69 | - | - | 6 | - | - | 6.63 | - | - |
| State Waters | Victoria State Waters | 100 | - | - | 0.67 | - | - | 100 | - | - | 0.83 | - | - |
| Nearshore Waters (Sub-LGA) | Bay of Islands | 56 | - | - | 1.71 | - | - | 56 | - | - | 2.04 | - | - |
| | Cape Otway West | 8 | - | - | 11.63 | - | - | 16 | - | - | 8.46 | - | - |
| | Childers Cove | 23 | - | - | 3.83 | - | - | 9 | - | - | 6.63 | - | - |
| | Moonlight Head | 56 | - | - | 4.38 | - | - | 73 | - | - | 5.54 | - | - |
| | Port Campbell | 44 | - | - | 2.75 | - | - | 59 | - | - | 2.54 | - | - |
| | Warrnambool | - | - | - | - | - | - | 2 | - | - | 6.83 | - | - |

*The release location resides within the receptor boundaries.

**Table 12.3 Summary of the maximum residence time of floating oil exposure for each individual grid cell within each individual receptor. Results are based on an 83,273 bbl (13,239 $m^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum residence time of floating oil exposure (hours) | | | Maximum residence time of floating oil exposure (hours) | | |
| | | Low | Moderate | High | Low | Moderate | High |
| BIA | Antipodean Albatross - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Australasian Gannet - Foraging | - | - | - | 0.13 | - | - |
| | Black-browed Albatross - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Bullers Albatross - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Campbell Albatross - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Common Diving-petrel - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Pygmy Blue Whale - Distribution* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Pygmy Blue Whale - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Short-tailed Shearwater - Foraging | 0.33 | - | - | 0.25 | - | - |
| | Shy Albatross - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Southern Right Whale - Aggregation | 2.5 | 0.21 | - | 2.58 | 0.42 | - |
| | Southern Right Whale - Known Core Range* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Wandering Albatross - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | Wedge-tailed Shearwater - Foraging* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | White Shark - Distribution* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| | White Shark - Foraging | - | - | - | 0.13 | - | - |
| IBRA | Otway Plain | 0.33 | - | - | 0.25 | - | - |
| | Otway Ranges | - | - | - | 0.17 | - | - |
| | Warrnambool Plain | 1.17 | - | - | 1.08 | - | - |
| IMCRA | Otway* | 21.92 | 1.08 | - | 21 | 1.42 | - |
| KEF | Bonney Coast Upwelling | - | - | - | 0.13 | - | - |
| MNP | Twelve Apostles | 0.71 | - | - | 0.71 | - | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum residence time of floating oil exposure (hours) | | | Maximum residence time of floating oil exposure (hours) | | |
| | | Low | Moderate | High | Low | Moderate | High |
| Nearshore Waters | Colac Otway | 0.33 | - | - | 0.25 | - | - |
| | Corangamite | 0.71 | - | - | 1.08 | - | - |
| | Lady Julia Percy Island | - | - | - | 0.13 | - | - |
| | Moyne | 1.08 | - | - | 0.79 | - | - |
| | Warrnambool | 0.17 | - | - | 0.67 | - | - |
| State Waters | Victoria State Waters | 1.58 | - | - | 1.08 | - | - |
| Nearshore Waters (Sub-LGA) | Bay of Islands | 0.96 | - | - | 0.79 | - | - |
| | Cape Otway West | 0.33 | - | - | 0.25 | - | - |
| | Childers Cove | 1.08 | - | - | 0.67 | - | - |
| | Moonlight Head | 0.71 | - | - | 0.83 | - | - |
| | Port Campbell | 0.71 | - | - | 1.08 | - | - |
| | Warrnambool | - | - | - | 0.04 | - | - |

*The release location resides within the receptor boundaries.

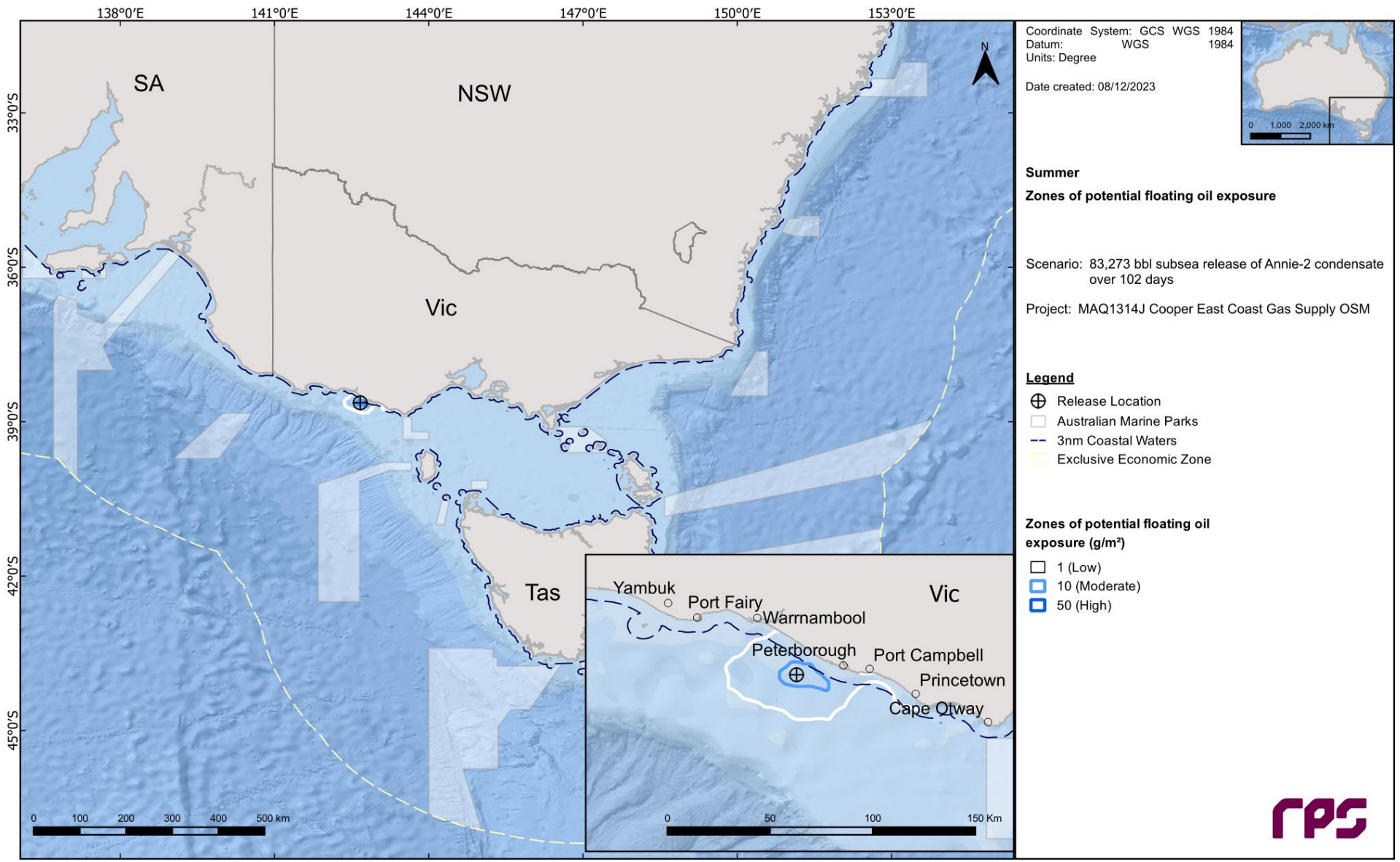



**Figure 12.1 Zones of potential floating oil exposure in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

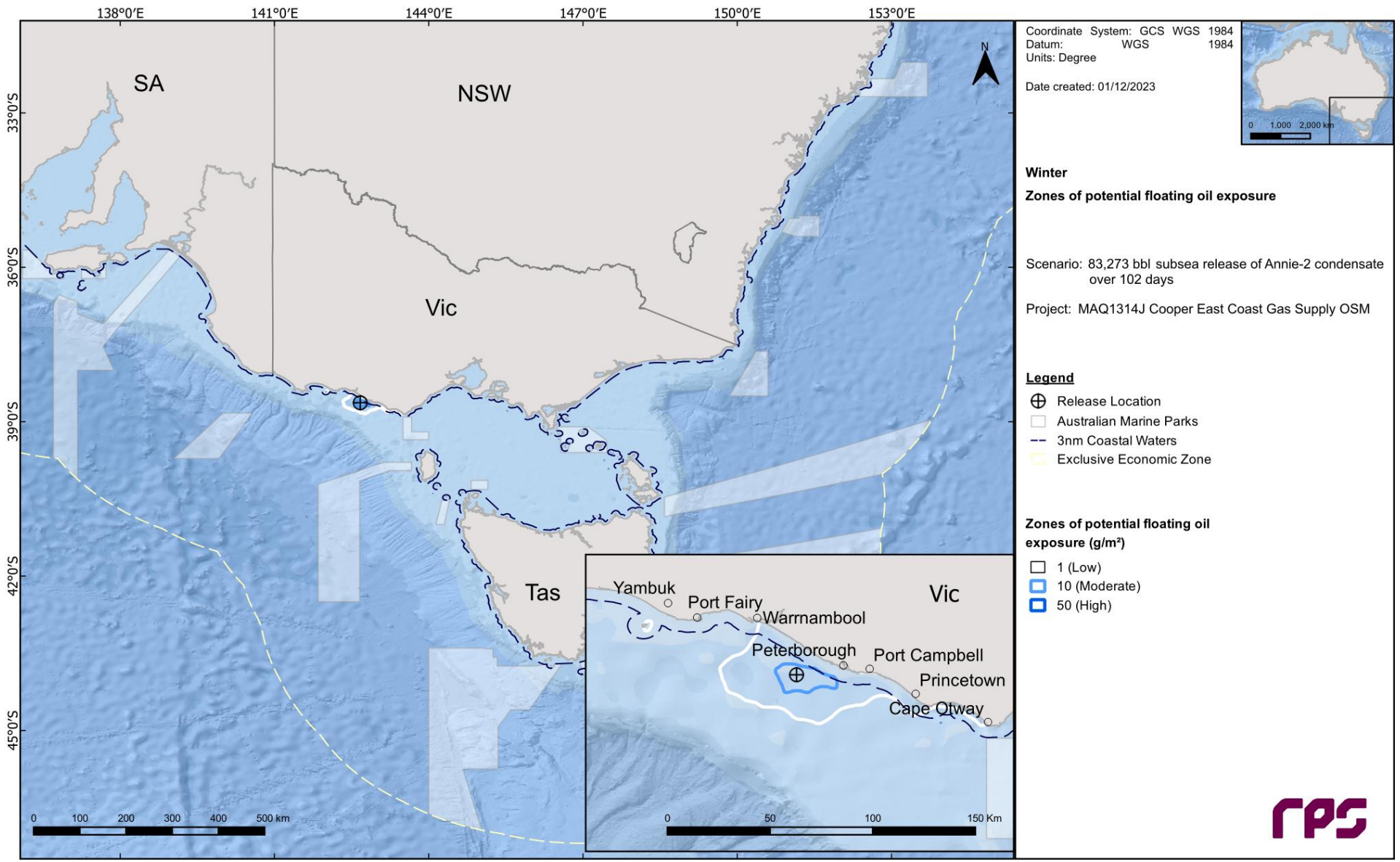



**Figure 12.2 Zones of potential floating oil exposure in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

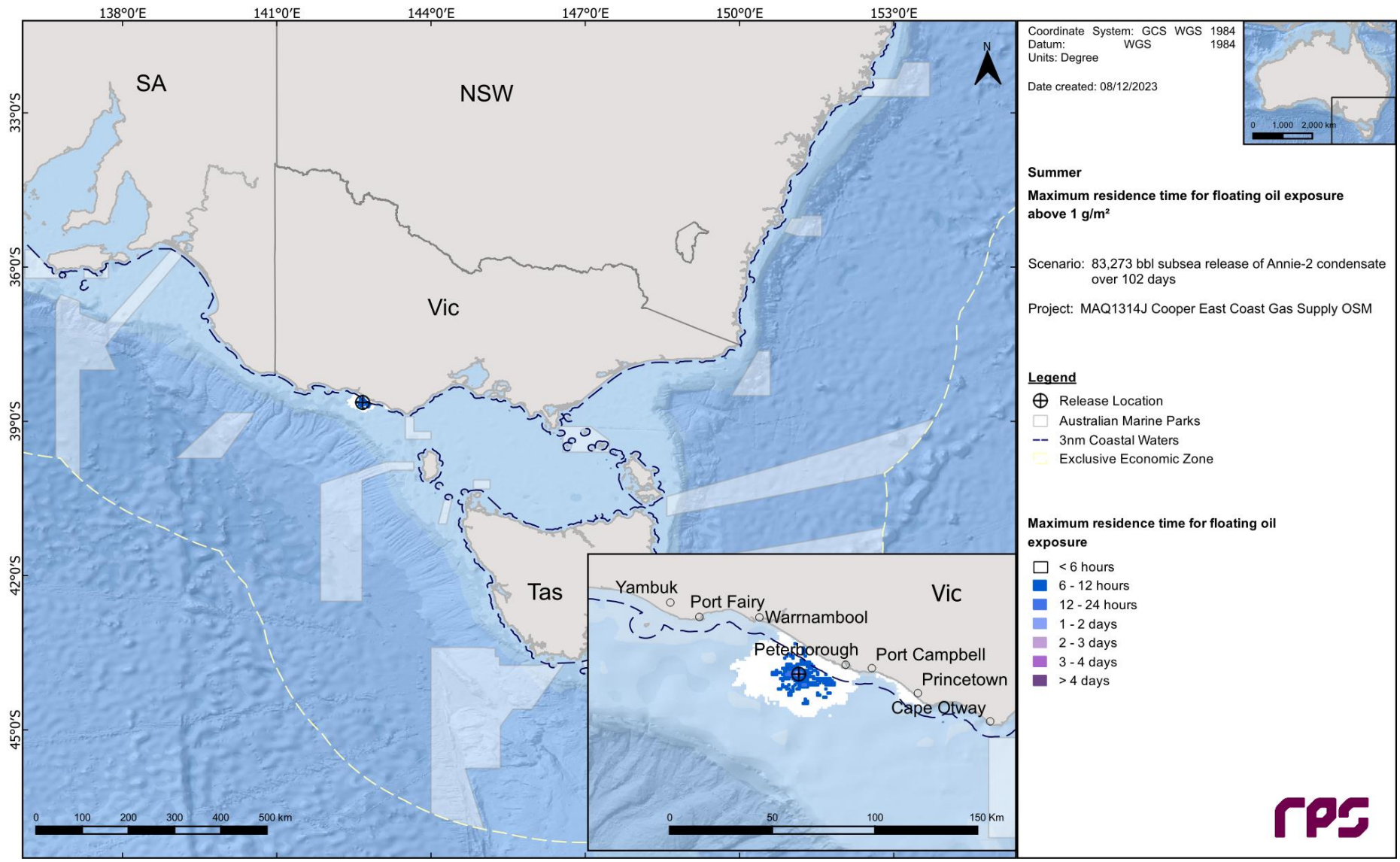



**Figure 12.3 Maximum residence time of floating oil exposure above 1 g/m$^2$, in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

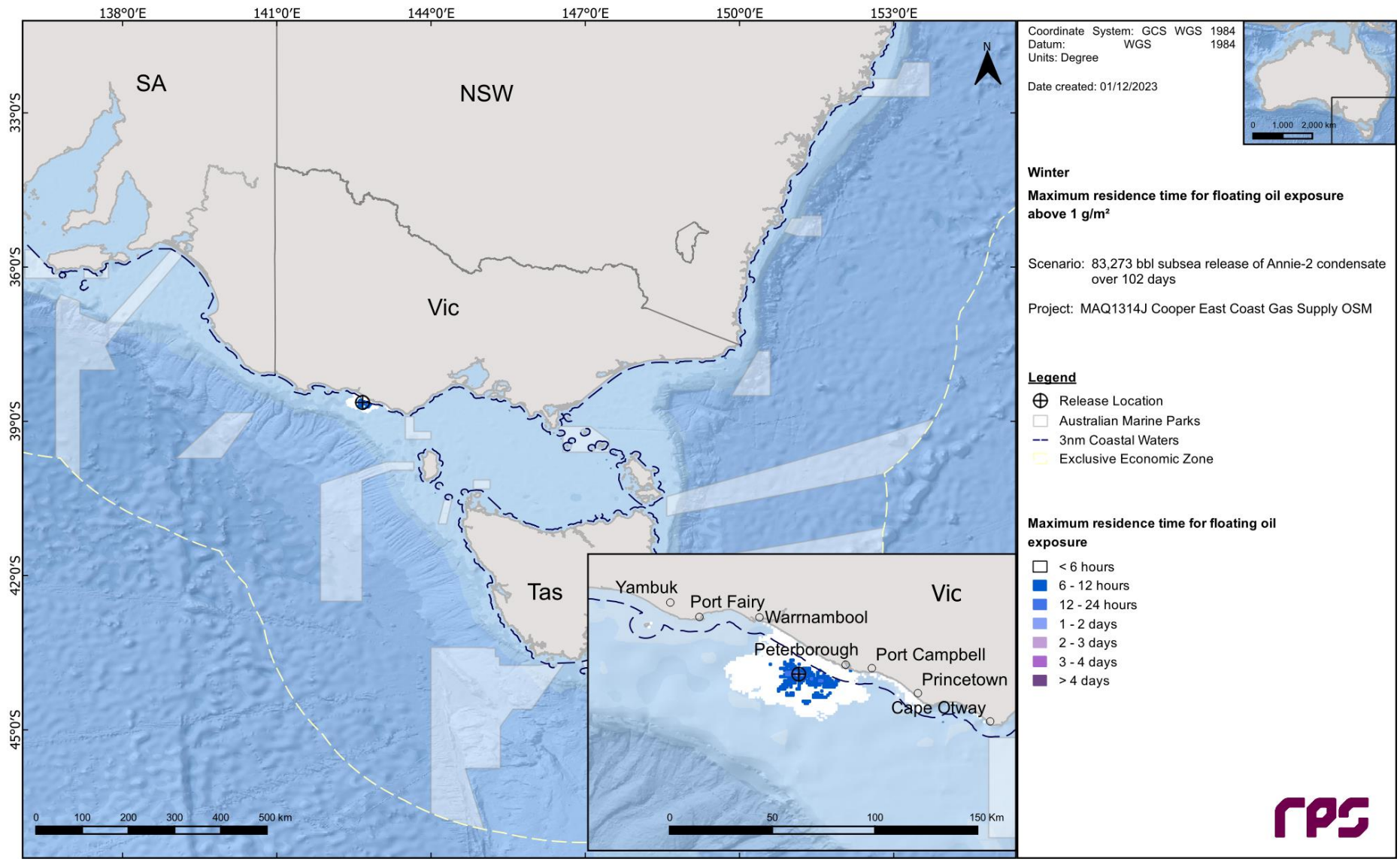



**Figure 12.4 Maximum residence time of floating oil exposure above 1 g/m$^2$, in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

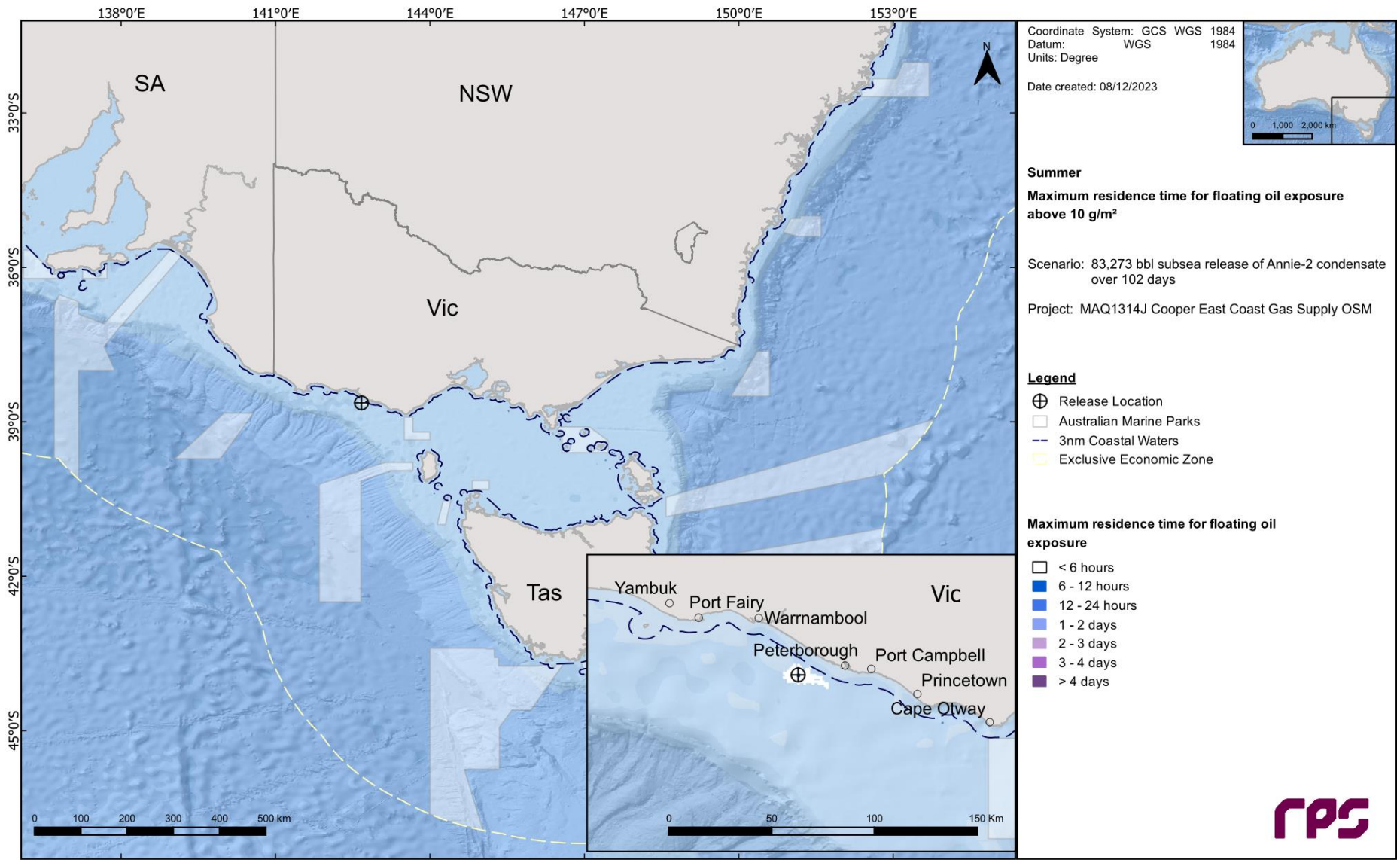



**Figure 12.5 Maximum residence time of floating oil exposure above 10 g/m$^2$, in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

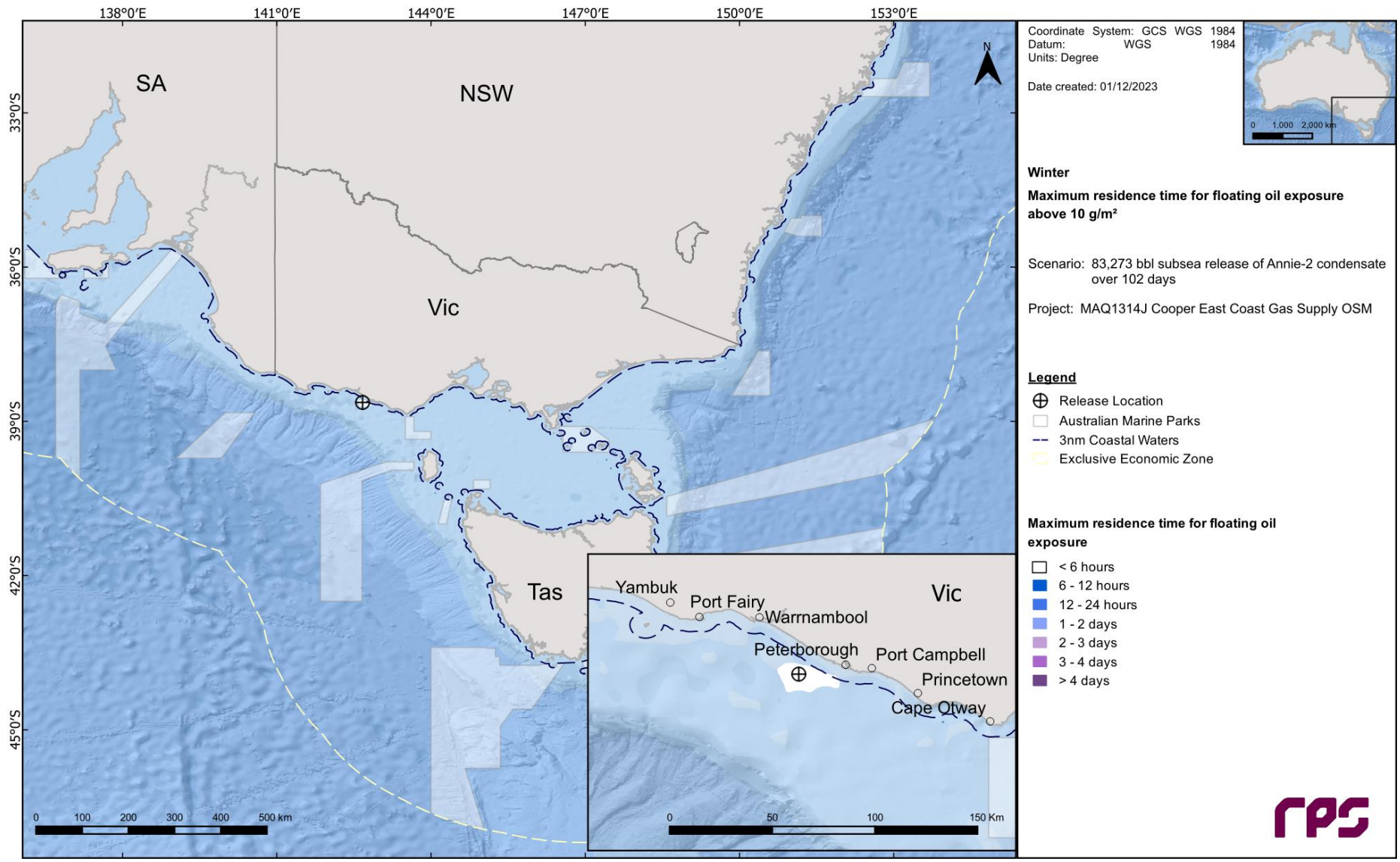



**Figure 12.6 Maximum residence time of floating oil exposure above 10 g/m$^2$, in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

### 12.1.2 Shoreline Accumulation

Table 12.4 presents a summary of the potential shoreline accumulation. The probability of accumulation to any shoreline at, or above, the low (10 g/m$^2$) threshold was 100% throughout the year. The minimum time before oil accumulation at, or above, the low threshold was 1.17 days. The maximum total volume ashore for a single spill trajectory was 406.6 m$^3$, and the maximum length of shoreline with accumulation above the low, moderate and high thresholds were 269.0 km (summer), 75.0 km (summer) and 6.0 km (winter), respectively.

Table 12.5 and Table 12.6 summarises the shoreline accumulation on individual receptors during summer and winter, respectively.

During summer conditions, the shoreline segment of Bay of Islands and Moyne had the highest probabilities of accumulation above all three thresholds with probabilities of 100%, 99% and 14% for the low, moderate and high thresholds. It is acknowledged that Corangamite and Moyne LGA and Port Campbell sub-LGA demonstrated 100% for low threshold shoreline accumulation. The minimum time for low threshold shoreline accumulation at these receptors was 1.21 days (Bay of Islands and Moyne LGAs).

Alternatively, in winter the shoreline segment with the highest probability of accumulation above all three thresholds was Corangamite with probabilities of 100%, 100% and 23% for the low, moderate and high thresholds. The minimum time for low threshold shoreline accumulation at Bay of Islands and Moyne LGA was 1.17 days.

The maximum potential shoreline loadings above each shoreline thresholds are presented in Figure 12.7 and Figure 12.8 for summer and winter respectively.

**Table 12.4 Summary of oil accumulation across all shorelines. Results are based on an 83,273 bbl (13,239 m$^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations per season.**

| Shoreline Statistics | Summer | Winter |
|---|---|---|
| Probability of accumulation on any shoreline (%) | 100 | 100 |
| Absolute minimum time for visible oil to shore (days) | 1.21 | 1.17 |
| Maximum total volume of hydrocarbons ashore (m$^3$) | 347.3 | 406.6 |
| Average total volume of hydrocarbons ashore (m$^3$) | 169.8 | 204.1 |
| Maximum length of the shoreline at **10 g/m$^2$** (km) | 269.0 | 251.0 |
| Average shoreline length (km) at **10 g/m$^2$** (km) | 150.8 | 154.0 |
| Maximum length of the shoreline at **100 g/m$^2$** (km) | 78.0 | 76.0 |
| Average shoreline length (km) at **100 g/m$^2$** (km) | 37.9 | 42.5 |
| Maximum length of the shoreline at **1,000 g/m$^2$** (km) | 4.0 | 6.0 |
| Average shoreline length (km) at **1,000 g/m$^2$** (km) | 2.4 | 2.0 |

**Table 12.5 Summary of oil accumulation on individual shoreline receptors. Results are based on an 83,273 bbl (13,239 $m^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

| Shoreline Receptor | | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| LGA Shoreline | Anglesea | 7 | - | - | 54.54 | - | - | 3 | 27 | 0.5 | 2.8 | 5.1 | - | - | 9.1 | - | - |
| | Apollo Bay | 62 | - | - | 10.92 | - | - | 6 | 73 | 1.9 | 5.5 | 6 | - | - | 13.6 | - | - |
| | Bass Coast | 6 | - | - | 20.38 | - | - | 2 | 22 | 0.3 | 1.3 | 1.4 | - | - | 3.6 | - | - |
| | Bay of Islands | 100 | 99 | 14 | 1.21 | 1.50 | 26.46 | 134 | 2,545 | 52 | 142.8 | 24.3 | 11.4 | 2 | 29.1 | 21.8 | 3.6 |
| | Bega Valley | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Colac Otway | 92 | 60 | - | 4.46 | 12.17 | - | 21 | 471 | 21.1 | 59.3 | 26.6 | 7.3 | - | 54.5 | 17.3 | - |
| | Corangamite | 100 | 99 | - | 1.75 | 3.21 | - | 81 | 936 | 61.6 | 118.8 | 43.6 | 14.3 | - | 56.3 | 26.4 | - |
| | East Gippsland | 10 | - | - | 80.50 | - | - | 2 | 25 | 0.6 | 1.8 | 1.9 | - | - | 3.6 | - | - |
| | French Island | 2 | - | - | 53.83 | - | - | 2 | 21 | < 0.1 | 0.5 | 0.9 | - | - | 0.9 | - | - |
| | Gabo Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Glenelg | 53 | 12 | - | 6.92 | 10.58 | - | 9 | 250 | 9.4 | 23.2 | 16.3 | 2.7 | - | 47.2 | 6.4 | - |
| | Glennie Group | 19 | - | - | 24.92 | - | - | 4 | 39 | 0.5 | 1.9 | 2.1 | - | - | 5.5 | - | - |
| | Grant | 4 | - | - | 22.33 | - | - | 2 | 25 | 0.6 | 5.2 | 4.3 | - | - | 9.1 | - | - |
| | Greater Geelong | 14 | 5 | - | 32.04 | 57.71 | - | 6 | 137 | 1.8 | 9.6 | 6.4 | 1.6 | - | 14.5 | 1.8 | - |
| | Hogan Island Group | 1 | - | - | 110.67 | - | - | 1 | 11 | 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | Kanowna Island | 9 | - | - | 92.04 | - | - | 3 | 16 | 0.2 | 0.7 | 1.2 | - | - | 1.8 | - | - |
| | King Island | 2 | - | - | 84.63 | - | - | 1 | 14 | 0.4 | 1.4 | 1.4 | - | - | 1.8 | - | - |
| | Lady Julia Percy Island | 60 | 23 | - | 4.21 | 16.67 | - | 30 | 195 | 2.8 | 5.8 | 4.3 | 1.6 | - | 6.4 | 2.7 | - |
| | Laurence Rocks | 45 | - | - | 8.67 | - | - | 19 | 78 | 0.7 | 1.9 | 2.1 | - | - | 2.7 | - | - |
| | Moncoeur Islands | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Montague Island | 1 | - | - | 87.79 | - | - | 2 | 15 | < 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | Mornington Peninsula | 18 | - | - | 38.29 | - | - | 2 | 32 | 1 | 5.2 | 4.8 | - | - | 14.5 | - | - |
| | Moyne | 100 | 99 | 14 | 1.21 | 1.50 | 26.33 | 71 | 2,545 | 69.4 | 168.1 | 40.1 | 14.6 | 2.2 | 81.8 | 31.8 | 3.6 |
| | Norman Island | 8 | - | - | 21.96 | - | - | 4 | 29 | 0.2 | 0.8 | 1.4 | - | - | 2.7 | - | - |
| | Phillip Island | 10 | - | - | 45.67 | - | - | 2 | 33 | 0.4 | 3.1 | 2.3 | - | - | 7.3 | - | - |
| | Rodondo Island | 12 | - | - | 71.58 | - | - | 4 | 36 | 0.2 | 0.8 | 1.1 | - | - | 1.8 | - | - |
| | Shellback Island | 1 | - | - | 31.13 | - | - | 3 | 11 | < 0.1 | 0.2 | 0.9 | - | - | 0.9 | - | - |
| | Skull Rock | 3 | - | - | 92.04 | - | - | 3 | 16 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| | South Gippsland | 28 | - | - | 20.17 | - | - | 3 | 77 | 2.3 | 13.4 | 9.7 | - | - | 29.1 | - | - |
| | Surf Coast | 13 | 2 | - | 24.96 | 58.96 | - | 3 | 116 | 1.5 | 11.3 | 10.4 | 0.9 | - | 24.5 | 0.9 | - |
| | Warrnambool | 81 | 23 | - | 3.50 | 12.17 | - | 20 | 738 | 6.1 | 28.2 | 11.6 | 3.2 | - | 22.7 | 6.4 | - |
| Sub-LGA Shoreline | Bega Valley | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Cape Conran | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Cape Howe / Mallacoota | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Cape Liptrap (NW) | 16 | - | - | 20.17 | - | - | 3 | 77 | 0.7 | 4.2 | 4.4 | - | - | 10 | - | - |
| | Cape Nelson | 53 | 12 | - | 6.92 | 10.58 | - | 12 | 250 | 8.2 | 22.3 | 14.5 | 2.7 | - | 30.9 | 6.4 | - |
| | Cape Otway West | 92 | 60 | - | 4.46 | 12.17 | - | 38 | 471 | 18.4 | 53.9 | 20.4 | 7.3 | - | 34.5 | 17.3 | - |
| | Cape Patton | 33 | - | - | 16.46 | - | - | 4 | 71 | 1.2 | 8 | 5.6 | - | - | 17.3 | - | - |
| | Childers Cove | 96 | 65 | 2 | 1.42 | 3.88 | 26.33 | 50 | 1,577 | 17.9 | 87 | 15.6 | 5.3 | 1.4 | 24.5 | 12.7 | 1.8 |
| | Croajingolong (West) | 5 | - | - | 86.63 | - | - | 2 | 24 | 0.2 | 0.8 | 0.9 | - | - | 0.9 | - | - |
| | Discovery Bay (East) | 4 | - | - | 27.75 | - | - | 2 | 17 | 0.3 | 1.6 | 2 | - | - | 4.5 | - | - |
| | Discovery Bay (West) | 2 | - | - | 29.83 | - | - | 2 | 20 | 0.3 | 1.9 | 4.1 | - | - | 5.5 | - | - |
| | French Island / Crib Point | 1 | - | - | 96.63 | - | - | 2 | 14 | < 0.1 | 0.2 | 0.9 | - | - | 0.9 | - | - |

| Shoreline Receptor | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| Kilcunda | 5 | - | - | 21.13 | - | - | 2 | 22 | 0.2 | 0.6 | 0.9 | - | - | 0.9 | - | - |
| Lorne | 13 | - | - | 24.96 | - | - | 3 | 17 | 0.5 | 1.9 | 2 | - | - | 5.5 | - | - |
| Marlo | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Moonlight Head | 98 | 94 | - | 2.50 | 4.58 | - | 84 | 781 | 34 | 83.6 | 20.4 | 8.5 | - | 30 | 14.5 | - |
| Mornington Peninsula (S) | 11 | - | - | 39.96 | - | - | 3 | 32 | 0.4 | 2.7 | 4 | - | - | 7.3 | - | - |
| Mornington Peninsula (SW) | 16 | - | - | 38.29 | - | - | 2 | 28 | 0.5 | 2.7 | 2.5 | - | - | 9.1 | - | - |
| New South Wales | 1 | - | - | 87.79 | - | - | 2 | 15 | 0.3 | 0.9 | 0.9 | - | - | 0.9 | - | - |
| Point Hicks | 9 | - | - | 80.50 | - | - | 3 | 25 | 0.3 | 0.8 | 1.6 | - | - | 2.7 | - | - |
| Port Campbell | 100 | 91 | - | 1.75 | 3.21 | - | 79 | 936 | 27.8 | 62.2 | 23.3 | 6.7 | - | 26.4 | 15.4 | - |
| Port Fairy | 64 | 8 | - | 7.75 | 13.38 | - | 11 | 249 | 4 | 15 | 7.8 | 2.3 | - | 26.4 | 4.5 | - |
| Port Phillip (Queenscliff) | 14 | - | - | 32.04 | - | - | 3 | 30 | 0.5 | 1.2 | 1.8 | - | - | 2.7 | - | - |
| Port Phillip (Sorrento Shore) | 1 | - | - | 50.13 | - | - | 2 | 11 | 0.2 | 0.5 | 0.9 | - | - | 0.9 | - | - |
| Portland Bay (East) | 13 | - | - | 20.29 | - | - | 3 | 26 | 0.5 | 2.1 | 2 | - | - | 4.5 | - | - |
| Portland Bay (West) | 22 | - | - | 24.5 | - | - | 3 | 31 | 0.7 | 2.2 | 2.8 | - | - | 6.4 | - | - |
| South Australia State Waters | 4 | - | - | 22.33 | - | - | 2 | 25 | 0.7 | 6 | 4.3 | - | - | 9.1 | - | - |
| Tasmania State Waters | 3 | - | - | 84.63 | - | - | 1 | 14 | 0.4 | 1.6 | 1.2 | - | - | 1.8 | - | - |
| Torquay | 8 | 5 | - | 32.96 | 57.71 | - | 6 | 137 | 2.2 | 16.2 | 18.9 | 2 | - | 26.4 | 2.7 | - |
| Venus Bay | 2 | - | - | 20.38 | - | - | 2 | 14 | 0.2 | 0.8 | 1.8 | - | - | 2.7 | - | - |
| Victoria State Waters | 100 | 100 | 14 | 1.21 | 1.5 | 26.33 | 39 | 2,545 | 169.2 | 347.3 | 136.8 | 34.4 | 2.2 | 244.4 | 70.9 | 3.6 |
| Waratah Bay | 4 | - | - | 97.17 | - | - | 2 | 30 | 0.2 | 0.7 | 0.9 | - | - | 0.9 | - | - |
| Warrnambool | 67 | 9 | - | 3.83 | 12.17 | - | 10 | 179 | 2.8 | 14.9 | 7.4 | 2 | - | 20.9 | 5.5 | - |
| Westernport | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Wilsons Promontory (East) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Wilsons Promontory (West) | 28 | - | - | 21.54 | - | - | 5 | 74 | 1.7 | 9.1 | 7 | - | - | 19.1 | - | - |

**Table 12.6 Summary of oil accumulation on individual shoreline receptors. Results are based on an 83,273 bbl (13,239 $m^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

| Shoreline Receptor | | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| LGA Shoreline | Anglesea | 6 | - | - | 14.71 | - | - | 2 | 43 | 0.3 | 3.9 | 4.1 | - | - | 9.1 | - | - |
| | Apollo Bay | 89 | - | - | 7.17 | - | - | 8 | 92 | 2.5 | 7.2 | 6.4 | - | - | 14.5 | - | - |
| | Bass Coast | 9 | - | - | 31.33 | - | - | 2 | 22 | 0.4 | 1.6 | 1.5 | - | - | 3.6 | - | - |
| | Bay of Islands | 100 | 97 | 11 | 1.17 | 2.42 | 36.13 | 119 | 1,431 | 45.6 | 136.7 | 21.4 | 10 | 1.4 | 29.1 | 20.9 | 3.6 |
| | Bega Valley | 17 | - | - | 35.21 | - | - | 2 | 32 | 0.5 | 1.6 | 1.9 | - | - | 3.6 | - | - |
| | Colac Otway | 98 | 87 | - | 4.08 | 8.54 | - | 27 | 394 | 29.3 | 67.8 | 34.1 | 7.7 | - | 63.6 | 15.4 | - |
| | Corangamite | 100 | 100 | 23 | 2.04 | 3.96 | 41.5 | 132 | 1,603 | 102.4 | 237.4 | 48.9 | 19.5 | 1.5 | 57.2 | 35.4 | 5.5 |
| | East Gippsland | 46 | - | - | 40.92 | - | - | 3 | 66 | 1.4 | 4.6 | 3.2 | - | - | 6.4 | - | - |
| | French Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Gabo Island | 15 | - | - | 41.83 | - | - | 4 | 33 | 0.2 | 0.9 | 1.8 | - | - | 2.7 | - | - |
| | Glenelg | 19 | 1 | - | 25.96 | 108.21 | - | 4 | 109 | 3.9 | 16.3 | 12.6 | 0.9 | - | 37.3 | 0.9 | - |
| | Glennie Group | 48 | - | - | 24.75 | - | - | 5 | 41 | 0.7 | 2.3 | 2.5 | - | - | 7.3 | - | - |
| | Grant | 4 | - | - | 58.38 | - | - | 2 | 25 | 0.8 | 3.9 | 2.7 | - | - | 5.5 | - | - |
| | Greater Geelong | 5 | 3 | - | 15.58 | 17.21 | - | 3 | 187 | 0.7 | 12.3 | 8.7 | 3 | - | 14.5 | 3.6 | - |
| | Hogan Island Group | 1 | - | - | 82.46 | - | - | 2 | 12 | 0.2 | 0.7 | 2.7 | - | - | 2.7 | - | - |
| | Kanowna Island | 29 | - | - | 27.63 | - | - | 5 | 41 | 0.4 | 1 | 2 | - | - | 2.7 | - | - |
| | King Island | 10 | - | - | 33.79 | - | - | 2 | 26 | 0.8 | 2.7 | 2.2 | - | - | 4.5 | - | - |
| | Lady Julia Percy Island | 34 | 11 | - | 10 | 10.5 | - | 22 | 234 | 2.1 | 7 | 3.9 | 1.6 | - | 6.4 | 2.7 | - |
| | Laurence Rocks | 13 | - | - | 21.54 | - | - | 9 | 37 | 0.3 | 1 | 1.8 | - | - | 2.7 | - | - |
| | Moncoeur Islands | 2 | - | - | 92.5 | - | - | 2 | 12 | 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | Montague Island | 6 | - | - | 65.96 | - | - | 4 | 25 | 0.2 | 0.8 | 1.5 | - | - | 2.7 | - | - |
| | Mornington Peninsula | 33 | - | - | 14.08 | - | - | 3 | 44 | 1.2 | 5.9 | 3.5 | - | - | 13.6 | - | - |
| | Moyne | 100 | 99 | 13 | 1.17 | 2.42 | 12.08 | 77 | 1,431 | 55.3 | 184.3 | 32.4 | 11.4 | 1.3 | 98.1 | 36.3 | 3.6 |
| | Norman Island | 17 | - | - | 25.75 | - | - | 4 | 30 | 0.2 | 0.9 | 1.7 | - | - | 2.7 | - | - |
| | Phillip Island | 39 | - | - | 15.38 | - | - | 3 | 47 | 0.9 | 3.2 | 2.5 | - | - | 7.3 | - | - |
| | Rodondo Island | 34 | - | - | 16.58 | - | - | 6 | 48 | 0.3 | 1.3 | 1.5 | - | - | 2.7 | - | - |
| | Shellback Island | 2 | - | - | 49.17 | - | - | 3 | 12 | < 0.1 | 0.2 | 0.9 | - | - | 0.9 | - | - |
| | Skull Rock | 27 | - | - | 27.63 | - | - | 5 | 23 | 0.2 | 0.5 | 1.1 | - | - | 1.8 | - | - |
| | South Gippsland | 65 | 1 | - | 20.88 | 72.54 | - | 5 | 106 | 3.5 | 12.2 | 9.1 | 0.9 | - | 23.6 | 0.9 | - |
| | Surf Coast | 9 | 2 | - | 14.71 | 18.29 | - | 2 | 124 | 0.9 | 13 | 8.8 | 0.9 | - | 24.5 | 0.9 | - |
| | Warrnambool | 56 | 23 | 1 | 5.13 | 6.92 | 12.13 | 25 | 1,185 | 7.5 | 43.2 | 11 | 3.6 | 0.9 | 25.4 | 11.8 | 0.9 |
| Sub-LGA Shoreline | Bega Valley | 17 | - | - | 35.21 | - | - | 2 | 32 | 0.5 | 1.6 | 1.9 | - | - | 3.6 | - | - |
| | Cape Conran | 1 | - | - | 70.46 | - | - | 1 | 11 | < 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | Cape Howe / Mallacoota | 14 | - | - | 40.92 | - | - | 3 | 16 | 0.2 | 0.8 | 1 | - | - | 1.8 | - | - |
| | Cape Liptrap (NW) | 51 | - | - | 20.88 | - | - | 5 | 50 | 0.8 | 2.4 | 2.4 | - | - | 7.3 | - | - |
| | Cape Nelson | 18 | 1 | - | 25.96 | 108.21 | - | 5 | 109 | 2.9 | 11.8 | 9.8 | 0.9 | - | 24.5 | 0.9 | - |
| | Cape Otway West | 98 | 87 | - | 4.08 | 8.54 | - | 51 | 394 | 25.2 | 49.6 | 25 | 7.7 | - | 32.7 | 15.4 | - |
| | Cape Patton | 60 | 1 | - | 13.75 | 44.13 | - | 5 | 102 | 1.7 | 13.1 | 5.3 | 0.9 | - | 19.1 | 0.9 | - |
| | Childers Cove | 80 | 30 | 2 | 2.54 | 4.92 | 12.08 | 30 | 1,185 | 10.1 | 99 | 11.4 | 5.6 | 1.4 | 24.5 | 17.3 | 1.8 |
| | Croajingolong (West) | 22 | - | - | 47 | - | - | 3 | 37 | 0.3 | 1 | 1 | - | - | 1.8 | - | - |
| | Discovery Bay (East) | 1 | - | - | 70.25 | - | - | 2 | 16 | 0.4 | 1.7 | 2.7 | - | - | 2.7 | - | - |
| | Discovery Bay (West) | 1 | - | - | 65.79 | - | - | 2 | 12 | 0.4 | 1.7 | 3.6 | - | - | 3.6 | - | - |
| | French Island / Crib Point | 3 | - | - | 28 | - | - | 2 | 19 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |

| Shoreline Receptor | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| Kilcunda | 4 | - | - | 46.42 | - | - | 2 | 16 | 0.2 | 0.7 | 1.1 | - | - | 1.8 | - | - |
| Lorne | 8 | - | - | 20 | - | - | 2 | 28 | 0.3 | 1.5 | 2.2 | - | - | 3.6 | - | - |
| Marlo | 12 | - | - | 69.75 | - | - | 2 | 23 | 0.2 | 0.6 | 0.9 | - | - | 0.9 | - | - |
| Moonlight Head | 100 | 100 | 21 | 2.71 | 5.96 | 44.92 | 154 | 1,603 | 63.9 | 167.5 | 25.5 | 11.4 | 1.2 | 30.9 | 15.4 | 4.5 |
| Mornington Peninsula (S) | 29 | - | - | 14.08 | - | - | 4 | 44 | 0.6 | 3.8 | 2.7 | - | - | 10.9 | - | - |
| Mornington Peninsula (SW) | 19 | - | - | 17.42 | - | - | 3 | 28 | 0.5 | 1.4 | 1.5 | - | - | 2.7 | - | - |
| New South Wales | 20 | - | - | 35.21 | - | - | 2 | 32 | 0.6 | 2 | 2 | - | - | 4.5 | - | - |
| Point Hicks | 41 | - | - | 41.04 | - | - | 6 | 66 | 0.7 | 2.2 | 2.3 | - | - | 3.6 | - | - |
| Port Campbell | 100 | 91 | 10 | 2.04 | 3.96 | 41.5 | 109 | 1,348 | 38.4 | 108.6 | 23 | 8.9 | 1 | 26.4 | 21.8 | 1.8 |
| Port Fairy | 40 | 17 | - | 10.21 | 13.29 | - | 15 | 379 | 5.6 | 23.9 | 10 | 2.1 | - | 30 | 4.5 | - |
| Port Phillip (Queenscliff) | 5 | - | - | 20.08 | - | - | 2 | 35 | 0.1 | 1.1 | 1.6 | - | - | 2.7 | - | - |
| Port Phillip (Sorrento Shore) | 2 | - | - | 35.42 | - | - | 2 | 12 | 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| Portland Bay (East) | 10 | - | - | 12.79 | - | - | 3 | 38 | 0.8 | 3.7 | 5.3 | - | - | 13.6 | - | - |
| Portland Bay (West) | 8 | - | - | 27.71 | - | - | 4 | 55 | 1.1 | 5.7 | 6.6 | - | - | 19.1 | - | - |
| South Australia State Waters | 4 | - | - | 58.38 | - | - | 2 | 25 | 0.9 | 4.3 | 2.7 | - | - | 5.5 | - | - |
| Tasmania State Waters | 11 | - | - | 33.79 | - | - | 2 | 26 | 0.7 | 3 | 2.2 | - | - | 4.5 | - | - |
| Torquay | 5 | 3 | - | 14.79 | 17.21 | - | 4 | 187 | 1.1 | 20.4 | 16.7 | 3.6 | - | 29.1 | 4.5 | - |
| Venus Bay | 7 | - | - | 31.33 | - | - | 2 | 22 | 0.2 | 1.2 | 1.3 | - | - | 1.8 | - | - |
| Victoria State Waters | 100 | 100 | 29 | 1.17 | 2.42 | 12.08 | 42 | 1,603 | 203.2 | 406.3 | 139.2 | 38.6 | 1.8 | 228.1 | 69.1 | 5.5 |
| Waratah Bay | 4 | - | - | 48.04 | - | - | 2 | 27 | 0.1 | 0.8 | 0.9 | - | - | 0.9 | - | - |
| Warrnambool | 46 | 15 | - | 7 | 13.38 | - | 14 | 470 | 4.2 | 34.7 | 7.7 | 2.6 | - | 28.2 | 9.1 | - |
| Westernport | 2 | - | - | 49.67 | - | - | 2 | 11 | 0.2 | 0.7 | 1.4 | - | - | 1.8 | - | - |
| Wilsons Promontory (East) | 1 | - | - | 107.75 | - | - | 1 | 18 | 0.1 | 0.9 | 1.8 | - | - | 1.8 | - | - |
| Wilsons Promontory (West) | 62 | 1 | - | 24 | 72.54 | - | 7 | 106 | 2.7 | 8.8 | 7.4 | 0.9 | - | 18.2 | 0.9 | - |

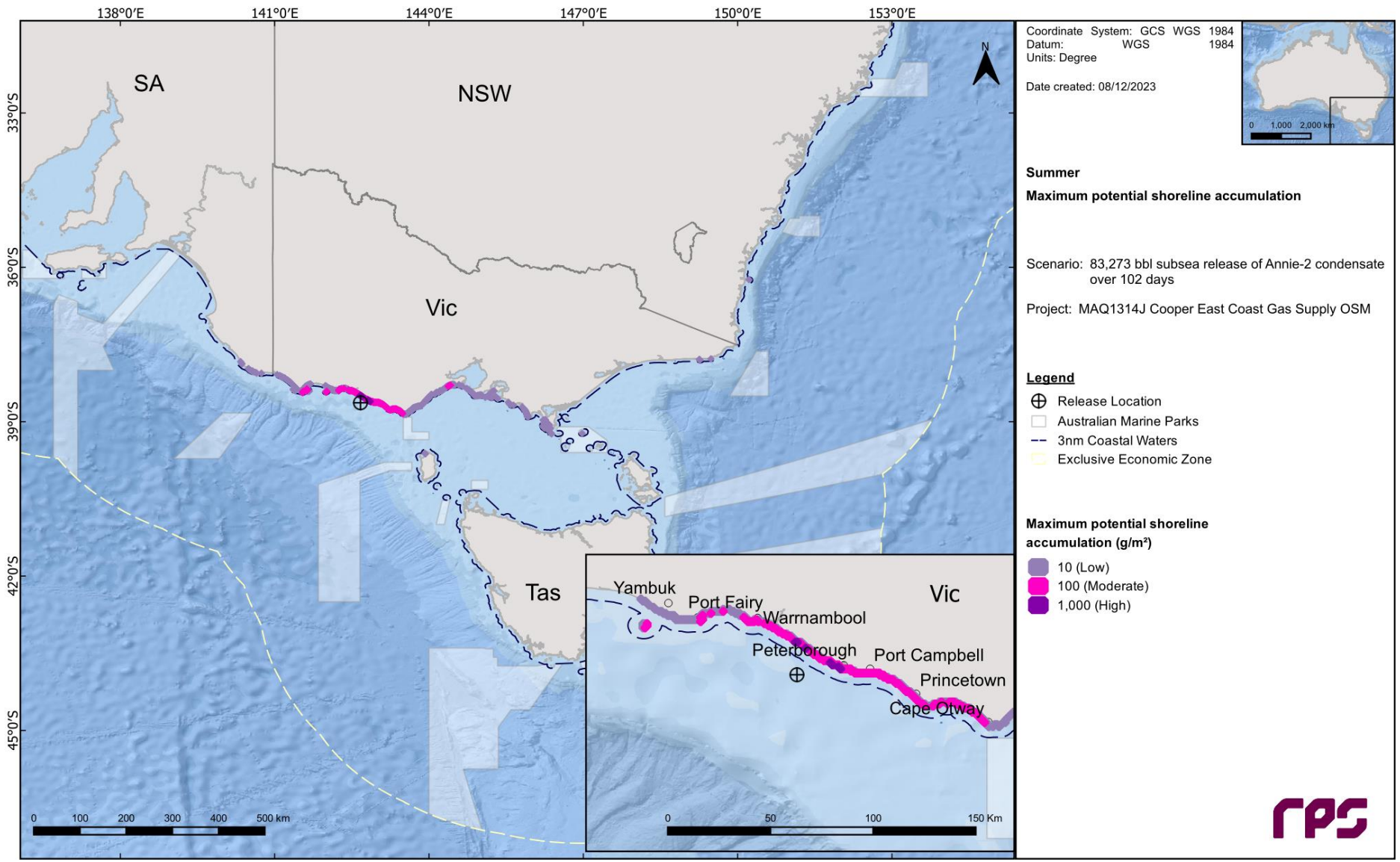



**Figure 12.7 Maximum potential shoreline accumulation in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

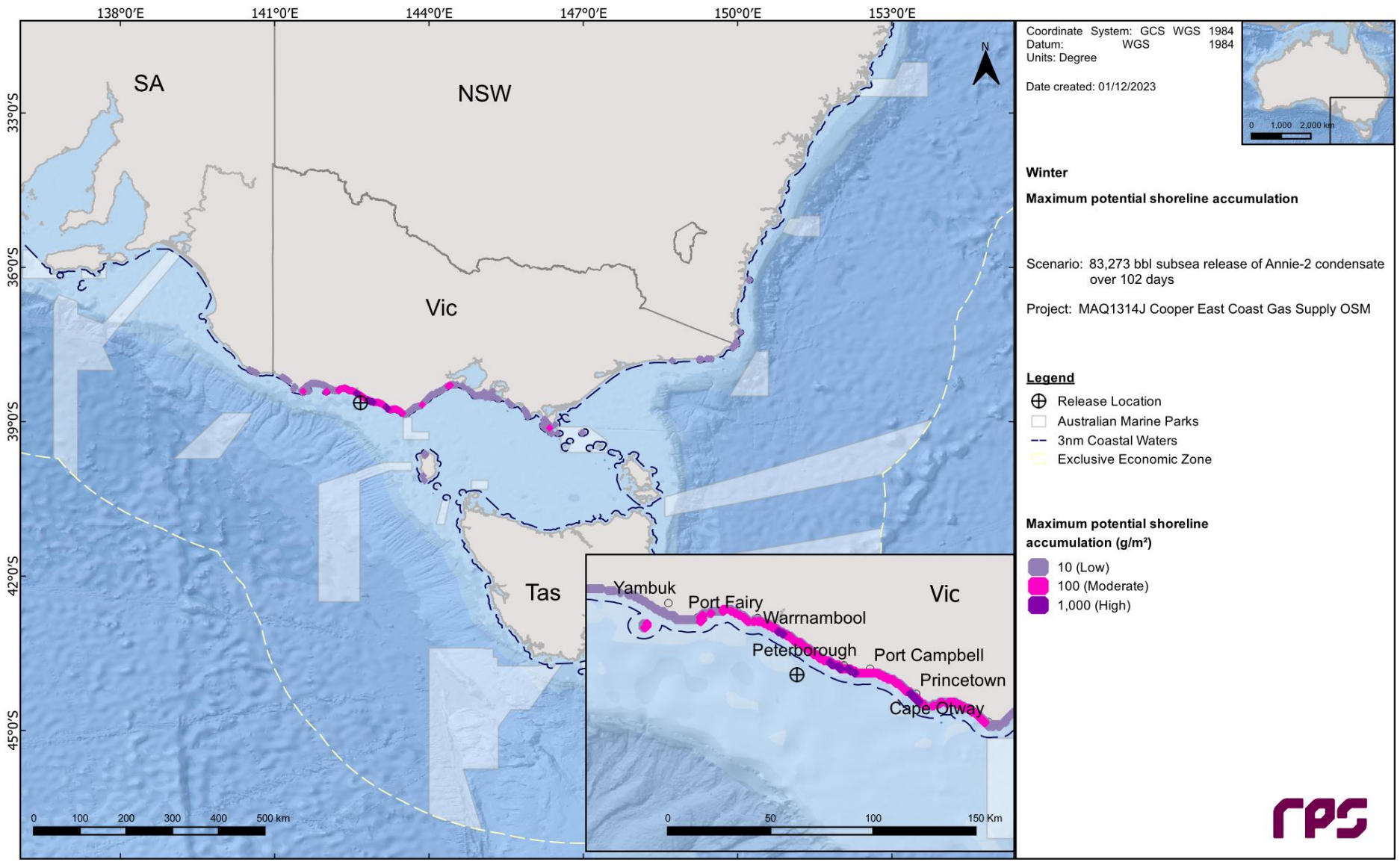



**Figure 12.8 Maximum potential shoreline accumulation in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

### 12.1.3 In-water exposure

#### 12.1.3.1 Dissolved Hydrocarbons

Table 12.7 summarises the potential in-water exposure to individual receptors from dissolved hydrocarbons in the 0-10 m layer.

A total of 20 BIAs were predicted to be exposed to dissolved hydrocarbon at, or above, the low threshold during both winter and summer. Excluding the BIAs that the release location resides within (see Section 10.3), the highest probability of low exposure was 21% during summer (Short-tailed Shearwater - Foraging,) and 59% during winter (Short-tailed Shearwater - Foraging).

The maximum dissolved hydrocarbon concentration at any given receptor(s) was predicted to be 50.1 ppb and 51.7 ppb during summer and winter respectively.

Table 12.8 presents the predicted minimum time to dissolved hydrocarbon exposure and maximum residence time for dissolved hydrocarbon exposure to individual receptors, in the 0-10 m depth layer, for all thresholds assessed.

Figure 12.9 and Figure 12.10 present the zones of potential dissolved hydrocarbon exposure for the 0-10 m depth layer for each season whilst Figure 12.11to Figure 12.12 present the maximum residence time of dissolved hydrocarbon exposure for the NOPSEMA thresholds.

**Table 12.7 Probability of dissolved hydrocarbons exposure to marine based receptors in the 0–10 m depth. Results are based on an 83,273 bbl (13,239 $m^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure(%) | | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | |
| | | | Low | Moderate | High | | Low | Moderate | High |
| AMP | Apollo | 13.3 | 2 | - | - | 22.8 | 4 | - | - |
| BIA | Antipodean Albatross - Foraging* | 40.4 | 28 | - | - | 39.5 | 35 | - | - |
| | Australasian Gannet - Foraging | 18.9 | 2 | - | - | 20.9 | 2 | - | - |
| | Black-browed Albatross - Foraging* | 40.4 | 28 | - | - | 43.1 | 35 | - | - |
| | Bullers Albatross - Foraging* | 40.4 | 28 | - | - | 43.1 | 35 | - | - |
| | Campbell Albatross - Foraging* | 40.4 | 28 | - | - | 43.1 | 35 | - | - |
| | Common Diving-petrel - Foraging* | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 40.4 | 28 | - | - | 43.1 | 35 | - | - |
| | Pygmy Blue Whale - Distribution* | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| | Pygmy Blue Whale - Foraging* | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| | Pygmy Blue Whale - Known Foraging Area | 18.8 | 2 | - | - | 43.1 | 4 | - | - |
| | Short-tailed Shearwater - Foraging | 27.7 | 21 | - | - | 43.1 | 59 | - | - |
| | Shy Albatross - Foraging* | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| | Southern Right Whale - Aggregation | 40.4 | 10 | - | - | 36.1 | 11 | - | - |
| | Southern Right Whale - Known Core Range* | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| | Wandering Albatross - Foraging* | 40.4 | 28 | - | - | 43.1 | 35 | - | - |
| | Wedge-tailed Shearwater - Foraging* | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| | White Shark - Distribution* | 40.4 | 28 | - | - | 43.1 | 35 | - | - |
| | White Shark - Foraging | 21.2 | 3 | - | - | 20.9 | 2 | - | - |
| | White-faced Storm-petrel - Foraging | 16.8 | 1 | - | - | 43.1 | 3 | - | - |
| IBRA | Otway Plain | 21.1 | 6 | - | - | 25.2 | 16 | - | - |
| | Otway Ranges | 20.4 | 6 | - | - | 31.8 | 30 | - | - |
| | Warrnambool Plain | 50.1 | 35 | 1 | - | 44.4 | 72 | - | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure(%) | | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | |
| | | | Low | Moderate | High | | Low | Moderate | High |
| IMCRA | Central Bass Strait | 16.8 | 1 | - | - | 24.8 | 3 | - | - |
| | Central Victoria | 16.1 | 1 | - | - | 43.1 | 4 | - | - |
| | Otway* | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| KEF | Bonney Coast Upwelling | 18.9 | 1 | - | - | 20.9 | 2 | - | - |
| MNP | Twelve Apostles | 44.1 | 35 | - | - | 51.7 | 69 | 1 | - |
| RSB | Bravenes Rock | 10.7 | 1 | - | - | 8.9 | - | - | - |
| Nearshore Waters | Colac Otway | 21.1 | 6 | - | - | 25.2 | 16 | - | - |
| | Corangamite | 50.1 | 35 | 1 | - | 44.4 | 72 | - | - |
| | Lady Julia Percy Island | 8.2 | - | - | - | 15.1 | 2 | - | - |
| | Moyne | 25.2 | 23 | - | - | 26.6 | 27 | - | - |
| | Warrnambool | 6.7 | - | - | - | 19.4 | 2 | - | - |
| State Waters | Victoria State Waters | 50.1 | 36 | 1 | - | 51.7 | 73 | 1 | - |
| Nearshore Waters (Sub-LGA) | Apollo Bay | 17.8 | 2 | - | - | 16.5 | 1 | - | - |
| | Bay of Islands | 25.2 | 23 | - | - | 26.6 | 27 | - | - |
| | Cape Otway West | 21.1 | 6 | - | - | 25.2 | 16 | - | - |
| | Childers Cove | 12.1 | 1 | - | - | 19.4 | 4 | - | - |
| | Moonlight Head | 50.1 | 35 | 1 | - | 44.4 | 72 | - | - |
| | Port Campbell | 38.2 | 29 | - | - | 30.9 | 41 | - | - |
| | Warrnambool | 6.7 | - | - | - | 10 | 1 | - | - |

*The release location resides within the receptor boundaries.

**Table 12.8 Predicted minimum time to dissolved hydrocarbon exposure and maximum residence time for dissolved hydrocarbon exposure to individual receptors in the 0-10 m depth layer. Results are based on an 83,273 bbl (13,239 $m^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High |
| AMP | Apollo | 7.13 | - | - | 0.04 | - | - | 3.33 | - | - | 0.08 | - | - |
| BIA | Antipodean Albatross - Foraging* | 1.00 | - | - | 0.25 | - | - | 0.88 | - | - | 0.25 | - | - |
| | Australasian Gannet - Foraging | 6.21 | - | - | 0.08 | - | - | 9.17 | - | - | 0.08 | - | - |
| | Black-browed Albatross - Foraging* | 1.00 | - | - | 0.25 | - | - | 0.88 | - | - | 0.25 | - | - |
| | Bullers Albatross - Foraging* | 1.00 | - | - | 0.25 | - | - | 0.88 | - | - | 0.25 | - | - |
| | Campbell Albatross - Foraging* | 1.00 | - | - | 0.25 | - | - | 0.88 | - | - | 0.25 | - | - |
| | Common Diving-petrel - Foraging* | 1.00 | 8.38 | - | 0.25 | - | - | 0.88 | 8.54 | - | 0.29 | - | - |
| | Indian Yellow-nosed Albatross - Foraging* | 1.00 | - | - | 0.25 | - | - | 0.88 | - | - | 0.25 | - | - |
| | Pygmy Blue Whale - Distribution* | 1.00 | 8.38 | - | 0.25 | - | - | 0.88 | 8.54 | - | 0.29 | - | - |
| | Pygmy Blue Whale - Foraging* | 1.00 | 8.38 | - | 0.25 | - | - | 0.88 | 8.54 | - | 0.29 | - | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 1.00 | 8.38 | - | 0.25 | - | - | 0.88 | 8.54 | - | 0.29 | - | - |
| | Pygmy Blue Whale - Known Foraging Area | 7.13 | - | - | 0.08 | - | - | 3.42 | - | - | 0.13 | - | - |
| | Short-tailed Shearwater - Foraging | 2.58 | - | - | 0.13 | - | - | 2.08 | - | - | 0.25 | - | - |
| | Shy Albatross - Foraging* | 1.00 | 8.38 | - | 0.25 | - | - | 0.88 | 8.54 | - | 0.29 | - | - |
| | Southern Right Whale - Aggregation* | 1.33 | - | - | 0.17 | - | - | 1.13 | - | - | 0.21 | - | - |
| | Southern Right Whale - Known Core Range* | 1.00 | 8.38 | - | 0.25 | - | - | 0.88 | 8.54 | - | 0.29 | - | - |
| | Wandering Albatross - Foraging* | 1.00 | - | - | 0.25 | - | - | 0.88 | - | - | 0.25 | - | - |
| | Wedge-tailed Shearwater - Foraging* | 1.00 | 8.38 | - | 0.25 | - | - | 0.88 | 8.54 | - | 0.29 | - | - |
| | White Shark - Distribution* | 1.00 | - | - | 0.25 | - | - | 0.88 | - | - | 0.25 | - | - |
| | White Shark - Foraging | 2.54 | - | - | 0.08 | - | - | 6.96 | - | - | 0.08 | - | - |
| | White-faced Storm-petrel - Foraging | 7.29 | - | - | 0.08 | - | - | 3.58 | - | - | 0.08 | - | - |
| IBRA | Otway Plain | 3.96 | - | - | 0.08 | - | - | 7.00 | - | - | 0.13 | - | - |
| | Otway Ranges | 2.58 | - | - | 0.13 | - | - | 4.67 | - | - | 0.17 | - | - |
| | Warrnambool Plain | 2.08 | 13.92 | - | 0.25 | - | - | 2.29 | 15.58 | - | 0.29 | - | - |

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High |
| IMCRA | Central Bass Strait | 8.88 | - | - | 0.08 | - | - | 3.88 | - | - | 0.08 | - | - |
| | Central Victoria | 7.13 | - | - | 0.08 | - | - | 3.42 | - | - | 0.13 | - | - |
| | Otway* | 1.00 | 8.38 | - | 0.25 | - | - | 0.88 | 8.54 | - | 0.29 | - | - |
| KEF | Bonney Coast Upwelling | 6.21 | - | - | 0.08 | - | - | 11.67 | - | - | 0.08 | - | - |
| MNP | Twelve Apostles | 2.42 | 22.33 | - | 0.21 | - | - | 2.13 | 8.54 | - | 0.21 | - | - |
| RSB | Bravenes Rock | 28.33 | - | - | 0.04 | - | - | 18.38 | - | - | 0.04 | - | - |
| Nearshore Waters | Colac Otway | 3.96 | - | - | 0.08 | - | - | 6.54 | - | - | 0.13 | - | - |
| | Corangamite | 2.58 | 13.92 | - | 0.25 | - | - | 2.50 | - | - | 0.29 | - | - |
| | Lady Julia Percy Island | - | - | - | - | - | - | 13.58 | - | - | 0.04 | - | - |
| | Moyne | 2.08 | - | - | 0.13 | - | - | 2.29 | - | - | 0.17 | - | - |
| | Warrnambool | - | - | - | - | - | - | 5.96 | - | - | 0.04 | - | - |
| State Waters | Victoria State Waters | 1.50 | 8.38 | - | 0.25 | - | - | 1.17 | 8.54 | - | 0.29 | - | - |
| Nearshore Waters (Sub-LGA) | Apollo Bay | 13.5 | - | - | 0.04 | - | - | 12.63 | - | - | 0.04 | - | - |
| | Bay of Islands | 2.08 | - | - | 0.13 | - | - | 2.29 | - | - | 0.17 | - | - |
| | Cape Otway West | 3.96 | - | - | 0.08 | - | - | 6.54 | - | - | 0.13 | - | - |
| | Childers Cove | 18.08 | - | - | 0.04 | - | - | 3.29 | - | - | 0.08 | - | - |
| | Moonlight Head | 2.58 | 13.92 | - | 0.25 | - | - | 2.13 | 15.58 | - | 0.29 | - | - |
| | Port Campbell | 3.50 | - | - | 0.13 | - | - | 2.50 | - | - | 0.17 | - | - |
| | Warrnambool | - | - | - | - | - | - | 18.67 | - | - | 0.04 | - | - |

*The release location resides within the receptor boundaries.

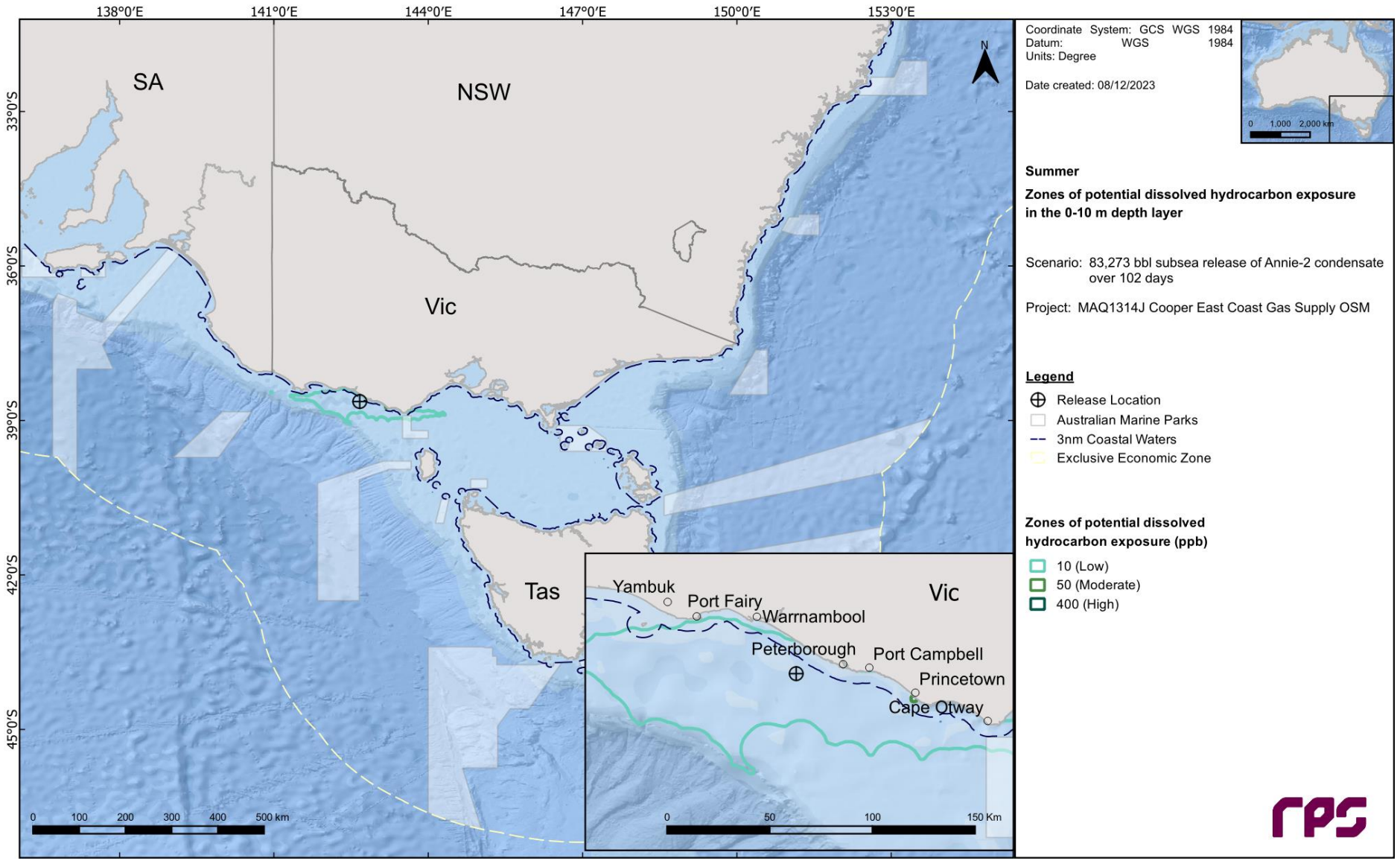



**Figure 12.9 Zones of potential dissolved hydrocarbon exposure at 0-10 m below the sea in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

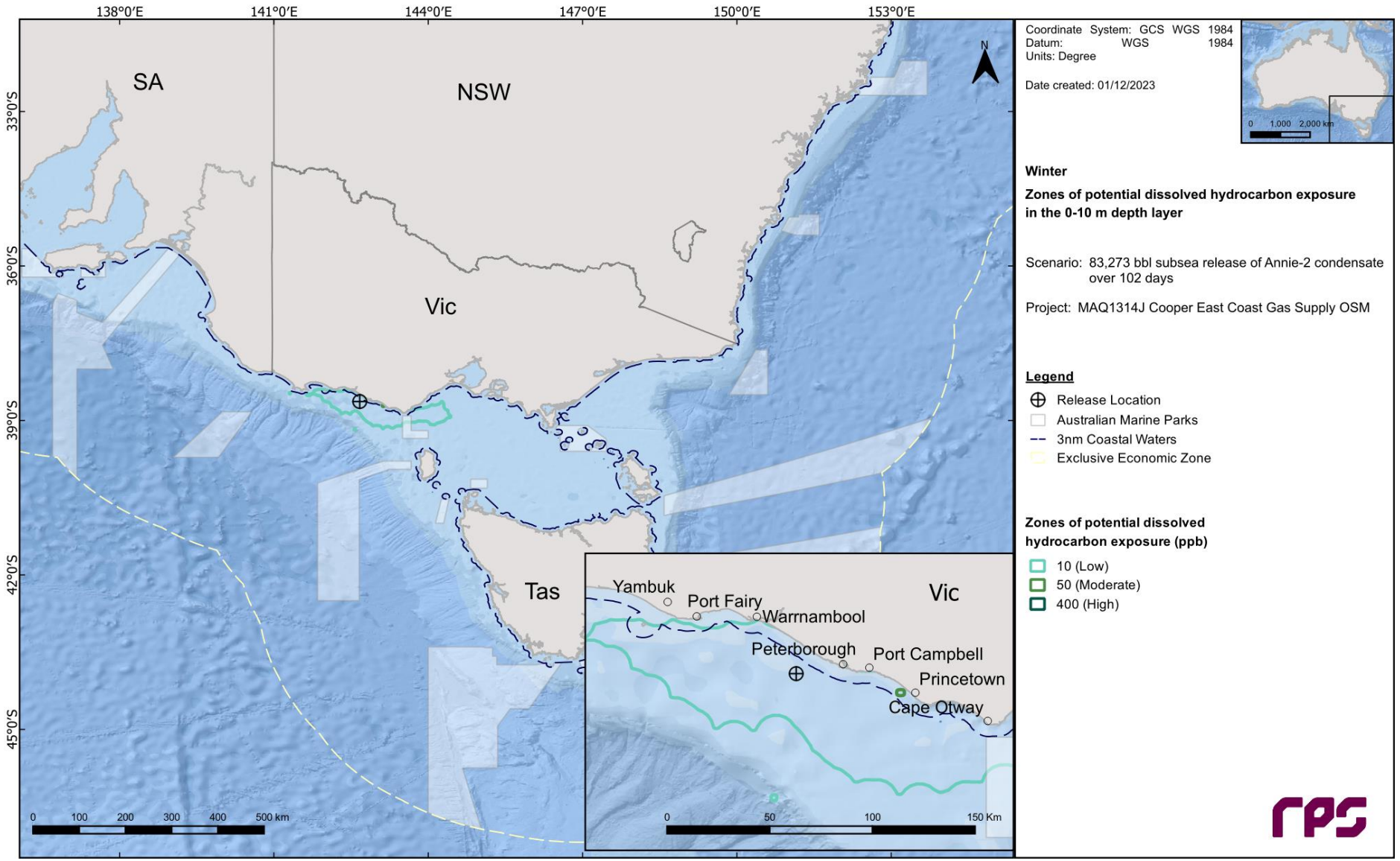



**Figure 12.10 Zones of potential dissolved hydrocarbon exposure at 0-10 m below the sea in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

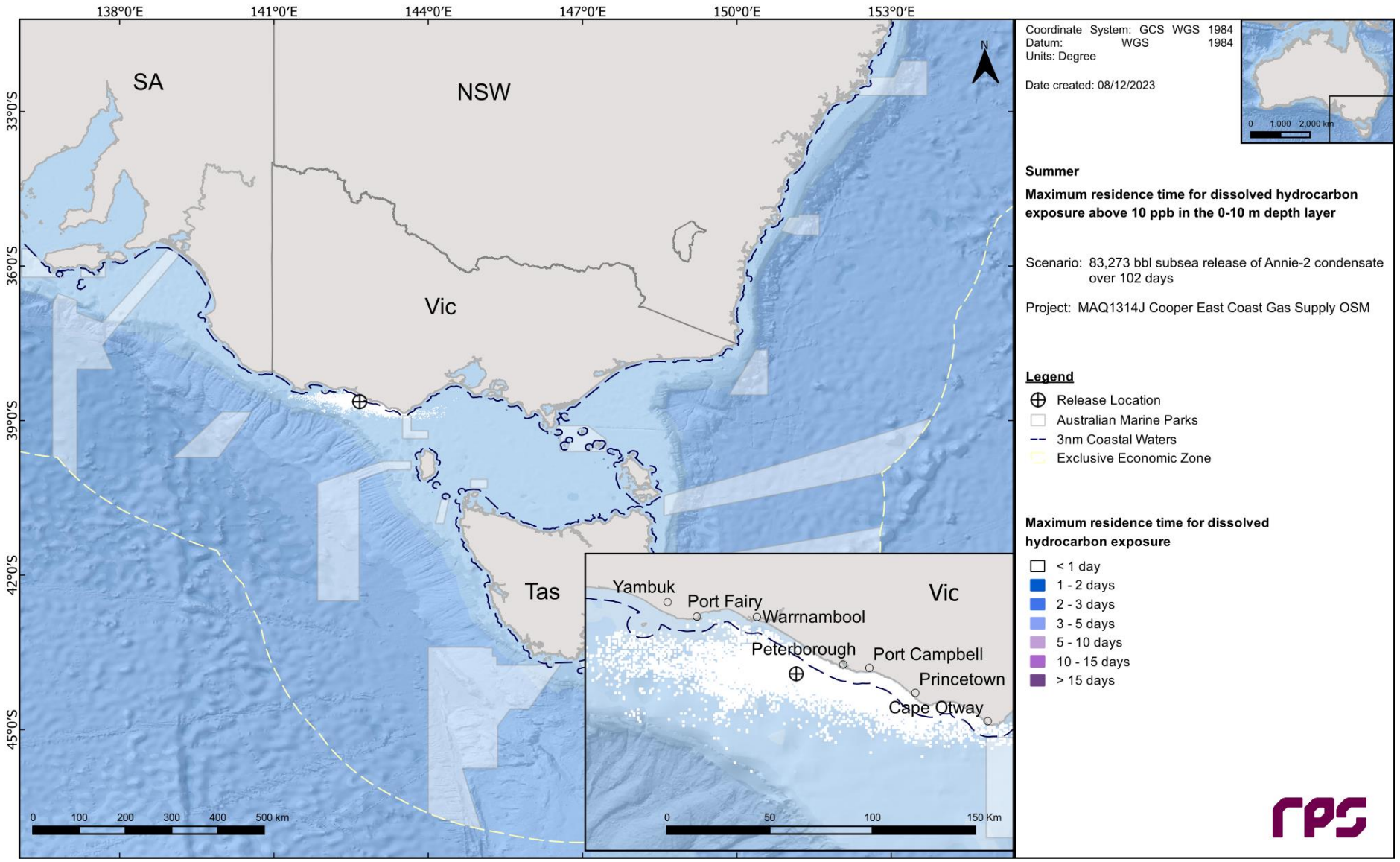



**Figure 12.11 Maximum residence time for dissolved hydrocarbon exposure above 10 ppb, at 0-10 m below the sea surface in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

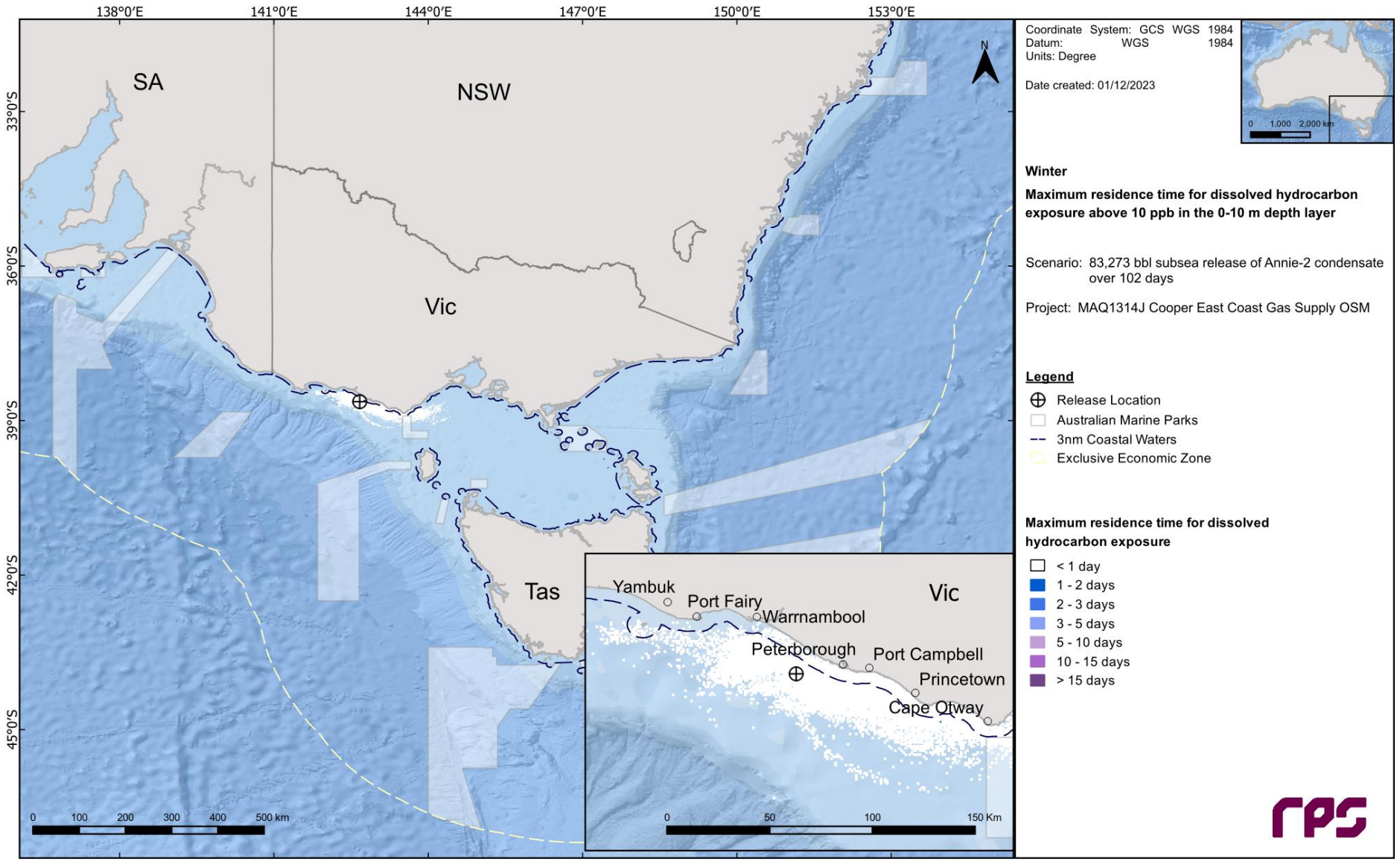



**Figure 12.12 Maximum residence time for dissolved hydrocarbon exposure above 10 ppb, at 0-10 m below the sea surface in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

### 12.1.3.2 Entrained Hydrocarbons

Table 12.9 summarises the potential in-water exposure to individual receptors from entrained hydrocarbons in the 0-10 m depth layer.

Many receptors were exposed above the low and high thresholds, however most of these receptors (predominantly BIAs) coincided with the release location.

In summer conditions, the highest probability of low entrained hydrocarbon exposure was recorded at 100% for receptors that the release location doesn't reside within, including Southern Right Whale – Aggregation BIA and Warrnambool Plain IBRA. Additional receptors including sub-LGAs, and AMPs were predicted with entrained hydrocarbon exposure (refer to Table 11.9). Similarly, during winter several receptors that the release location doesn't reside within revealed probabilities of 100% for low entrained hydrocarbon exposure.

Table 12.10 presents the predicted minimum time to entrained hydrocarbon exposure and maximum residence time for entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer, for all thresholds assessed.

Figure 12.13 and Figure 12.14 present the zones of potential entrained hydrocarbon exposure for the 0-10 m depth layer for each season whilst Figure 12.15 to Figure 12.18 present the maximum residence time of entrained hydrocarbon exposure for the NOPSEMA thresholds.

**Table 12.9 Probability of entrained hydrocarbons exposure to marine based receptors in the 0–10 m depth layer. Results are based on an 83,273 bbl (13,239 $m^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| AMP | Apollo | 165.5 | 82 | 16 | 216.7 | 93 | 31 |
| | Beagle | 36.8 | 39 | - | 37.1 | 59 | - |
| | East Gippsland | 11.0 | 3 | - | 10.3 | 1 | - |
| | Franklin | 11.7 | 3 | - | 9.2 | - | - |
| | Nelson | 18.9 | 6 | - | 16.1 | 3 | - |
| | Zeehan | 33.8 | 15 | - | 19.1 | 7 | - |
| BIA | Antipodean Albatross - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Australasian Gannet - Foraging | 148.6 | 72 | 19 | 243 | 77 | 5 |
| | Australian Sea Lion - Foraging | 17.0 | 20 | - | 11.9 | 1 | - |
| | Black Petrel - Foraging | 25.1 | 4 | - | 15.3 | 6 | - |
| | Black-browed Albatross - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Black-faced Cormorant - Foraging | 19.1 | 10 | - | 18.7 | 7 | - |
| | Bullers Albatross - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Campbell Albatross - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Common Diving-petrel - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Crested Tern - Breeding | 14.3 | 4 | - | 13.4 | 6 | - |
| | Crested Tern - Foraging | 16.0 | 4 | - | 15.3 | 6 | - |
| | Flesh-footed Shearwater - Foraging | 25.1 | 4 | - | 15.3 | 6 | - |
| | Great-winged Petrel - Foraging | 25.1 | 3 | - | 12.4 | 6 | - |
| | Grey Nurse Shark - Foraging | 24.6 | 12 | - | 14.7 | 12 | - |
| | Grey Nurse Shark - Migration | 41.4 | 14 | - | 16.3 | 14 | - |
| | Humpback Whale - Foraging | 42.6 | 14 | - | 18.4 | 14 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Indo-Pacific/Spotted Bottlenose Dolphin - Breeding | 16.8 | 11 | - | 13.4 | 6 | - |
| | Little Penguin - Breeding | 14.5 | 4 | - | 14.5 | 6 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Little Penguin - Foraging | 33.0 | 47 | - | 45.1 | 73 | - |
| | Northern Giant Petrel - Foraging | 25.1 | 3 | - | 12.4 | 6 | - |
| | Pygmy Blue Whale - Distribution* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Pygmy Blue Whale - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Pygmy Blue Whale - Foraging annual high use area* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Pygmy Blue Whale - Known Foraging Area | 180.1 | 81 | 16 | 208.6 | 93 | 31 |
| | Short-tailed Shearwater - Foraging | 300.8 | 98 | 90 | 379.4 | 100 | 100 |
| | Shy Albatross - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Soft-plumaged Petrel - Foraging | 10.1 | 1 | - | 7.4 | - | - |
| | Sooty Shearwater - Foraging | 36.1 | 13 | - | 16.3 | 14 | - |
| | Southern Giant Petrel - Foraging | 25.1 | 3 | - | 12.4 | 6 | - |
| | Southern Right Whale - Aggregation | 833.2 | 100 | 100 | 1,262.8 | 100 | 100 |
| | Southern Right Whale - Connecting Habitat | 11.7 | 2 | - | 14.8 | 7 | - |
| | Southern Right Whale - Known Core Range* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Wandering Albatross - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Wedge-tailed Shearwater - Foraging* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | White Shark - Breeding | 23.3 | 37 | - | 28.4 | 56 | - |
| | White Shark - Distribution* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | White Shark - Foraging | 218.7 | 87 | 34 | 243 | 79 | 24 |
| | White-capped Albatross - Foraging | 25.1 | 3 | - | 12.4 | 6 | - |
| | White-faced Storm-petrel - Breeding | 25.1 | 8 | - | 15.3 | 7 | - |
| | White-faced Storm-petrel - Foraging | 153.7 | 81 | 11 | 208.6 | 93 | 23 |
| | Wilsons Storm Petrel - Migration | 25.1 | 3 | - | 12.4 | 6 | - |
| IBRA | Bateman | 11.4 | 3 | - | 11.6 | 4 | - |
| | Bridgewater | 113.5 | 52 | 8 | 104.1 | 20 | 2 |
| | East Gippsland Lowlands | 17.4 | 7 | - | 12.3 | 9 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Flinders | 23.7 | 20 | - | 31.4 | 21 | - |
| | Gippsland Plain | 65.3 | 41 | - | 77.0 | 66 | - |
| | Glenelg Plain | 148.6 | 53 | 11 | 108.5 | 22 | 2 |
| | King Island | 11.7 | 1 | - | 14.8 | 7 | - |
| | Otway Plain | 260 | 94 | 58 | 252 | 98 | 82 |
| | Otway Ranges | 209.7 | 97 | 65 | 259.5 | 100 | 92 |
| | Strzelecki Ranges | 30.4 | 40 | - | 35.5 | 65 | - |
| | Tasmanian West | 10.0 | 1 | - | 7.1 | - | - |
| | Warrnambool Plain | 513.7 | 100 | 98 | 626.6 | 100 | 100 |
| | Wilsons Promontory | 72.4 | 43 | - | 81.4 | 69 | - |
| IMCRA | Batemans Shelf | 20 | 7 | - | 15.3 | 7 | - |
| | Central Bass Strait | 135.9 | 76 | 11 | 204.1 | 91 | 17 |
| | Central Victoria | 149.6 | 80 | 13 | 208.6 | 93 | 25 |
| | Coorong | 10.9 | 1 | - | 9.0 | - | - |
| | Flinders | 73.3 | 43 | - | 82.9 | 69 | - |
| | Franklin | 10.6 | 1 | - | 8.0 | - | - |
| | Otway* | 940.7 | 100 | 100 | 1,534.8 | 100 | 100 |
| | Twofold Shelf | 42.6 | 21 | - | 29.2 | 28 | - |
| | Victorian Embayments | 31.8 | 27 | - | 30.6 | 50 | - |
| KEF | Big Horseshoe Canyon | 11.7 | 2 | - | 9.9 | - | - |
| | Bonney Coast Upwelling | 148.6 | 73 | 19 | 243 | 53 | 7 |
| | Canyons on the Eastern Continental Slope | 25.1 | 2 | - | 9.1 | - | - |
| | Shelf rocky reefs | 13.9 | 4 | - | 13.4 | 6 | - |
| | Upwelling East of Eden | 42.6 | 18 | - | 20.6 | 21 | - |
| | West Tasmania Canyons | 44.6 | 23 | - | 38.3 | 14 | - |
| MNP | Bunurong | 33.8 | 29 | - | 32.1 | 52 | - |
| | Cape Howe | 18.9 | 12 | - | 13.3 | 8 | - |
| | Churchill Island | 23.8 | 10 | - | 20.0 | 12 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Discovery Bay | 51.1 | 47 | - | 41.9 | 13 | - |
| | Point Addis | 57.4 | 28 | - | 58.6 | 39 | - |
| | Point Hicks | 11.3 | 3 | - | 11.1 | 4 | - |
| | Port Phillip Heads | 33.0 | 25 | - | 37.0 | 29 | - |
| | Twelve Apostles | 455.9 | 99 | 98 | 572.8 | 100 | 100 |
| | Wilsons Promontory | 73.3 | 43 | - | 82.9 | 69 | - |
| MP | Batemans | 14.3 | 4 | - | 13.4 | 6 | - |
| | Lower South East | 26.5 | 15 | - | 27.3 | 4 | - |
| | Upper South East | 12.8 | 2 | - | 4.4 | - | - |
| MS | Mushroom Reef | 19.2 | 22 | - | 24.2 | 48 | - |
| NPS4 | Bunurong Marine Park | 40.2 | 31 | - | 48.1 | 49 | - |
| | Wilsons Promontory Marine Park | 64.3 | 41 | - | 75.2 | 61 | - |
| RAMSAR | Port Phillip Bay Western Shoreline and Bellarine Peninsula | 23.6 | 17 | - | 23.3 | 10 | - |
| | Western Port | 23.8 | 10 | - | 22.3 | 25 | - |
| RSB | Bell Reef | 11.0 | 1 | - | 7.2 | - | - |
| | Bravenes Rock | 181.0 | 91 | 41 | 177.2 | 98 | 55 |
| | Cody Bank | 21.3 | 40 | - | 29.6 | 61 | - |
| | Cutter Rock | 26.8 | 24 | - | 33.6 | 18 | - |
| | New Zealand Star Bank | 20.0 | 11 | - | 14.4 | 13 | - |
| Nearshore Waters | Anser Island | 62.4 | 43 | - | 67.1 | 67 | - |
| | Bass Coast | 40.2 | 31 | - | 52.2 | 53 | - |
| | Bega Valley | 16.8 | 6 | - | 11.6 | 5 | - |
| | Colac Otway | 260.0 | 96 | 58 | 259.5 | 100 | 82 |
| | Corangamite | 522.4 | 100 | 97 | 572.8 | 100 | 100 |
| | Curtis Island | 23.7 | 11 | - | 31.4 | 10 | - |
| | East Gippsland | 17.4 | 6 | - | 12.2 | 7 | - |
| | French Island | 8.3 | - | - | 13.3 | 5 | - |
| | Gabo Island | 17.1 | 7 | - | 12.3 | 9 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Glenelg | 146.4 | 53 | 11 | 108.5 | 22 | 2 |
| | Glennie Group | 66.3 | 43 | - | 73.3 | 69 | - |
| | Grant | 36.7 | 23 | - | 35.9 | 5 | - |
| | Greater Geelong | 57.8 | 24 | - | 58.3 | 16 | - |
| | Hogan Island Group | 22.4 | 20 | - | 28.9 | 21 | - |
| | Kanowna Island | 58.5 | 43 | - | 63.1 | 66 | - |
| | King Island | 11.7 | 1 | - | 14.8 | 7 | - |
| | Lady Julia Percy Island | 134.8 | 64 | 19 | 243.0 | 44 | 5 |
| | Laurence Rocks | 108.3 | 53 | 4 | 90.1 | 22 | - |
| | Moncoeur Islands | 35.0 | 39 | - | 27.6 | 52 | - |
| | Montague Island | 11.4 | 3 | - | 11.6 | 4 | - |
| | Mornington Peninsula | 42.6 | 31 | - | 37.5 | 53 | - |
| | Moyne | 508.9 | 100 | 98 | 626.6 | 100 | 95 |
| | Mud Island | 14.8 | 10 | - | 16.2 | 4 | - |
| | Norman Island | 72.4 | 42 | - | 80.8 | 69 | - |
| | Phillip Island | 28.9 | 31 | - | 33.6 | 58 | - |
| | Robe | 10.9 | 1 | - | 3.2 | - | - |
| | Rodondo Island | 45.9 | 41 | - | 44.8 | 60 | - |
| | Seal Islands | 8.7 | - | - | 13.9 | 15 | - |
| | Shellback Island | 52.9 | 41 | - | 66.4 | 60 | - |
| | Skull Rock | 54.0 | 42 | - | 60.8 | 66 | - |
| | South Gippsland | 69.1 | 43 | - | 79.2 | 68 | - |
| | Surf Coast | 56.7 | 31 | - | 56.3 | 55 | - |
| | Warrnambool | 257.7 | 95 | 29 | 310.5 | 62 | 23 |
| | Wattle Range | 14.4 | 4 | - | 14.4 | 3 | - |
| | West Coast | 10.0 | 1 | - | 7.1 | - | - |
| State Waters | New South Wales | 16.8 | 11 | - | 13.4 | 6 | - |
| | South Australia State Waters | 40.1 | 26 | - | 38.7 | 5 | - |
| | Tasmania State Waters | 29.2 | 21 | - | 35.0 | 26 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Victoria State Waters | 640.5 | 100 | 100 | 626.6 | 100 | 100 |
| Nearshore Waters (Sub-LGA) | Anglesea | 42.6 | 20 | - | 43.0 | 25 | - |
| | Apollo Bay | 153.7 | 84 | 10 | 108.8 | 93 | 3 |
| | Bay of Islands | 508.9 | 100 | 98 | 626.6 | 100 | 95 |
| | Bega Valley | 16.8 | 6 | - | 11.6 | 5 | - |
| | Cape Howe / Mallacoota | 17.4 | 6 | - | 12.2 | 7 | - |
| | Cape Liptrap – Northwest | 36.9 | 40 | - | 45.9 | 66 | - |
| | Cape Nelson | 146.4 | 53 | 11 | 108.5 | 22 | 2 |
| | Cape Otway West | 260 | 96 | 59 | 259.5 | 100 | 84 |
| | Cape Patton | 84.3 | 70 | - | 79.2 | 89 | - |
| | Childers Cove | 320.9 | 100 | 60 | 313.1 | 87 | 31 |
| | Croajingolong - East | 10.6 | 1 | - | 10.5 | 1 | - |
| | Croajingolong - West | 10.2 | 1 | - | 10.0 | 1 | - |
| | Discovery Bay - East | 46.3 | 36 | - | 39.3 | 11 | - |
| | Discovery Bay - West | 28.5 | 28 | - | 28.6 | 5 | - |
| | French Island - East | 5.4 | - | - | 13.2 | 2 | - |
| | French Island / Crib Point | 8.1 | - | - | 13.6 | 8 | - |
| | French Island / San Remo | 23.5 | 21 | - | 25.2 | 35 | - |
| | Kilcunda | 39.6 | 29 | - | 52.1 | 53 | - |
| | Lorne | 42.0 | 38 | - | 41.6 | 62 | - |
| | Moonlight Head | 455.9 | 99 | 97 | 572.8 | 100 | 100 |
| | Mornington Peninsula - South | 30.0 | 31 | - | 27.1 | 50 | - |
| | Mornington Peninsula - Southwest | 42.6 | 30 | - | 37.5 | 52 | - |
| | Point Hicks | 10.1 | 1 | - | 10.7 | 4 | - |
| | Port Campbell | 522.4 | 100 | 97 | 482.4 | 100 | 96 |
| | Port Fairy | 187.1 | 67 | 8 | 200.1 | 41 | 5 |
| | Port Phillip - Queenscliff | 42.7 | 24 | - | 42.5 | 16 | - |
| | Port Phillip - Sorrento Shore | 36.2 | 26 | - | 37.0 | 41 | - |
| | Port Phillip Heads | 30.5 | 21 | - | 27.4 | 13 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Portland Bay - East | 79.3 | 59 | - | 94.7 | 32 | - |
| | Portland Bay - West | 91.1 | 47 | - | 84.7 | 18 | - |
| | Torquay | 57.8 | 22 | - | 58.3 | 18 | - |
| | Venus Bay | 40.2 | 31 | - | 52.2 | 53 | - |
| | Waratah Bay | 30.4 | 40 | - | 35.5 | 65 | - |
| | Warrnambool | 213.4 | 82 | 12 | 197.1 | 57 | 16 |
| | Westernport | 18.0 | 16 | - | 22.3 | 47 | - |
| | Wilsons Promontory - East | 42.3 | 42 | - | 46.1 | 64 | - |
| | Wilsons Promontory - West | 69.1 | 43 | - | 79.2 | 68 | - |

*The release location resides within the receptor boundaries.

**Table 12.10 Predicted minimum time to entrained hydrocarbon exposure and maximum residence time for entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer. Results are based on an 83,273 bbl (13,239 $m^3$) subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| AMP | Apollo | 2.88 | 10.67 | 39.33 | 0.42 | 2.63 | 3.5 | 24.21 | 0.58 |
| | Beagle | 16.71 | - | 7.58 | - | 16.96 | - | 8 | - |
| | East Gippsland | 90.33 | - | 0.13 | - | 64.08 | - | 0.04 | - |
| | Franklin | 64.92 | - | 0.08 | - | - | - | - | - |
| | Nelson | 16.63 | - | 1.96 | - | 80.13 | - | 1.25 | - |
| | Zeehan | 14.21 | - | 7.13 | - | 16.08 | - | 3.08 | - |
| BIA | Antipodean Albatross – Foraging* | 0.04 | 0.08 | 101.71 | 24.83 | 0.04 | 0.04 | 109.29 | 21.88 |
| | Australasian Gannet – Foraging | 2.33 | 7.04 | 89.83 | 6.63 | 5.42 | 9.25 | 99.83 | 3.08 |
| | Australian Sea Lion – Foraging | 10.13 | - | 0.63 | - | 75.33 | - | 0.08 | - |
| | Black Petrel – Foraging | 60.13 | - | 1.63 | - | 63.67 | - | 0.75 | - |
| | Black-browed Albatross – Foraging* | 0.04 | 0.08 | 101.88 | 24.83 | 0.04 | 0.04 | 109.29 | 26.29 |
| | Black-faced Cormorant – Foraging | 23.33 | - | 2.08 | - | 17.79 | - | 0.54 | - |
| | Bullers Albatross – Foraging* | 0.04 | 0.08 | 101.88 | 24.83 | 0.04 | 0.04 | 109.29 | 26.29 |
| | Campbell Albatross – Foraging* | 0.04 | 0.08 | 101.88 | 24.83 | 0.04 | 0.04 | 109.29 | 26.29 |
| | Common Diving-petrel – Foraging* | 0.04 | 0.08 | 109.38 | 35.46 | 0.04 | 0.04 | 112.54 | 42.17 |
| | Crested Tern – Breeding | 85.25 | - | 0.58 | - | 64.13 | - | 0.33 | - |
| | Crested Tern – Foraging | 60.63 | - | 1 | - | 63.67 | - | 0.75 | - |
| | Flesh-footed Shearwater – Foraging | 60.13 | - | 1.63 | - | 63.67 | - | 0.75 | - |
| | Great-winged Petrel – Foraging | 60.13 | - | 1.63 | - | 65.21 | - | 0.08 | - |
| | Grey Nurse Shark – Foraging | 57.46 | - | 1.42 | - | 33.54 | - | 0.33 | - |
| | Grey Nurse Shark – Migration | 29.83 | - | 1.79 | - | 33.50 | - | 0.75 | - |
| | Humpback Whale – Foraging | 29.50 | - | 1.79 | - | 32.75 | - | 0.75 | - |
| | Indian Yellow-nosed Albatross – Foraging* | 0.04 | 0.08 | 101.88 | 24.83 | 0.04 | 0.04 | 109.29 | 26.29 |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Indo-Pacific/Spotted Bottlenose Dolphin – Breeding | 57.08 | - | 1.92 | - | 33.71 | - | 0.33 | - |
| | Little Penguin – Breeding | 85.13 | - | 1 | - | 64.08 | - | 0.75 | - |
| | Little Penguin – Foraging | 15.42 | - | 12 | - | 10.96 | - | 25.63 | - |
| | Northern Giant Petrel – Foraging | 60.13 | - | 1.63 | - | 65.21 | - | 0.08 | - |
| | Pygmy Blue Whale – Distribution* | 0.04 | 0.08 | 109.38 | 35.46 | 0.04 | 0.04 | 112.54 | 42.17 |
| | Pygmy Blue Whale – Foraging* | 0.04 | 0.08 | 109.38 | 35.46 | 0.04 | 0.04 | 112.54 | 42.17 |
| | Pygmy Blue Whale – Foraging annual high use area* | 0.04 | 0.08 | 109.38 | 35.46 | 0.04 | 0.04 | 112.54 | 42.17 |
| | Pygmy Blue Whale – Known Foraging Area | 2.42 | 6.71 | 54.83 | 1.21 | 2.29 | 3.63 | 46.42 | 1.13 |
| | Short-tailed Shearwater – Foraging | 1.58 | 4.13 | 99.71 | 24.25 | 1.13 | 2.38 | 110.54 | 13.79 |
| | Shy Albatross – Foraging* | 0.04 | 0.08 | 109.38 | 35.46 | 0.04 | 0.04 | 112.54 | 42.17 |
| | Soft-plumaged Petrel – Foraging | 82.17 | - | 0.04 | - | - | - | - | - |
| | Sooty Shearwater – Foraging | 30.17 | - | 1.79 | - | 44.38 | - | 0.75 | - |
| | Southern Giant Petrel – Foraging | 60.13 | - | 1.63 | - | 65.21 | - | 0.08 | - |
| | Southern Right Whale - Aggregation* | 0.04 | 0.08 | 89.83 | 35.46 | 0.04 | 0.08 | 102.58 | 22.88 |
| | Southern Right Whale – Connecting Habitat | 48.04 | - | 0.08 | - | 19.88 | - | 1.08 | - |
| | Southern Right Whale – Known Core Range* | 0.04 | 0.08 | 109.38 | 35.46 | 0.04 | 0.04 | 112.54 | 42.17 |
| | Wandering Albatross – Foraging* | 0.04 | 0.08 | 101.88 | 24.83 | 0.04 | 0.04 | 109.29 | 26.29 |
| | Wedge-tailed Shearwater – Foraging* | 0.04 | 0.08 | 109.38 | 35.46 | 0.04 | 0.04 | 112.54 | 42.17 |
| | White Shark – Breeding | 49.42 | - | 9.38 | - | 19.38 | - | 30.75 | - |
| | White Shark – Distribution* | 0.04 | 0.08 | 101.88 | 24.83 | 0.04 | 0.04 | 109.29 | 26.29 |
| | White Shark – Foraging | 1.25 | 3 | 89.83 | 1.92 | 2.13 | 6.83 | 99.83 | 22.88 |
| | White-capped Albatross – Foraging | 60.13 | - | 1.63 | - | 65.21 | - | 0.08 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | White-faced Storm-petrel – Breeding | 59.50 | - | 1.63 | - | 45.38 | - | 0.75 | - |
| | White-faced Storm-petrel – Foraging | 2.50 | 10.79 | 54.46 | 0.42 | 2.79 | 4 | 46.42 | 1.13 |
| | Wilsons Storm Petrel – Migration | 60.13 | - | 1.63 | - | 65.21 | - | 0.08 | - |
| IBRA | Bateman | 85.42 | - | 0.08 | - | 64.38 | - | 0.04 | - |
| | Bridgewater | 5.38 | 26.46 | 61.63 | 1.38 | 19.75 | 99.46 | 44.58 | 0.04 |
| | East Gippsland Lowlands | 53.63 | - | 2.42 | - | 40.38 | - | 0.17 | - |
| | Flinders | 20.63 | - | 4.5 | - | 18.54 | - | 3.08 | - |
| | Gippsland Plain | 15.63 | - | 28.92 | - | 11.42 | - | 50.67 | - |
| | Glenelg Plain | 4.63 | 8.71 | 78.42 | 5.88 | 19.38 | 99.04 | 48.58 | 0.13 |
| | King Island | 35.42 | - | 0.08 | - | 19.88 | - | 1.08 | - |
| | Otway Plain | 2.21 | 7.29 | 85.25 | 23.38 | 2.25 | 2.88 | 83.08 | 13.71 |
| | Otway Ranges | 1.88 | 6.42 | 99.71 | 12.54 | 1.92 | 5.42 | 101.92 | 9.13 |
| | Strzelecki Ranges | 15.71 | - | 16.38 | - | 19.08 | - | 18.42 | - |
| | Tasmanian West | 89.42 | - | 0.04 | - | - | - | - | - |
| | Warrnambool Plain | 0.83 | 1.33 | 99.63 | 35.21 | 0.63 | 1.29 | 111.08 | 41.79 |
| | Wilsons Promontory | 13.83 | - | 53.54 | - | 10.88 | - | 69.54 | - |
| IMCRA | Batemans Shelf | 59.58 | - | 1 | - | 45.58 | - | 0.75 | - |
| | Central Bass Strait | 3.38 | 11.79 | 21.54 | 0.38 | 2.92 | 3.71 | 21.75 | 1.13 |
| | Central Victoria | 2.88 | 10.79 | 46.54 | 0.42 | 2.79 | 3.63 | 46.42 | 0.54 |
| | Coorong | 23.75 | - | 0.04 | - | - | - | - | - |
| | Flinders | 13.08 | - | 53.83 | - | 10.29 | - | 69.54 | - |
| | Franklin | 82.17 | - | 0.04 | - | - | - | - | - |
| | Otway* | 0.04 | 0.08 | 109.38 | 35.46 | 0.04 | 0.04 | 112.54 | 42.17 |
| | Twofold Shelf | 17.63 | - | 5.17 | - | 17.58 | - | 3.67 | - |
| | Victorian Embayments | 31.58 | - | 10.83 | - | 15.04 | - | 16.92 | - |
| KEF | Big Horseshoe Canyon | 55.88 | - | 0.04 | - | - | - | - | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Bonney Coast Upwelling | 2.13 | 7.04 | 89.83 | 6.63 | 6.63 | 8.92 | 99.83 | 4.25 |
| | Canyons on the Eastern Continental Slope | 60.17 | - | 1.38 | - | - | - | - | - |
| | Shelf rocky reefs | 85.00 | - | 0.42 | - | 64.00 | - | 0.33 | - |
| | Upwelling East of Eden | 29.42 | - | 3 | - | 32.58 | - | 2.96 | - |
| | West Tasmania Canyons | 12.13 | - | 11.42 | - | 12.25 | - | 2.75 | - |
| MNP | Bunurong | 16 | - | 8.5 | - | 17.04 | - | 13.13 | - |
| | Cape Howe | 53.54 | - | 2.38 | - | 40.50 | - | 0.21 | - |
| | Churchill Island | 50.08 | - | 5.58 | - | 32.29 | - | 9.71 | - |
| | Discovery Bay | 5.58 | - | 8.88 | - | 28.00 | - | 7 | - |
| | Point Addis | 29.13 | - | 41.67 | - | 12.75 | - | 41.83 | - |
| | Point Hicks | 77.96 | - | 0.04 | - | 54.29 | - | 0.08 | - |
| | Port Phillip Heads | 31.58 | - | 10.79 | - | 20.88 | - | 14 | - |
| | Twelve Apostles | 1.25 | 1.79 | 109.38 | 31.04 | 0.92 | 1.38 | 112.54 | 42.17 |
| | Wilsons Promontory | 14 | - | 53.83 | - | 10.67 | - | 69.46 | - |
| MP | Batemans | 85.25 | - | 0.58 | - | 64.13 | - | 0.33 | - |
| | Lower South East | 15.67 | - | 4.29 | - | 56.96 | - | 11.54 | - |
| | Upper South East | 27.21 | - | 0.08 | - | - | - | - | - |
| MS | Mushroom Reef | 36.08 | - | 8.38 | - | 15.79 | - | 3.79 | - |
| NPS4 | Bunurong Marine Park | 16.92 | - | 9.63 | - | 16.75 | - | 12.42 | - |
| | Wilsons Promontory Marine Park | 16.29 | - | 28.92 | - | 19.38 | - | 51.33 | - |
| RAMSAR | Port Phillip Bay Western Shoreline and Bellarine Peninsula | 32.67 | - | 8.17 | - | 21.42 | - | 9.21 | - |
| | Western Port | 50.08 | - | 5.58 | - | 17.5 | - | 10.63 | - |
| RSB | Bell Reef | 92.21 | - | 0.04 | - | - | - | - | - |
| | Bravenes Rock | 1.83 | 6.21 | 89.63 | 1.13 | 1.71 | 6.13 | 84.67 | 1.54 |
| | Cody Bank | 14.79 | - | 2.54 | - | 17.5 | - | 4.17 | - |
| | Cutter Rock | 44.08 | - | 1.75 | - | 16.96 | - | 2.21 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | New Zealand Star Bank | 52.92 | - | 2.13 | - | 39.08 | - | 1.17 | - |
| Nearshore Waters | Anser Island | 16.88 | - | 52.83 | - | 16.92 | - | 65.25 | - |
| | Bass Coast | 16.92 | - | 12 | - | 16.13 | - | 21.25 | - |
| | Bega Valley | 78.88 | - | 1.79 | - | 41.42 | - | 0.08 | - |
| | Colac Otway | 2.17 | 7.29 | 85.25 | 23.38 | 2.13 | 2.88 | 94.04 | 13.71 |
| | Corangamite | 0.79 | 1.50 | 99.71 | 30.88 | 0.63 | 1.63 | 111.08 | 41.79 |
| | Curtis Island | 44.17 | - | 1 | - | 18.83 | - | 1.13 | - |
| | East Gippsland | 78.79 | - | 2 | - | 40.54 | - | 0.17 | - |
| | French Island | - | - | - | - | 43.21 | - | 0.17 | - |
| | Gabo Island | 53.63 | - | 2.33 | - | 40.42 | - | 0.17 | - |
| | Glenelg | 4.63 | 8.71 | 78.42 | 5.88 | 19.38 | 99.04 | 87.17 | 0.13 |
| | Glennie Group | 16.13 | - | 53.54 | - | 11.00 | - | 65.83 | - |
| | Grant | 18.42 | - | 5.58 | - | 56.33 | - | 12.17 | - |
| | Greater Geelong | 29.83 | - | 19.63 | - | 14.17 | - | 21.38 | - |
| | Hogan Island Group | 20.63 | - | 4.5 | - | 18.54 | - | 3.08 | - |
| | Kanowna Island | 14.04 | - | 52.13 | - | 14.83 | - | 62.54 | - |
| | King Island | 35.42 | - | 0.08 | - | 19.88 | - | 1.08 | - |
| | Lady Julia Percy Island | 3.00 | 15.71 | 65.63 | 1.88 | 8.96 | 9.29 | 97.08 | 3.08 |
| | Laurence Rocks | 4.33 | 32.63 | 79.58 | 0.38 | 15.29 | - | 27.29 | - |
| | Moncoeur Islands | 17.04 | - | 8.21 | - | 17.42 | - | 6.13 | - |
| | Montague Island | 85.42 | - | 0.08 | - | 64.38 | - | 0.04 | - |
| | Mornington Peninsula | 31.71 | - | 10.63 | - | 11.42 | - | 11.25 | - |
| | Moyne | 0.83 | 1.33 | 92.88 | 29 | 0.71 | 1.29 | 98.92 | 20.63 |
| | Mud Island | 43.04 | - | 0.96 | - | 56.50 | - | 1.25 | - |
| | Norman Island | 16.00 | - | 32.88 | - | 10.88 | - | 51.88 | - |
| | Phillip Island | 16.08 | - | 11.38 | - | 14.83 | - | 22.75 | - |
| | Robe | 30.17 | - | 0.04 | - | - | - | - | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Rodondo Island | 13.83 | - | 15.38 | - | 15.00 | - | 13 | - |
| | Seal Islands | - | - | - | - | 35.79 | - | 0.42 | - |
| | Shellback Island | 15.96 | - | 23.17 | - | 19.29 | - | 33.5 | - |
| | Skull Rock | 14.04 | - | 52.13 | - | 14.83 | - | 55.96 | - |
| | South Gippsland | 15.63 | - | 53.17 | - | 18.42 | - | 69.46 | - |
| | Surf Coast | 29.71 | - | 45.92 | - | 13.17 | - | 46.29 | - |
| | Warrnambool | 2.46 | 3.29 | 59.08 | 9.79 | 1.83 | 5.25 | 101.42 | 6.38 |
| | Wattle Range | 25.46 | - | 0.29 | - | 66.25 | - | 1 | - |
| | West Coast | 89.42 | - | 0.04 | - | - | - | - | - |
| State Waters | New South Wales | 57.13 | - | 1.79 | - | 33.71 | - | 0.33 | - |
| | South Australia State Waters | 15.08 | - | 9.38 | - | 55.29 | - | 12.58 | - |
| | Tasmania State Waters | 18.08 | - | 5.17 | - | 17.21 | - | 4.33 | - |
| | Victoria State Waters | 0.29 | 0.38 | 109.38 | 35.46 | 0.29 | 0.42 | 112.54 | 42.17 |
| Nearshore Waters (Sub-LGA) | Anglesea | 29.71 | - | 39.42 | - | 13.21 | - | 41.29 | - |
| | Apollo Bay | 2.46 | 28.25 | 59.04 | 4.33 | 2.33 | 9.63 | 31.88 | 0.17 |
| | Bay of Islands | 0.83 | 1.33 | 92.88 | 29 | 0.71 | 1.29 | 84.54 | 20.63 |
| | Bega Valley | 78.88 | - | 1.79 | - | 41.42 | - | 0.08 | - |
| | Cape Howe / Mallacoota | 78.83 | - | 2 | - | 40.38 | - | 0.17 | - |
| | Cape Liptrap – Northwest | 15.63 | - | 16.42 | - | 19.33 | - | 20.13 | - |
| | Cape Nelson | 4.58 | 8.71 | 78.42 | 5.88 | 19.38 | 99.04 | 48.58 | 0.13 |
| | Cape Otway West | 2.17 | 7.17 | 85.29 | 23.67 | 2.13 | 2.88 | 94.04 | 10.29 |
| | Cape Patton | 9.33 | - | 23.13 | - | 5.25 | - | 20.63 | - |
| | Childers Cove | 0.92 | 2.75 | 55.67 | 35.21 | 1.75 | 2.17 | 51.21 | 9.38 |
| | Croajingolong – East | 78.83 | - | 0.04 | - | 76.04 | - | 0.04 | - |
| | Croajingolong – West | 81.46 | - | 0.04 | - | 77.42 | - | 0.04 | - |
| | Discovery Bay – East | 9.42 | - | 14.25 | - | 32.46 | - | 18 | - |
| | Discovery Bay – West | 15.92 | - | 14.29 | - | 57 | - | 14.54 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | French Island – East | - | - | - | - | 74.5 | - | 1.33 | - |
| | French Island / Crib Point | - | - | - | - | 42.21 | - | 0.13 | - |
| | French Island / San Remo | 35.58 | - | 6.83 | - | 16.13 | - | 16.92 | - |
| | Kilcunda | 16.96 | - | 9.17 | - | 16.42 | - | 21.25 | - |
| | Lorne | 26.79 | - | 20 | - | 13.67 | - | 14.29 | - |
| | Moonlight Head | 1.79 | 2.33 | 109.38 | 27.67 | 1.21 | 1.71 | 111.08 | 41.79 |
| | Mornington Peninsula – South | 34.00 | - | 10.58 | - | 14.83 | - | 6.58 | - |
| | Mornington Peninsula – Southwest | 33.79 | - | 10.63 | - | 11.42 | - | 10 | - |
| | Point Hicks | 114.54 | - | 0.04 | - | 55.04 | - | 0.04 | - |
| | Port Campbell | 0.79 | 1.5 | 90.63 | 30.88 | 0.63 | 1.63 | 87.58 | 24.58 |
| | Port Fairy | 2.75 | 12.71 | 80.04 | 1.58 | 8.63 | 12.25 | 98.92 | 13.13 |
| | Port Phillip – Queenscliff | 29.88 | - | 19.63 | - | 15.08 | - | 20.42 | - |
| | Port Phillip – Sorrento Shore | 31.71 | - | 8.96 | - | 20.96 | - | 13.79 | - |
| | Port Phillip Heads | 32.54 | - | 4.08 | - | 21 | - | 10.83 | - |
| | Portland Bay – East | 6.29 | - | 68.54 | - | 9.67 | - | 96.79 | - |
| | Portland Bay – West | 11.33 | - | 66.96 | - | 20.29 | - | 87.17 | - |
| | Torquay | 29.79 | - | 45.92 | - | 13.38 | - | 46.29 | - |
| | Venus Bay | 16.92 | - | 12 | - | 16.75 | - | 13.17 | - |
| | Waratah Bay | 15.71 | - | 16.38 | - | 19.08 | - | 18.42 | - |
| | Warrnambool | 2.50 | 10.67 | 85.21 | 4.13 | 5.08 | 5.25 | 101.42 | 20.17 |
| | Westernport | 45.08 | - | 9.46 | - | 16.38 | - | 3.5 | - |
| | Wilsons Promontory – East | 25.08 | - | 26.21 | - | 18.75 | - | 50.58 | - |
| | Wilsons Promontory – West | 16.21 | - | 53.17 | - | 18.42 | - | 69.46 | - |

*The release location resides within the receptor boundaries.

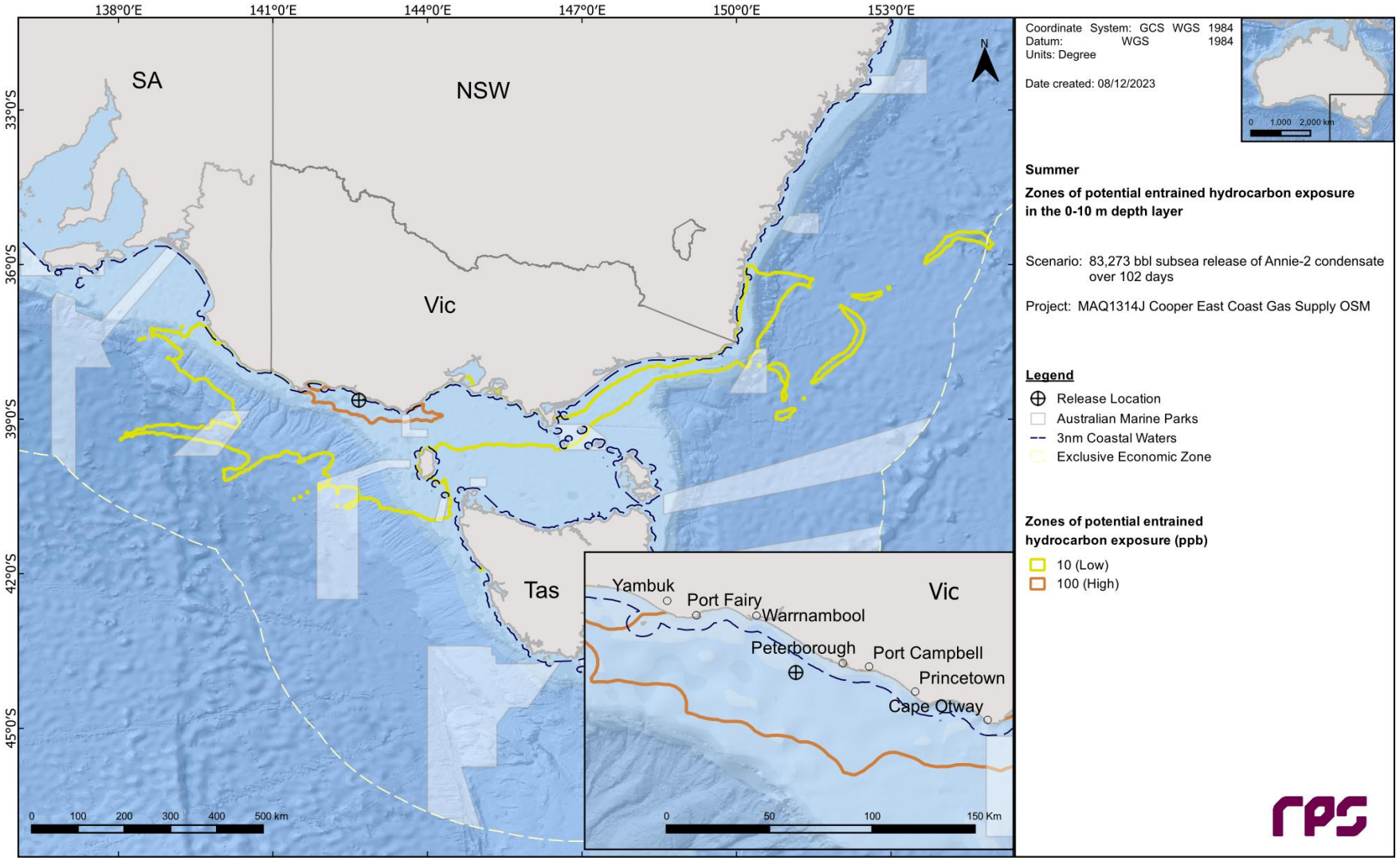



**Figure 12.13 Zones of potential entrained hydrocarbon exposure at 0-10 m below the sea surface in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

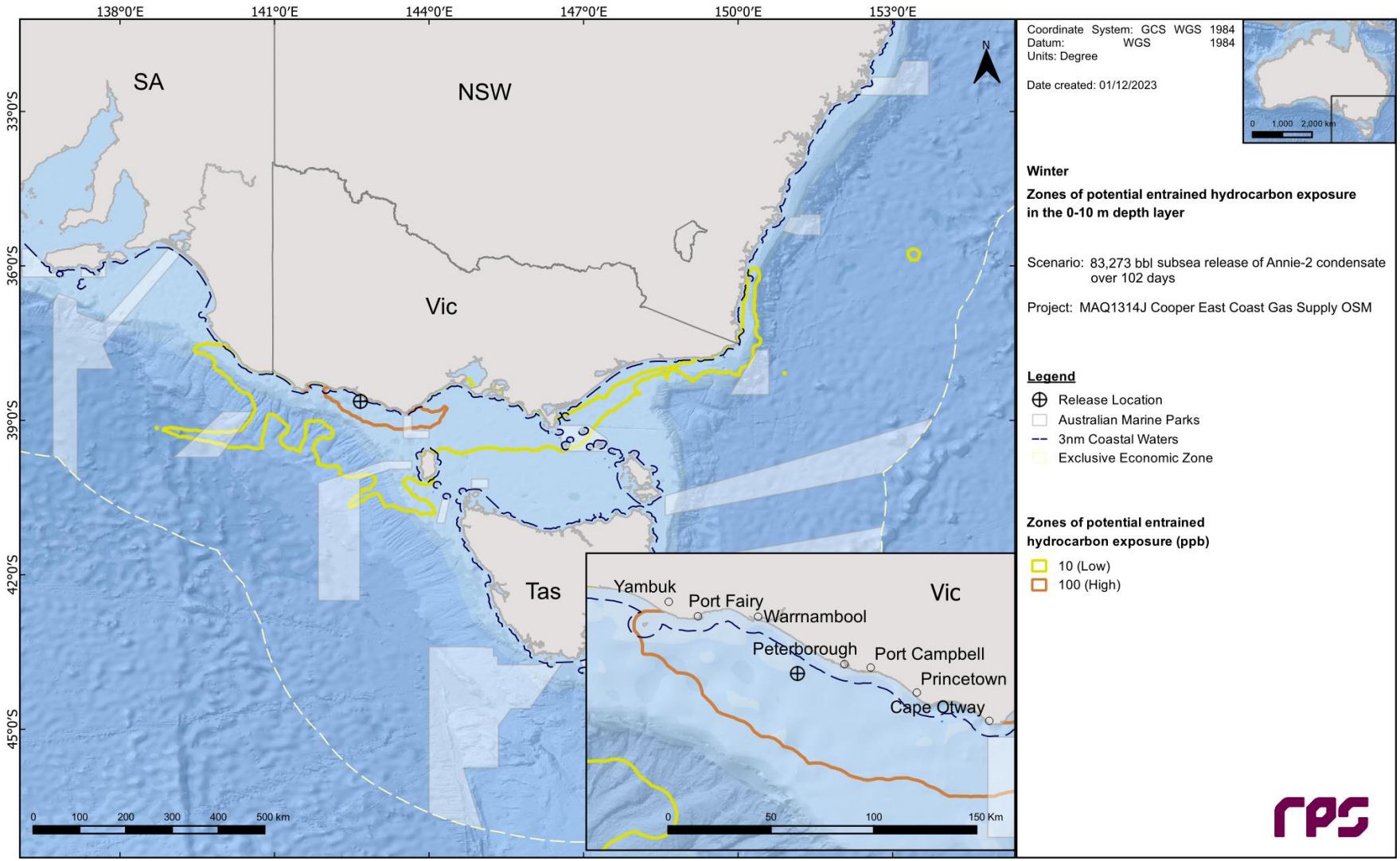



**Figure 12.14 Zones of potential entrained hydrocarbon exposure at 0-10 m below the sea surface in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

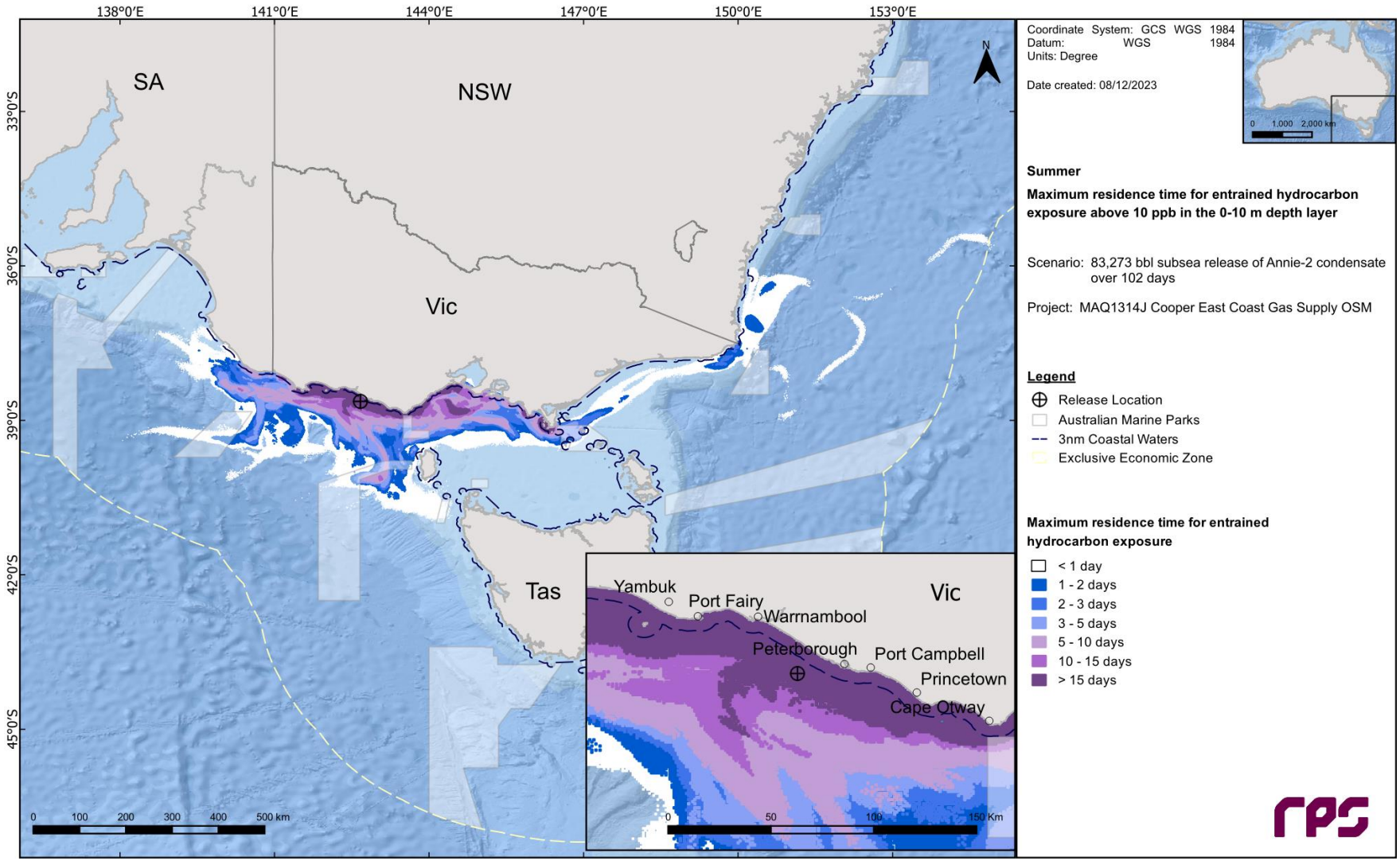



**Figure 12.15 Maximum residence time for entrained hydrocarbon exposure above 10 ppb, at 0-10 m below the sea in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

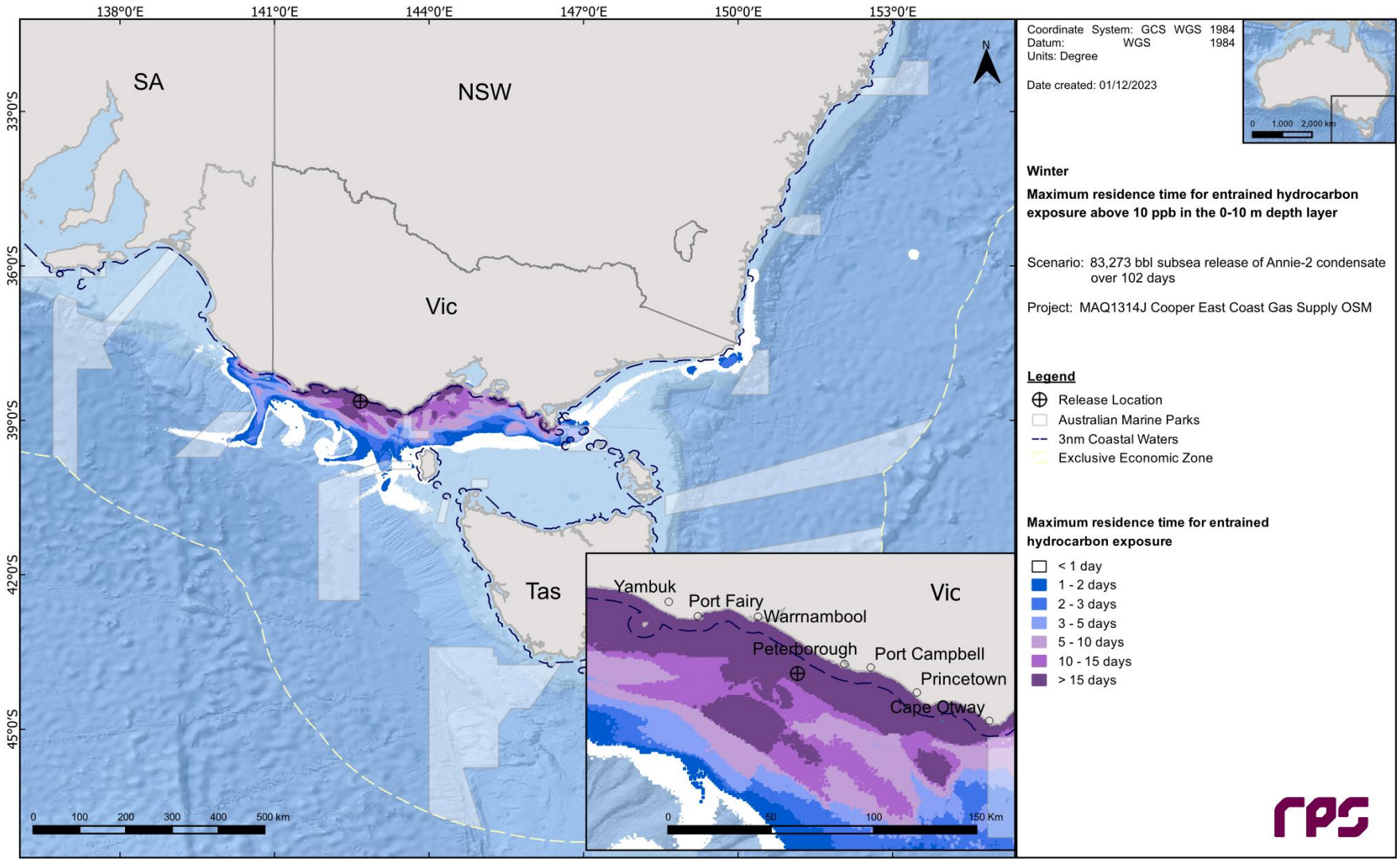



**Figure 12.16 Maximum residence time for entrained hydrocarbon exposure above 10 ppb, at 0-10 m below the sea in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

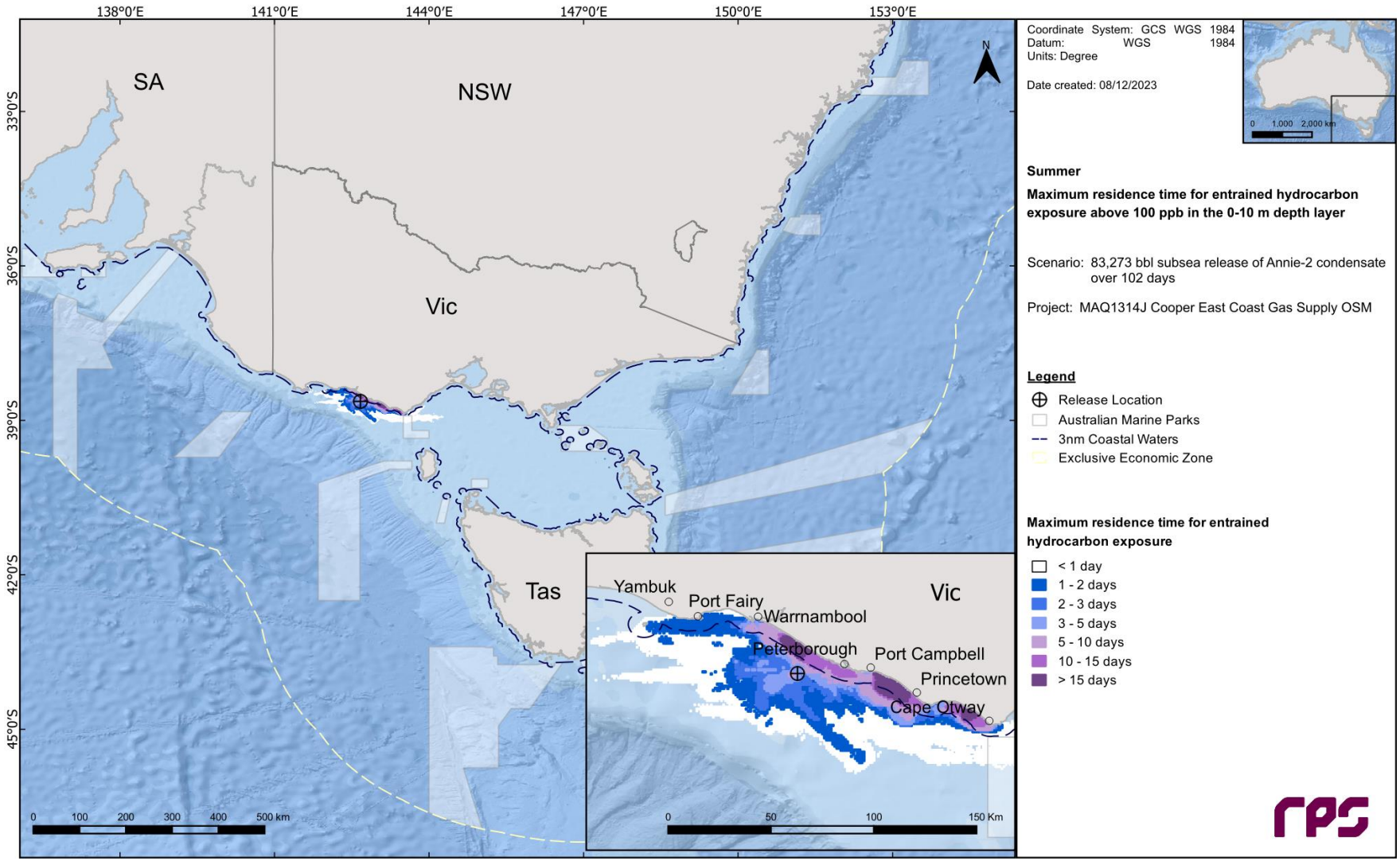



**Figure 12.17 Maximum residence time for entrained hydrocarbon exposure above 100 ppb, at 0-10 m below the sea in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during summer conditions.**

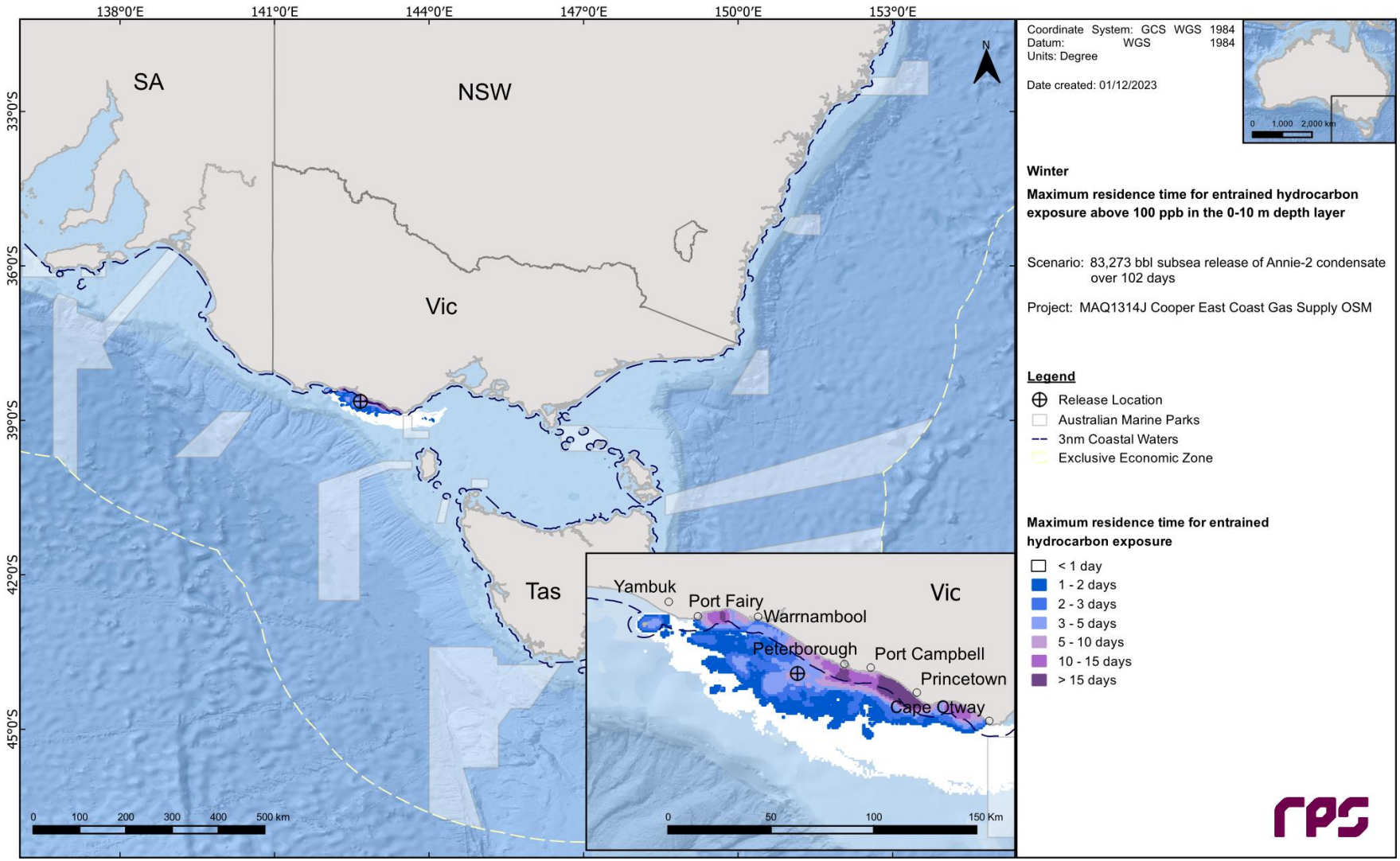



**Figure 12.18 Maximum residence time for entrained hydrocarbon exposure above 100 ppb, at 0-10 m below the sea in the event of an 83,273 bbl subsurface release from a loss of well control at Pecten East-2 over 102 days. The results were calculated from 100 spill simulations during winter conditions.**

## 12.2 Deterministic Analysis

The stochastic modelling results were assessed, and the “worst case” deterministic runs were identified and are presented below for the following criteria:

a. Largest swept area for surface oil above 10 g/m$^2$;
b. Largest (total) volume of oil ashore;
c. Longest length of shoreline with oil accumulation above 100 g/m$^2$;
d. Largest area of entrained hydrocarbon exposure above 100 ppb; and
e. Largest area of dissolved hydrocarbon exposure above 50 ppb.

Table 12.11 presents a summary of in-water exposure and shoreline accumulation at the assessed thresholds for the identified deterministic simulations.

**Table 12.11 Summary of the worst-case deterministic analysis based on the scenario presented in the stochastic analysis section.**

| Variable | Threshold | Deterministic Analysis Criteria | | | | |
|---|---|---|---|---|---|---|
| | | Largest swept area of floating oil >10 g/m² | Largest volume of oil ashore | Longest length of shoreline with accumulation >100 g/m² | Largest area of entrained hydrocarbon exposure >100 ppb | Largest area of dissolved hydrocarbon exposure >50 ppb |
| **Season** | | Summer | Winter | Summer | Winter | Summer |
| **Run Number** | | 61 | 13 | 57 | 58 | 68 |
| **Total area of floating Oil exposure (km²)** | 1 g/m² | 740 | 270 | 575 | 511 | 329 |
| | 10 g/m² | **45** | 8 | 10 | 25 | 8 |
| | 50 g/m² | - | - | - | - | - |
| **Total length of shoreline accumulation (km)** | 10 g/m² | 134 | 164 | 187 | 133 | 65 |
| | 100 g/m² | 47 | 69 | **71** | 45 | 14 |
| | 1,000 g/m² | - | 3 | 4 | - | - |
| **Minimum time before accumulation on any shoreline (hours)** | 10 g/m² | 60 | 77 | 113 | 207 | 327 |
| | 100 g/m² | 375 | 103 | 125 | 240 | 390 |
| | 1,000 g/m² | - | 1,665 | 1,147 | - | - |
| **Total volume of oil ashore (m³)** | | 196 | **343** | 287 | 184 | 63 |
| **Total area of entrained hydrocarbon exposure (km²)** | 10 ppb | 25,660 | 15,963 | 26,125 | 22,543 | 35,799 |
| | 100 ppb | 3,143 | 2,678 | 3,050 | **5,589** | 2,606 |
| **Total area of dissolved hydrocarbon exposure (km²)** | 10 ppb | 68 | 216 | 61 | 125 | 131 |
| | 50 ppb | - | - | - | - | **1** |
| | 400 ppb | - | - | - | - | - |
| **Start Date** | | 27th April 2010 3 pm | 23rd July 2010 4 am | 19th March 2012 11 am | 3rd August 2014 2 am | 29th April 2016 11 am |

NC = No contact at, or above the specified shoreline accumulation threshold.

## 12.2.1 Deterministic Case: Largest swept area of floating oil above 10 g/m$^2$

The deterministic trajectory that resulted in the largest swept area of floating oil above 10 g/m$^2$ was identified as summer run number 61, which started on 27$^{th}$ April 2010.

Figure 11.19 illustrates the floating oil exposure and shoreline accumulation over the 116-day simulation.

Figure 11.20 displays the time series of the area of sea surface exposure above the low (1 g/m$^2$), moderate (10 g/m$^2$) and high (50 g/m$^2$) thresholds over the 116-day simulation.

Figure 11.21 presents the fates and weathering graph for the corresponding single spill trajectory and Table 11.12 summarises the mass balance peaks and at the end of the simulation.

**Table 12.12 Summary of the mass balance for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface (m$^3$) | 382.3 | 20.3 | 0.1 |
| Entrained (m$^3$) | 1,925.8 | 78.0 | 1,476.6 |
| Dissolved (m$^3$) | 8.1 | 14.1 | 0.5 |
| Evaporation (m$^3$) | 7,868.8 | 116.0 | 7,868.8 |
| Decay (m$^3$) | 3,154.7 | 116.0 | 3,154.7 |
| Ashore (m$^3$) | 199.6 | 107.8 | 195.9 |

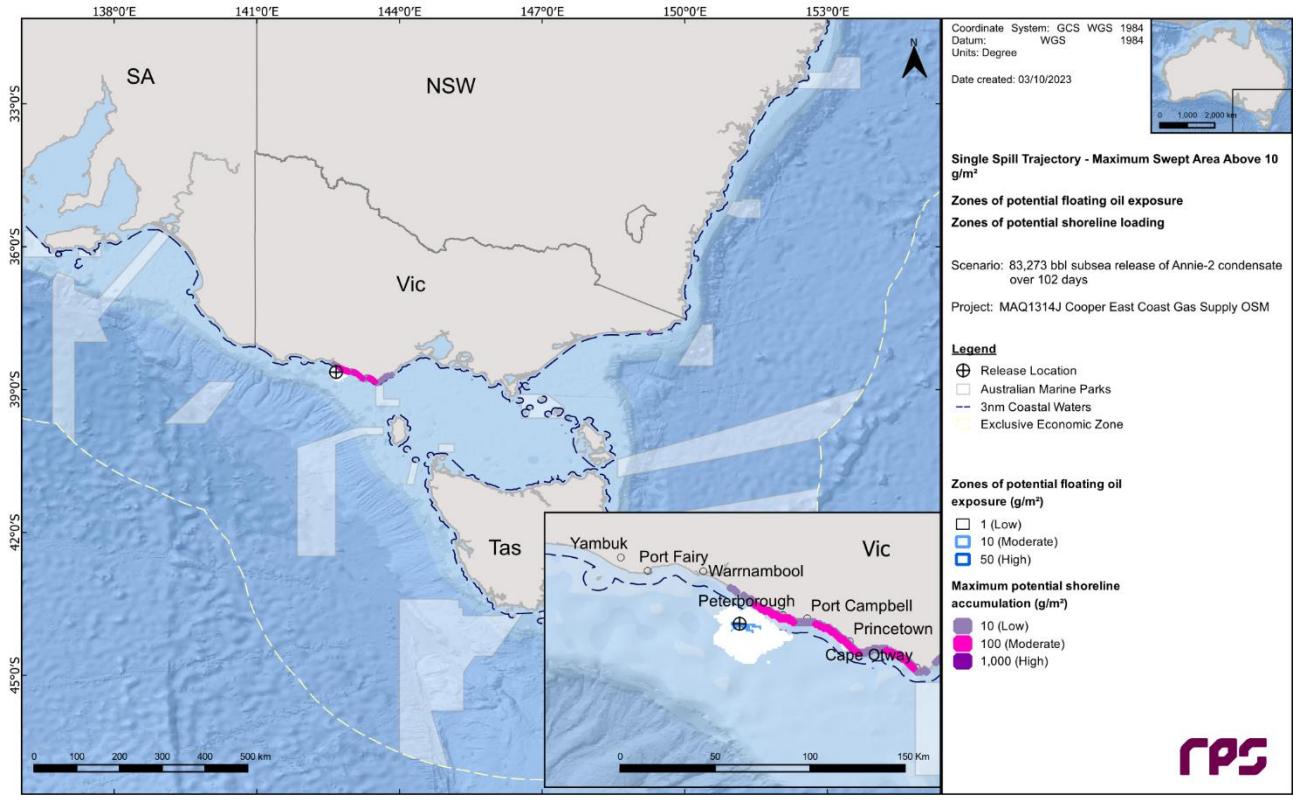



**Figure 12.19 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

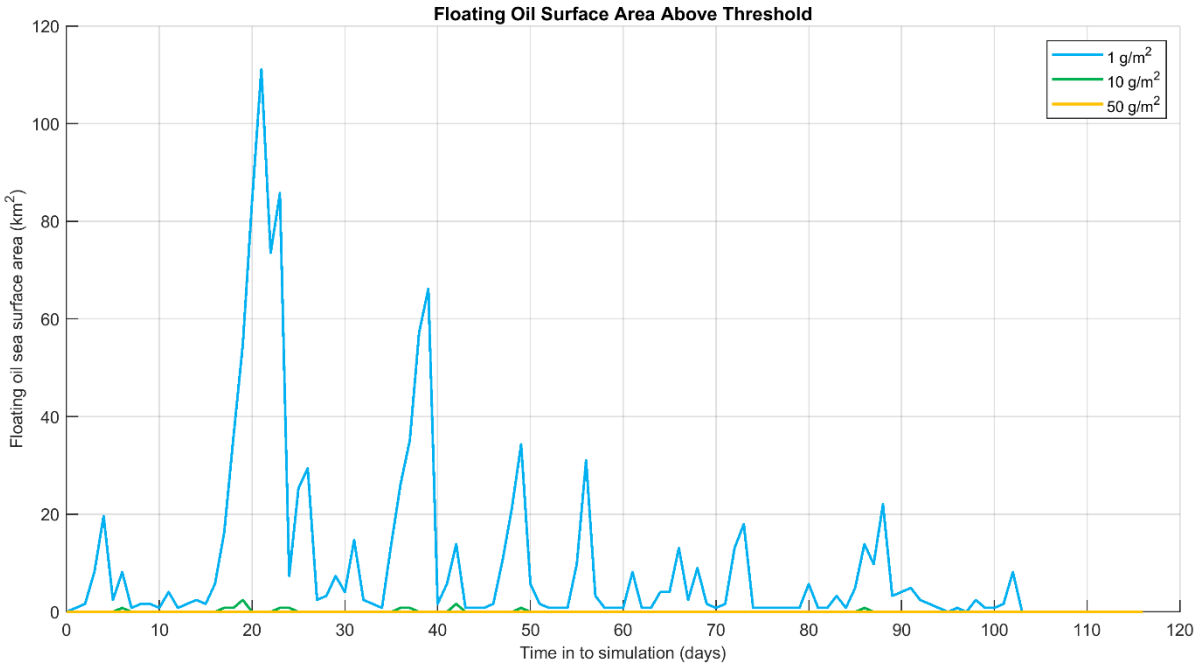



**Figure 12.20 Time series of the sea surface exposure above each threshold for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

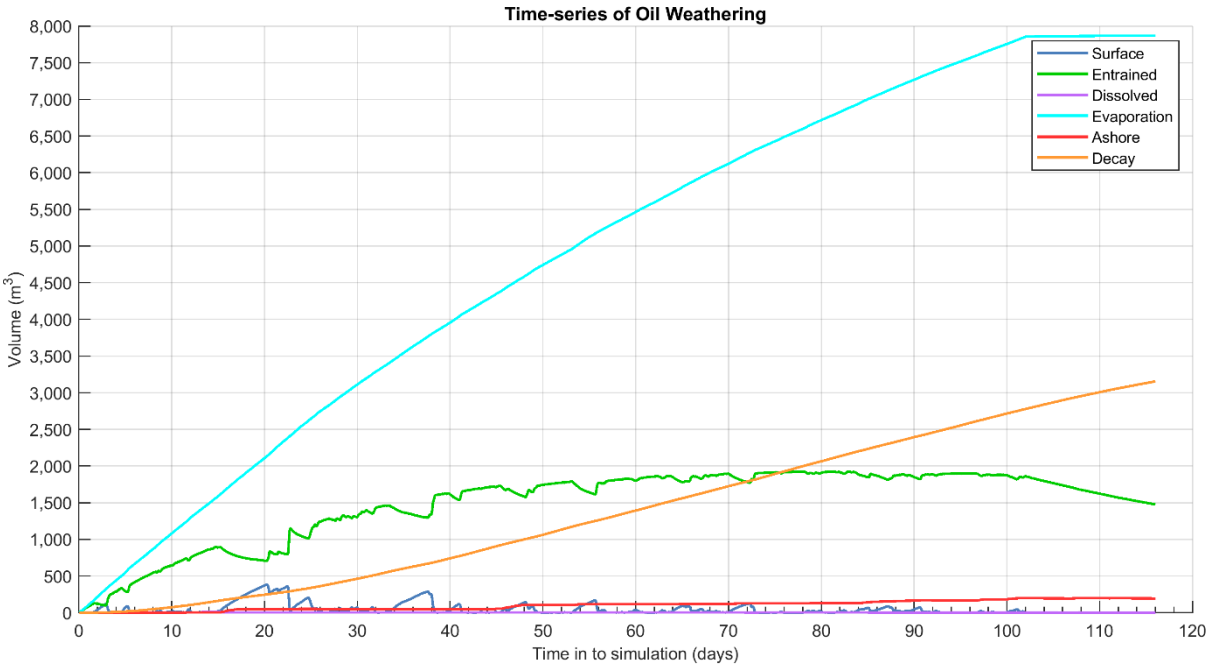



**Figure 12.21 Predicted weathering and fates graph for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

## 12.2.2 Deterministic Case: Largest volume of oil ashore

The deterministic trajectory that resulted in the largest volume of oil ashore was identified as winter run number 13, which started on 23rd July 2010.

Figure 12.22 illustrates the floating oil exposure and shoreline accumulation over the 116-day simulation.

Figure 12.23 displays the time series of the volume of oil accumulating on shorelines at the low (10 g/m$^2$), moderate (100 g/m$^2$) and high (1,000 g/m$^2$) thresholds over the 116-day simulation.

Figure 12.24 presents the fates and weathering graph for the corresponding single spill trajectory and Table 12.13 summarises the mass balance peaks and at the end of the simulation.

**Table 12.13 Summary of the mass balance for the trajectory with the largest volume ashore.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface (m$^3$) | 156.7 | 37.3 | 0.2 |
| Entrained (m$^3$) | 1,857.0 | 87.0 | 1,433.1 |
| Dissolved (m$^3$) | 7.9 | 18.5 | 0.5 |
| Evaporation (m$^3$) | 7,697.1 | 116.0 | 7,697.1 |
| Decay (m$^3$) | 3,222.8 | 116.0 | 3,222.8 |
| Ashore (m$^3$) | 348.4 | 104.1 | 342.9 |

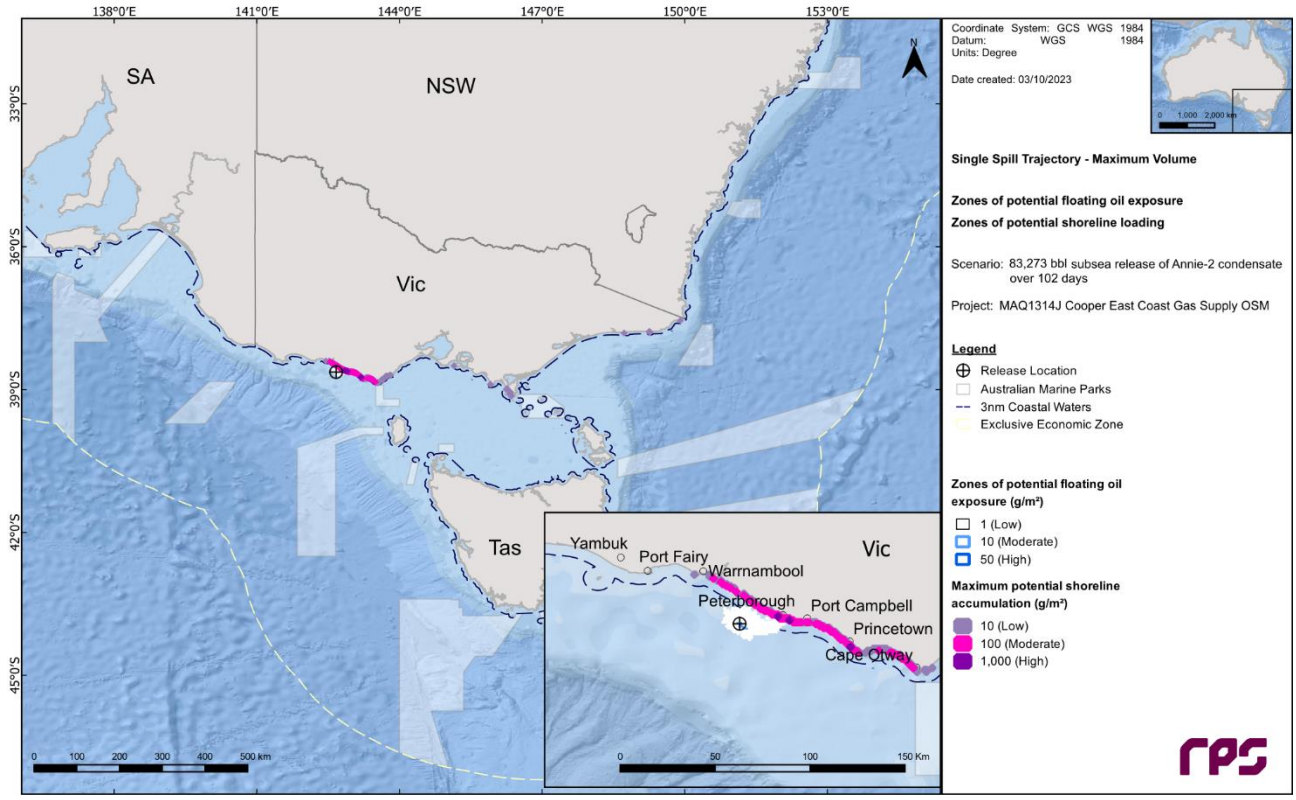



**Figure 12.22 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest volume ashore.**

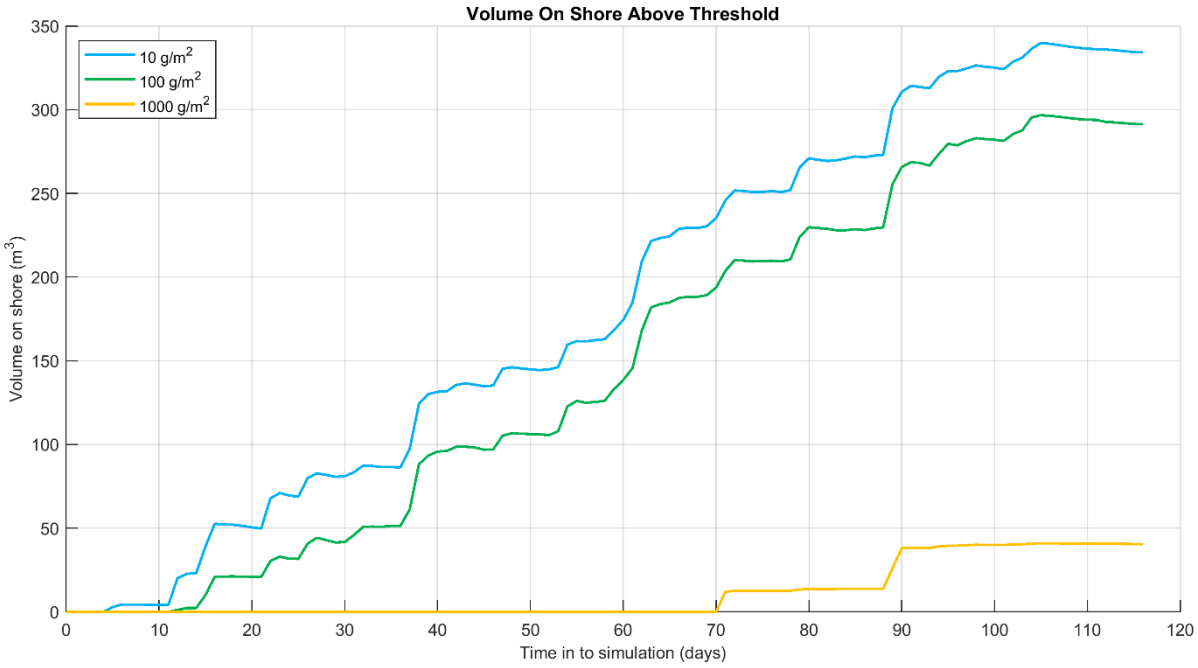



**Figure 12.23 Time series of oil accumulation on the shoreline above each threshold for the trajectory with the largest volume ashore.**

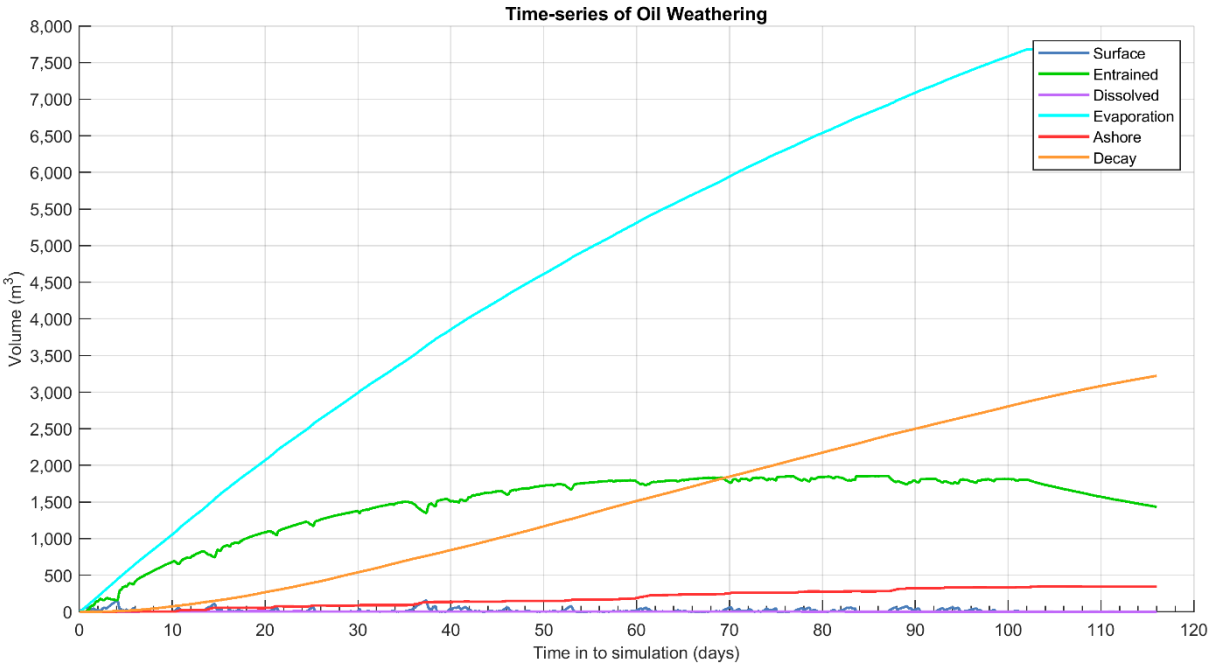



**Figure 12.24 Predicted weathering and fates graph for the trajectory with the largest volume ashore.**

### 12.2.3 Deterministic Case: Longest length of shoreline with accumulation above 100 g/m$^2$

The deterministic trajectory that resulted in the longest length of shoreline with accumulation above 100 g/m$^2$ was identified as summer run number 57, which started on 19$^{th}$ March 2012.

Figure 12.25 illustrates the floating oil exposure and shoreline accumulation over the 116-day simulation.

Figure 12.26 displays the time series of the length of shoreline with accumulation at the low (10 g/m$^2$), moderate (100 g/m$^2$) and high (1,000 g/m$^2$) thresholds over the 116-day simulation.

Figure 12.27 presents the fates and weathering graph for the corresponding single spill trajectory and Table 12.14 summarises the mass balance peaks and at the end of the simulation.

**Table 12.14 Summary of the mass balance for the trajectory with the longest length of shoreline with accumulation above 100 g/m$^2$.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface (m$^3$) | 353.5 | 5.3 | 0.7 |
| Entrained (m$^3$) | 1,884.2 | 89.0 | 1,458.1 |
| Dissolved (m$^3$) | 8.1 | 20.9 | 0.4 |
| Evaporation (m$^3$) | 7,765.0 | 116.0 | 7,765.0 |
| Decay (m$^3$) | 3,222.7 | 116.0 | 3,222.7 |
| Ashore (m$^3$) | 250.0 | 115.5 | 249.9 |

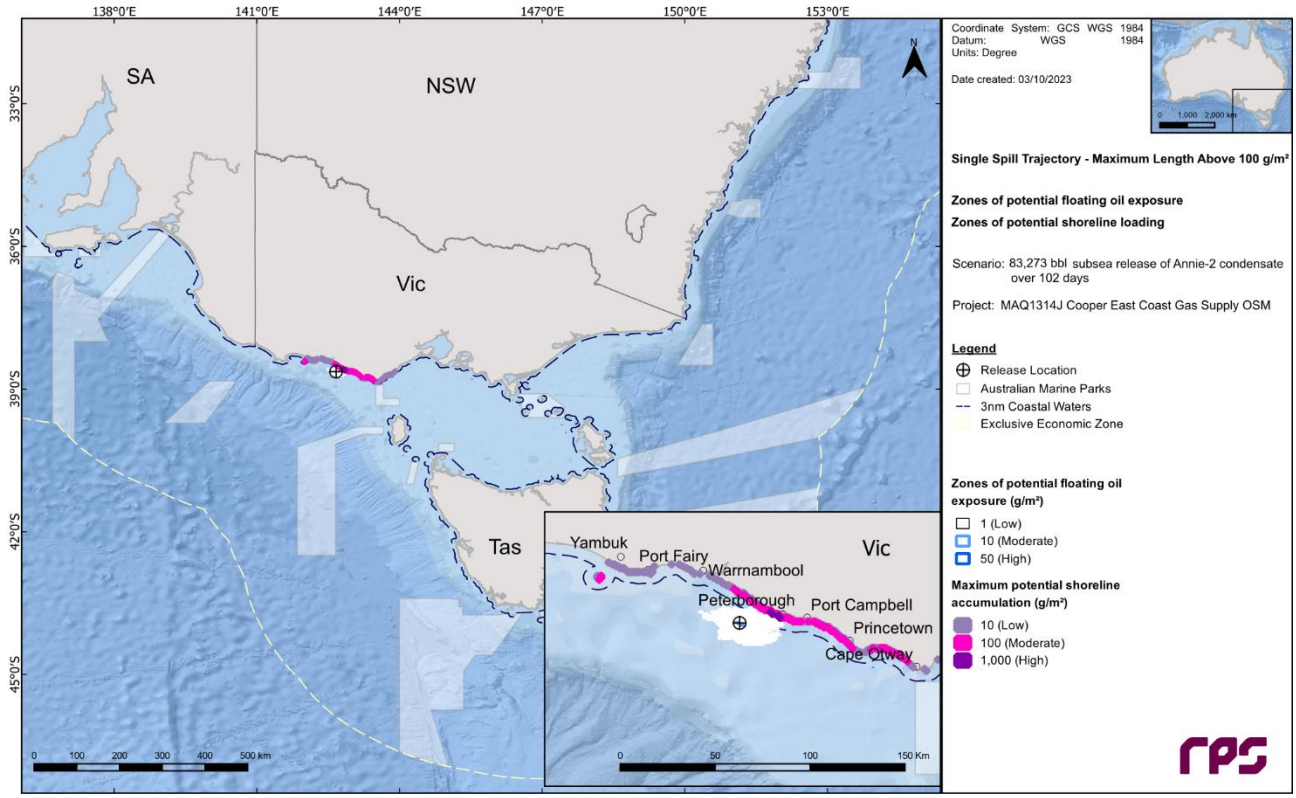



**Figure 12.25 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the longest length of shoreline with accumulation above 100 g/m$^2$.**

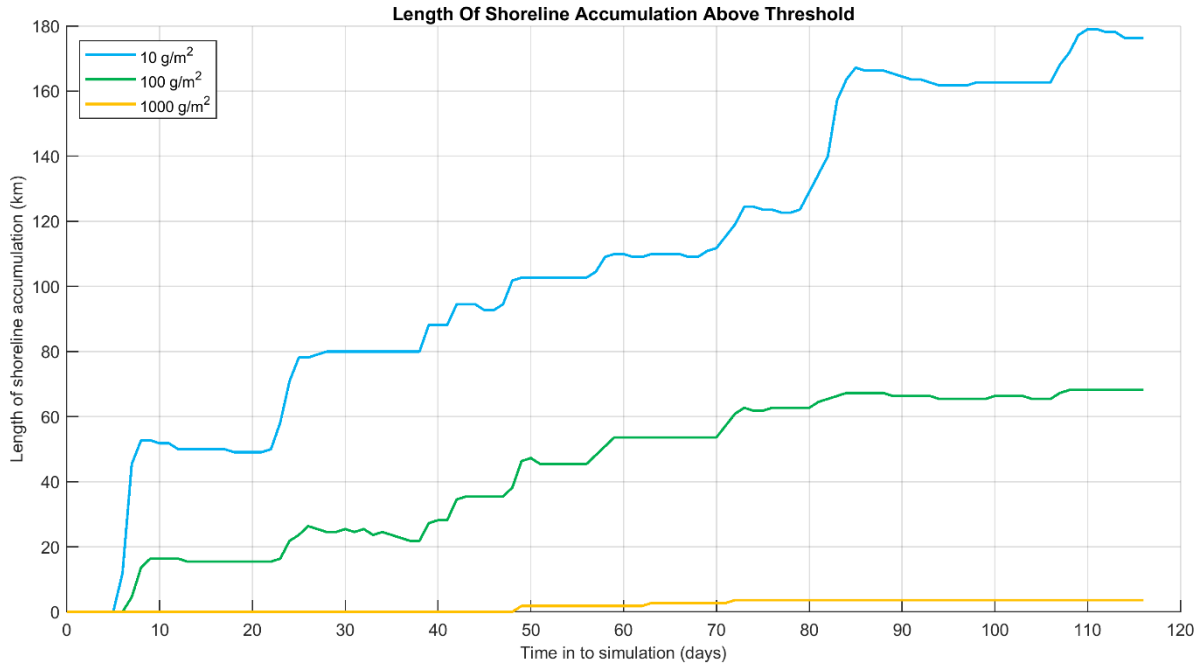



**Figure 12.26 Time series of the length of shoreline with accumulation above each threshold for the trajectory with the longest length of shoreline with accumulation above 100 g/m².**

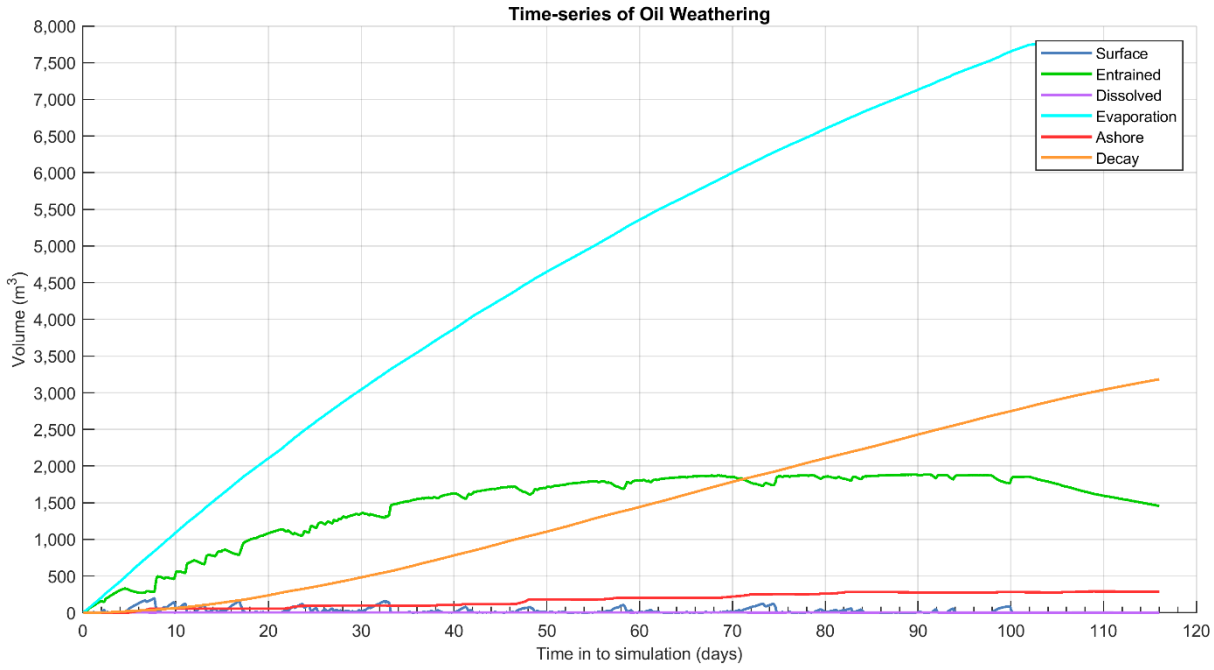



**Figure 12.27 Predicted weathering and fates graph for the trajectory with the longest length of shoreline with accumulation above 100 g/m².**

### 12.2.4 Deterministic Case: Largest area of entrained hydrocarbon exposure above 100 ppb

The deterministic trajectory that resulted in the largest area of entrained hydrocarbon exposure above 100 ppb was identified as winter run number 58, which started on 3rd August 2014.

Figure 12.28 illustrates the zones of potential entrained hydrocarbon exposure over the 116-day simulation.

Figure 12.29 displays the time series of the area of entrained hydrocarbon exposure at the low (10 ppb) and high (100 ppb) thresholds over the 116-day simulation.

Figure 12.30 presents the fates and weathering graph for the corresponding single spill trajectory and Table 12.15 summarises the mass balance peaks and at the end of the simulation.

**Table 12.15 Summary of the mass balance for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface ($m^3$) | 266.1 | 13.8 | 0.1 |
| Entrained ($m^3$) | 1,935.0 | 85.5 | 1,506.6 |
| Dissolved ($m^3$) | 8.1 | 22.0 | 0.5 |
| Evaporation ($m^3$) | 7,751.3 | 116.0 | 7,751.3 |
| Decay ($m^3$) | 3,254.5 | 116.0 | 3,254.5 |
| Ashore ($m^3$) | 184.5 | 113.0 | 183.8 |

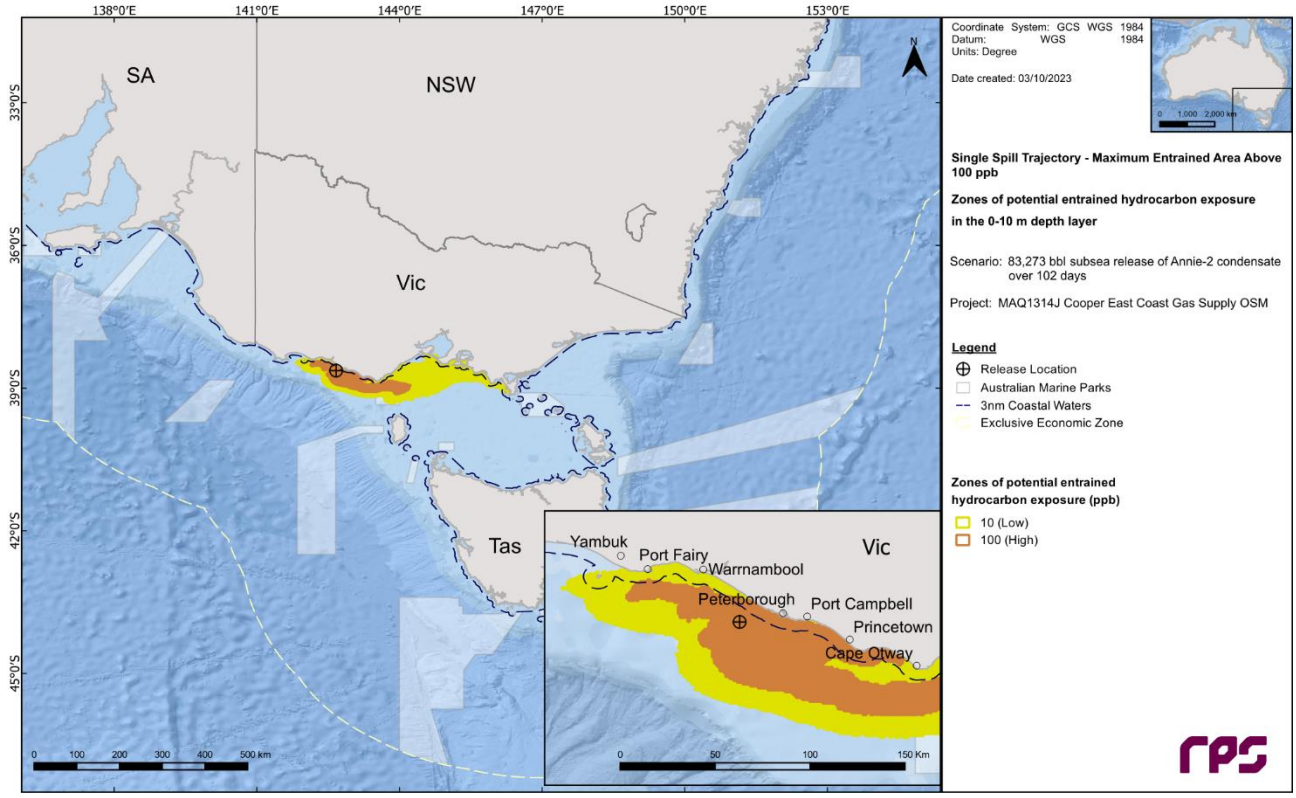



**Figure 12.28 Zones of potential entrained hydrocarbon exposure, for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

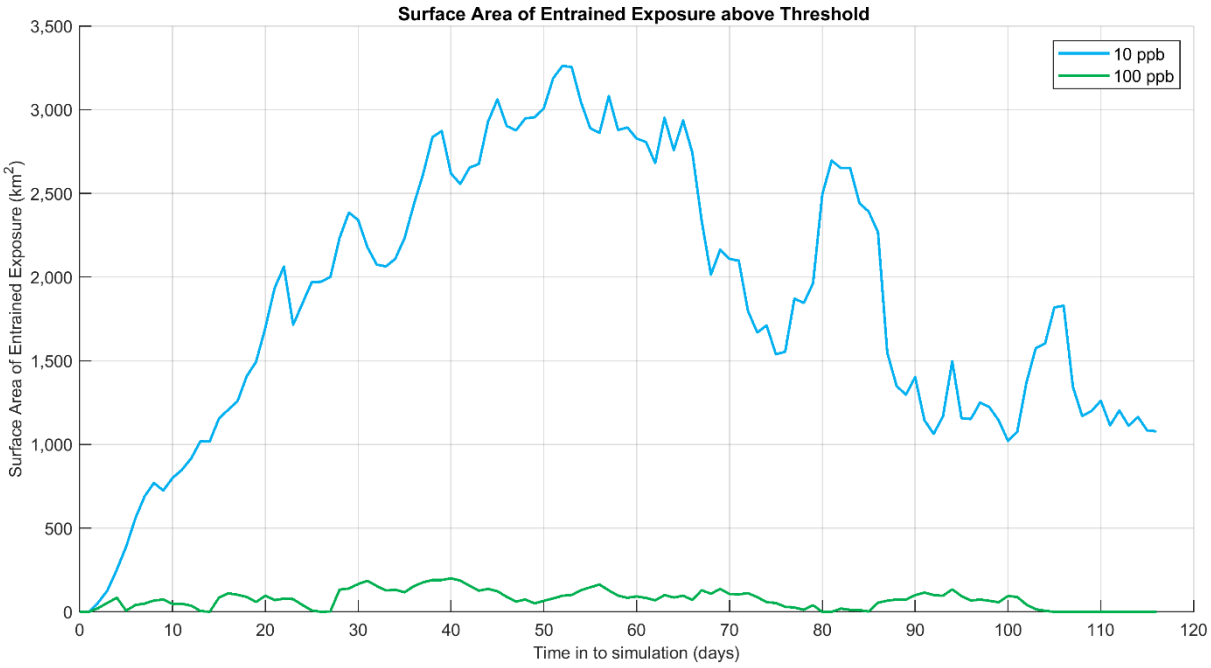



**Figure 12.29 Time series of the entrained hydrocarbon exposure area above each threshold for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

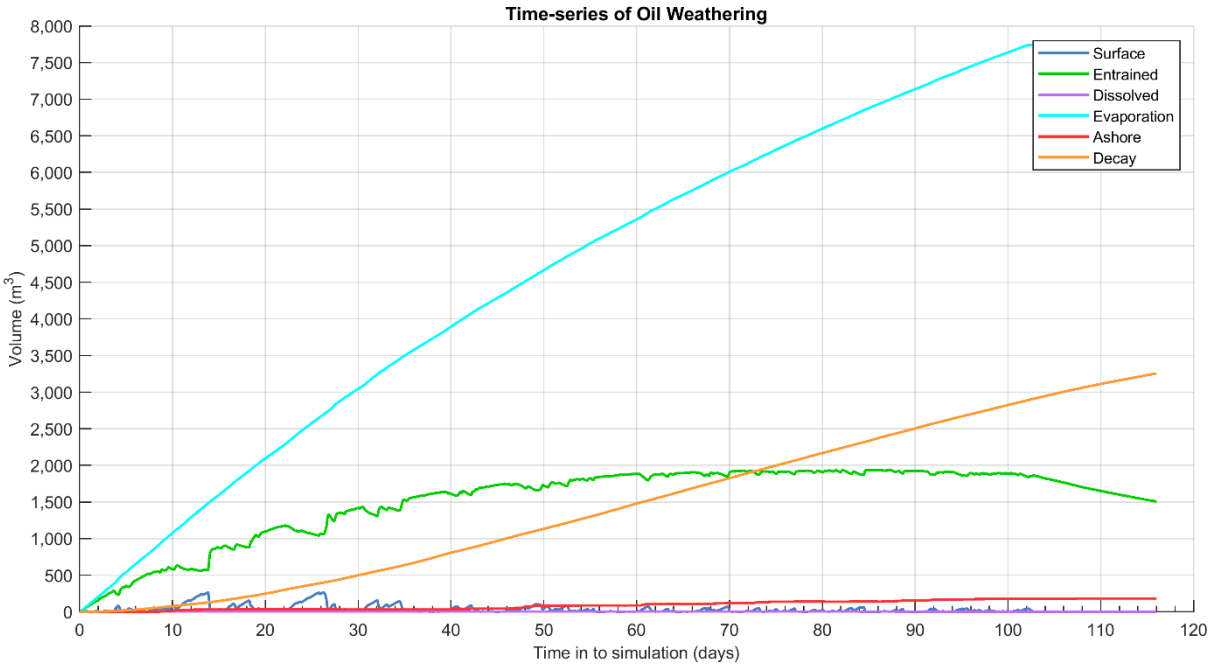



**Figure 12.30 Predicted weathering and fates graph for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

### 12.2.5 Deterministic Case: Largest area of dissolved hydrocarbon exposure above 50 ppb

The deterministic trajectory that resulted in the largest area of dissolved hydrocarbon exposure above 50 ppb was identified as summer run number 68, which started on 29th April 2016.

Figure 12.31 illustrates the zones of potential dissolved hydrocarbon exposure over the 116-day simulation.

Figure 12.32 displays the time series of the area of dissolved hydrocarbon exposure at the low (10 ppb), moderate (50 ppb) and high (400 ppb) thresholds over the 116-day simulation.

Figure 12.33 presents the fates and weathering graph for the corresponding single spill trajectory and Table 12.16 summarises the mass balance peaks and at the end of the simulation.

**Table 12.16 Summary of the mass balance for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 116 |
|---|---|---|---|
| Surface ($m^3$) | 160.9 | 7.8 | 0.7 |
| Entrained ($m^3$) | 1,982.5 | 74.3 | 1,550.5 |
| Dissolved ($m^3$) | 7.7 | 17.8 | 0.3 |
| Evaporation ($m^3$) | 7,670.3 | 116.0 | 7,670.3 |
| Decay ($m^3$) | 3,411.7 | 116.0 | 3,411.7 |
| Ashore ($m^3$) | 66.6 | 99.3 | 63.1 |

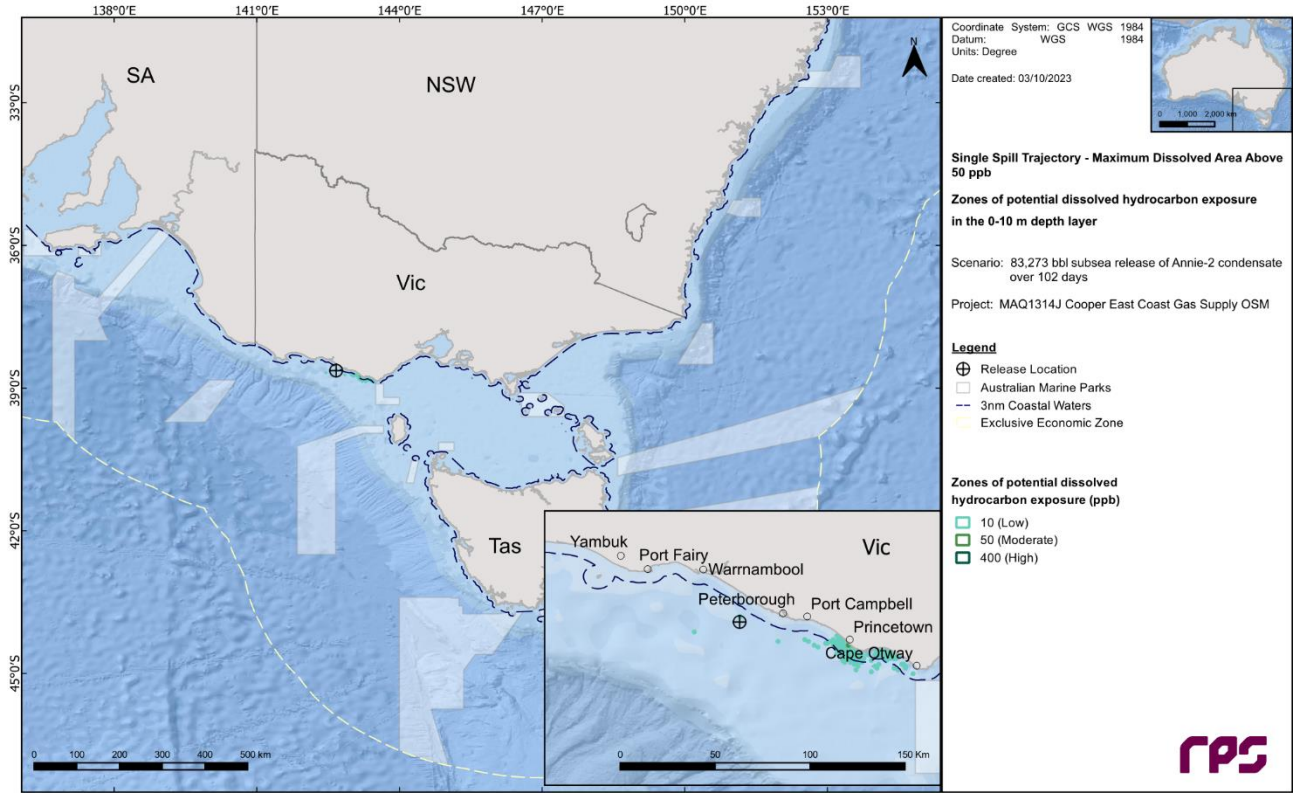



**Figure 12.31 Zones of potential dissolved hydrocarbon exposure, for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb.**

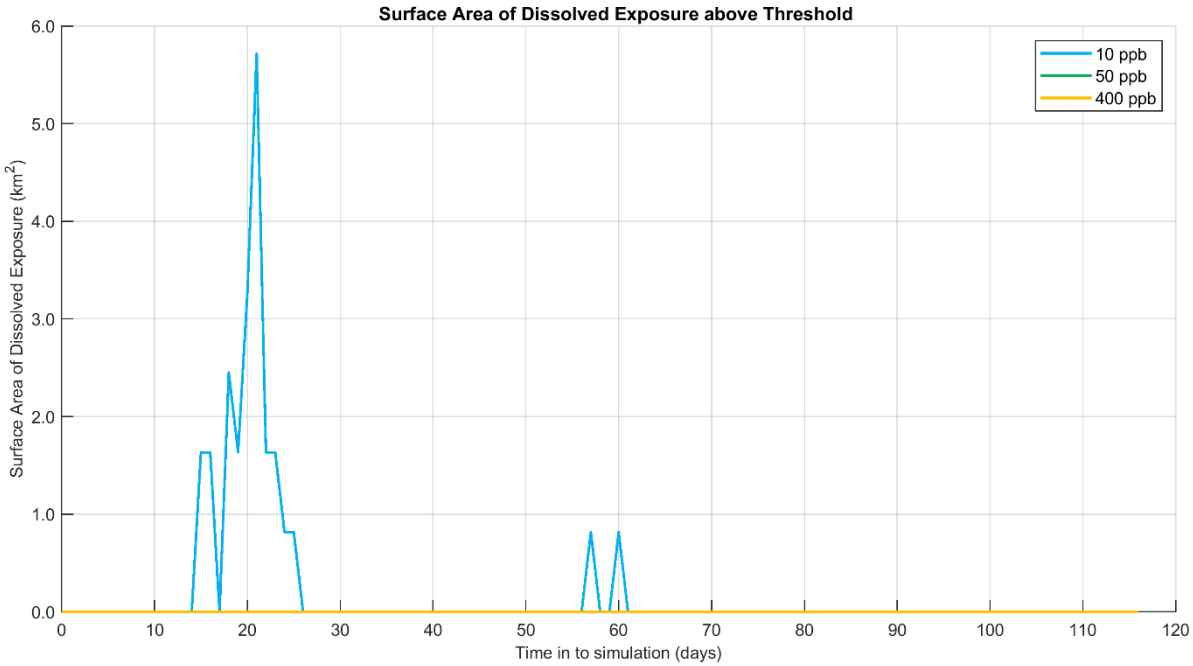



**Figure 12.32 Time series of the dissolved hydrocarbon exposure area above each threshold for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb.**

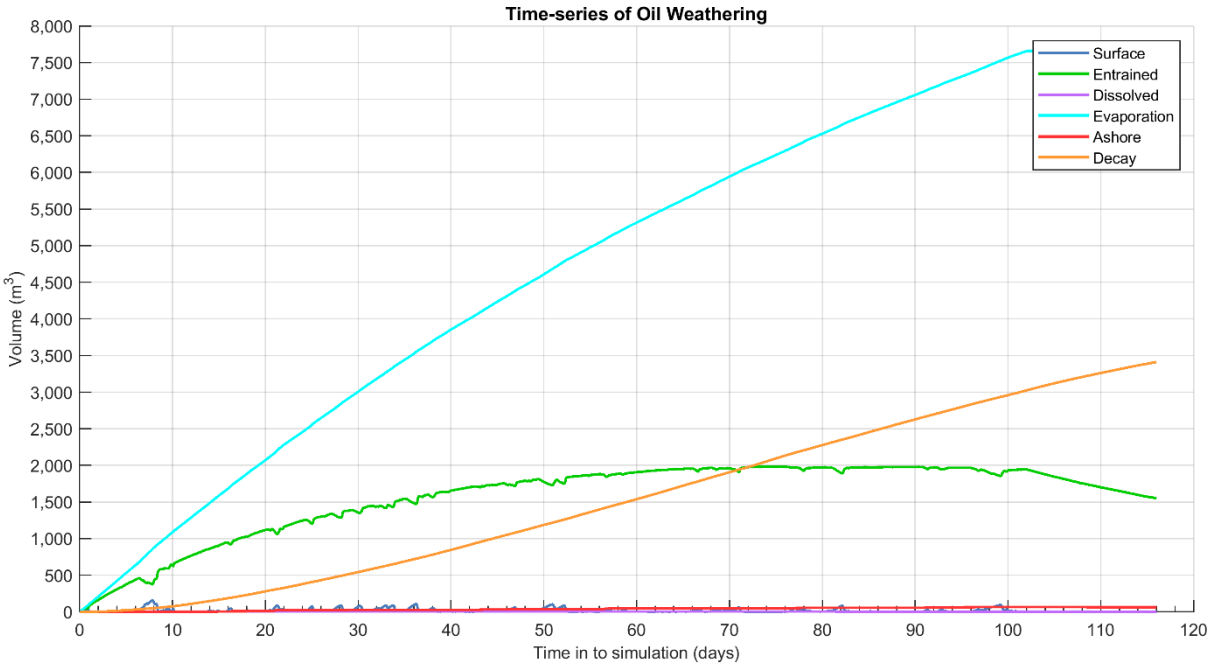



**Figure 12.33 Predicted weathering and fates graph for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb.**

# 13 RESULTS – SCENARIO 3 – 66,430 BBL (10,562 M$^3$) SUBSURFACE RELEASE FROM A LOSS OF WELL CONTROL AT ANNIE-2

This scenario examined a 66,430 bbl (10,562 m$^3$) subsurface release of condensate over 104 days to represent a LOWC scenario at Annie-2 well. A total of 100 spill simulations were run per season (summer and winter) and each simulation was tracked for 118 days. The results are presented on a seasonal basis.

Sections 13.1 and 13.2 present the seasonal stochastic analysis and deterministic analysis results, respectively.

## 13.1 Stochastic Analysis

### 13.1.1 Floating Oil Exposure

Table 13.1 summarises the maximum distance travelled by floating oil on the sea surface at each threshold. The maximum distance and corresponding direction from the release location to the low (1–10 g/m$^2$) and moderate (10–50 g/m$^2$) exposure zones was 55.7.0 km (east, winter) and 3.2 km (east, winter), respectively. No high (>50 g/m$^2$) exposure zones were predicted during either summer or winter conditions.

Table 13.2 summarises the potential floating oil exposure to individual receptors.

During summer, a total of 16 BIAs were predicted to be exposed to floating oil at, or above, the low threshold. Excluding the BIAs that the release location resides within (see Section 10.3), the highest probability (38%) of low exposure was predicted at the Southern Right Whale – Aggregation BIA. The minimum time before low exposure to the Southern Right Whale – Aggregation was 0.83 days.

Similarly, during winter, a total of 16 BIAs were predicted to be exposed to floating oil at, or above, the low threshold. Again, the highest probability (8%) of low exposure was predicted at the Southern Right Whale – Aggregation BIA. The minimum time before low exposure to the Southern Right Whale – Aggregation was 2.17 days.

Table 13.3 presents the maximum residence time of floating oil exposure for each individual grid cell within each individual receptor.

Figure 13.1 and Figure 13.2 present the zones of potential floating oil exposure for each season whilst Figure 13.3 to Figure 13.6 present the maximum residence time of floating oil exposure for the NOPSEMA thresholds.

**Table 13.1 Maximum distance and direction from the release location to the edge of floating oil exposure. Results are based on a 66,430 bbl (10,562 m$^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations per season.**

| Distance and direction travelled | Zones of potential floating oil exposure | | | | | |
|---|---|---|---|---|---|---|
| | Summer | | | Winter | | |
| | Low | Moderate | High | Low | Moderate | High |
| Maximum distance (km) from release location | 53.0 | 1.6 | - | 55.7 | 3.2 | - |
| Maximum distance (km) from release location (99$^{th}$ percentile) | 30.0 | 1.6 | - | 33.1 | 3.2 | - |
| Direction | E | W | - | E | E | - |

**Table 13.2 Summary of the potential floating oil exposure to individual receptors. Results are based on a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | |
| | | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High |
| BIA | Antipodean Albatross - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Black-browed Albatross - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Bullers Albatross - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Campbell Albatross - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Common Diving-petrel - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Pygmy Blue Whale - Distribution* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Pygmy Blue Whale - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Short-tailed Shearwater - Foraging | 2 | - | - | 12.29 | - | - | 2 | - | - | 13.63 | - | - |
| | Shy Albatross - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Southern Right Whale - Aggregation | 38 | - | - | 0.83 | - | - | 8 | - | - | 2.17 | - | - |
| | Southern Right Whale - Known Core Range* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Wandering Albatross - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | Wedge-tailed Shearwater - Foraging* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| | White Shark - Distribution* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| IBRA | Otway Plain | 2 | - | - | 12.29 | - | - | 2 | - | - | 13.63 | - | - |
| | Warrnambool Plain | 65 | - | - | 1.63 | - | - | 78 | - | - | 1.33 | - | - |
| IMCRA | Otway* | 100 | 57 | - | 0.04 | 0.50 | - | 100 | 44 | - | 0.04 | 0.58 | - |
| MNP | Twelve Apostles | 36 | - | - | 7.42 | - | - | 58 | - | - | 4.21 | - | - |
| Nearshore Waters | Colac Otway | 2 | - | - | 12.29 | - | - | 2 | - | - | 13.63 | - | - |
| | Corangamite | 50 | - | - | 4.92 | - | - | 78 | - | - | 1.17 | - | - |
| | Moyne | 22 | - | - | 1.63 | - | - | 11 | - | - | 5.96 | - | - |

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (days) | | |
| | | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High |
| State Waters | Victoria State Waters | 99 | - | - | 0.50 | - | - | 99 | - | - | 0.54 | - | - |
| Nearshore Waters (Sub-LGA) | Bay of Islands | 22 | - | - | 1.63 | - | - | 10 | - | - | 5.96 | - | - |
| | Cape Otway West | 2 | - | - | 12.29 | - | - | 2 | - | - | 13.63 | - | - |
| | Moonlight Head | 42 | - | - | 7.21 | - | - | 66 | - | - | 4.54 | - | - |
| | Port Campbell | 15 | - | - | 4.92 | - | - | 35 | - | - | 1.17 | - | - |

*The release location resides within the receptor boundaries.

**Table 13.3 Summary of the maximum residence time of floating oil exposure for each individual grid cell within each individual receptor. Results are based on a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum residence time of floating oil exposure (days) | | | Maximum residence time of floating oil exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High |
| BIA | Antipodean Albatross - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Black-browed Albatross - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Bullers Albatross - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Campbell Albatross - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Common Diving-petrel - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Pygmy Blue Whale - Distribution* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Pygmy Blue Whale - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Short-tailed Shearwater - Foraging | 0.04 | - | - | 0.17 | - | - |
| | Shy Albatross - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Southern Right Whale - Aggregation | 0.17 | - | - | 0.25 | - | - |
| | Southern Right Whale - Known Core Range* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Wandering Albatross - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | Wedge-tailed Shearwater - Foraging* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| | White Shark - Distribution* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| IBRA | Otway Plain | 0.04 | - | - | 0.17 | - | - |
| | Warrnambool Plain | 0.71 | - | - | 0.75 | - | - |
| IMCRA | Otway* | 12.83 | 0.46 | - | 8.42 | 0.58 | - |
| MNP | Twelve Apostles | 0.54 | - | - | 0.63 | - | - |
| Nearshore Waters | Colac Otway | 0.04 | - | - | 0.17 | - | - |
| | Corangamite | 0.71 | - | - | 0.75 | - | - |
| | Moyne | 0.38 | - | - | 0.33 | - | - |
| State Waters | Victoria State Waters | 1.5 | - | - | 1.21 | - | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum residence time of floating oil exposure (days) | | | Maximum residence time of floating oil exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High |
| Nearshore Waters (Sub-LGA) | Bay of Islands | 0.38 | - | - | 0.33 | - | - |
| | Cape Otway West | 0.04 | - | - | 0.17 | - | - |
| | Moonlight Head | 0.54 | - | - | 0.63 | - | - |
| | Port Campbell | 0.71 | - | - | 0.75 | - | - |

*The release location resides within the receptor boundaries.

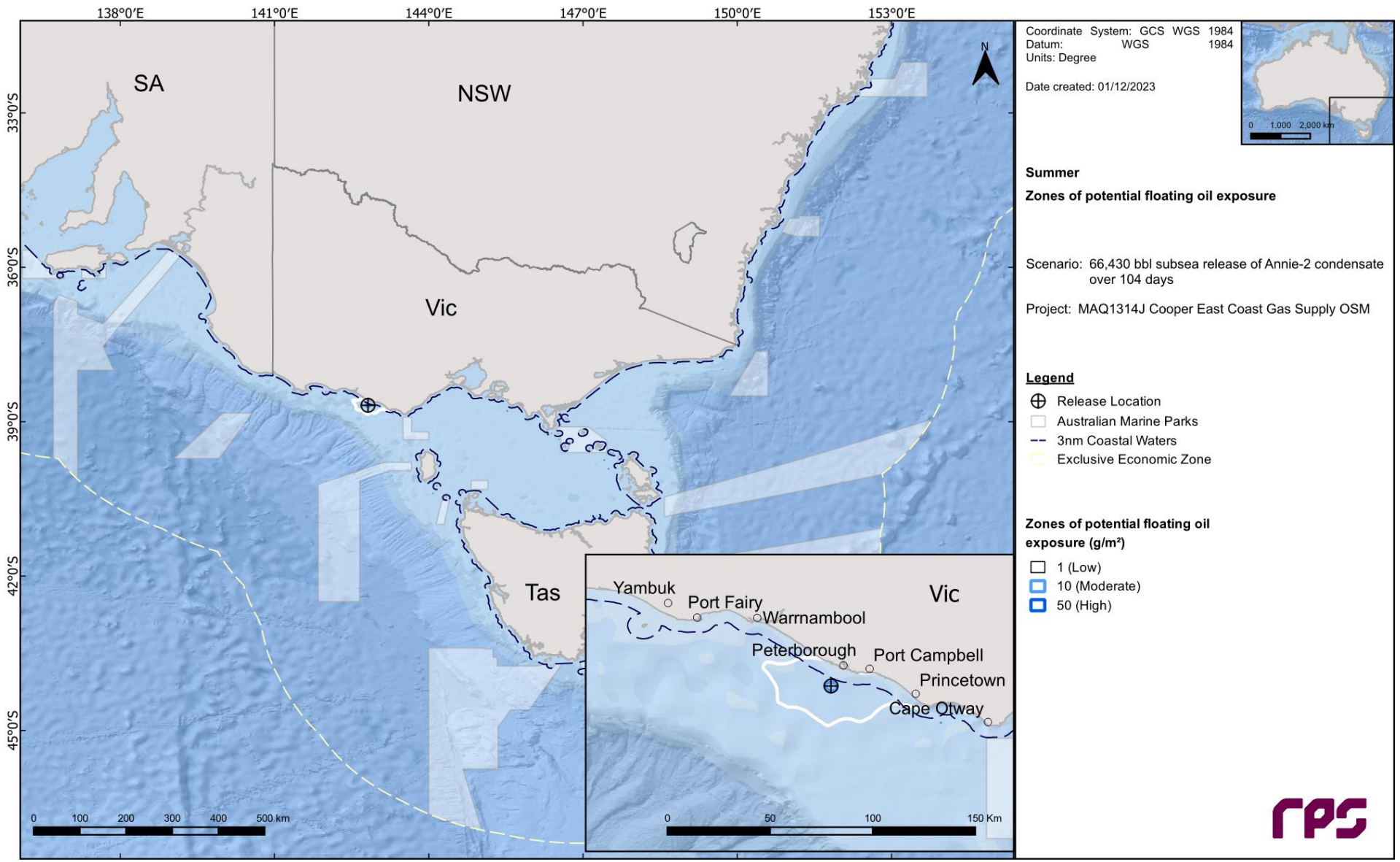



**Figure 13.1 Zones of potential floating oil exposure in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

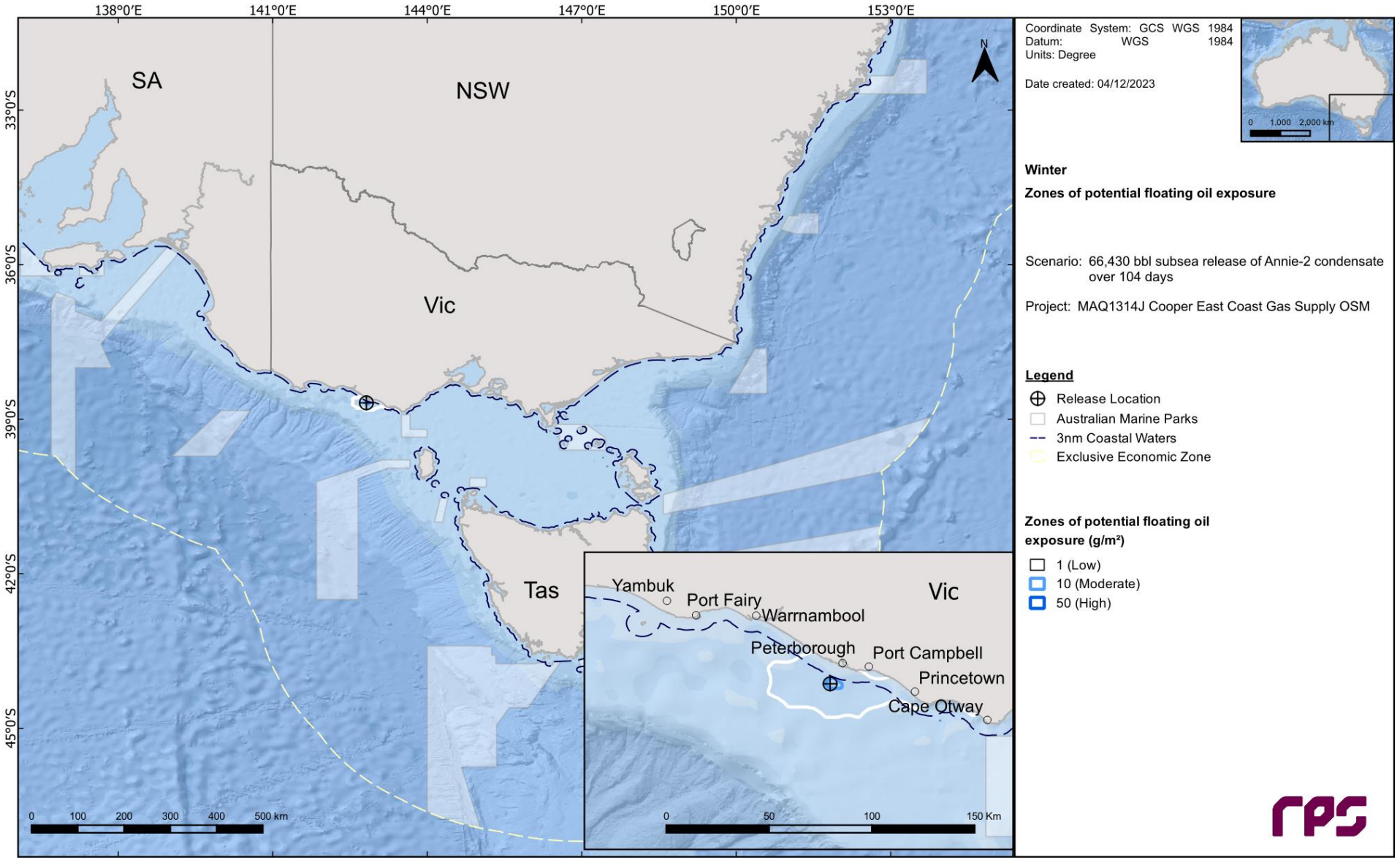



**Figure 13.2 Zones of potential floating oil exposure in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

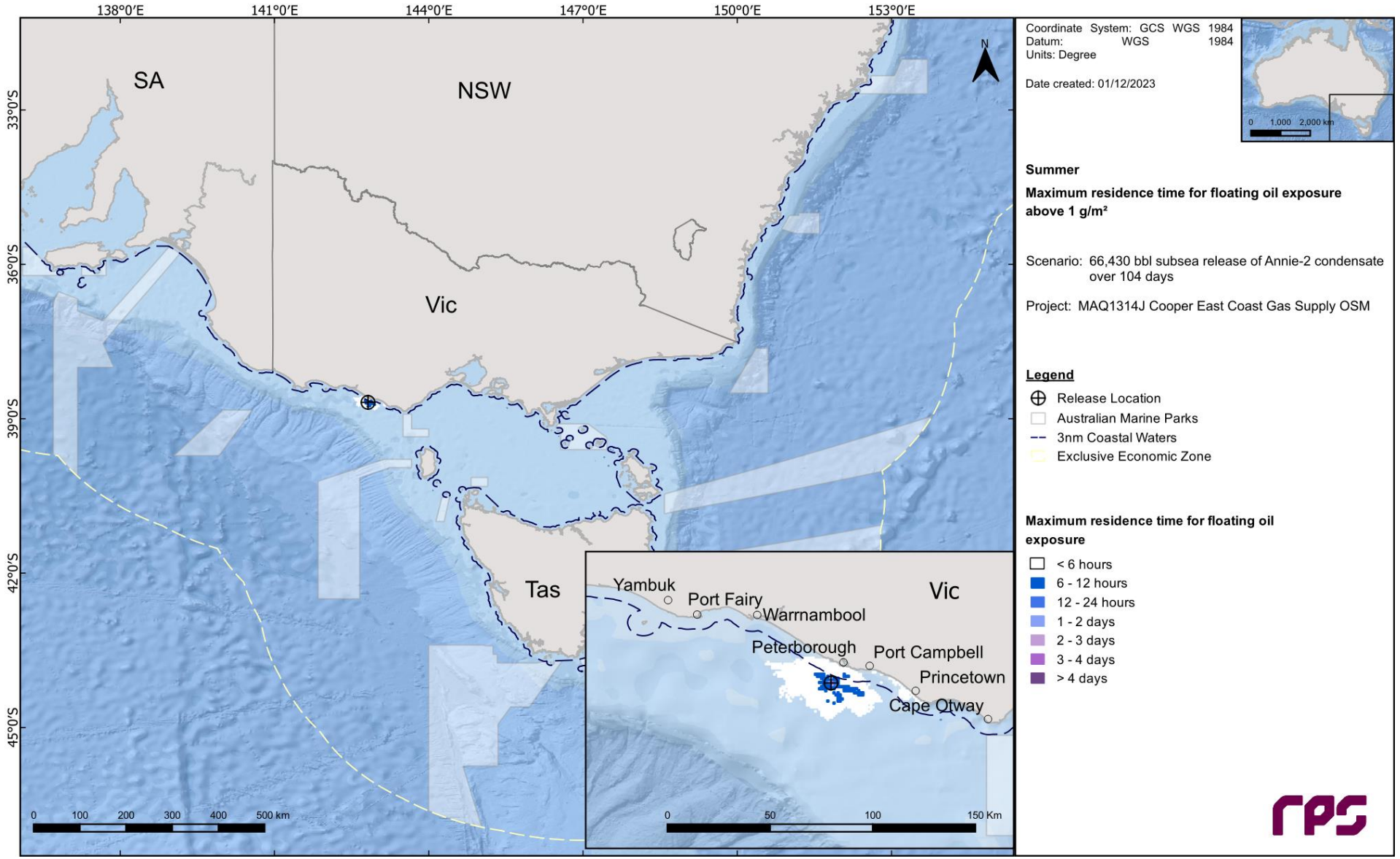



**Figure 13.3 Maximum residence time of floating oil exposure above 1 g/m², in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

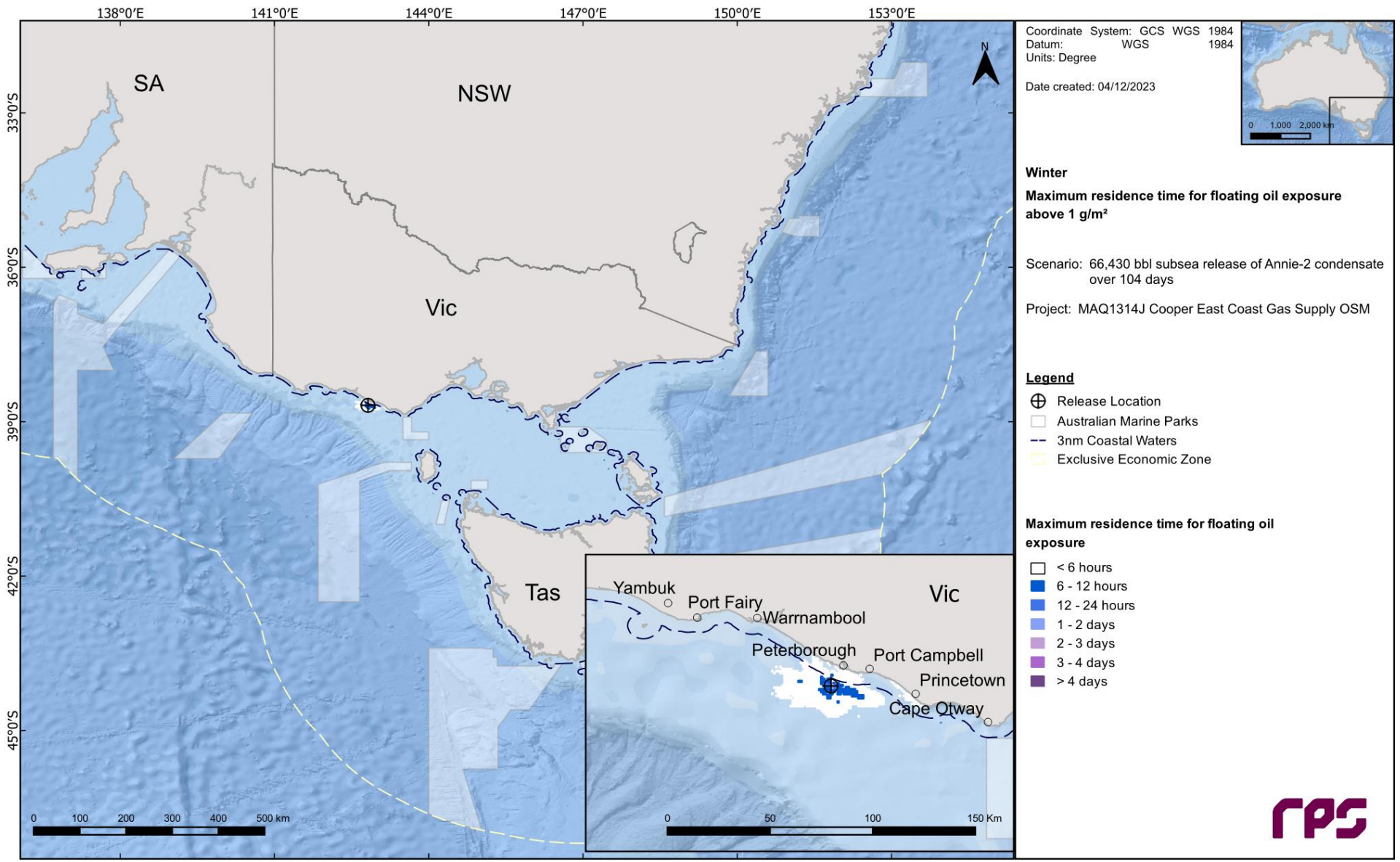



**Figure 13.4 Maximum residence time of floating oil exposure above 1 g/m², in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

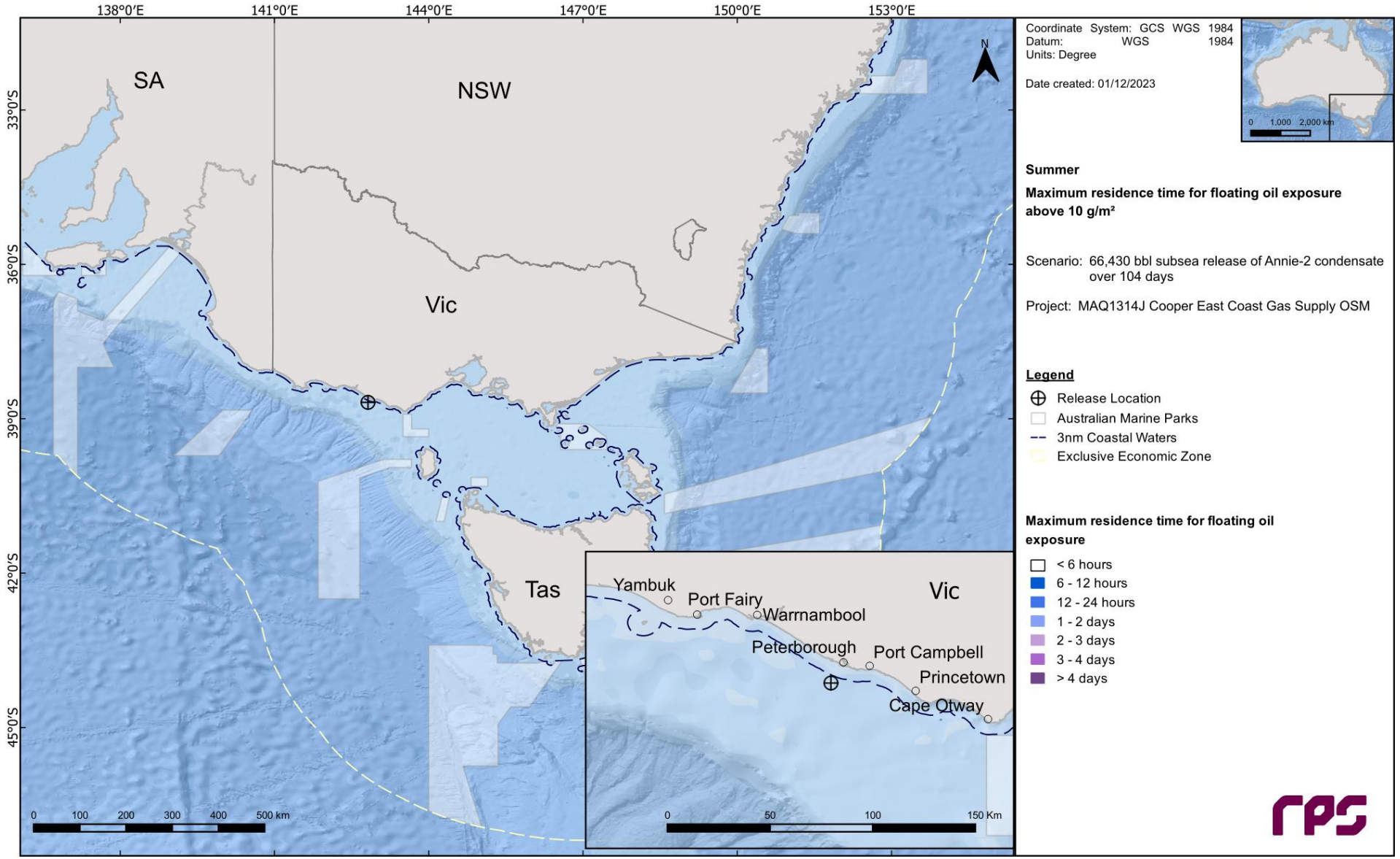



**Figure 13.5 Maximum residence time of floating oil exposure above 10 g/m², in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

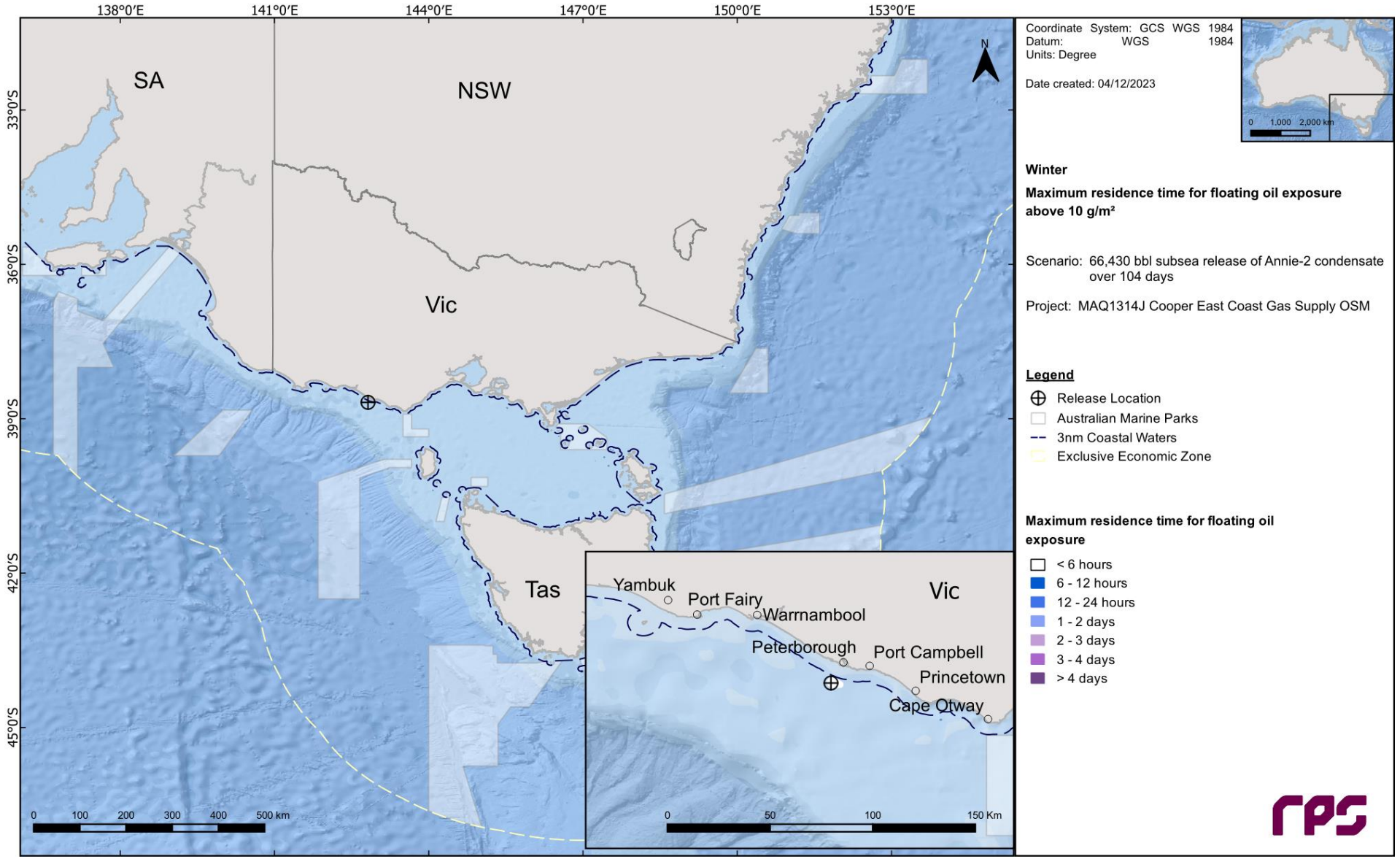



**Figure 13.6 Maximum residence time of floating oil exposure above 10 g/m², in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

### 13.1.2 Shoreline Accumulation

Table 13.4 presents a summary of the potential shoreline accumulation. The probability of accumulation to any shoreline at, or above, the low (10 g/m$^2$) threshold was 100% throughout the year. The minimum time before oil accumulation at, or above, the low threshold was 0.96 day. The maximum total volume ashore for a single spill trajectory was 312.1 m$^3$, and the maximum length of shoreline with accumulation above the low, moderate and high thresholds were 224.0 km (winter), 62.0 km (winter) and 6.0 km (winter), respectively.

Table 13.5 and Table 13.6 summarises the shoreline accumulation on individual receptors during summer and winter, respectively.

During summer conditions, the shoreline segment of Corangamite LGA had the highest probability of accumulation above the low and moderate thresholds (100% and 99% respectively), whilst Moyne LGA and Bay of Islands sub-LGA shoreline had the highest probability of accumulation above the high threshold (5%). The minimum time for low threshold shoreline accumulation at Moyne was 0.96 days.

Alternatively, in winter the shoreline segment with the highest probability of accumulation above all three thresholds was Corangamite LGA (100%, 100% and 27% for low, moderate and high, respectively). The minimum time for low threshold shoreline accumulation at the Corangamite LGA receptor was 1 day.

The maximum potential shoreline loadings above each shoreline thresholds are presented in Figure 13.7 and Figure 13.8 for summer and winter respectively.

**Table 13.4 Summary of oil accumulation across all shorelines. Results are based on a 66,430 bbl (10,562 m$^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations per season.**

| Shoreline Statistics | Summer | Winter |
|---|---|---|
| Probability of accumulation on any shoreline (%) | 100 | 100 |
| Absolute minimum time for visible oil to shore (days) | 0.96 | 1.00 |
| Maximum total volume of hydrocarbons ashore (m$^3$) | 206.3 | 312.1 |
| Average total volume of hydrocarbons ashore (m$^3$) | 124.1 | 161.7 |
| Maximum length of the shoreline at **10 g/m$^2$** (km) | 220.0 | 224.0 |
| Average shoreline length (km) at **10 g/m$^2$** (km) | 124.9 | 131.7 |
| Maximum length of the shoreline at **100 g/m$^2$** (km) | 58.0 | 62.0 |
| Average shoreline length (km) at **100 g/m$^2$** (km) | 28.6 | 33.3 |
| Maximum length of the shoreline at **1,000 g/m$^2$** (km) | 2.0 | 6.0 |
| Average shoreline length (km) at **1,000 g/m$^2$** (km) | 1.2 | 1.6 |

**Table 13.5 Summary of oil accumulation on individual shoreline receptors. Results are based on a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

| Shoreline Receptor | | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| LGA Shoreline | Anser Island | 10 | - | - | 61.46 | - | - | 3 | 26 | 0.2 | 0.7 | 1.3 | - | - | 2.7 | - | - |
| | Bass Coast | 4 | - | - | 50.79 | - | - | 1 | 15 | 0.2 | 0.7 | 1.1 | - | - | 1.8 | - | - |
| | Bega Valley | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Colac Otway | 98 | 66 | - | 2.29 | 6.83 | - | 23 | 400 | 22.5 | 56.3 | 26.6 | 7.6 | - | 54.5 | 14.5 | - |
| | Corangamite | 100 | 99 | - | 1.54 | 2.79 | - | 82 | 811 | 63.5 | 126.8 | 44.8 | 15.3 | - | 55.4 | 31.8 | - |
| | East Gippsland | 1 | - | - | 103.25 | - | - | 1 | 18 | 0.3 | 1.1 | 0.9 | - | - | 0.9 | - | - |
| | Gabo Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Glenelg | 47 | 1 | - | 7.58 | 55.38 | - | 5 | 103 | 4.2 | 10 | 9.4 | 0.9 | - | 20 | 0.9 | - |
| | Glennie Group | 9 | - | - | 45.38 | - | - | 2 | 20 | 0.3 | 1.3 | 1.5 | - | - | 2.7 | - | - |
| | Greater Geelong | 12 | - | - | 42.75 | - | - | 3 | 94 | 0.9 | 7.4 | 5.2 | - | - | 14.5 | - | - |
| | Hogan Island Group | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Kanowna Island | 6 | - | - | 66.21 | - | - | 2 | 12 | 0.2 | 0.7 | 1.2 | - | - | 1.8 | - | - |
| | Kent Island Group | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | King Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Lady Julia Percy Island | 54 | - | - | 8.29 | - | - | 13 | 90 | 1.2 | 2.8 | 2.8 | - | - | 5.5 | - | - |
| | Laurence Rocks | 36 | - | - | 16.67 | - | - | 10 | 41 | 0.4 | 1 | 1.7 | - | - | 2.7 | - | - |
| | Montague Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Mornington Peninsula | 10 | - | - | 49.33 | - | - | 2 | 21 | 0.6 | 3.1 | 2.7 | - | - | 5.5 | - | - |
| | Moyne | 99 | 92 | 5 | 0.96 | 1.33 | 25.38 | 35 | 1,354 | 29.3 | 78.9 | 28 | 6.3 | 1.1 | 49.1 | 15.4 | 1.8 |
| | Norman Island | 9 | - | - | 47.75 | - | - | 3 | 23 | 0.2 | 0.6 | 1.1 | - | - | 1.8 | - | - |
| | Phillip Island | 8 | - | - | 48.13 | - | - | 2 | 22 | 0.5 | 2.8 | 2.6 | - | - | 6.4 | - | - |
| | Rodondo Island | 8 | - | - | 82.42 | - | - | 3 | 24 | 0.2 | 0.6 | 1.4 | - | - | 1.8 | - | - |
| | Shellback Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Skull Rock | 4 | - | - | 66.21 | - | - | 2 | 11 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| | South Gippsland | 23 | - | - | 42.92 | - | - | 2 | 55 | 1.5 | 8.2 | 7.5 | - | - | 20 | - | - |
| | Surf Coast | 9 | - | - | 45.54 | - | - | 2 | 81 | 0.8 | 7.9 | 8.5 | - | - | 20.9 | - | - |
| | Warrnambool | 62 | 11 | - | 5.25 | 7.63 | - | 9 | 160 | 2.6 | 12.9 | 7.2 | 1.4 | - | 20 | 2.7 | - |
| | Wellington | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Sub-LGA Shoreline | Anglesea | 5 | - | - | 45.54 | - | - | 2 | 25 | 0.3 | 1.9 | 3.1 | - | - | 6.4 | - | - |
| | Apollo Bay | 64 | - | - | 5.17 | - | - | 5 | 80 | 1.6 | 4.9 | 5.4 | - | - | 12.7 | - | - |
| | Bay of Islands | 99 | 87 | 5 | 0.96 | 1.33 | 25.38 | 64 | 1,354 | 24.4 | 72.7 | 19.3 | 6.2 | 1.1 | 29.1 | 13.6 | 1.8 |
| | Bega Valley | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Cape Howe / Mallacoota | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Cape Liptrap - Northwest | 15 | - | - | 43.17 | - | - | 2 | 35 | 0.4 | 1.9 | 2.4 | - | - | 3.6 | - | - |
| | Cape Nelson | 47 | 1 | - | 7.58 | 55.38 | - | 7 | 103 | 3.8 | 9.4 | 9 | 0.9 | - | 18.2 | 0.9 | - |
| | Cape Otway West | 98 | 66 | - | 2.29 | 6.83 | - | 42 | 400 | 20.3 | 49.9 | 22.1 | 7.6 | - | 34.5 | 14.5 | - |
| | Cape Patton | 17 | - | - | 19.88 | - | - | 3 | 43 | 0.7 | 4.4 | 5.3 | - | - | 15.4 | - | - |
| | Childers Cove | 88 | 9 | - | 3.33 | 7.63 | - | 14 | 179 | 4.8 | 18.8 | 9.8 | 4 | - | 19.1 | 5.5 | - |
| | Croajingolong - West | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Discovery Bay - East | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Discovery Bay - West | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | French Island / Crib Point | 4 | - | - | 80.54 | - | - | 2 | 13 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| | Kilcunda | 4 | - | - | 50.79 | - | - | 2 | 15 | 0.2 | 0.5 | 1.1 | - | - | 1.8 | - | - |

| Shoreline Receptor | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| Lorne | 6 | - | - | 64.79 | - | - | 2 | 16 | 0.2 | 1.3 | 2 | - | - | 4.5 | - | - |
| Marlo | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Moonlight Head | 100 | 96 | - | 2.00 | 2.79 | - | 93 | 811 | 38.5 | 77.6 | 21.9 | 9.3 | - | 29.1 | 13.6 | - |
| Mornington Peninsula - South | 7 | - | - | 70.38 | - | - | 2 | 15 | 0.2 | 1 | 1.7 | - | - | 2.7 | - | - |
| Mornington Peninsula - Southwest | 6 | - | - | 49.33 | - | - | 2 | 21 | 0.3 | 1.8 | 2 | - | - | 4.5 | - | - |
| Point Hicks | 1 | - | - | 103.25 | - | - | 2 | 18 | 0.1 | 0.5 | 0.9 | - | - | 0.9 | - | - |
| Port Campbell | 100 | 89 | - | 1.54 | 3.08 | - | 70 | 677 | 24.8 | 61.7 | 22.6 | 7 | - | 26.4 | 20.9 | - |
| Port Fairy | 59 | 10 | - | 9.67 | 31.29 | - | 6 | 156 | 1.9 | 9.3 | 3.8 | 1.5 | - | 17.3 | 2.7 | - |
| Port Phillip - Queenscliff | 12 | - | - | 42.75 | - | - | 2 | 25 | 0.3 | 1.1 | 2 | - | - | 3.6 | - | - |
| Portland Bay - East | 2 | - | - | 43.00 | - | - | 1 | 12 | 0.2 | 0.7 | 0.9 | - | - | 0.9 | - | - |
| Portland Bay - West | 7 | - | - | 32.21 | - | - | 2 | 15 | 0.2 | 0.7 | 1.3 | - | - | 1.8 | - | - |
| Snake Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Torquay | 4 | - | - | 45.54 | - | - | 3 | 94 | 1.1 | 11.8 | 23.2 | - | - | 25.4 | - | - |
| Venus Bay | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Waratah Bay | 2 | - | - | 87.88 | - | - | 1 | 14 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| Warrnambool | 46 | 2 | - | 5.79 | 12.5 | - | 5 | 150 | 1.5 | 7.3 | 4.8 | 0.9 | - | 15.4 | 0.9 | - |
| Wilsons Promontory - East | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Wilsons Promontory - West | 23 | - | - | 42.92 | - | - | 3 | 55 | 1.1 | 6.2 | 5.8 | - | - | 16.4 | - | - |

**Table 13.6 Summary of oil accumulation on individual shoreline receptors. Results are based on a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

| Shoreline Receptor | | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| LGA Shoreline | Anser Island | 36 | - | - | 21.08 | - | - | 5 | 33 | 0.3 | 0.9 | 1.5 | - | - | 2.7 | - | - |
| | Bass Coast | 5 | - | - | 30.42 | - | - | 2 | 15 | 0.4 | 1.6 | 1.3 | - | - | 1.8 | - | - |
| | Bega Valley | 4 | - | - | 54.13 | - | - | 2 | 17 | 0.3 | 1 | 1.4 | - | - | 1.8 | - | - |
| | Colac Otway | 100 | 93 | - | 2.88 | 7 | - | 28 | 406 | 31.8 | 61.2 | 36.4 | 8.2 | - | 61.8 | 17.3 | - |
| | Corangamite | 100 | 100 | 27 | 1.00 | 1.25 | 49.21 | 128 | 1,845 | 99.2 | 225 | 48.9 | 18.6 | 1.4 | 58.2 | 34.5 | 5.5 |
| | East Gippsland | 36 | - | - | 27.92 | - | - | 2 | 65 | 1.2 | 3.8 | 2.8 | - | - | 6.4 | - | - |
| | Gabo Island | 4 | - | - | 90.25 | - | - | 2 | 21 | 0.1 | 0.6 | 1.8 | - | - | 1.8 | - | - |
| | Glenelg | 8 | - | - | 37.67 | - | - | 2 | 40 | 1.4 | 7.1 | 5.6 | - | - | 16.4 | - | - |
| | Glennie Group | 39 | - | - | 21.67 | - | - | 4 | 48 | 0.6 | 3 | 2.8 | - | - | 8.2 | - | - |
| | Greater Geelong | 4 | - | - | 12.04 | - | - | 2 | 75 | 0.3 | 6.5 | 5.9 | - | - | 13.6 | - | - |
| | Hogan Island Group | 1 | - | - | 44.63 | - | - | 1 | 11 | 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | Kanowna Island | 19 | - | - | 34.38 | - | - | 3 | 22 | 0.3 | 0.8 | 1.7 | - | - | 2.7 | - | - |
| | Kent Island Group | 1 | - | - | 32.29 | - | - | 1 | 16 | < 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | King Island | 11 | - | - | 39.92 | - | - | 1 | 25 | 0.5 | 1.7 | 1.2 | - | - | 1.8 | - | - |
| | Lady Julia Percy Island | 13 | - | - | 23.29 | - | - | 4 | 68 | 0.3 | 2.2 | 2 | - | - | 3.6 | - | - |
| | Laurence Rocks | 4 | - | - | 66.96 | - | - | 5 | 17 | 0.2 | 0.4 | 1.1 | - | - | 1.8 | - | - |
| | Montague Island | 2 | - | - | 102.21 | - | - | 2 | 11 | < 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | Mornington Peninsula | 21 | - | - | 13.83 | - | - | 2 | 28 | 0.8 | 3.8 | 2.8 | - | - | 10 | - | - |
| | Moyne | 100 | 78 | - | 1.21 | 1.71 | - | 34 | 718 | 20 | 90.6 | 19.8 | 5.3 | - | 75.4 | 20.9 | - |
| | Norman Island | 8 | - | - | 31.38 | - | - | 3 | 22 | 0.2 | 0.7 | 1.4 | - | - | 1.8 | - | - |
| | Phillip Island | 29 | - | - | 18.79 | - | - | 2 | 47 | 0.8 | 3.3 | 2.8 | - | - | 7.3 | - | - |
| | Rodondo Island | 18 | - | - | 29.67 | - | - | 4 | 40 | 0.2 | 1 | 1.7 | - | - | 2.7 | - | - |
| | Shellback Island | 1 | - | - | 45.38 | - | - | 3 | 11 | < 0.1 | 0.2 | 0.9 | - | - | 0.9 | - | - |
| | Skull Rock | 14 | - | - | 42.63 | - | - | 4 | 20 | 0.1 | 0.5 | 1.2 | - | - | 1.8 | - | - |
| | South Gippsland | 59 | - | - | 20.75 | - | - | 4 | 83 | 2.7 | 8.3 | 7.1 | - | - | 19.1 | - | - |
| | Surf Coast | 12 | - | - | 10.75 | - | - | 2 | 86 | 0.8 | 9.5 | 4.2 | - | - | 20 | - | - |
| | Warrnambool | 50 | 15 | - | 5.00 | 13.54 | - | 12 | 260 | 3.1 | 19 | 8.4 | 1.4 | - | 20.9 | 3.6 | - |
| | Wellington | 1 | - | - | 78.33 | - | - | 1 | 10 | 0.3 | 2.2 | 0.9 | - | - | 0.9 | - | - |
| Sub-LGA Shoreline | Anglesea | 4 | - | - | 14.08 | - | - | 2 | 23 | 0.3 | 2 | 2.5 | - | - | 5.5 | - | - |
| | Apollo Bay | 91 | - | - | 2.96 | - | - | 8 | 96 | 2.6 | 7.2 | 6.8 | - | - | 19.1 | - | - |
| | Bay of Islands | 100 | 74 | - | 1.21 | 1.71 | - | 48 | 718 | 16.9 | 62.6 | 14.5 | 5.2 | - | 25.4 | 16.4 | - |
| | Bega Valley | 4 | - | - | 54.13 | - | - | 2 | 17 | 0.3 | 1 | 1.4 | - | - | 1.8 | - | - |
| | Cape Howe / Mallacoota | 2 | - | - | 93.75 | - | - | 2 | 11 | 0.1 | 0.6 | 0.9 | - | - | 0.9 | - | - |
| | Cape Liptrap - Northwest | 31 | - | - | 20.75 | - | - | 3 | 45 | 0.6 | 2.1 | 2.4 | - | - | 5.5 | - | - |
| | Cape Nelson | 6 | - | - | 66.54 | - | - | 2 | 40 | 1 | 4.4 | 5.8 | - | - | 12.7 | - | - |
| | Cape Otway West | 100 | 93 | - | 2.88 | 7 | - | 56 | 406 | 27.7 | 51.1 | 26.7 | 8.2 | - | 33.6 | 17.3 | - |
| | Cape Patton | 61 | - | - | 5.25 | - | - | 5 | 45 | 1.5 | 4.8 | 5.6 | - | - | 16.4 | - | - |
| | Childers Cove | 59 | 15 | - | 2.50 | 22.67 | - | 12 | 187 | 3.9 | 22 | 9.6 | 2 | - | 18.2 | 6.4 | - |
| | Croajingolong - West | 16 | - | - | 44.79 | - | - | 2 | 21 | 0.2 | 0.8 | 0.9 | - | - | 0.9 | - | - |
| | Discovery Bay - East | 1 | - | - | 104.79 | - | - | 1 | 10 | 0.3 | 1 | 0.9 | - | - | 0.9 | - | - |
| | Discovery Bay - West | 1 | - | - | 104.25 | - | - | 1 | 12 | 0.2 | 1.1 | 0.9 | - | - | 0.9 | - | - |
| | French Island / Crib Point | 6 | - | - | 30.25 | - | - | 2 | 20 | < 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| | Kilcunda | 2 | - | - | 67.79 | - | - | 2 | 12 | 0.2 | 0.5 | 0.9 | - | - | 0.9 | - | - |

| Shoreline Receptor | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| Lorne | 12 | - | - | 10.42 | - | - | 2 | 20 | 0.4 | 1.5 | 2.1 | - | - | 4.5 | - | - |
| Marlo | 4 | - | - | 89.00 | - | - | 1 | 19 | 0.1 | 0.5 | 0.9 | - | - | 0.9 | - | - |
| Moonlight Head | 100 | 100 | 24 | 1.96 | 4.33 | 49.21 | 166 | 1,845 | 68.8 | 161 | 26.3 | 11.4 | 1.3 | 30.9 | 16.4 | 5.5 |
| Mornington Peninsula - South | 10 | - | - | 13.83 | - | - | 2 | 24 | 0.3 | 1.4 | 2.4 | - | - | 5.5 | - | - |
| Mornington Peninsula - Southwest | 15 | - | - | 17.63 | - | - | 2 | 28 | 0.3 | 2.2 | 2 | - | - | 6.4 | - | - |
| Point Hicks | 36 | - | - | 27.92 | - | - | 4 | 65 | 0.6 | 2.3 | 2.2 | - | - | 3.6 | - | - |
| Port Campbell | 99 | 89 | 5 | 1.00 | 1.25 | 66.96 | 86 | 1,202 | 30.3 | 87.5 | 22.3 | 8.1 | 1.3 | 26.4 | 20 | 1.8 |
| Port Fairy | 36 | 6 | - | 11.96 | 13.38 | - | 5 | 185 | 1.7 | 13.2 | 4.3 | 2 | - | 26.4 | 2.7 | - |
| Port Phillip - Queenscliff | 2 | - | - | 17.54 | - | - | 1 | 16 | 0.1 | 1 | 2.7 | - | - | 3.6 | - | - |
| Portland Bay - East | 2 | - | - | 25.42 | - | - | 2 | 16 | 0.3 | 1.5 | 1.8 | - | - | 2.7 | - | - |
| Portland Bay - West | 3 | - | - | 37.67 | - | - | 2 | 21 | 0.6 | 2.7 | 2.7 | - | - | 5.5 | - | - |
| Snake Island | 1 | - | - | 78.33 | - | - | 1 | 10 | < 0.1 | 0.4 | 0.9 | - | - | 0.9 | - | - |
| Torquay | 3 | - | - | 12.04 | - | - | 2 | 86 | 0.5 | 12.6 | 16.1 | - | - | 24.5 | - | - |
| Venus Bay | 4 | - | - | 30.42 | - | - | 2 | 15 | 0.2 | 1.3 | 1.1 | - | - | 1.8 | - | - |
| Waratah Bay | 5 | - | - | 39.17 | - | - | 1 | 23 | 0.1 | 0.7 | 0.9 | - | - | 0.9 | - | - |
| Warrnambool | 38 | 4 | - | 6.08 | 13.54 | - | 7 | 260 | 1.9 | 16.6 | 6 | 1.6 | - | 23.6 | 1.8 | - |
| Wilsons Promontory - East | 1 | - | - | 38.79 | - | - | 1 | 14 | 0.1 | 0.7 | 0.9 | - | - | 0.9 | - | - |
| Wilsons Promontory - West | 58 | - | - | 29.88 | - | - | 5 | 83 | 1.9 | 6.1 | 5.9 | - | - | 14.5 | - | - |

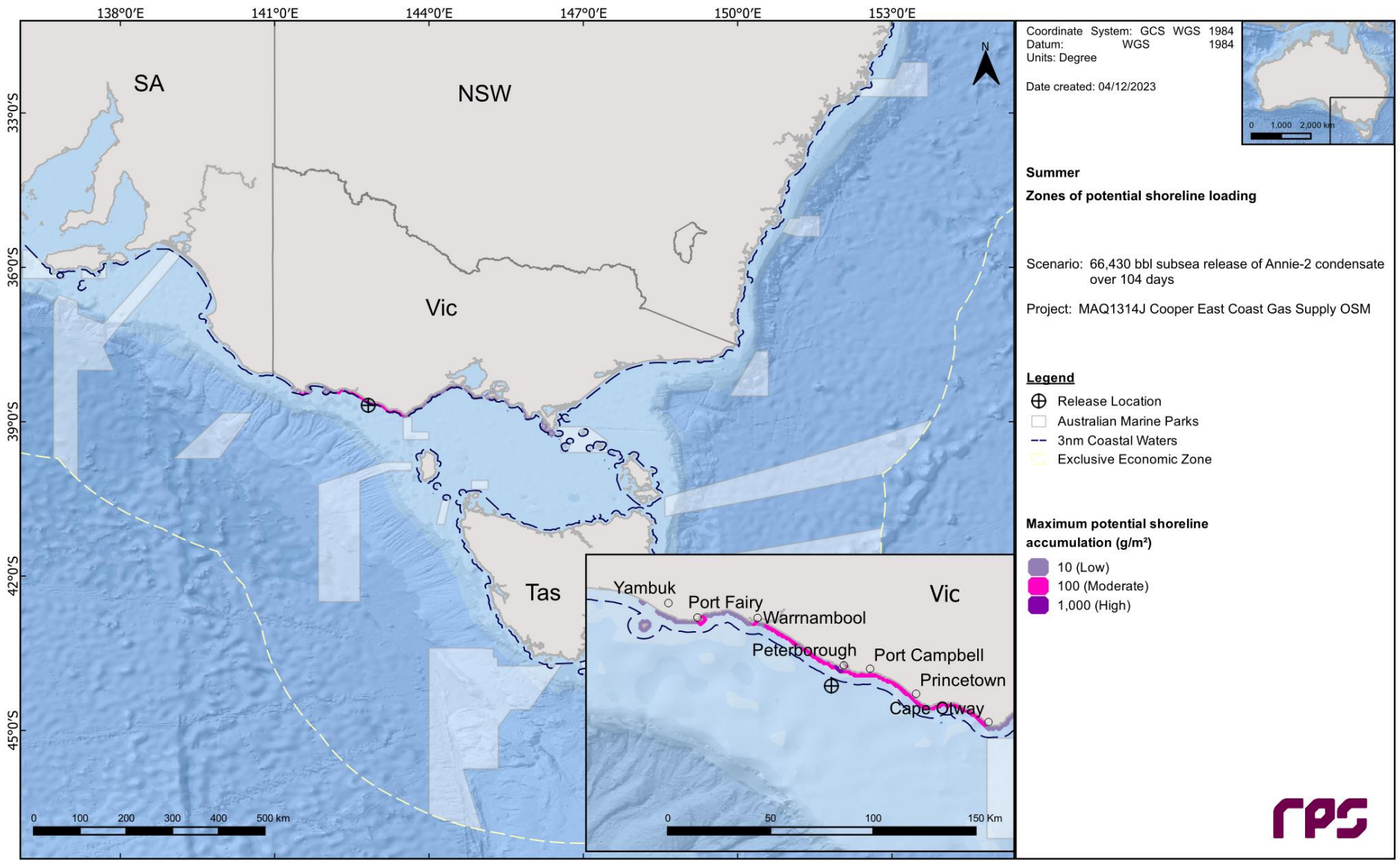



**Figure 13.7 Maximum potential shoreline accumulation in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

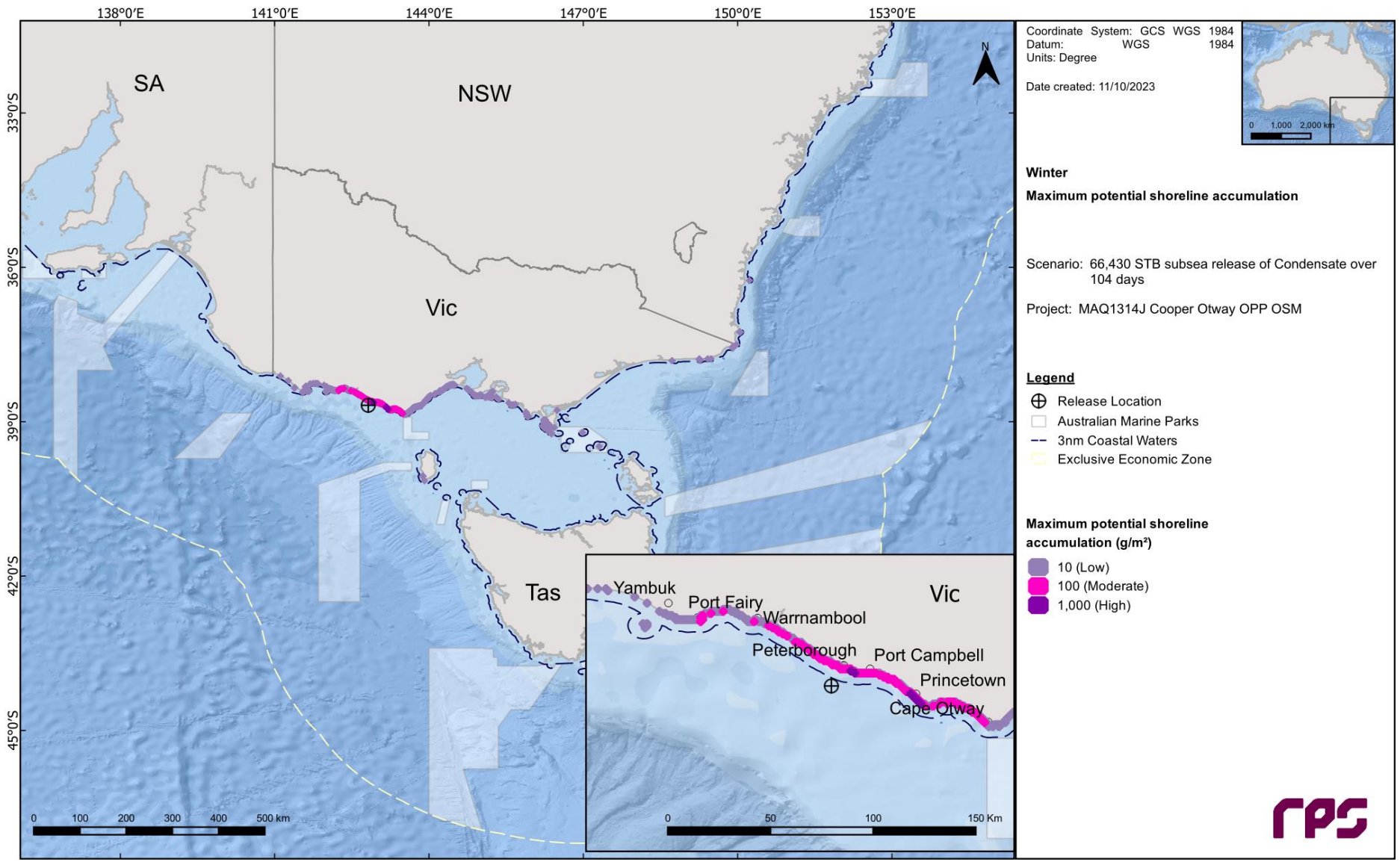



**Figure 13.8 Maximum potential shoreline accumulation in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

### 13.1.3 In-water exposure

#### 13.1.3.1 Dissolved Hydrocarbons

Table 13.7 summarises the potential in-water exposure to individual receptors from dissolved hydrocarbons in the 0-10 m layer.

A total of 20 BIAs were predicted to be exposed to dissolved hydrocarbon at, or above, the low threshold. Excluding the BIAs that the release location resides within (see Section 10.3), the highest probability of low exposure was 10% during summer and 33% during winter at the Short-tailed Shearwater - Foraging BIA receptor.

The maximum dissolved hydrocarbon concentration at any given receptor(s) was shown to be 35.3 ppb and 41.0 ppb during summer and winter respectively.

Table 13.8 presents the predicted minimum time to dissolved hydrocarbon exposure and maximum residence time for dissolved hydrocarbon exposure to individual receptors, in the 0-10 m depth layer, for all thresholds assessed.

Figure 13.9 and Figure 13.10 present the zones of potential dissolved hydrocarbon exposure for the 0-10 m depth layer for each season whilst Figure 13.11 and Figure 13.12 present the maximum residence time of dissolved hydrocarbon exposure for the NOPSEMA thresholds.

**Table 13.7 Probability of dissolved hydrocarbons exposure to marine based receptors in the 0–10 m depth. Results are based on a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | |
| | | | Low | Moderate | High | | Low | Moderate | High |
| AMP | Apollo | 14.5 | 1 | - | - | 14.8 | 1 | - | - |
| BIA | Antipodean Albatross - Foraging* | 30.4 | 13 | - | - | 23.8 | 11 | - | - |
| | Australasian Gannet - Foraging | 14.5 | 1 | - | - | 6.9 | - | - | - |
| | Black-browed Albatross - Foraging* | 30.4 | 13 | - | - | 23.8 | 11 | - | - |
| | Bullers Albatross - Foraging* | 30.4 | 13 | - | - | 23.8 | 11 | - | - |
| | Campbell Albatross - Foraging* | 30.4 | 13 | - | - | 23.8 | 11 | - | - |
| | Common Diving-petrel - Foraging* | 35.3 | 24 | - | - | 41 | 50 | - | - |
| | Indian Yellow-nosed Albatross - Foraging* | 30.4 | 13 | - | - | 23.8 | 11 | - | - |
| | Pygmy Blue Whale - Distribution* | 35.3 | 24 | - | - | 41.0 | 50 | - | - |
| | Pygmy Blue Whale - Foraging* | 35.3 | 24 | - | - | 41.0 | 50 | - | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 35.3 | 24 | - | - | 41.0 | 50 | - | - |
| | Pygmy Blue Whale - Known Foraging Area | 16.6 | 1 | - | - | 21.6 | 3 | - | - |
| | Short-tailed Shearwater - Foraging | 21.9 | 10 | - | - | 41.0 | 33 | - | - |
| | Shy Albatross - Foraging* | 35.3 | 24 | - | - | 41.0 | 50 | - | - |
| | Southern Right Whale - Aggregation | 20.1 | 2 | - | - | 19.4 | 2 | - | - |
| | Southern Right Whale - Known Core Range* | 35.3 | 24 | - | - | 41.0 | 50 | - | - |
| | Wandering Albatross - Foraging* | 30.4 | 13 | - | - | 23.8 | 11 | - | - |
| | Wedge-tailed Shearwater - Foraging* | 35.3 | 24 | - | - | 41.0 | 50 | - | - |
| | White Shark - Distribution* | 30.4 | 13 | - | - | 23.8 | 11 | - | - |
| | White Shark - Foraging | 17.7 | 1 | - | - | 8.9 | - | - | - |
| | White-faced Storm-petrel - Foraging | 16.6 | 1 | - | - | 21.6 | 3 | - | - |
| IBRA | Otway Plain | 17.3 | 3 | - | - | 17.1 | 9 | - | - |
| | Otway Ranges | 15.5 | 4 | - | - | 23.2 | 9 | - | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure (%) | | |
| | | | Low | Moderate | High | | Low | Moderate | High |
| | Warrnambool Plain | 29.6 | 23 | - | - | 35.1 | 50 | - | - |
| IMCRA | Central Bass Strait | 16.6 | 1 | - | - | 21.6 | 3 | - | - |
| | Central Victoria | 16.1 | 1 | - | - | 17.2 | 2 | - | - |
| | Otway* | 35.3 | 24 | - | - | 41.0 | 50 | - | - |
| KEF | Bonney Coast Upwelling | 11.1 | 1 | - | - | 5.9 | - | - | - |
| MNP | Twelve Apostles | 27.7 | 20 | - | - | 33.8 | 40 | - | - |
| RSB | Bravenes Rock | 11.2 | 2 | - | - | 10.8 | 1 | - | - |
| Nearshore Waters | Colac Otway | 17.3 | 3 | - | - | 18.2 | 9 | - | - |
| | Corangamite | 29.6 | 23 | - | - | 35.1 | 48 | - | - |
| | Moyne | 11.5 | 1 | - | - | 13.2 | 1 | - | - |
| State Waters | Victoria State Waters | 35.3 | 24 | - | - | 41.0 | 50 | - | - |
| Nearshore Waters (Sub-LGA) | Apollo Bay | 9.6 | - | - | - | 13.0 | 2 | - | - |
| | Bay of Islands | 11.5 | 1 | - | - | 13.2 | 1 | - | - |
| | Cape Otway West | 17.3 | 3 | - | - | 18.2 | 9 | - | - |
| | Moonlight Head | 29.6 | 23 | - | - | 35.1 | 50 | - | - |
| | Port Campbell | 20.6 | 6 | - | - | 15.3 | 2 | - | - |

*The release location resides within the receptor boundaries.

**Table 13.8 Predicted minimum time to dissolved hydrocarbon exposure and maximum residence time for dissolved hydrocarbon exposure to individual receptors in the 0-10 m depth layer. Results are based on a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High |
| AMP | Apollo | 9.71 | - | - | 0.04 | - | - | 6.29 | - | - | 0.04 | - | - |
| BIA | Antipodean Albatross - Foraging* | 2.46 | - | - | 0.13 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Australasian Gannet - Foraging | 5.38 | - | - | 0.04 | - | - | - | - | - | - | - | - |
| | Black-browed Albatross - Foraging* | 2.46 | - | - | 0.13 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Bullers Albatross - Foraging* | 2.46 | - | - | 0.13 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Campbell Albatross - Foraging* | 2.46 | - | - | 0.13 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Common Diving-petrel - Foraging* | 2.46 | - | - | 0.25 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Indian Yellow-nosed Albatross - Foraging* | 2.46 | - | - | 0.13 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Pygmy Blue Whale - Distribution* | 2.46 | - | - | 0.25 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Pygmy Blue Whale - Foraging* | 2.46 | - | - | 0.25 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Pygmy Blue Whale - Foraging annual high use area* | 2.46 | - | - | 0.25 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Pygmy Blue Whale - Known Foraging Area | 9.96 | - | - | 0.04 | - | - | 6.38 | - | - | 0.08 | - | - |
| | Short-tailed Shearwater - Foraging | 4.63 | - | - | 0.08 | - | - | 3.42 | - | - | 0.13 | - | - |
| | Shy Albatross - Foraging* | 2.46 | - | - | 0.25 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Southern Right Whale - Aggregation | 3.33 | - | - | 0.08 | - | - | 3.79 | - | - | 0.13 | - | - |
| | Southern Right Whale - Known Core Range* | 2.46 | - | - | 0.25 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Wandering Albatross - Foraging* | 2.46 | - | - | 0.13 | - | - | 1.63 | - | - | 0.21 | - | - |
| | Wedge-tailed Shearwater - Foraging* | 2.46 | - | - | 0.25 | - | - | 1.63 | - | - | 0.21 | - | - |
| | White Shark - Distribution* | 2.46 | - | - | 0.13 | - | - | 1.63 | - | - | 0.21 | - | - |
| | White Shark - Foraging | 5.38 | - | - | 0.04 | - | - | 78.46 | - | - | 0.04 | - | - |
| | White-faced Storm-petrel - Foraging | 9.96 | - | - | 0.04 | - | - | 6.42 | - | - | 0.08 | - | - |
| IBRA | Otway Plain | 11.42 | - | - | 0.08 | - | - | 4.75 | - | - | 0.08 | - | - |

| Receptor | | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | | Minimum time before dissolved hydrocarbon exposure (days) | | | Maximum residence time for dissolved hydrocarbon exposure (days) | | |
| | | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High | Low | Moderate | High |
| | Otway Ranges | 11.46 | - | - | 0.08 | - | - | 4.29 | - | - | 0.08 | - | - |
| | Warrnambool Plain | 4.63 | - | - | 0.17 | - | - | 2.96 | - | - | 0.21 | - | - |
| IMCRA | Central Bass Strait | 10.29 | - | - | 0.04 | - | - | 7.33 | - | - | 0.08 | - | - |
| | Central Victoria | 9.96 | - | - | 0.04 | - | - | 7 | - | - | 0.08 | - | - |
| | Otway* | 2.46 | - | - | 0.25 | - | - | 1.63 | - | - | 0.21 | - | - |
| KEF | Bonney Coast Upwelling | 11.67 | - | - | 0.04 | - | - | - | - | - | - | - | - |
| MNP | Twelve Apostles | 3.54 | - | - | 0.17 | - | - | 2.96 | - | - | 0.21 | - | - |
| RSB | Bravenes Rock | 30.88 | - | - | 0.04 | - | - | 23.79 | - | - | 0.04 | - | - |
| Nearshore Waters | Colac Otway | 11.42 | - | - | 0.08 | - | - | 4.29 | - | - | 0.08 | - | - |
| | Corangamite | 4.63 | - | - | 0.17 | - | - | 2.96 | - | - | 0.21 | - | - |
| | Moyne | 11.33 | - | - | 0.04 | - | - | 4.5 | - | - | 0.13 | - | - |
| State Waters | Victoria State Waters | 3.54 | - | - | 0.25 | - | - | 2.96 | - | - | 0.21 | - | - |
| Nearshore Waters (Sub-LGA) | Apollo Bay | - | - | - | - | - | - | 10.21 | - | - | 0.08 | - | - |
| | Bay of Islands | 11.33 | - | - | 0.04 | - | - | 4.5 | - | - | 0.13 | - | - |
| | Cape Otway West | 11.42 | - | - | 0.08 | - | - | 4.29 | - | - | 0.08 | - | - |
| | Moonlight Head | 4.54 | - | - | 0.17 | - | - | 2.96 | - | - | 0.21 | - | - |
| | Port Campbell | 5.17 | - | - | 0.08 | - | - | 3.88 | - | - | 0.08 | - | - |

*The release location resides within the receptor boundaries.

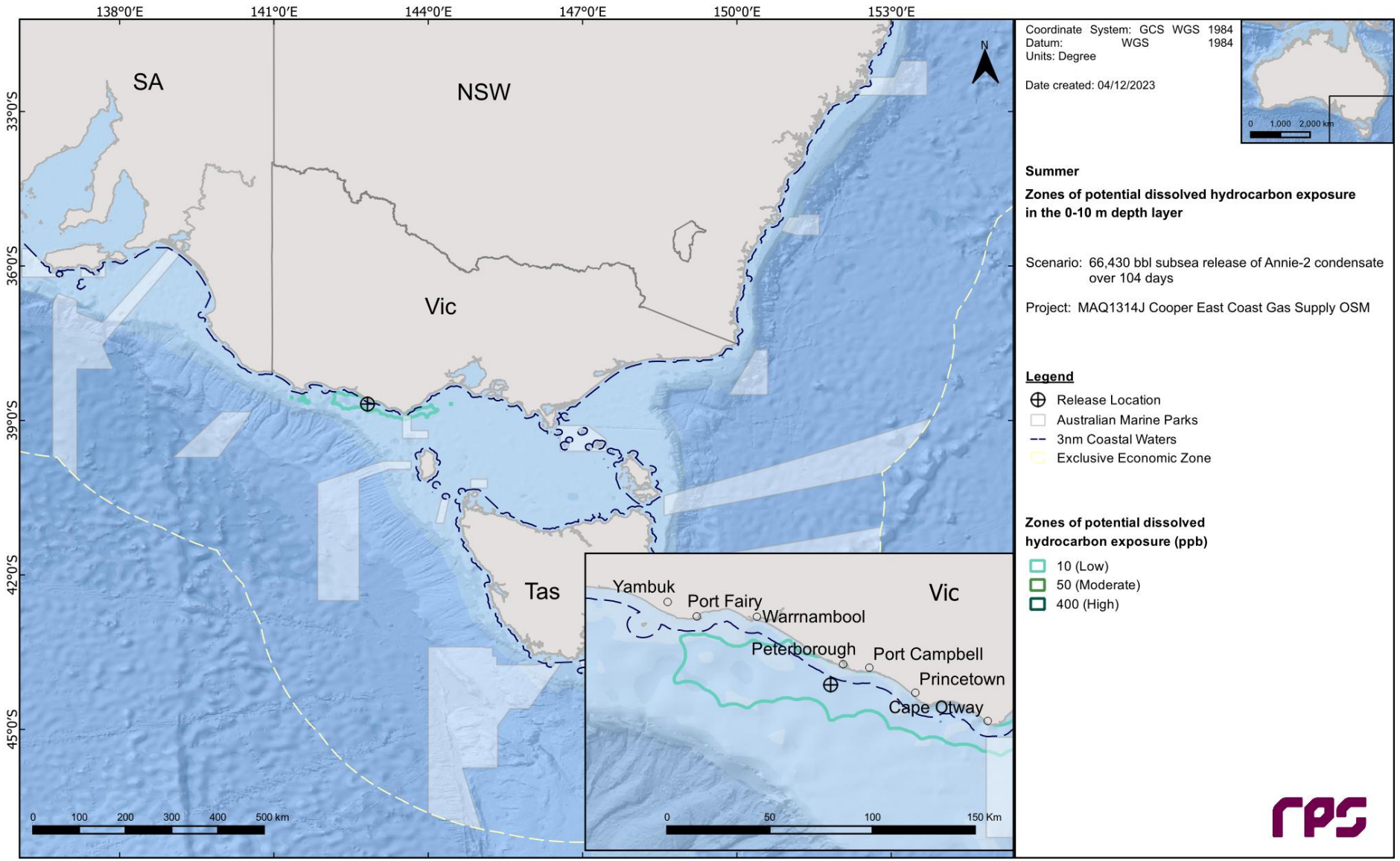



**Figure 13.9 Zones of potential dissolved hydrocarbon exposure at 0-10 m below the sea in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

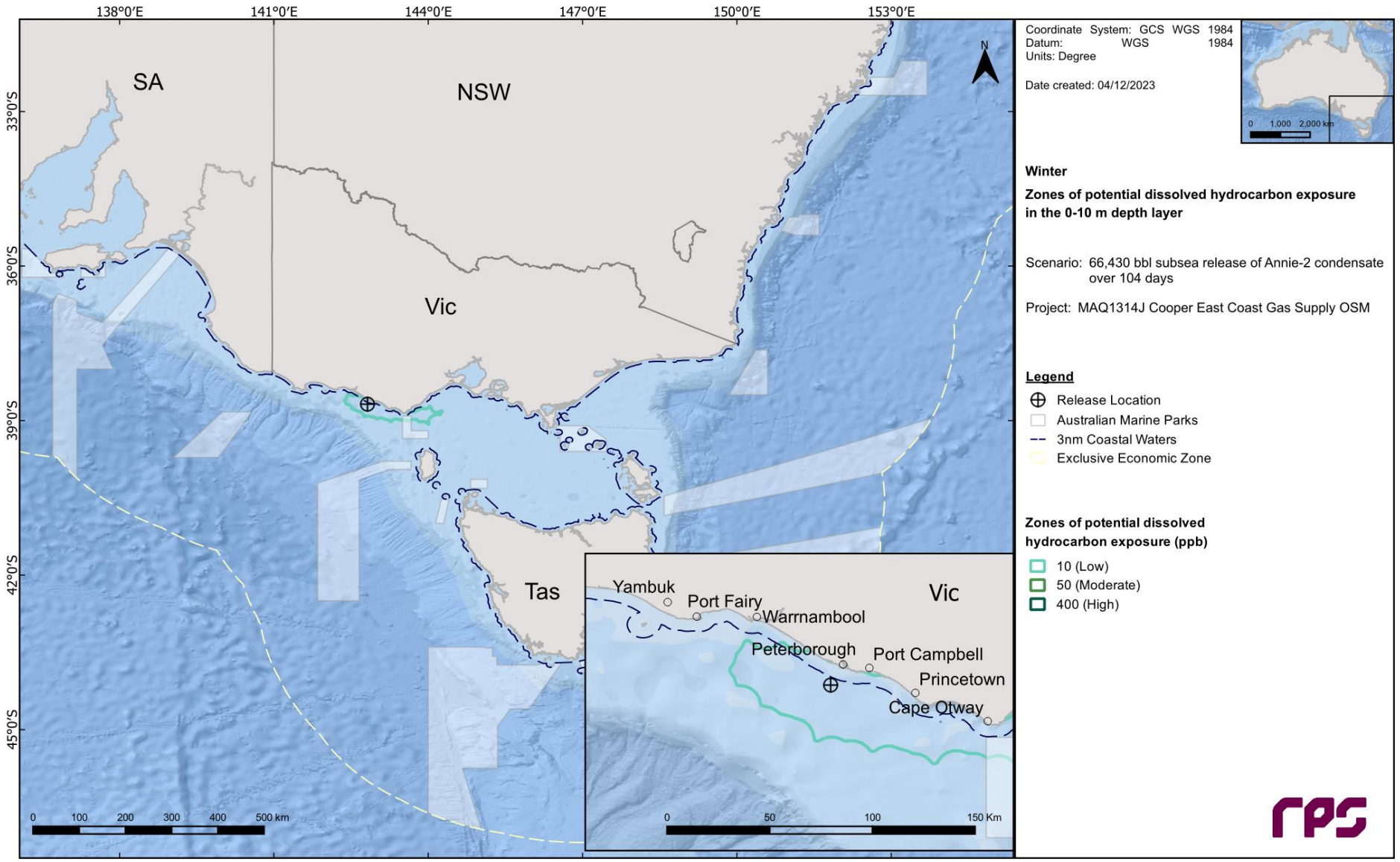



**Figure 13.10 Zones of potential dissolved hydrocarbon exposure at 0-10 m below the sea in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

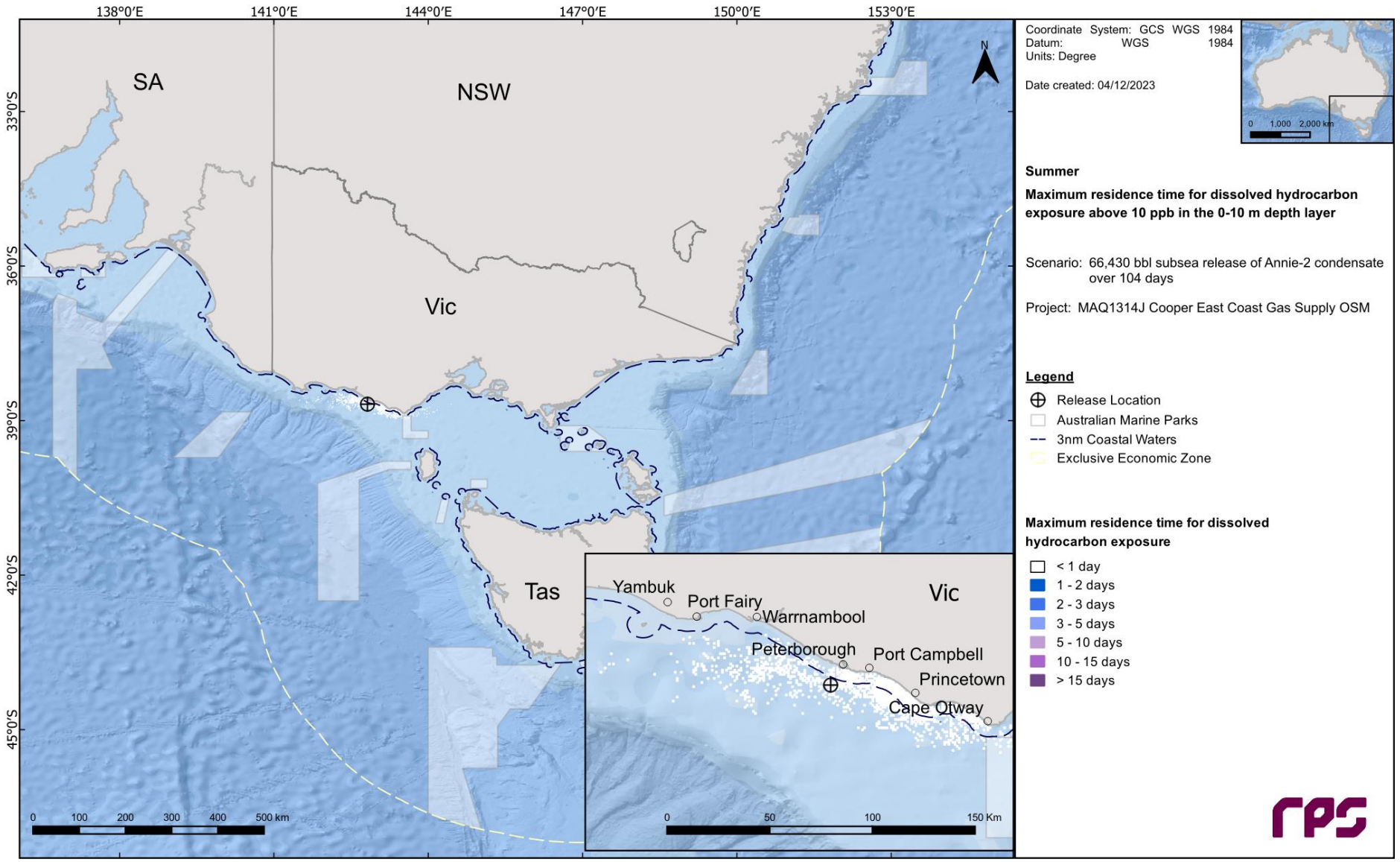



**Figure 13.11 Maximum residence time for dissolved hydrocarbon exposure above 10 ppb, at 0-10 m below the sea surface in the event of a 66,430 bbl (10,562 m$^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

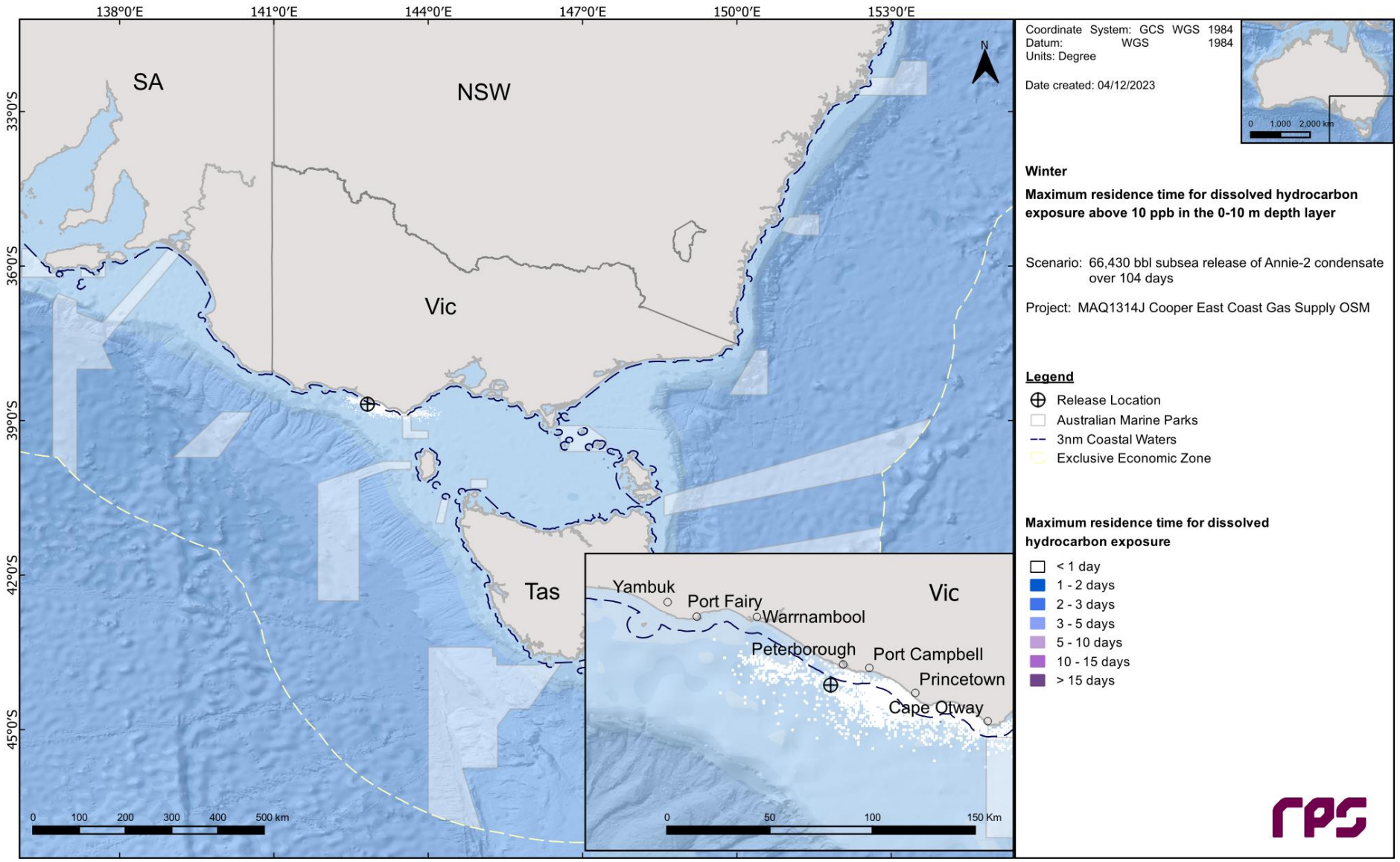



**Figure 13.12 Maximum residence time for dissolved hydrocarbon exposure above 10 ppb, at 0-10 m below the sea surface in the event of a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

### 13.1.3.2 Entrained Hydrocarbons

Table 13.9 summarises the potential in-water exposure to individual receptors from entrained hydrocarbons in the 0-10 m depth layer.

Many receptors were exposed above the low and high thresholds, however most of these receptors (predominantly BIAs) coincided with the release location.

In summer conditions, the highest probability of low entrained hydrocarbon exposure was recorded at 100% for receptors that the release location doesn't reside within, including Short-tailed Shearwater – Foraging, Southern Right Whale – Aggregation BIAs and Warrnambool Plain IBRA. Additional receptors including near-shore sub-LGA waters, and AMPs were predicted with entrained hydrocarbon exposure (refer to Table 13.9). Similarly, during winter several receptors that the release location doesn't reside within revealed probabilities of 100% for low entrained hydrocarbon exposure.

Table 13.10 presents the predicted minimum time to entrained hydrocarbon exposure and maximum residence time for entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer, for all thresholds assessed.

Figure 13.13 and Figure 13.14 present the zones of potential entrained hydrocarbon exposure for the 0-10 m depth layer for each season whilst Figure 13.15 to Figure 13.18 present the maximum residence time of entrained hydrocarbon exposure for the NOPSEMA thresholds.

**Table 13.9 Probability of entrained hydrocarbons exposure to marine based receptors in the 0–10 m depth layer. Results are based on a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| AMP | Apollo | 119.1 | 86 | 6 | 124.6 | 97 | 5 |
| | Beagle | 25.0 | 36 | - | 26.9 | 34 | - |
| | Nelson | 15.5 | 7 | - | 14.3 | 1 | - |
| | Zeehan | 17.0 | 9 | - | 15.6 | 8 | - |
| BIA | Antipodean Albatross - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Australasian Gannet - Foraging | 87.5 | 71 | - | 74.5 | 66 | - |
| | Australian Sea Lion - Foraging | 13.0 | 7 | - | 6.9 | - | - |
| | Black Petrel - Foraging | 15.4 | 6 | - | 11.7 | 2 | - |
| | Black-browed Albatross - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Black-faced Cormorant - Foraging | 16.0 | 3 | - | 14 | 8 | - |
| | Bullers Albatross - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Campbell Albatross - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Common Diving-petrel - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Crested Tern - Breeding | 8.1 | - | - | 10.5 | 1 | - |
| | Crested Tern - Foraging | 9.3 | - | - | 11.7 | 2 | - |
| | Flesh-footed Shearwater - Foraging | 15.4 | 6 | - | 11.7 | 2 | - |
| | Great-winged Petrel - Foraging | 15.4 | 6 | - | 9.2 | - | - |
| | Grey Nurse Shark - Foraging | 16 | 6 | - | 13.3 | 4 | - |
| | Grey Nurse Shark - Migration | 26.5 | 7 | - | 12.9 | 4 | - |
| | Humpback Whale - Foraging | 26.8 | 7 | - | 13.3 | 5 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Indo-Pacific/Spotted Bottlenose Dolphin - Breeding | 10.6 | 1 | - | 12.5 | 2 | - |
| | Little Penguin - Breeding | 8.4 | - | - | 11.7 | 2 | - |
| | Little Penguin - Foraging | 24.9 | 43 | - | 28.8 | 61 | - |
| | Northern Giant Petrel - Foraging | 15.4 | 6 | - | 9.2 | - | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Pygmy Blue Whale - Distribution* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Pygmy Blue Whale - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Pygmy Blue Whale - Foraging annual high use area* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Pygmy Blue Whale - Known Foraging Area | 125.8 | 86 | 4 | 113.1 | 97 | 6 |
| | Short-tailed Shearwater - Foraging | 254.5 | 100 | 95 | 256.5 | 100 | 99 |
| | Shy Albatross - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Sooty Shearwater - Foraging | 24.3 | 7 | - | 13.3 | 4 | - |
| | Southern Giant Petrel - Foraging | 15.4 | 6 | - | 9.2 | - | - |
| | Southern Right Whale - Aggregation | 347.5 | 100 | 83 | 287.9 | 98 | 76 |
| | Southern Right Whale - Connecting Habitat | 10.3 | 1 | - | 9.8 | - | - |
| | Southern Right Whale - Known Core Range* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Wandering Albatross - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Wedge-tailed Shearwater - Foraging* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | White Shark - Breeding | 17.9 | 18 | - | 18.0 | 27 | - |
| | White Shark - Distribution* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | White Shark - Foraging | 99.1 | 84 | - | 111.7 | 73 | 2 |
| | White-capped Albatross - Foraging | 15.4 | 6 | - | 9.2 | - | - |
| | White-faced Storm-petrel - Breeding | 16.0 | 6 | - | 11.7 | 2 | - |
| | White-faced Storm-petrel - Foraging | 110.8 | 86 | 4 | 103.4 | 97 | 2 |
| | Wilsons Storm Petrel - Migration | 15.4 | 6 | - | 9.2 | - | - |
| IBRA | Bridgewater | 80.0 | 42 | - | 71.0 | 9 | - |
| | East Gippsland Lowlands | 8.0 | - | - | 13.0 | 2 | - |
| | Flinders | 19.1 | 11 | - | 23.0 | 13 | - |
| | Gippsland Plain | 48.7 | 31 | - | 54.4 | 52 | - |
| | Glenelg Plain | 87.5 | 52 | - | 74.0 | 10 | - |
| | Otway Plain | 243.6 | 99 | 59 | 183.1 | 100 | 67 |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Otway Ranges | 202.1 | 99 | 67 | 206.6 | 100 | 76 |
| | Strzelecki Ranges | 19.6 | 26 | - | 26.8 | 50 | - |
| | Warrnambool Plain | 475.1 | 100 | 99 | 441.0 | 100 | 100 |
| | Wilsons Promontory | 59.4 | 42 | - | 60.4 | 60 | - |
| IMCRA | Batemans Shelf | 13.0 | 5 | - | 11.7 | 2 | - |
| | Central Bass Strait | 110.8 | 85 | 3 | 103.4 | 95 | 2 |
| | Central Victoria | 112.7 | 86 | 4 | 107.6 | 97 | 2 |
| | Flinders | 60.8 | 43 | - | 61.0 | 61 | - |
| | Otway* | 647.2 | 100 | 100 | 663.8 | 100 | 100 |
| | Twofold Shelf | 26.8 | 12 | - | 21.1 | 16 | - |
| | Victorian Embayments | 27.4 | 24 | - | 20.5 | 40 | - |
| KEF | Bonney Coast Upwelling | 87.5 | 71 | - | 85.5 | 50 | - |
| | Canyons on the Eastern Continental Slope | 15.4 | 6 | - | 5.8 | - | - |
| | Shelf rocky reefs | 8.5 | - | - | 10.8 | 1 | - |
| | Upwelling East of Eden | 26.8 | 10 | - | 15.1 | 8 | - |
| | West Tasmania Canyons | 29.6 | 27 | - | 38.2 | 22 | - |
| MNP | Bunurong | 22.9 | 15 | - | 21.4 | 28 | - |
| | Cape Howe | 10.1 | 1 | - | 13.8 | 2 | - |
| | Churchill Island | 15.2 | 12 | - | 18.9 | 12 | - |
| | Discovery Bay | 36.6 | 30 | - | 29 | 2 | - |
| | Point Addis | 43.0 | 23 | - | 41.7 | 21 | - |
| | Port Phillip Heads | 27.4 | 25 | - | 21.5 | 16 | - |
| | Twelve Apostles | 483.8 | 100 | 99 | 445.8 | 100 | 100 |
| | Wilsons Promontory | 58.8 | 43 | - | 60.3 | 60 | - |
| MP | Batemans | 8.1 | - | - | 10.5 | 1 | - |
| | Lower South East | 16.1 | 3 | - | 11.4 | 1 | - |
| MS | Mushroom Reef | 16.1 | 18 | - | 18.0 | 25 | - |
| NPS4 | Bunurong Marine Park | 26.6 | 21 | - | 30 | 36 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Wilsons Promontory Marine Park | 47.3 | 32 | - | 50.9 | 52 | - |
| RAMSAR | Port Phillip Bay Western Shoreline and Bellarine Peninsula | 19.7 | 6 | - | 15.5 | 4 | - |
| | Western Port | 15.2 | 12 | - | 18.9 | 12 | - |
| RSB | Bravenes Rock | 205.4 | 95 | 24 | 123.0 | 99 | 12 |
| | Cody Bank | 16.0 | 20 | - | 19.0 | 40 | - |
| | Cutter Rock | 22.3 | 17 | - | 25.5 | 15 | - |
| | New Zealand Star Bank | 13.7 | 5 | - | 12.0 | 2 | - |
| Nearshore Waters | Anser Island | 53.1 | 41 | - | 52.3 | 59 | - |
| | Bass Coast | 29.5 | 23 | - | 33.1 | 44 | - |
| | Bega Valley | 8.1 | - | - | 12.1 | 2 | - |
| | Colac Otway | 243.6 | 99 | 59 | 183.1 | 100 | 67 |
| | Corangamite | 475.1 | 100 | 99 | 441.0 | 100 | 100 |
| | Curtis Island | 19.1 | 11 | - | 23.0 | 7 | - |
| | East Gippsland | 8.0 | - | - | 13.0 | 2 | - |
| | French Island | 9.7 | - | - | 11.8 | 2 | - |
| | Gabo Island | 8.3 | - | - | 12.6 | 2 | - |
| | Glenelg | 87.5 | 52 | - | 74.0 | 10 | - |
| | Glennie Group | 57.9 | 43 | - | 57.6 | 60 | - |
| | Grant | 12.4 | 4 | - | 9.0 | - | - |
| | Greater Geelong | 48.6 | 25 | - | 40.0 | 12 | - |
| | Hogan Island Group | 16.1 | 11 | - | 20.2 | 13 | - |
| | Kanowna Island | 49.7 | 41 | - | 47.5 | 59 | - |
| | Lady Julia Percy Island | 76.5 | 62 | - | 71.1 | 25 | - |
| | Laurence Rocks | 69.7 | 47 | - | 62.4 | 9 | - |
| | Moncoeur Islands | 22.4 | 33 | - | 26.7 | 36 | - |
| | Mornington Peninsula | 28.9 | 30 | - | 31.5 | 42 | - |
| | Moyne | 308.3 | 100 | 79 | 377.8 | 100 | 75 |
| | Mud Island | 12.5 | 4 | - | 11.2 | 3 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Norman Island | 59.4 | 39 | - | 60.4 | 57 | - |
| | Phillip Island | 21.6 | 28 | - | 22.3 | 44 | - |
| | Rodondo Island | 33.9 | 39 | - | 33.8 | 49 | - |
| | Seal Islands | 7.4 | - | - | 10.8 | 1 | - |
| | Shellback Island | 38.0 | 29 | - | 41.8 | 44 | - |
| | Skull Rock | 46.9 | 41 | - | 44.6 | 59 | - |
| | South Gippsland | 58.3 | 41 | - | 58.0 | 60 | - |
| | Surf Coast | 44.3 | 23 | - | 40.3 | 40 | - |
| | Warrnambool | 199.1 | 84 | 4 | 159.7 | 56 | 12 |
| State Waters | New South Wales | 9.7 | - | - | 12.5 | 2 | - |
| | South Australia State Waters | 17.4 | 10 | - | 12.1 | 2 | - |
| | Tasmania State Waters | 23.4 | 15 | - | 25.5 | 15 | - |
| | Victoria State Waters | 499.5 | 100 | 100 | 462.8 | 100 | 100 |
| Nearshore Waters (Sub-LGA) | Anglesea | 34.6 | 18 | - | 30.9 | 11 | - |
| | Apollo Bay | 133.7 | 86 | 7 | 101.4 | 97 | 1 |
| | Bay of Islands | 308.3 | 100 | 79 | 377.8 | 100 | 75 |
| | Bega Valley | 8.1 | - | - | 12.1 | 2 | - |
| | Cape Howe / Mallacoota | 7.7 | - | - | 13.0 | 2 | - |
| | Cape Liptrap - Northwest | 25.5 | 28 | - | 29.0 | 52 | - |
| | Cape Nelson | 87.5 | 52 | - | 74.0 | 10 | - |
| | Cape Otway West | 249.8 | 99 | 59 | 183.1 | 100 | 67 |
| | Cape Patton | 49.9 | 76 | - | 60.2 | 94 | - |
| | Childers Cove | 210.6 | 93 | 12 | 176.2 | 75 | 14 |
| | Discovery Bay - East | 33.3 | 18 | - | 27.2 | 1 | - |
| | Discovery Bay - West | 19.2 | 15 | - | 19.6 | 1 | - |
| | French Island / Crib Point | 8.0 | - | - | 11.5 | 2 | - |
| | French Island / San Remo | 14.1 | 20 | - | 19.2 | 18 | - |
| | Kilcunda | 29.5 | 23 | - | 33.1 | 44 | - |

| Receptor | | Summer | | | Winter | | |
|---|---|---|---|---|---|---|---|
| | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
| | | | Low | High | | Low | High |
| | Lorne | 30.8 | 23 | - | 26.6 | 46 | - |
| | Moonlight Head | 483.8 | 100 | 99 | 445.8 | 100 | 100 |
| | Mornington Peninsula - South | 21.1 | 23 | - | 21.2 | 40 | - |
| | Mornington Peninsula - Southwest | 28.9 | 30 | - | 31.7 | 42 | - |
| | Port Campbell | 426.8 | 100 | 86 | 346.1 | 100 | 88 |
| | Port Fairy | 68.3 | 62 | - | 104.6 | 31 | 1 |
| | Port Phillip - Queenscliff | 34.4 | 25 | - | 29.3 | 12 | - |
| | Port Phillip - Sorrento Shore | 26.4 | 25 | - | 24.4 | 27 | - |
| | Port Phillip Heads | 25.1 | 15 | - | 20.5 | 9 | - |
| | Portland Bay - East | 38.3 | 46 | - | 38.8 | 10 | - |
| | Portland Bay - West | 63.6 | 31 | - | 57.4 | 7 | - |
| | Torquay | 48.6 | 16 | - | 40.3 | 10 | - |
| | Venus Bay | 27.6 | 23 | - | 32.2 | 40 | - |
| | Waratah Bay | 19.6 | 26 | - | 26.8 | 50 | - |
| | Warrnambool | 103.3 | 66 | 2 | 121 | 45 | 3 |
| | Westernport | 15.2 | 16 | - | 15.6 | 18 | - |
| | Wilsons Promontory - East | 37.0 | 38 | - | 34.1 | 53 | - |
| | Wilsons Promontory - West | 58.3 | 41 | - | 58.0 | 60 | - |

*The release location resides within the receptor boundaries.

**Table 13.10 Predicted minimum time to entrained hydrocarbon exposure and maximum residence time for entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer. Results are based on a 66,430 bbl (10,562 $m^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations per season.**

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| AMP | Apollo | 3.13 | 24.42 | 30.29 | 0.21 | 2.00 | 8.25 | 11.54 | 0.21 |
| | Beagle | 26.46 | - | 6.63 | - | 25.63 | - | 4 | - |
| | Nelson | 20.04 | - | 1.38 | - | 84.88 | - | 1 | - |
| | Zeehan | 26.17 | - | 2.21 | - | 18.58 | - | 0.71 | - |
| BIA | Antipodean Albatross - Foraging* | 0.04 | 0.08 | 93.08 | 14.96 | 0.04 | 0.08 | 104.75 | 15.08 |
| | Australasian Gannet - Foraging | 2.29 | - | 84.17 | - | 6.25 | - | 55.04 | - |
| | Australian Sea Lion - Foraging | 11.38 | - | 0.67 | - | - | - | - | - |
| | Black Petrel - Foraging | 42.83 | - | 0.54 | - | 54.83 | - | 0.08 | - |
| | Black-browed Albatross - Foraging* | 0.04 | 0.08 | 93.08 | 15.46 | 0.04 | 0.08 | 104.75 | 15.08 |
| | Black-faced Cormorant - Foraging | 29.71 | - | 0.29 | - | 17.92 | - | 0.38 | - |
| | Bullers Albatross - Foraging* | 0.04 | 0.08 | 93.08 | 15.46 | 0.04 | 0.08 | 104.75 | 15.08 |
| | Campbell Albatross - Foraging* | 0.04 | 0.08 | 93.08 | 15.46 | 0.04 | 0.08 | 104.75 | 15.08 |
| | Common Diving-petrel - Foraging* | 0.04 | 0.08 | 93.08 | 22.25 | 0.04 | 0.08 | 109.71 | 32.5 |
| | Crested Tern - Breeding | - | - | - | - | 55.08 | - | 0.04 | - |
| | Crested Tern - Foraging | - | - | - | - | 54.83 | - | 0.08 | - |
| | Flesh-footed Shearwater - Foraging | 42.83 | - | 0.54 | - | 54.83 | - | 0.08 | - |
| | Great-winged Petrel - Foraging | 42.83 | - | 0.54 | - | - | - | - | - |
| | Grey Nurse Shark - Foraging | 40.33 | - | 0.92 | - | 49.33 | - | 0.13 | - |
| | Grey Nurse Shark - Migration | 40.04 | - | 1.67 | - | 49.08 | - | 0.17 | - |
| | Humpback Whale - Foraging | 39.71 | - | 1.67 | - | 36.88 | - | 0.25 | - |
| | Indian Yellow-nosed Albatross - Foraging* | 0.04 | 0.08 | 93.08 | 15.46 | 0.04 | 0.08 | 104.75 | 15.08 |
| | Indo-Pacific/Spotted Bottlenose Dolphin - Breeding | 73.33 | - | 0.04 | - | 48.63 | - | 0.25 | - |
| | Little Penguin –– Breeding | - | - | - | - | 54.83 | - | 0.08 | - |
| | Little Penguin - Foraging | 26.42 | - | 14.88 | - | 10.08 | - | 20.42 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Northern Giant Petrel - Foraging | 42.83 | - | 0.54 | - | - | - | - | - |
| | Pygmy Blue Whale - Distribution* | 0.04 | 0.08 | 93.08 | 22.25 | 0.04 | 0.08 | 109.71 | 32.5 |
| | Pygmy Blue Whale - Foraging* | 0.04 | 0.08 | 93.08 | 22.25 | 0.04 | 0.08 | 109.71 | 32.5 |
| | Pygmy Blue Whale - Foraging annual high use area* | 0.04 | 0.08 | 93.08 | 22.25 | 0.04 | 0.08 | 109.71 | 32.5 |
| | Pygmy Blue Whale - Known Foraging Area | 3.17 | 24.54 | 31.42 | 0.25 | 2.00 | 8.33 | 30.5 | 0.08 |
| | Short-tailed Shearwater - Foraging | 0.79 | 2.00 | 93.08 | 20.29 | 0.92 | 3.21 | 104.92 | 11.04 |
| | Shy Albatross - Foraging* | 0.04 | 0.08 | 93.08 | 22.25 | 0.04 | 0.08 | 109.71 | 32.5 |
| | Sooty Shearwater - Foraging | 40.33 | - | 1.67 | - | 49.08 | - | 0.17 | - |
| | Southern Giant Petrel - Foraging | 42.83 | - | 0.54 | - | - | - | - | - |
| | Southern Right Whale - Aggregation | 0.5 | 0.96 | 84.17 | 2.96 | 0.46 | 1.00 | 96.63 | 2.25 |
| | Southern Right Whale - Connecting Habitat | 32.21 | - | 0.04 | - | - | - | - | - |
| | Southern Right Whale - Known Core Range* | 0.04 | 0.08 | 93.08 | 22.25 | 0.04 | 0.08 | 109.71 | 32.5 |
| | Wandering Albatross - Foraging* | 0.04 | 0.08 | 93.08 | 15.46 | 0.04 | 0.08 | 104.75 | 15.08 |
| | Wedge-tailed Shearwater - Foraging* | 0.04 | 0.08 | 93.08 | 22.25 | 0.04 | 0.08 | 109.71 | 32.5 |
| | White Shark - Breeding | 67.63 | - | 5.17 | - | 30.25 | - | 8.58 | - |
| | White Shark - Distribution* | 0.04 | 0.08 | 93.08 | 15.46 | 0.04 | 0.08 | 104.75 | 15.08 |
| | White Shark - Foraging | 1.54 | - | 84.17 | - | 3.88 | 21.5 | 96.63 | 0.21 |
| | White-capped Albatross - Foraging | 42.83 | - | 0.54 | - | - | - | - | - |
| | White-faced Storm-petrel - Breeding | 42.54 | - | 0.54 | - | 54.83 | - | 0.08 | - |
| | White-faced Storm-petrel - Foraging | 3.71 | 24.67 | 28.46 | 0.17 | 2.13 | 18.33 | 30.5 | 0.04 |
| | Wilsons Storm Petrel - Migration | 42.83 | - | 0.54 | - | - | - | - | - |
| IBRA | Bridgewater | 7.63 | - | 52.5 | - | 24.04 | - | 43.75 | - |
| | East Gippsland Lowlands | - | - | - | - | 48.71 | - | 0.33 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Flinders | 26.58 | - | 1.17 | - | 27.96 | - | 1.54 | - |
| | Gippsland Plain | 32.08 | - | 17.25 | - | 13.29 | - | 28.79 | - |
| | Glenelg Plain | 6.21 | - | 60.29 | - | 22.83 | - | 43.75 | - |
| | Otway Plain | 1.38 | 5.13 | 92.04 | 18.79 | 1.88 | 4.13 | 94.5 | 7.42 |
| | Otway Ranges | 0.83 | 4.67 | 68.67 | 6.63 | 1.92 | 4.58 | 102.29 | 7.42 |
| | Strzelecki Ranges | 39.21 | - | 10.92 | - | 24.71 | - | 12.54 | - |
| | Warrnambool Plain | 0.71 | 1.50 | 90.67 | 21 | 0.71 | 1.25 | 108.17 | 32.42 |
| | Wilsons Promontory | 26.75 | - | 32.54 | - | 15.04 | - | 40.13 | - |
| IMCRA | Batemans Shelf | 48.54 | - | 0.17 | - | 54.83 | - | 0.08 | - |
| | Central Bass Strait | 4.46 | 24.79 | 17.33 | 0.13 | 2.33 | 15.75 | 16.67 | 0.04 |
| | Central Victoria | 3.67 | 24.58 | 24.88 | 0.21 | 2.13 | 18.25 | 30.5 | 0.04 |
| | Flinders | 26.00 | - | 35.79 | - | 14.96 | - | 40.13 | - |
| | Otway* | 0.04 | 0.08 | 93.08 | 22.25 | 0.04 | 0.08 | 109.71 | 32.5 |
| | Twofold Shelf | 27.08 | - | 1.67 | - | 27.88 | - | 2.54 | - |
| | Victorian Embayments | 35.00 | - | 10.13 | - | 15.33 | - | 12.33 | - |
| KEF | Bonney Coast Upwelling | 2.92 | - | 84.17 | - | 7.79 | - | 55.04 | - |
| | Canyons on the Eastern Continental Slope | 42.83 | - | 0.46 | - | - | - | - | - |
| | Shelf rocky reefs | - | - | - | - | 54.88 | - | 0.04 | - |
| | Upwelling East of Eden | 36.50 | - | 1.67 | - | 36.79 | - | 1 | - |
| | West Tasmania Canyons | 18.58 | - | 4.88 | - | 11.04 | - | 2.67 | - |
| MNP | Bunurong | 38.42 | - | 4.96 | - | 20.71 | - | 7.08 | - |
| | Cape Howe | 73.25 | - | 0.04 | - | 48.67 | - | 0.71 | - |
| | Churchill Island | 51.38 | - | 2.58 | - | 24.92 | - | 12.33 | - |
| | Discovery Bay | 7.83 | - | 6.46 | - | 63.29 | - | 5.88 | - |
| | Point Addis | 24.29 | - | 10.75 | - | 12.17 | - | 23.17 | - |
| | Port Phillip Heads | 33.13 | - | 3.63 | - | 14.50 | - | 8.58 | - |
| | Twelve Apostles | 0.58 | 1.83 | 91.33 | 22.25 | 0.46 | 1.29 | 108.33 | 32.5 |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Wilsons Promontory | 26.88 | - | 35.79 | - | 15.04 | - | 40.13 | - |
| MP | Batemans | - | - | - | - | 55.08 | - | 0.04 | - |
| | Lower South East | 37.67 | - | 2.38 | - | 96.54 | - | 0.08 | - |
| MS | Mushroom Reef | 39.08 | - | 4.5 | - | 20.25 | - | 5.38 | - |
| NPS4 | Bunurong Marine Park | 39.71 | - | 8 | - | 21.79 | - | 9.92 | - |
| | Wilsons Promontory Marine Park | 38.79 | - | 18.04 | - | 20.79 | - | 33.58 | - |
| RAMSAR | Port Phillip Bay Western Shoreline and Bellarine Peninsula | 47.42 | - | 3.63 | - | 35.54 | - | 1.92 | - |
| | Western Port | 51.38 | - | 2.58 | - | 24.92 | - | 12.33 | - |
| RSB | Bravenes Rock | 2.21 | 11.33 | 56.96 | 0.96 | 1.13 | 13.96 | 89 | 0.63 |
| | Cody Bank | 35.17 | - | 4.5 | - | 15.42 | - | 2 | - |
| | Cutter Rock | 26.5 | - | 2.04 | - | 26.63 | - | 1.21 | - |
| | New Zealand Star Bank | 42.25 | - | 0.33 | - | 47.88 | - | 0.13 | - |
| Nearshore Waters | Anser Island | 36.29 | - | 16.63 | - | 15.08 | - | 37.42 | - |
| | Bass Coast | 39.58 | - | 8.5 | - | 21.25 | - | 10.04 | - |
| | Bega Valley | - | - | - | - | 49.17 | - | 0.33 | - |
| | Colac Otway | 1.21 | 5.13 | 92.04 | 18.79 | 1.88 | 4.13 | 94.5 | 7.46 |
| | Corangamite | 0.71 | 1.50 | 90.79 | 21 | 0.79 | 1.58 | 108.17 | 32.42 |
| | Curtis Island | 26.58 | - | 0.67 | - | 42.75 | - | 0.92 | - |
| | East Gippsland | - | - | - | - | 49.13 | - | 0.25 | - |
| | French Island | - | - | - | - | 100.25 | - | 0.25 | - |
| | Gabo Island | - | - | - | - | 48.83 | - | 0.25 | - |
| | Glenelg | 6.21 | - | 60.29 | - | 22.83 | - | 43.75 | - |
| | Glennie Group | 35.58 | - | 31.92 | - | 17.83 | - | 36.67 | - |
| | Grant | 26.38 | - | 0.33 | - | - | - | - | - |
| | Greater Geelong | 33.13 | - | 10.08 | - | 13.75 | - | 12.38 | - |
| | Hogan Island Group | 27.25 | - | 1.17 | - | 27.96 | - | 1.54 | - |
| | Kanowna Island | 28.92 | - | 16.63 | - | 15.04 | - | 37.04 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Lady Julia Percy Island | 5.17 | - | 38.88 | - | 15.54 | - | 38.25 | - |
| | Laurence Rocks | 6.92 | - | 60.58 | - | 21.46 | - | 33.67 | - |
| | Moncoeur Islands | 27 | - | 6.96 | - | 25.5 | - | 2.67 | - |
| | Mornington Peninsula | 32.08 | - | 7.25 | - | 13.29 | - | 9.38 | - |
| | Moyne | 0.75 | 1.88 | 57.5 | 8.04 | 0.79 | 1.25 | 95.04 | 5 |
| | Mud Island | 56.38 | - | 0.42 | - | 66.33 | - | 0.25 | - |
| | Norman Island | 38.42 | - | 27.25 | - | 20.75 | - | 36.25 | - |
| | Phillip Island | 34.67 | - | 14.88 | - | 19.25 | - | 20.42 | - |
| | Rodondo Island | 26.75 | - | 12.04 | - | 24.46 | - | 8.08 | - |
| | Seal Islands | - | - | - | - | 62.04 | - | 0.04 | - |
| | Shellback Island | 38.67 | - | 14.75 | - | 20.38 | - | 14.63 | - |
| | Skull Rock | 28.92 | - | 16.46 | - | 15.04 | - | 36.71 | - |
| | South Gippsland | 36.38 | - | 32.54 | - | 19.04 | - | 40.13 | - |
| | Surf Coast | 24.33 | - | 10.79 | - | 9.38 | - | 17.17 | - |
| | Warrnambool | 3.13 | 6.00 | 37.46 | 1.67 | 4.33 | 20.83 | 85.5 | 1.33 |
| State Waters | New South Wales | - | - | - | - | 48.79 | - | 0.25 | - |
| | South Australia State Waters | 25.38 | - | 2.46 | - | 96.42 | - | 0.17 | - |
| | Tasmania State Waters | 26.50 | - | 2.79 | - | 27.46 | - | 2.67 | - |
| | Victoria State Waters | 0.21 | 0.42 | 93.04 | 22.25 | 0.21 | 0.42 | 109.71 | 32.5 |
| Nearshore Waters (Sub-LGA) | Anglesea | 28.67 | - | 10.29 | - | 12.67 | - | 15.13 | - |
| | Apollo Bay | 3.25 | 31.71 | 33.71 | 0.71 | 2.00 | 34.04 | 22.71 | 0.04 |
| | Bay of Islands | 0.75 | 1.88 | 57.5 | 8.04 | 0.79 | 1.29 | 59.58 | 5 |
| | Bega Valley | - | - | - | - | 49.17 | - | 0.33 | - |
| | Cape Howe / Mallacoota | - | - | - | - | 49.13 | - | 0.25 | - |
| | Cape Liptrap - Northwest | 39.04 | - | 10.42 | - | 24.75 | - | 13.46 | - |
| | Cape Nelson | 6.21 | - | 60.29 | - | 22.83 | - | 43.75 | - |
| | Cape Otway West | 1.21 | 5.17 | 92.04 | 20.29 | 1.88 | 5.25 | 94.5 | 7.42 |
| | Cape Patton | 16.42 | - | 22.13 | - | 4.54 | - | 19.08 | - |

| Receptor | | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | | Minimum time before entrained hydrocarbon exposure (days) | | Maximum residence time for entrained hydrocarbon exposure (days) | |
| | | Low | High | Low | High | Low | High | Low | High |
| | Childers Cove | 3.00 | 5.67 | 38.21 | 2.75 | 0.83 | 3.83 | 38.63 | 1.79 |
| | Discovery Bay - East | 10.58 | - | 7.21 | - | 64.21 | - | 4.71 | - |
| | Discovery Bay - West | 21.75 | - | 2.88 | - | 69.42 | - | 5.54 | - |
| | French Island / Crib Point | - | - | - | - | 104.96 | - | 0.13 | - |
| | French Island / San Remo | 44.25 | - | 1.25 | - | 24.21 | - | 10.04 | - |
| | Kilcunda | 40.13 | - | 8.5 | - | 21.71 | - | 9.96 | - |
| | Lorne | 24.17 | - | 19.58 | - | 9.38 | - | 10.67 | - |
| | Moonlight Head | 0.79 | 2.92 | 82 | 21.67 | 0.88 | 1.58 | 108.17 | 32.42 |
| | Mornington Peninsula - South | 32.33 | - | 6.58 | - | 13.50 | - | 7.96 | - |
| | Mornington Peninsula - Southwest | 32.04 | - | 7.25 | - | 13.29 | - | 9.29 | - |
| | Port Campbell | 0.75 | 1.50 | 90.79 | 14.54 | 0.79 | 1.83 | 87 | 13.17 |
| | Port Fairy | 7.46 | - | 50.38 | - | 11.29 | 36.92 | 56.13 | 0.08 |
| | Port Phillip - Queenscliff | 33.13 | - | 10.08 | - | 14.58 | - | 12.38 | - |
| | Port Phillip - Sorrento Shore | 32.63 | - | 7.21 | - | 14.33 | - | 8.63 | - |
| | Port Phillip Heads | 41.04 | - | 3.29 | - | 15.33 | - | 3.71 | - |
| | Portland Bay - East | 8.50 | - | 38.58 | - | 22.96 | - | 51.75 | - |
| | Portland Bay - West | 16.46 | - | 53.33 | - | 30.79 | - | 40.5 | - |
| | Torquay | 29.50 | - | 9.88 | - | 12.79 | - | 17.17 | - |
| | Venus Bay | 39.58 | - | 8.5 | - | 21.25 | - | 9.92 | - |
| | Waratah Bay | 39.21 | - | 10.92 | - | 24.71 | - | 12.54 | - |
| | Warrnambool | 3.71 | 13.88 | 30.75 | 0.04 | 8.58 | 33.96 | 95.04 | 1.13 |
| | Westernport | 40.13 | - | 5.38 | - | 27.38 | - | 5.33 | - |
| | Wilsons Promontory - East | 47.04 | - | 15 | - | 25.50 | - | 31.71 | - |
| | Wilsons Promontory - West | 36.38 | - | 32.54 | - | 19.04 | - | 40.13 | - |

*The release location resides within the receptor boundaries.

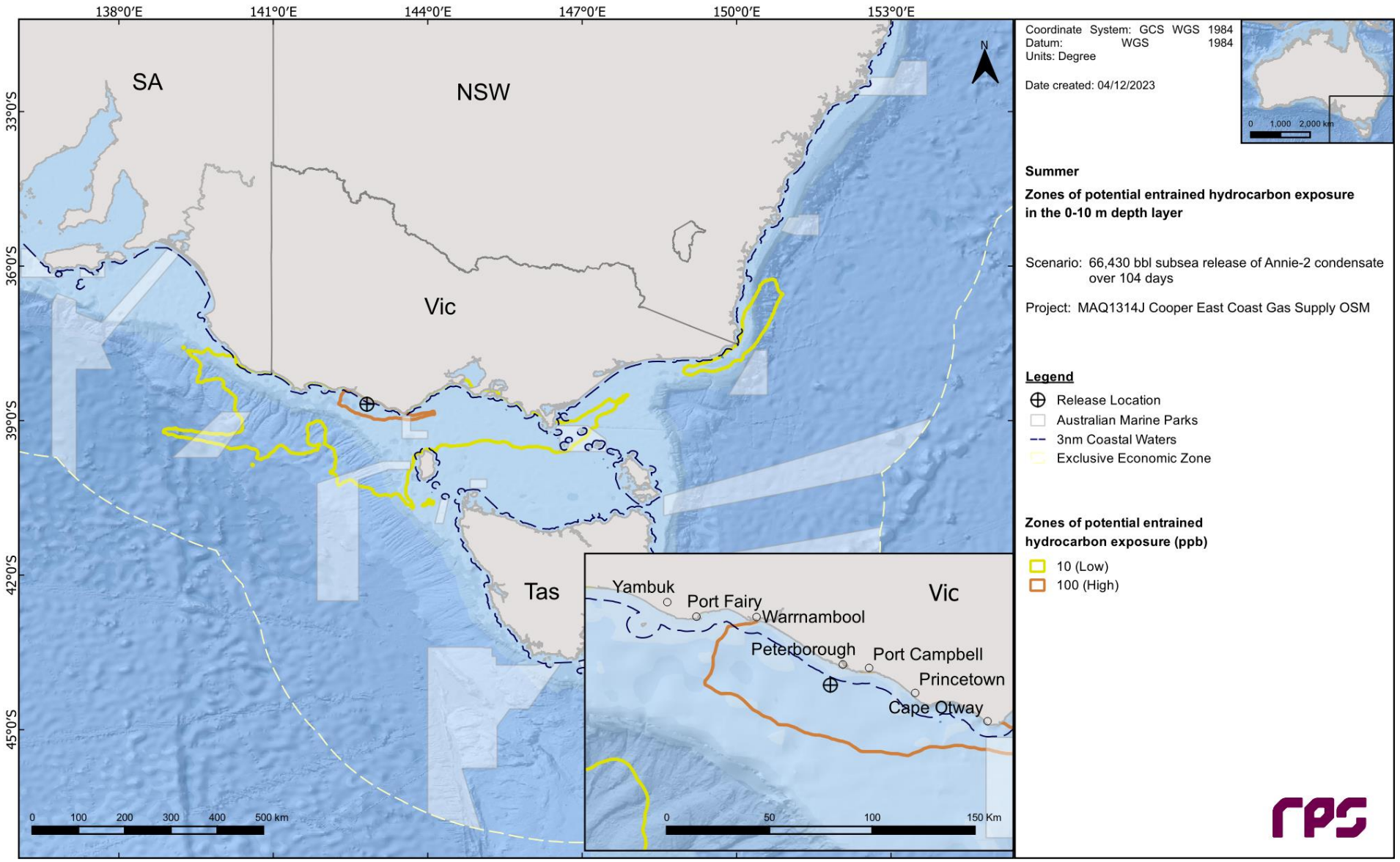



**Figure 13.13 Zones of potential entrained hydrocarbon exposure at 0-10 m below the sea surface in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

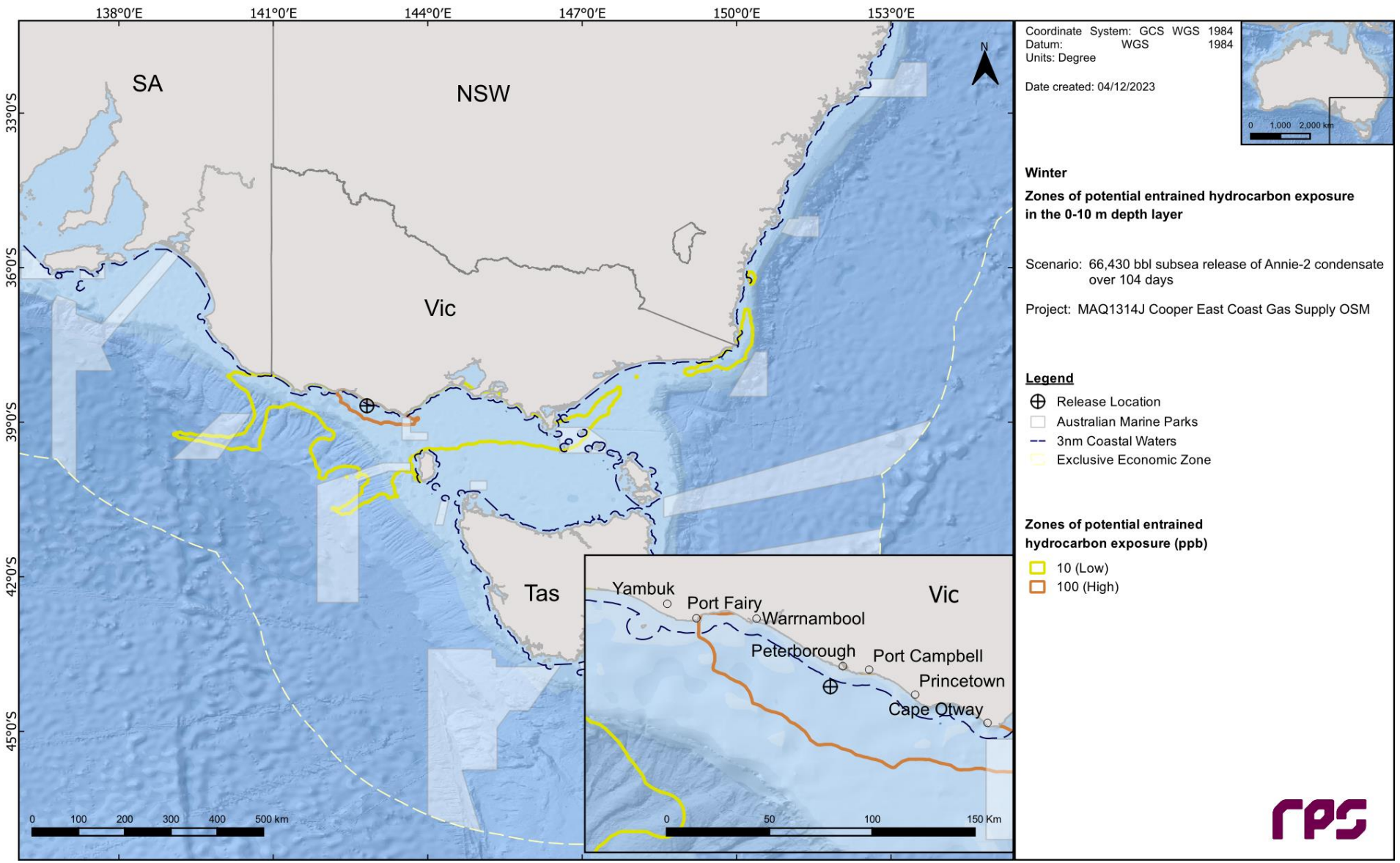



**Figure 13.14 Zones of potential entrained hydrocarbon exposure at 0-10 m below the sea surface in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

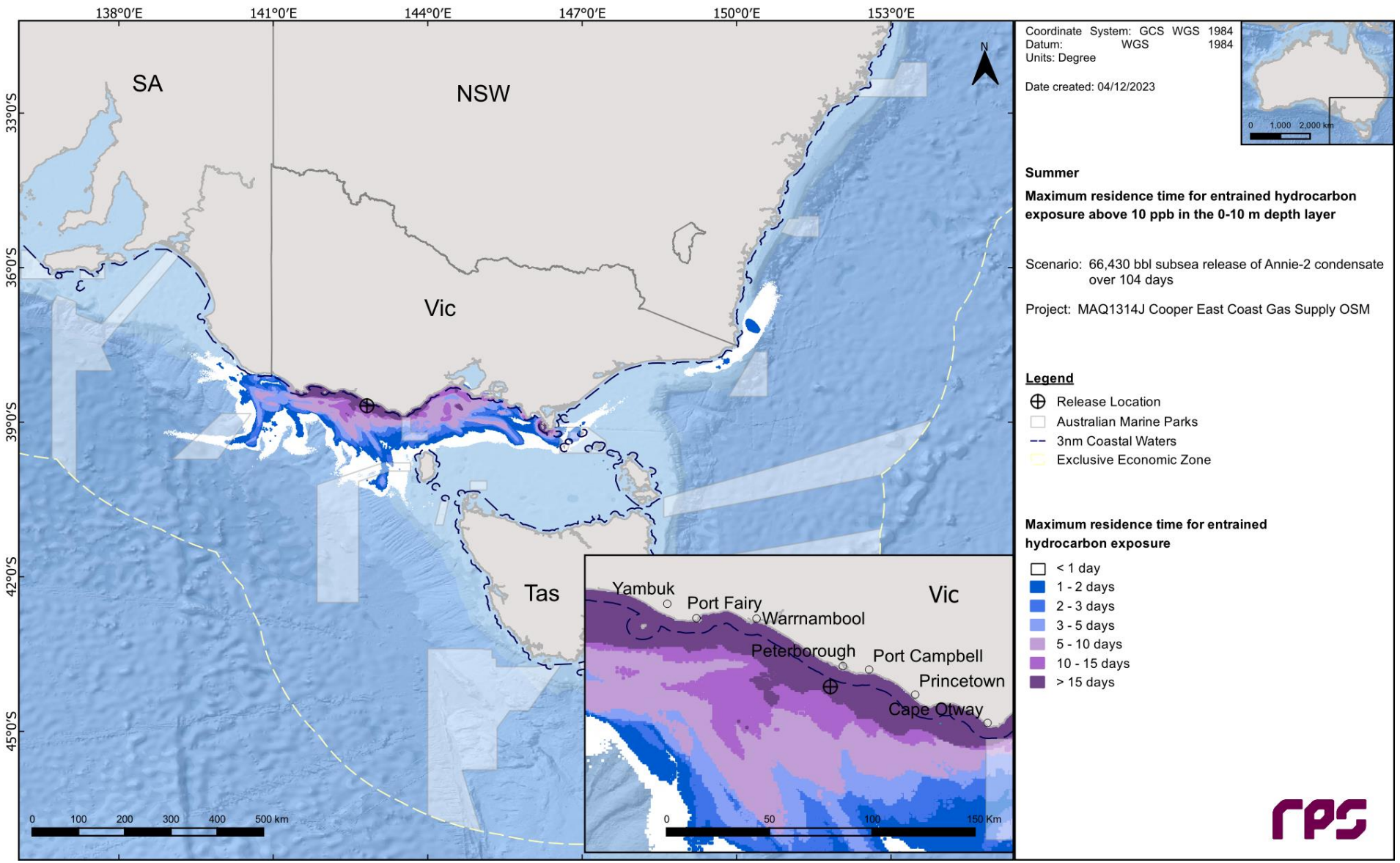



**Figure 13.15 Maximum residence time for entrained hydrocarbon exposure above 10 ppb, at 0-10 m below the sea in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

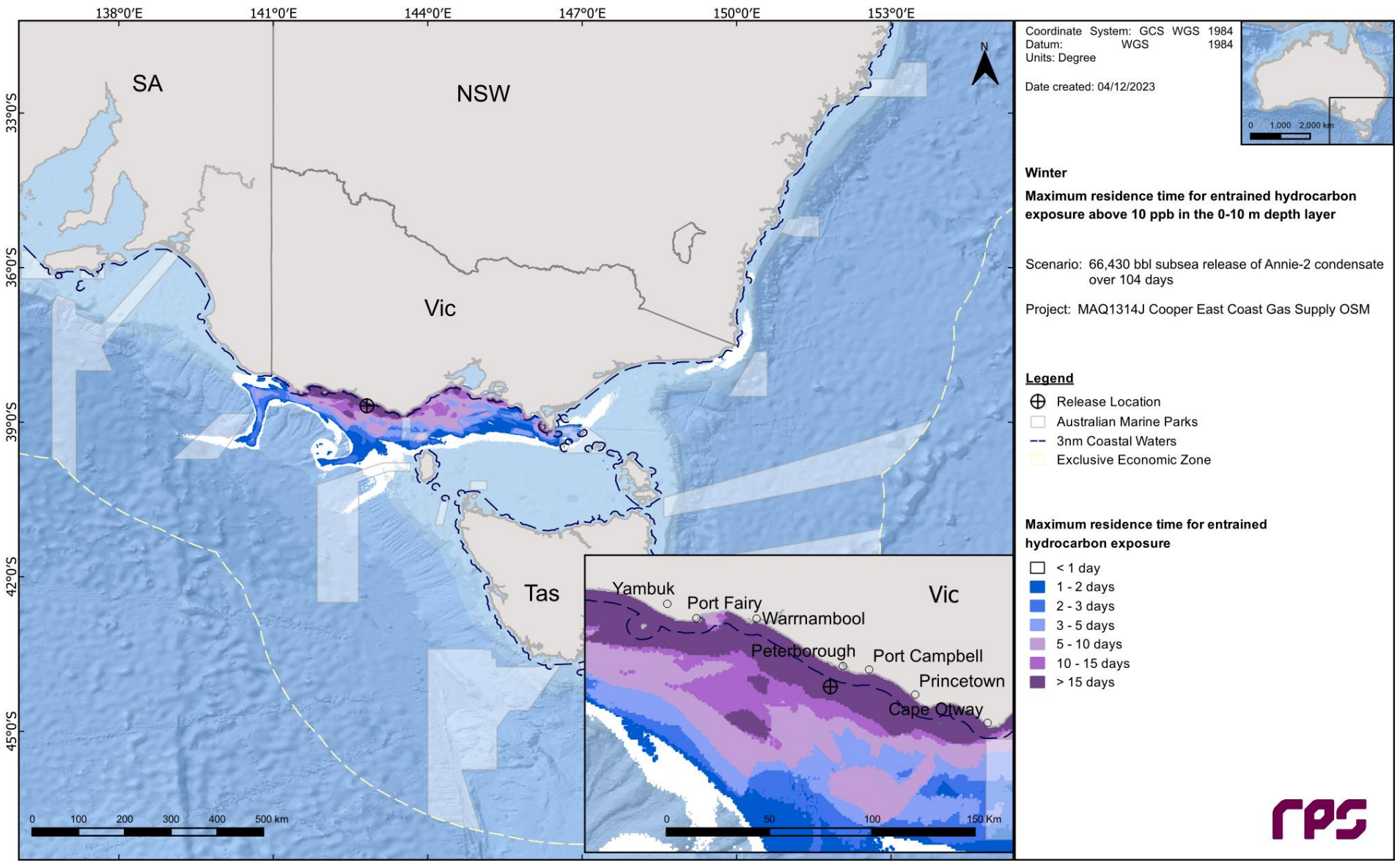



**Figure 13.16 Maximum residence time for entrained hydrocarbon exposure above 10 ppb, at 0-10 m below the sea in the event of a 66,430 bbl subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

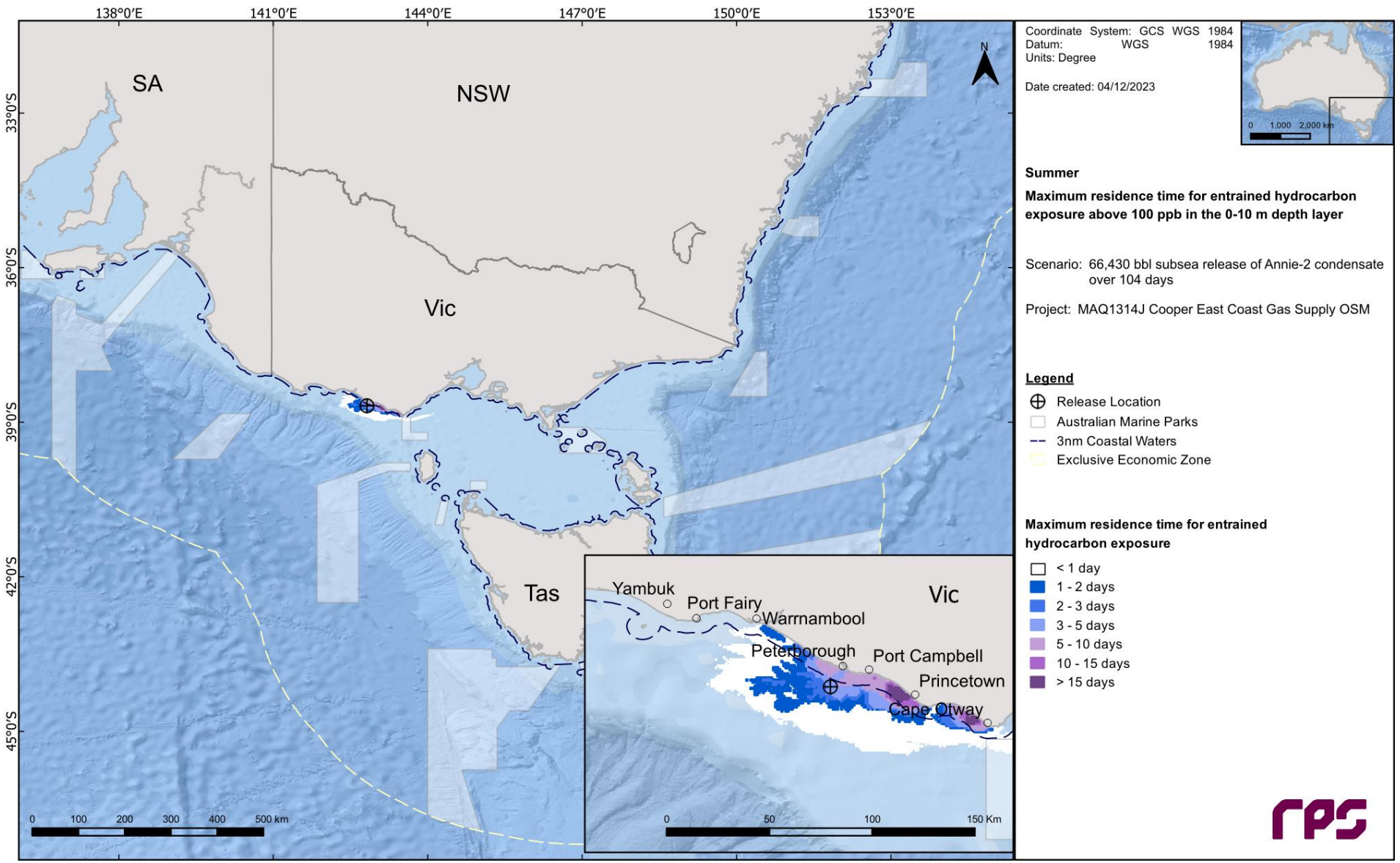



**Figure 13.17 Maximum residence time for entrained hydrocarbon exposure above 100 ppb, at 0-10 m below the sea in the event of a 66,430 bbl (10,562 m$^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during summer conditions.**

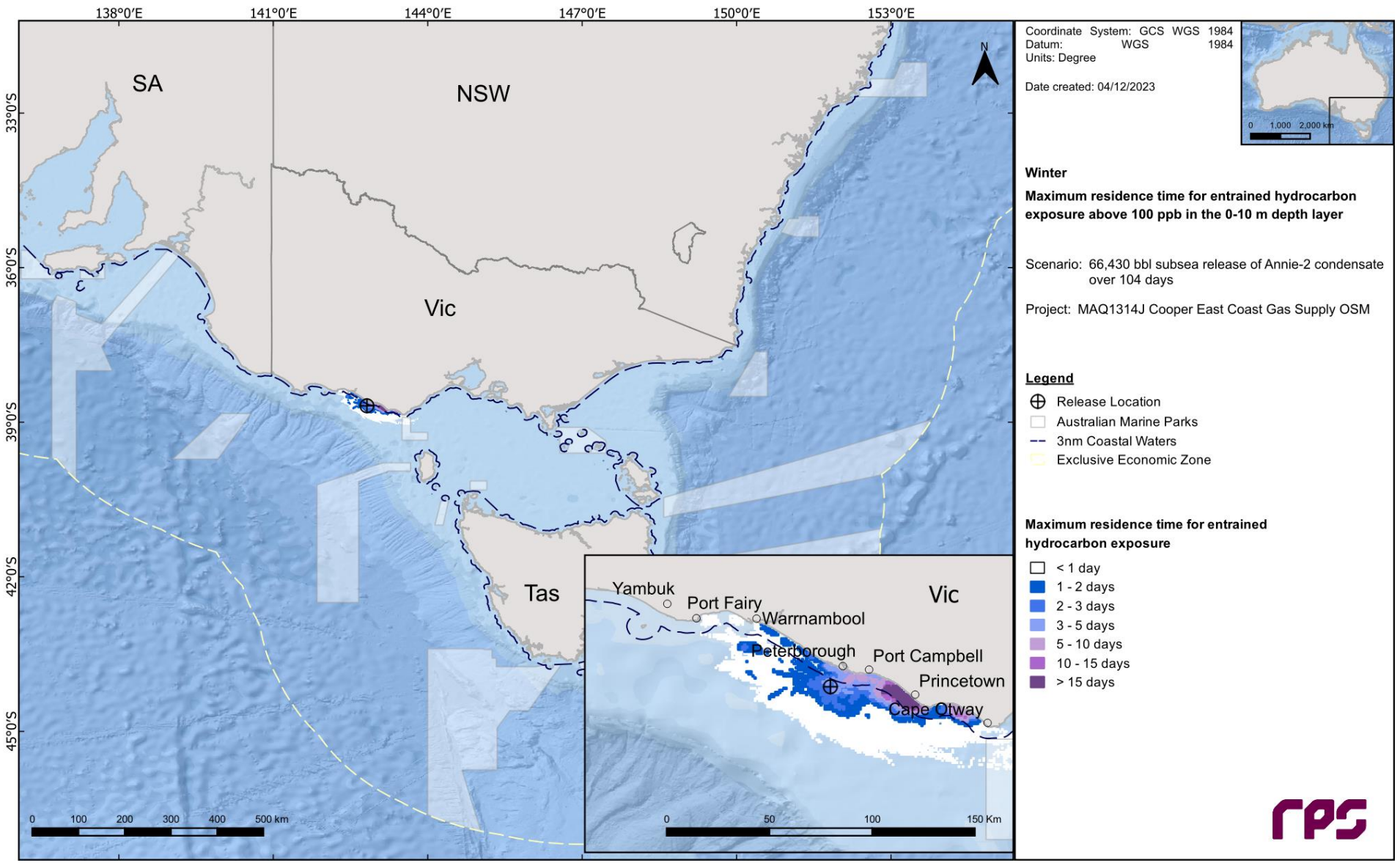



**Figure 13.18 Maximum residence time for entrained hydrocarbon exposure above 100 ppb, at 0-10 m below the sea in the event of a 66,430 bbl (10,562 m$^3$) subsurface release from a loss of well control at Annie-2 over 104 days. The results were calculated from 100 spill simulations during winter conditions.**

## 13.2 Deterministic Analysis

The stochastic modelling results were assessed, and the “worst case” deterministic runs were identified and are presented below for the following criteria:

a. Largest swept area for surface oil above 10 g/m$^2$;
b. Largest (total) volume of oil ashore;
c. Longest length of shoreline with oil accumulation above 100 g/m$^2$; and
d. Largest area of entrained hydrocarbon exposure above 100 ppb.
e. Largest area of dissolved hydrocarbon exposure above 50 ppb.

Note, no dissolved hydrocarbon concentrations above 50 ppb were predicted for this scenario.

Table 13.11 presents a summary of in-water exposure and shoreline accumulation at the assessed thresholds for the identified deterministic simulations.

**Table 13.11 Summary of the worst-case deterministic analysis based on the scenario presented in the stochastic analysis section.**

| Variable | Threshold | Deterministic Analysis Criteria | | | | |
|---|---|---|---|---|---|---|
| | | Largest swept area of floating oil >10 g/m² | Largest volume of oil ashore | Longest length of shoreline with accumulation >100 g/m² | Largest area of entrained hydrocarbon exposure >100 ppb | Largest area of dissolved hydrocarbon exposure >50 ppb |
| Season | | Winter | Winter | Winter | Winter | - |
| Run Number | | 61 | 88 | 88 | 77 | - |
| Total area of floating Oil exposure (km²) | 1 g/m² | 291.7 | 190.4 | 190.4 | 251.6 | - |
| | 10 g/m² | **4.9** | 0.8 | 0.8 | 0.8 | - |
| | 50 g/m² | - | - | - | - | - |
| Total length of shoreline accumulation (km) | 10 g/m² | 175 | 149 | 149 | 114 | - |
| | 100 g/m² | 25 | 56 | **56** | 40 | - |
| | 1,000 g/m² | - | 3 | 3 | 1 | - |
| Minimum time before accumulation on any shoreline (hours) | 10 g/m² | 272 | 101 | 101 | 102 | - |
| | 100 g/m² | 380 | 389 | 389 | 284 | - |
| | 1,000 g/m² | - | 2,020 | 2,020 | 2,100 | - |
| Total volume of oil ashore (m³) | | 125 | **263** | 263 | 154 | - |
| Total area of entrained hydrocarbon exposure (km²) | 10 ppb | 28,379 | 17,526 | 17,526 | 17,586 | - |
| | 100 ppb | 1,449 | 1,581 | 1,581 | **2,295** | - |
| Total area of dissolved hydrocarbon exposure (km²) | 10 ppb | 11 | 29 | 29 | 20 | - |
| | 50 ppb | - | - | - | - | - |
| | 400 ppb | - | - | - | - | - |
| Start Date | | 28th May 2011 | 3rd July 2010 | 3rd July 2010 | 14th May 2013 | - |

NC = No contact at, or above the specified shoreline accumulation threshold.

### 13.2.1 Deterministic Case: Largest swept area of floating oil above 10 g/m$^2$

The deterministic trajectory that resulted in the largest swept area of floating oil above 10 g/m$^2$ was identified during winter as run number 61, which started on 28th May 2011.

Figure 13.19 illustrates the floating oil exposure and shoreline accumulation over the 118-day simulation.

Figure 13.20 displays the time series of the area of sea surface exposure above the low (1 g/m$^2$), moderate (10 g/m$^2$) and high (50 g/m$^2$) thresholds over the 118-day simulation.

Figure 13.21 presents the fates and weathering graph for the corresponding single spill trajectory and Table 13.12 summarises the mass balance peaks and at the end of the simulation.

**Table 13.12 Summary of the mass balance for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 118 |
|---|---|---|---|
| Surface (m$^3$) | 194.4 | 3.8 | 0.0 |
| Entrained (m$^3$) | 1451.7 | 95.2 | 1131.7 |
| Dissolved (m$^3$) | 4.5 | 14.5 | 0.2 |
| Evaporation (m$^3$) | 5695.9 | 118.0 | 5695.9 |
| Decay (m$^3$) | 2402.3 | 118.0 | 2402.3 |
| Ashore (m$^3$) | 126.3 | 113.4 | 125.1 |

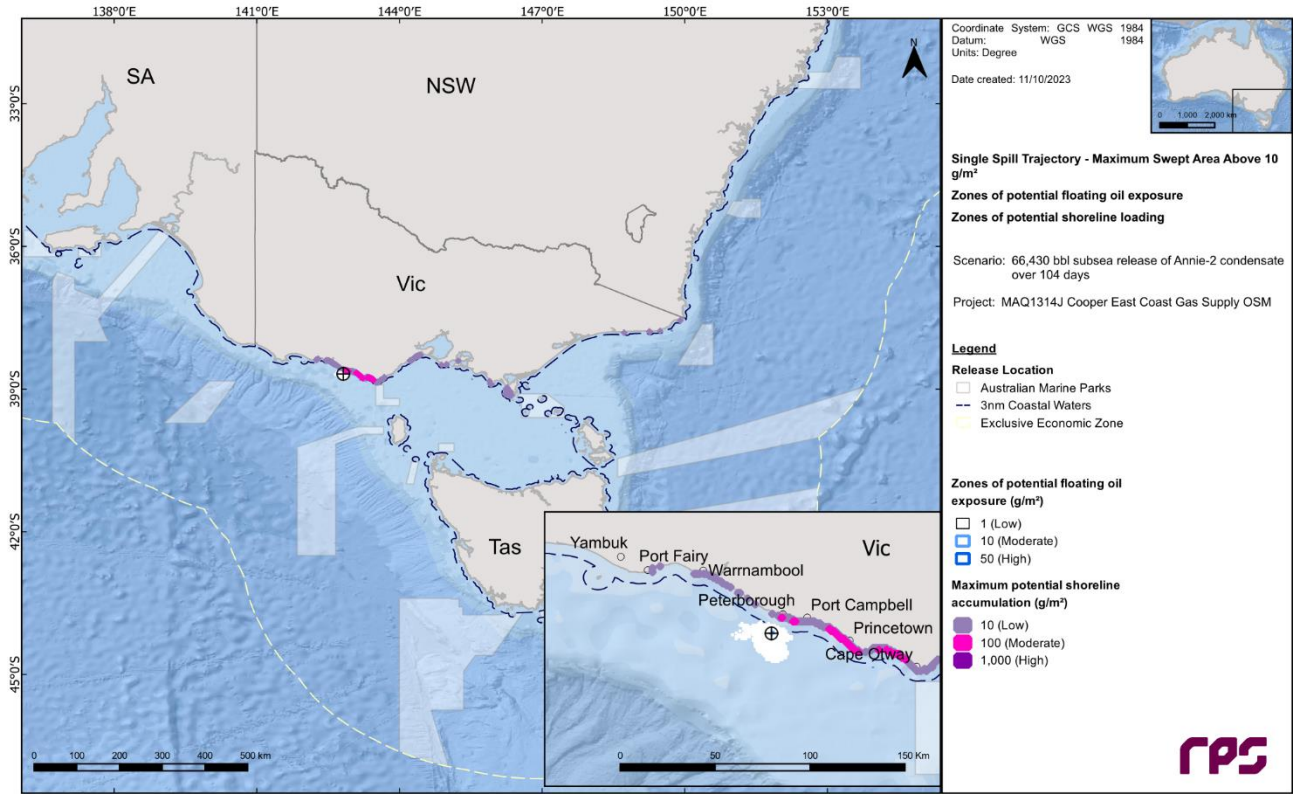



**Figure 13.19 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

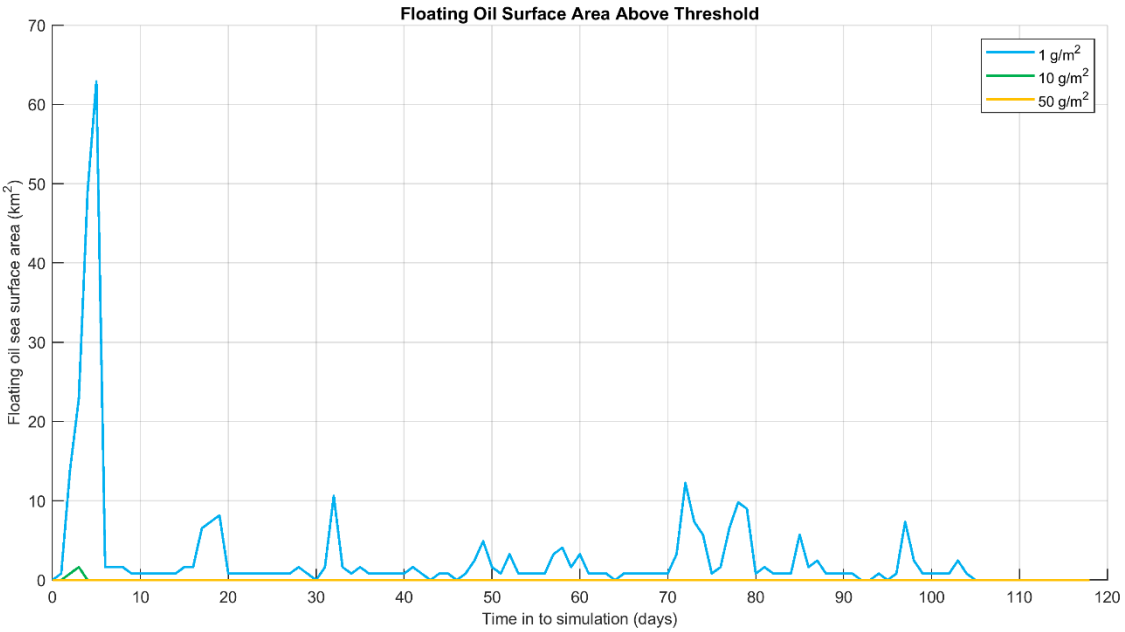



**Figure 13.20 Time series of the sea surface exposure above each threshold for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

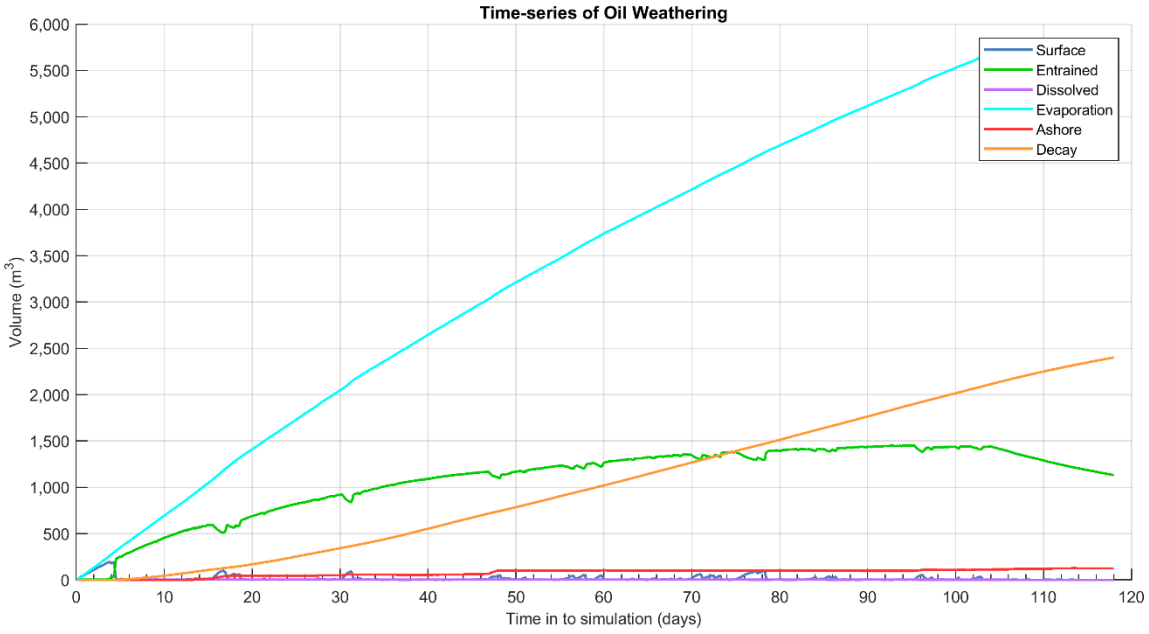



**Figure 13.21 Predicted weathering and fates graph for the trajectory with the largest swept area of floating oil above 10 g/m$^2$.**

## 13.2.2 Deterministic Case: Largest volume of oil ashore and longest length of shoreline with accumulation above 100 g/m$^2$

The deterministic trajectory that resulted in the largest volume of oil ashore and the longest length of shoreline with accumulation above 100 g/m$^2$ was identified during winter as run number 88, which started on 3rd July 2010.

Figure 13.22 illustrates the floating oil exposure and shoreline accumulation over the 118-day simulation.

Figure 13.23 displays the time series of the volume of oil accumulating on shorelines at the low (10 g/m$^2$), moderate (100 g/m$^2$) and high (1,000 g/m$^2$) thresholds over the 118-day simulation.

Figure 13.24 presents the fates and weathering graph for the corresponding single spill trajectory and Table 13.13summarises the mass balance peaks and at the end of the simulation.

**Table 13.13 Summary of the mass balance for the trajectory with the largest volume ashore and the longest length of shoreline with accumulation above 100 g/m$^2$.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 118 |
|---|---|---|---|
| Surface (m$^3$) | 137.4 | 5.2 | 0.3 |
| Entrained (m$^3$) | 1363.9 | 96.2 | 1057.9 |
| Dissolved (m$^3$) | 4.8 | 28.3 | 0.4 |
| Evaporation (m$^3$) | 5695.2 | 118.0 | 5695.2 |
| Decay (m$^3$) | 2338.5 | 118.0 | 2338.5 |
| Ashore (m$^3$) | 264.9 | 113.0 | 263.0 |

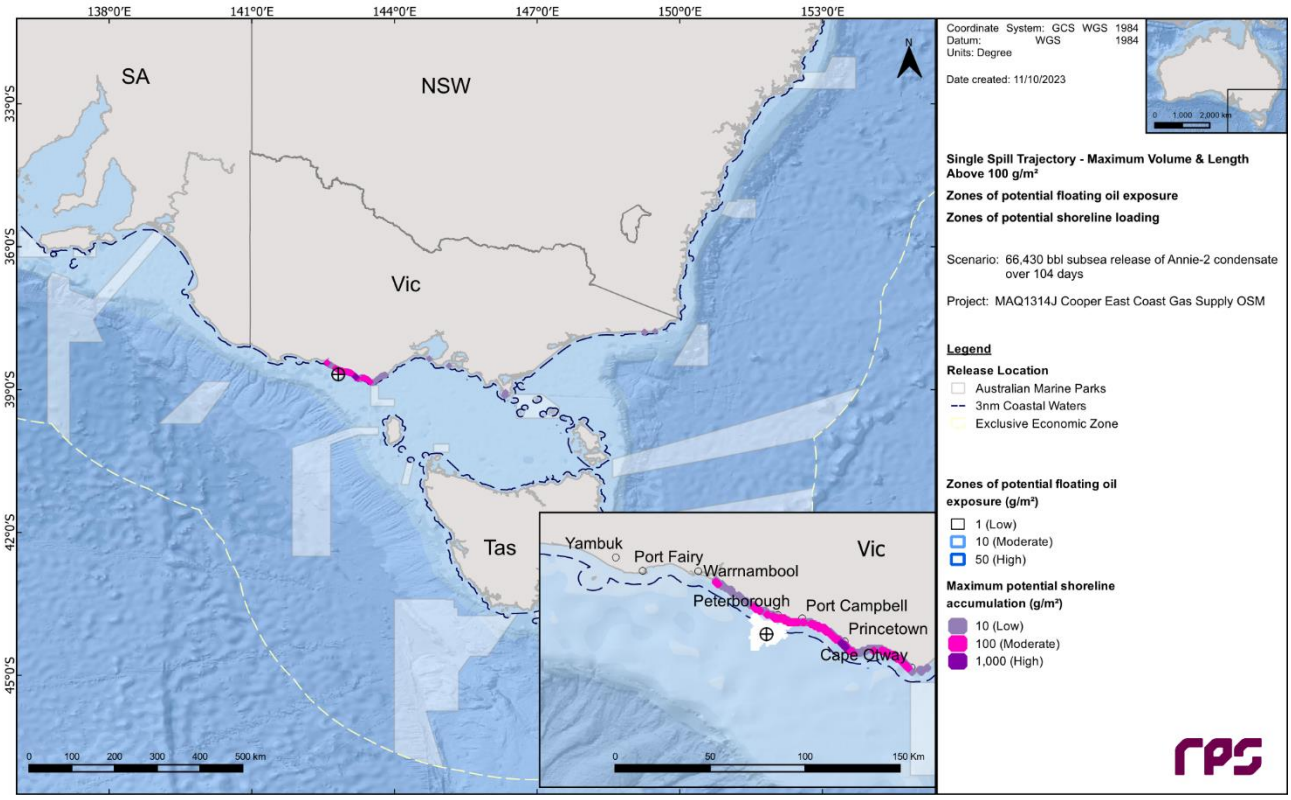



**Figure 13.22 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest volume ashore and the longest length of shoreline with accumulation above 100 g/m$^2$.**

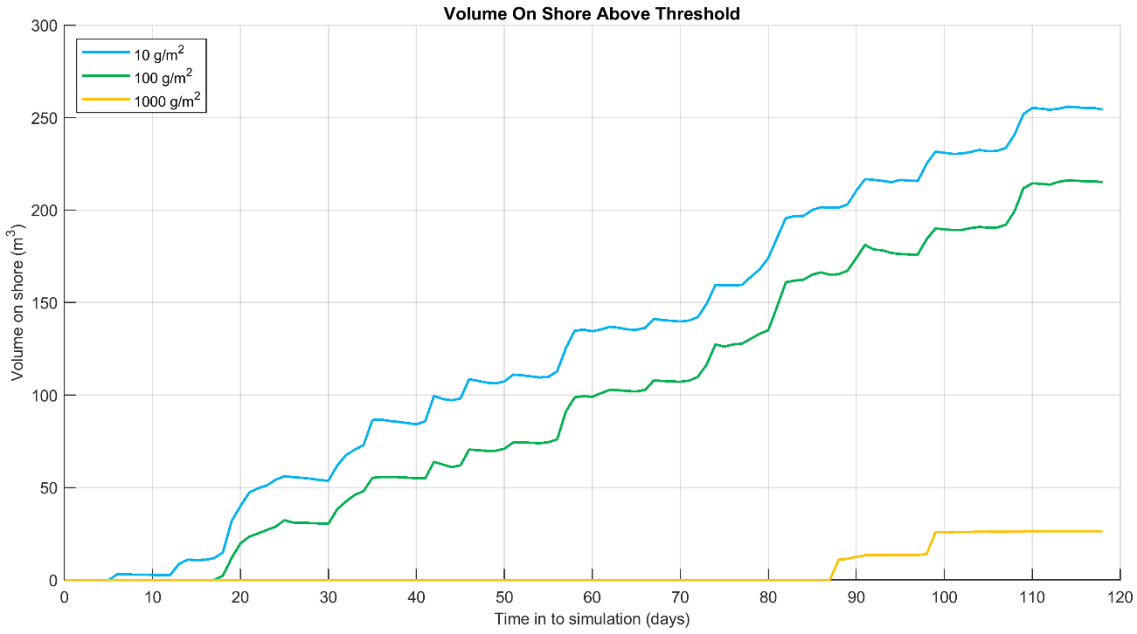



**Figure 13.23 Time series of oil accumulation on the shoreline above each threshold for the trajectory with the largest volume ashore and the longest length of shoreline with accumulation above 100 g/m$^2$.**

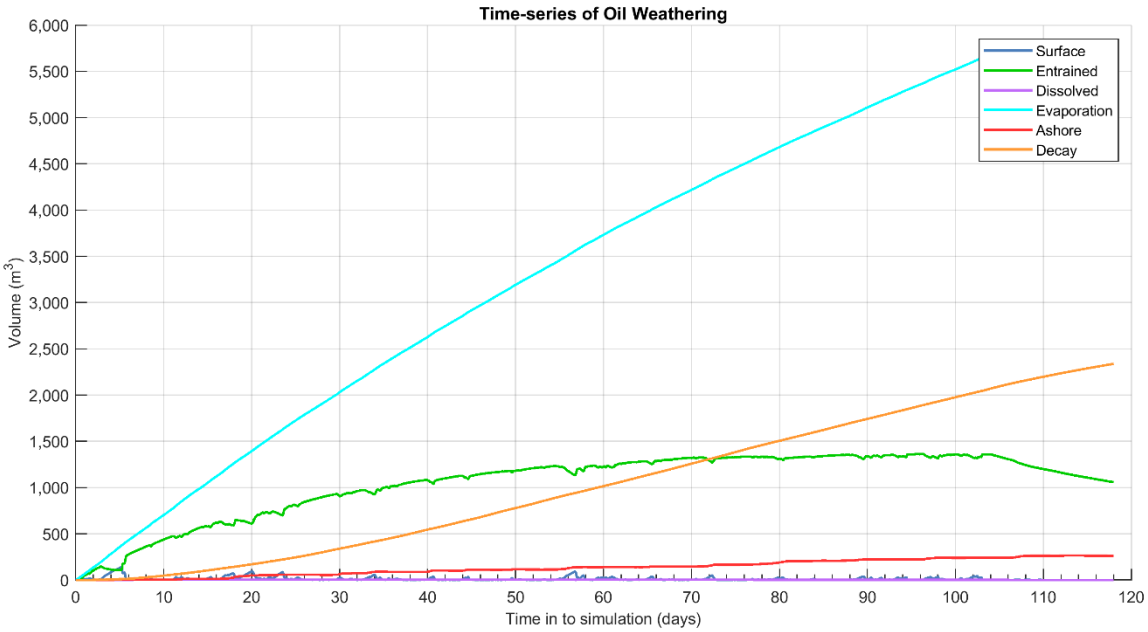



**Figure 13.24 Predicted weathering and fates graph for the trajectory with the largest volume ashore and the longest length of shoreline with accumulation above 100 g/m$^2$.**

### 13.2.3 Deterministic Case: Largest area of entrained hydrocarbon exposure above 100 ppb

The deterministic trajectory that resulted in the largest area of entrained hydrocarbon exposure above 100 ppb was identified during winter as run number 77, which started on 14th May 2014.

Figure 13.25 illustrates the zones of potential entrained hydrocarbon exposure over the 118-day simulation.

Figure 13.26 displays the time series of the area of entrained hydrocarbon exposure at the low (10 ppb) and high (100 ppb) thresholds over the 118-day simulation.

Figure 13.27 presents the fates and weathering graph for the corresponding single spill trajectory and Table 13.14 summarises the mass balance peaks and at the end of the simulation.

**Table 13.14 Summary of the mass balance for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 118 |
|---|---|---|---|
| Surface ($m^3$) | 169.6 | 21.9 | 0.1 |
| Entrained ($m^3$) | 1417.1 | 102.2 | 1120.2 |
| Dissolved ($m^3$) | 5.2 | 17.9 | 0.4 |
| Evaporation ($m^3$) | 5736.8 | 118.0 | 5736.8 |
| Decay ($m^3$) | 2344.2 | 118.0 | 2344.2 |
| Ashore ($m^3$) | 154.9 | 111.7 | 153.5 |

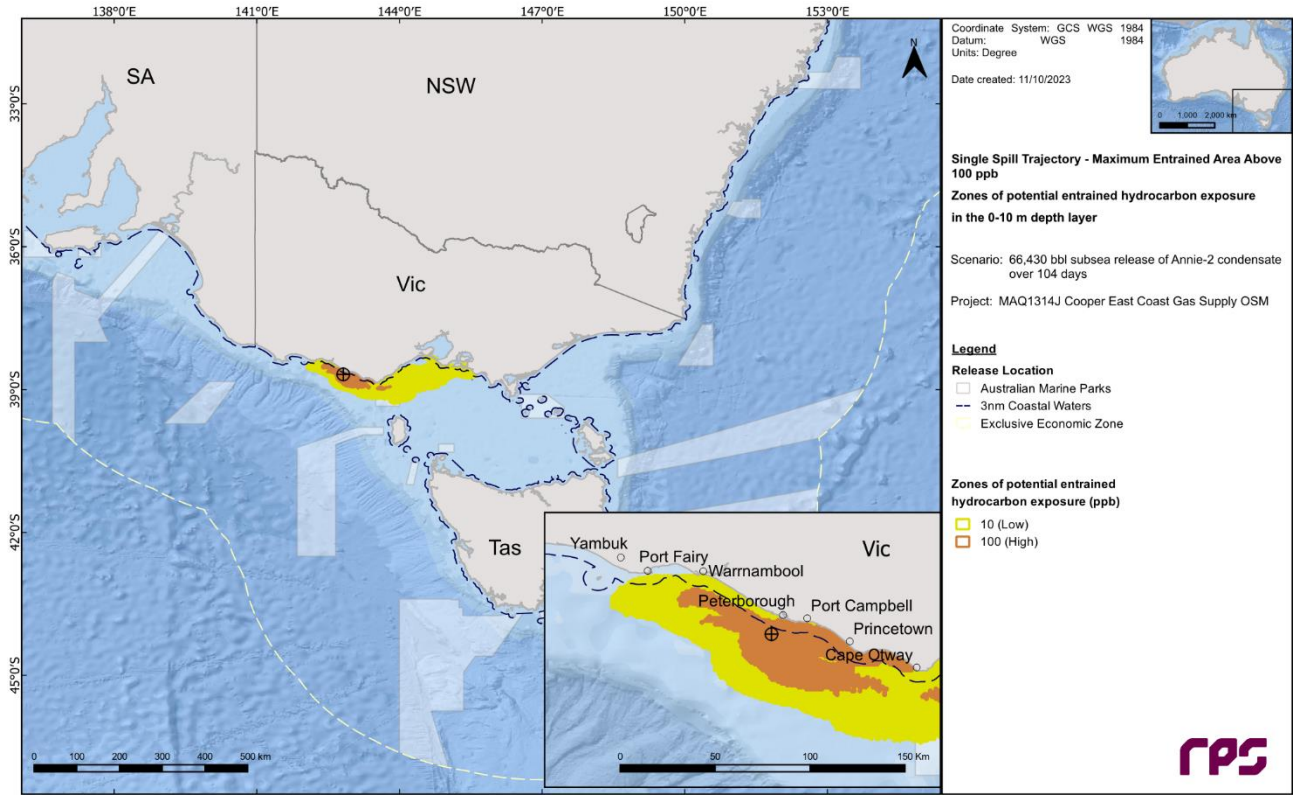



**Figure 13.25 Zones of potential entrained hydrocarbon exposure, for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

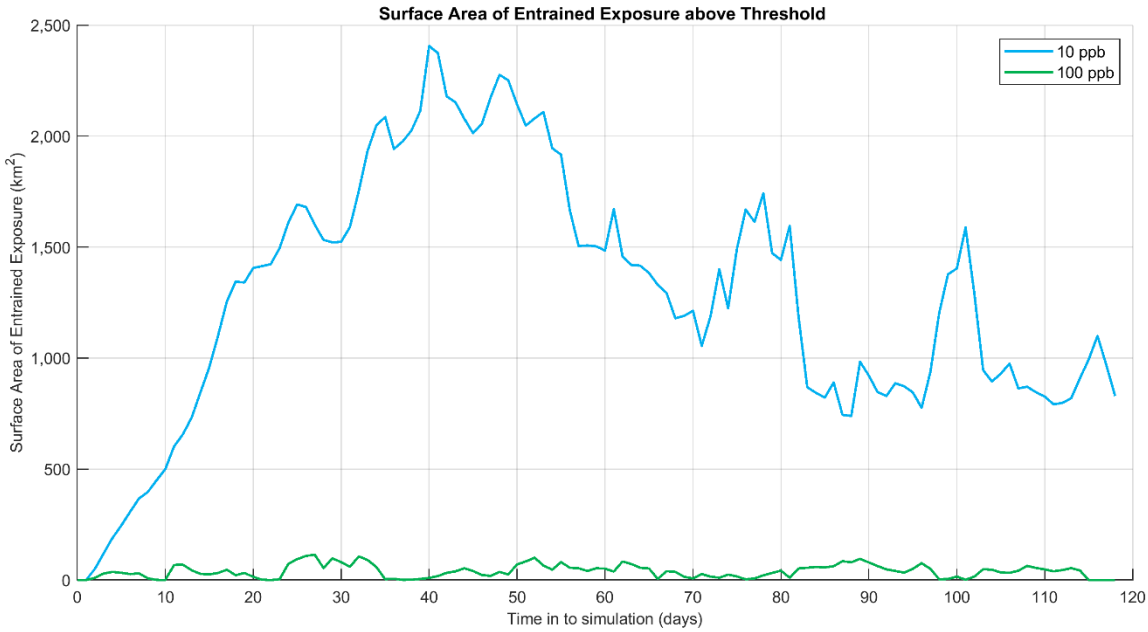



**Figure 13.26 Time series of the entrained hydrocarbon exposure area above each threshold for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

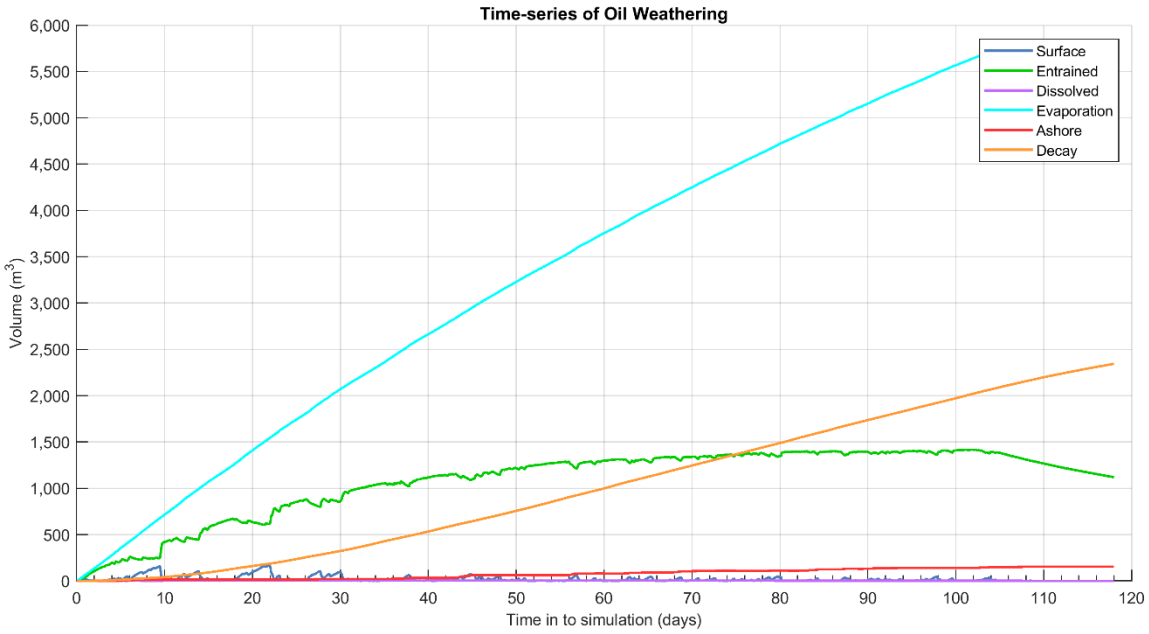



**Figure 13.27 Predicted weathering and fates graph for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb.**

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# ANNIE-2 – VESSEL COLLISION

## Oil Spill Modelling



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# TERMS AND ABBREVIATIONS

| | |
|---|---|
| AMP | Australian Marine Park |
| AMSA | Australian Maritime Safety Authority |
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| API | American Petroleum Institute gravity. A measure of how heavy or light a petroleum liquid is compared to water. |
| ARMCANZ | Agriculture and Resource Management Council of Australia and New Zealand |
| ASTM | American Society for Testing and Materials |
| BIA | Biologically Important Area |
| Bonn Agreement | An agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances, 1983, includes: Governments of the Kingdom of Belgium, the Kingdom of Denmark, the French Republic, the Federal Republic of Germany, the Republic of Ireland, the Kingdom of the Netherlands, the Kingdom of Norway, the Kingdom of Sweden, the United Kingdom of Great Britain and Northern Ireland and the European Union. |
| BP | Boiling point. The temperature at which the vapor pressure of the liquid is equal to the pressure exerted on it by the surrounding atmosphere |
| BTEX | Benzene, Toluene, Ethylbenzene, and Xylenes |
| CFSR | Climate Forecast System Reanalysis |
| Decay | The process where oil components are changed either chemically or biologically (biodegradation) to another compound. It includes breakdown to simpler organic carbon compounds by bacteria and other organisms, photo-oxidation by solar energy, and other chemical reactions. |
| Deterministic oil spill modelling | Oil spill modelling involving a computer simulation of a single hypothetical oil spill event subject to a single sequence of wind, current and other sea conditions over time. Single oil spill modelling, also referred to as "deterministic modelling" provides a simulation of one possible outcome of a given spill scenario, subject to the metocean conditions that are imposed. Single oil spill modelling is commonly used to consider the fate and effects of 'worst-case' oil spill scenarios that are carefully selected in consideration of the nature and scale of the offshore petroleum activity and the local environment (NOPSEMA, 2017). Because the outcomes of a single oil spill simulation can only represent the outcome of that scenario under one sequence of metocean conditions, worst-case conditions are often identified from stochastic modelling. It is impossible to calculate the likelihood of any outcome from a single oil spill simulation. Single oil spill modelling is generally used for response planning, preparedness planning and for supporting oil spill response operations in the event of an actual spill |
| Dynamic viscosity | The dynamic viscosity of a fluid expresses its resistance to shearing flows, where adjacent layers move parallel to each other with different speeds. |
| Floating oil exposure | Contact by floating oil on the sea surface at concentrations equal to or exceeding defined threshold concentrations. The consequence will vary depending on the threshold and the receptors |
| GODAE | Global Ocean Data Assimilation Experiment |
| HYCOM | Hybrid Coordinate Ocean Model. A data-assimilative, three-dimensional ocean model |
| HYDROMAP | Advanced ocean/coastal tidal model used to predict tidal water levels, current speed and current direction. |
| IMCRA | Integrated marine and coastal regionalisation areas |
| IOA | Index of Agreement |
| ITOPF | International Tanker Owners Pollution Federation Limited |
| KEF | Key Ecological Feature |
| LGA | Local Government Areas |
| MAE | Mean Absolute Error |
| MAHs | Monoaromatic Hydrocarbons |
| MDO | Marine diesel oil |
| MNP | Marine National Park |
| MP | Marine Park |

| | |
|---|---|
| MS | Marine Sanctuary |
| NASA | National Aeronautics and Space Administration (USA) |
| NCEP | National Centres for Environmental Prediction (USA) |
| NOAA | National Oceanic and Atmospheric Administration (USA) |
| NOPSEMA | National Offshore Petroleum Safety and Environmental Management Authority |
| NP | National Park |
| NR | Nature Reserve |
| PAH | Polynuclear Aromatic Hydrocarbons |
| Pour Point | The pour point of a liquid is the temperature below which the liquid loses its flow characteristics |
| ppb | Parts per billion (concentration) |
| psu | Practical salinity units |
| Ramsar site | A site listed under the Ramsar Convention on wetlands which is an international intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. |
| RSB | Reefs, Shoals and Banks |
| Shoreline accumulation | Arrival of oil at or near shorelines at on-water concentrations equal to or exceeding defined threshold concentrations. Shoreline contact is judged for floating oil arriving within a 2 km buffer zone from any shoreline as a conservative measure |
| SIMAP | Spill Impact Model Application Package. SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for surface or subsea releases |
| SRTM | Shuttle Radar Topography Mission |
| State Waters | Low water mark seaward for three nautical miles |
| STB | Standard Barrel |
| Stochastic oil spill modelling | Stochastic oil spill modelling is created by overlaying and statistically analysing the outcomes of many single oil-spill simulations of a defined spill scenario, where each simulation was subject to a different sequence of metocean conditions, selected objectively (typically by random selection) from a long sequence of historic conditions for the study area. Analysis of this larger set of simulations provides a more accurate indication of the area of hydrocarbon exposure and indicates which locations are more likely to be exposed (as well as other statistics). Stochastic oil spill modelling avoids biases that affect single oil spill modelling (due to the reliance on only one possible sequence of conditions). However, when interpreting stochastic modelling, which is based on a wide range of potential conditions that might happen to occur, it is essential to understand that calculations will encompass a much larger area than could be exposed in any single spill event, where a more limited set of conditions will occur. Consequently, it is misleading to imply that the region derived from stochastic modelling indicate the outcomes expected from a single spill event (NOPSEMA, 2017) Stochastic modelling is generally used for risk assessment and preparedness planning by indicating locations that could be exposed and may require response or subsequent impact assessment |
| Sub-LGA | Sub-Local Government Areas |
| TOPEX/Poseidon | A joint satellite mission between NASA and CNES to map ocean surface topography using an array of satellites equipped with detailed altimeters |
| US EPA | United States Environmental Protection Agency |
| US CG | United States Coast Guard |
| World Ocean Atlas | A collection of physicochemical parameters (e.g. temperature, salinity, oxygen, phosphate, silicate, and nitrate) based on profile data from the World Ocean Database (NCEI, 2021) established by NOAA's National Centers for Environmental Information (NCEI) |
| WGS 1984 | World Geodetic System 1984 (WGS84); reference coordinate system |

# EXECUTIVE SUMMARY

## Background

Cooper Energy (Cooper) plans to drill and operate the Annie-2 well in the Otway Basin (Figure 1.1).

In order to inform the offshore environmental impact and risk assessments Cooper commissioned RPS to conduct a detailed oil spill modelling study assessing a 250 $m^3$ surface release of marine diesel oil over 6 hours following a vessel collision.

The modelling assessment was undertaken on an annual basis.

The purpose of the modelling is to provide an understanding of a conservative 'outer envelope' of the potential area of exposure in the unlikely event of hydrocarbon spill. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill. Therefore, the modelling results represent the maximum extent of hydrocarbon exposure.

The spill modelling was performed using an advanced three-dimensional trajectory and fates model; Spill Impact Model Application 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.

## Methodology

The modelling study was carried out in several stages. Firstly, a ten-year wind and current dataset (2010–2019) was generated and the currents included the combined influence of three-dimensional large-scale ocean currents and tidal currents. Secondly, the currents, winds and detailed hydrocarbon characteristics were used as inputs in the three-dimensional oil spill model (SIMAP) to simulate the drift, spread, weathering and fate of the spilled oil.

As spills can occur during any set of wind and current conditions, modelling was conducted using a stochastic (random or non-deterministic) approach, which involved running 100 randomly selected single trajectory simulations per scenario, with each simulation having the same spill information (location, spill volume, duration and composition of hydrocarbons) but varying start times. This ensured that each spill simulation was subject to a unique set of wind and current conditions

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*".

## Oil Properties

The marine diesel oil (MDO) used for the scenario has an API of 24 and a density of 890 kg/$m^3$ (at 25 ºC) with a viscosity value (14.0 cP at 25 ºC) classifying it as a Group II (light-persistent) oil according to the International Tankers Owners Pollution Federation (ITOPF, 2014) and US EPA/USCG classifications.

The MDO is a mixture of volatile and persistent hydrocarbons with high proportions of semi- and low-volatile components. In favourable evaporation conditions, about 4.0% of the oil mass should evaporate within the first 12 hours (BP < 180°C), a further 32% should evaporate within the first 24 hours (180°C < BP < 265°C) and a further 54% should evaporate over several days (265°C < BP < 380°C). Approximately 10% of the oil is shown to be persistent.

# Results

## Scenario: 250 m³ loss of containment from a vessel collision

- The maximum distance from the release location to the low (1–10 g/m$^2$), moderate (10–50 g/m$^2$) and high (> 50 g/m$^2$) floating oil exposure zones was 32.5 km (west), 10.3 km (west) and 2.8 km (east-southeast), respectively.
- The probability of accumulation to any shoreline at, or above, the low (10 g/m$^2$) threshold was 60%. The minimum time before oil accumulation at, or above, the low threshold was 22 hours whilst the maximum total volume ashore for a single spill trajectory was 43.2 m$^3$, and the maximum length of shoreline with accumulation above the low, moderate and high thresholds were 32 km, 11 km and 1 km, respectively.
- Excluding the 13 BIAs that the release location resides within, the highest probability of low dissolved hydrocarbon exposure ranged between 1% (Short-tailed Shearwater - Foraging) and 2% (Southern Right Whale - Aggregation).
- The highest probability of low entrained hydrocarbon exposure was recorded for the Twelve Apostles MNP (65%) and Short-tailed Shearwater – Foraging BIA (64%). Additional receptors including LGAs, sub-LGAs, and AMPs were predicted with entrained hydrocarbon exposure.

# 1 INTRODUCTION

## 1.1 Background

Cooper Energy (Cooper) plans to drill and operate the Annie-2 well in the Otway Basin (Figure 1.1).

In order to inform the offshore environmental impact and risk assessments Cooper commissioned RPS to conduct a detailed oil spill modelling study assessing a 250 $m^3$ surface release of marine diesel oil over 6 hours following a vessel collision.

The modelling assessment was undertaken on an annual basis.

The purpose of the modelling is to provide an understanding of a conservative 'outer envelope' of the potential area of exposure in the unlikely event of hydrocarbon spill. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill. Therefore, the modelling results represent the maximum extent of hydrocarbon exposure.

The spill modelling was performed using an advanced three-dimensional trajectory and fates model; Spill Impact Model Application 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.

Note that the oil spill model, the method and analysis presented herein uses modelling algorithms which have been anonymously peer reviewed and published in international journals. Furthermore, RPS warrants that this work meets and exceeds the American Society for Testing and Materials (ASTM) Standard F2067-13 "*Standard Practice for Development and Use of Oil Spill Models*".

**Table 1-1 Coordinates of the release location.**

| Infrastructure | Latitude | Longitude | Water Depth (m) |
|---|---|---|---|
| Annie-2 | 38.68375° S | 142.82456° E | 36 |

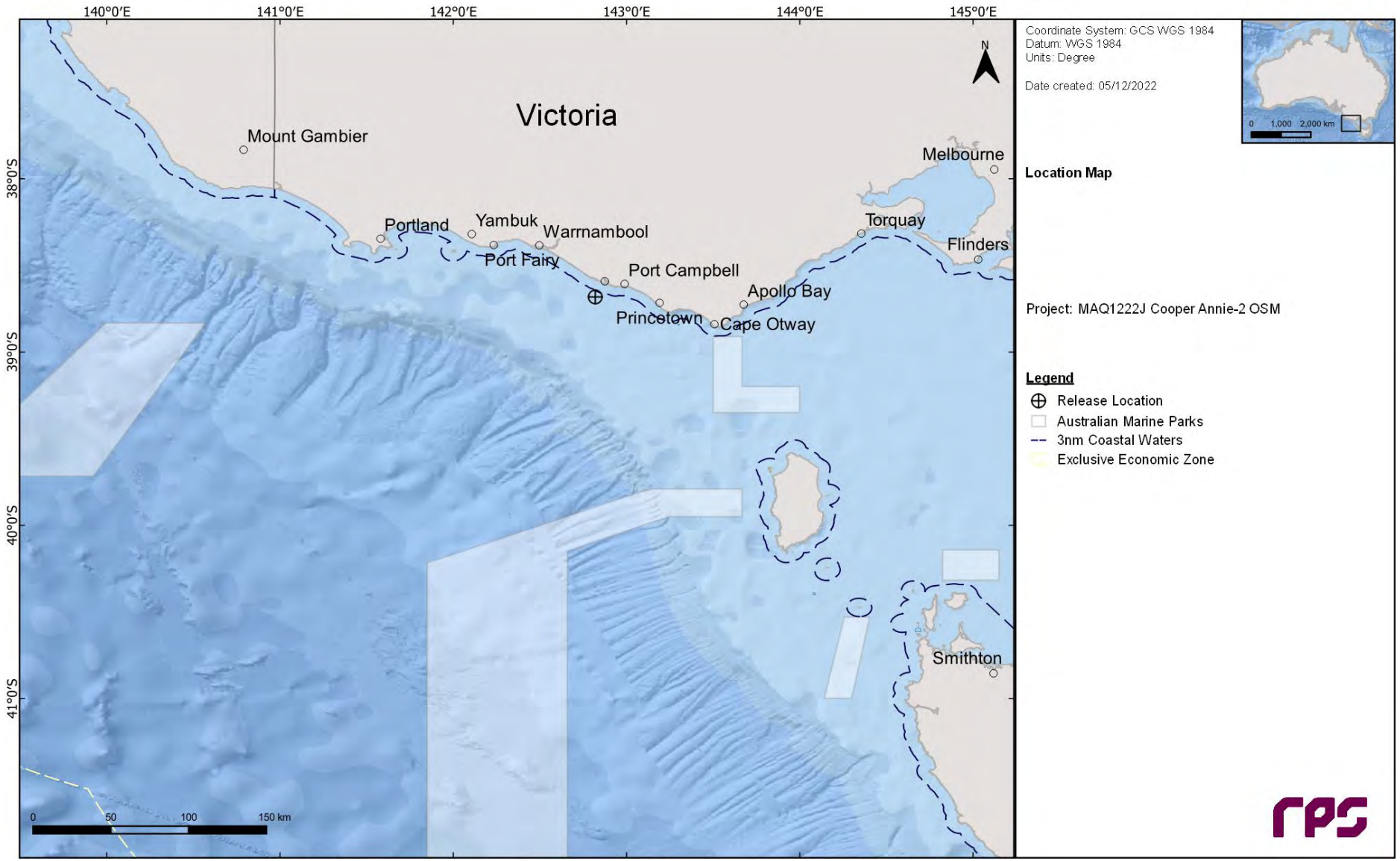



**Figure 1.1 Map of the Annie-2 release location.**

## 1.2 What is Oil Spill Modelling?

Oil spill modelling is a valuable tool widely used for risk assessment, emergency response and contingency planning where it can be particularly helpful to proponents and decision makers. By modelling a series of the most likely oil spill scenarios, decisions concerning suitable response measures and strategic locations for deploying equipment and materials can be made, and the locations at most risk can be identified. The two types of oil spill modelling often used are stochastic (Section 1.2.1) and deterministic (Section 1.2.2) modelling.

### 1.2.1 Stochastic Modelling (Multiple Spill Simulations)

Stochastic oil spill modelling is created by overlaying a great number (often hundreds) of individual, computer-simulated hypothetical spills (NOPSEMA, 2018; Figure 1.2).

Stochastic modelling is a common means of assessing the potential risks from oil spills related to new projects and facilities. Stochastic modelling typically utilises hydrodynamic data for the location in combination with historic wind data. Typically, 100 iterations of the model will be run utilising the data that is most relevant to the season or timing of the project.

The outcomes are often presented as a probability of exposure and is primarily used for risk assessment purposes in view to understand the range of environments that may be affected or impacted by a spill. Elements of the stochastic modelling can also be used in oil spill preparedness and planning.

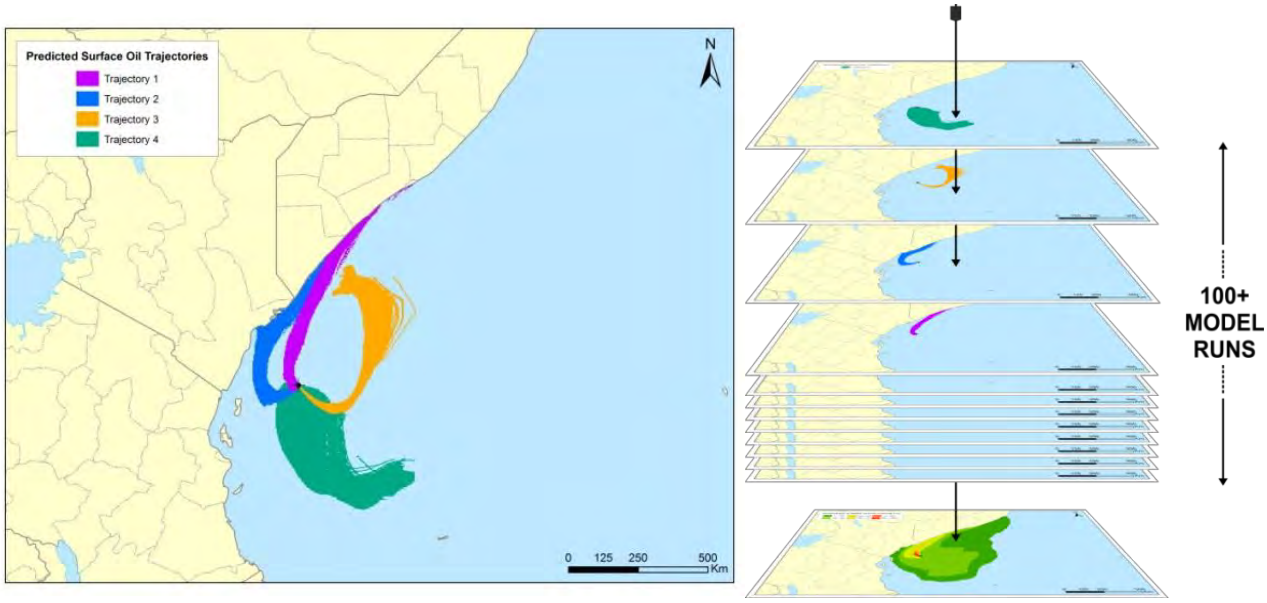



**Figure 1.2 Examples of four individual spill trajectories (four replicate simulations) predicted by SIMAP for a spill scenario. The frequency of contact with given locations is used to calculate the probability of impacts during a spill. Essentially, all model runs are overlain (shown as the stacked runs on the right) and the number of times that trajectories contact a given location at a concentration is used to calculate the probability.**

### 1.2.2 Deterministic Modelling (Single Spill Simulation)

Deterministic modelling is the predictive modelling of a single incident subject to a single sample of wind and weather conditions over time (NOPSEMA, 2018; Figure 1.3).

Deterministic modelling is often paired with stochastic modelling to place the large stochastic footprint into perspective. This deterministic analysis is generally a single run selected from the stochastic analysis and serves as the basis for developing the plans and equipment needs for a realistic spill response. Deterministic spills can be selected on several basis such as minimum time to shoreline, largest swept area, maximum volume ashore, longest length of shoreline contacted by oil or largest area of entrained or dissolved hydrocarbons.

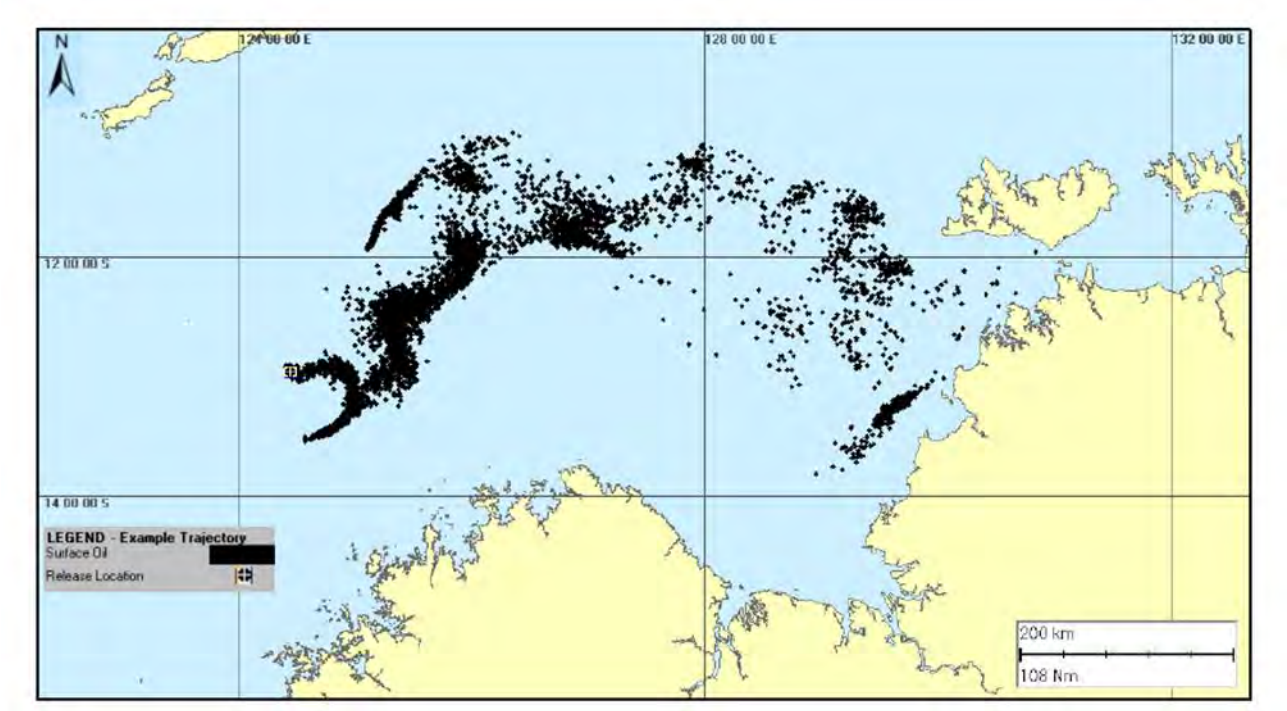



**Figure 1.3 Example of an individual spill trajectory predicted by SIMAP for a spill scenario. Note, this image represents surface oil as spillets and do not take any thresholds into consideration.**

# 2 SCOPE OF WORK

The scope of work included the following components:

- Generate 10 years of winds and three-dimensional currents from 2010 to 2019 (inclusive). The currents included the combined influence of tidal and ocean currents.
- Include the wind and current data and characteristics of the MDO as input into the three-dimensional oil spill model (SIMAP), to model the movement, spreading, weathering and shoreline contact by hydrocarbons over time.
- Use SIMAP's stochastic model (also known as a probability model) to calculate exposure to surround waters and shorelines. This involved running 100 randomly selected single trajectory simulations for the scenario, with each simulation having the same spill information (spill volume, duration and composition of hydrocarbons) but varying start times. This ensured that each spill simulation was subject to a unique set of wind and current conditions.
- Results were assessed to determine the exposure to surrounding waters and contact to shorelines based upon the thresholds outlined in the NOPSEMA Oil Spill Modelling Bulletin (NOPSEMA 2019).
- The stochastic modelling results were reviewed, and the "worst case" deterministic runs were identified and presented based on the following criteria (if applicable):
    a. Largest swept area for surface oil above 10 g/m$^2$
    b. Largest swept area for surface oil above 50 g/m$^2$
    c. Largest volume of oil ashore
    d. Longest length of shoreline with oil accumulation above 100 g/m$^2$
    e. Largest area of entrained hydrocarbon exposure above 100 ppb
    f. Largest area of dissolved hydrocarbon exposure above 50 ppb

# 3 REGIONAL CURRENTS

Bass Strait is a body of water separating Tasmania from the southern Australian mainland, specifically the state of Victoria. The strait is a relatively shallow area of the continental shelf, connecting the southeast Indian Ocean with the Tasman Sea. Currents within the straight are primarily driven by tides, winds, incident continental shelf waves and density driven flows; high winds and strong tidal currents are frequent within the area (Jones, 1980).

The varied geography and bathymetry of the region, in addition to the forcing of the south-eastern Indian Ocean and local meteorology lead to complex shelf and slope circulation patterns (Middleton & Bye, 2007). Figure 3.1 displays seasonal current trends within the Bass Strait. During winter there is a strong eastward water flow due to the strengthening of the South Australian Current (fed by the Leeuwin Current in the Northwest Shelf), which bifurcates with one extension moving though the Bass Strait, and another forming the Zeehan Current off western Tasmania (Sandery & Kämpf, 2007). During summer, water flow reverses off Tasmania, King Island and the Otway Basin travelling eastward, as the coastal current develops due to south-easterly winds.

To accurately describe the variability in currents between the inshore and offshore region, a hybrid regional dataset was developed by combining deep ocean predictions obtained from HYCOM (Hybrid Coordinate Ocean Model) with surface tidal currents developed by RPS. The following sections provide a summary of the hybrid regional dataset.

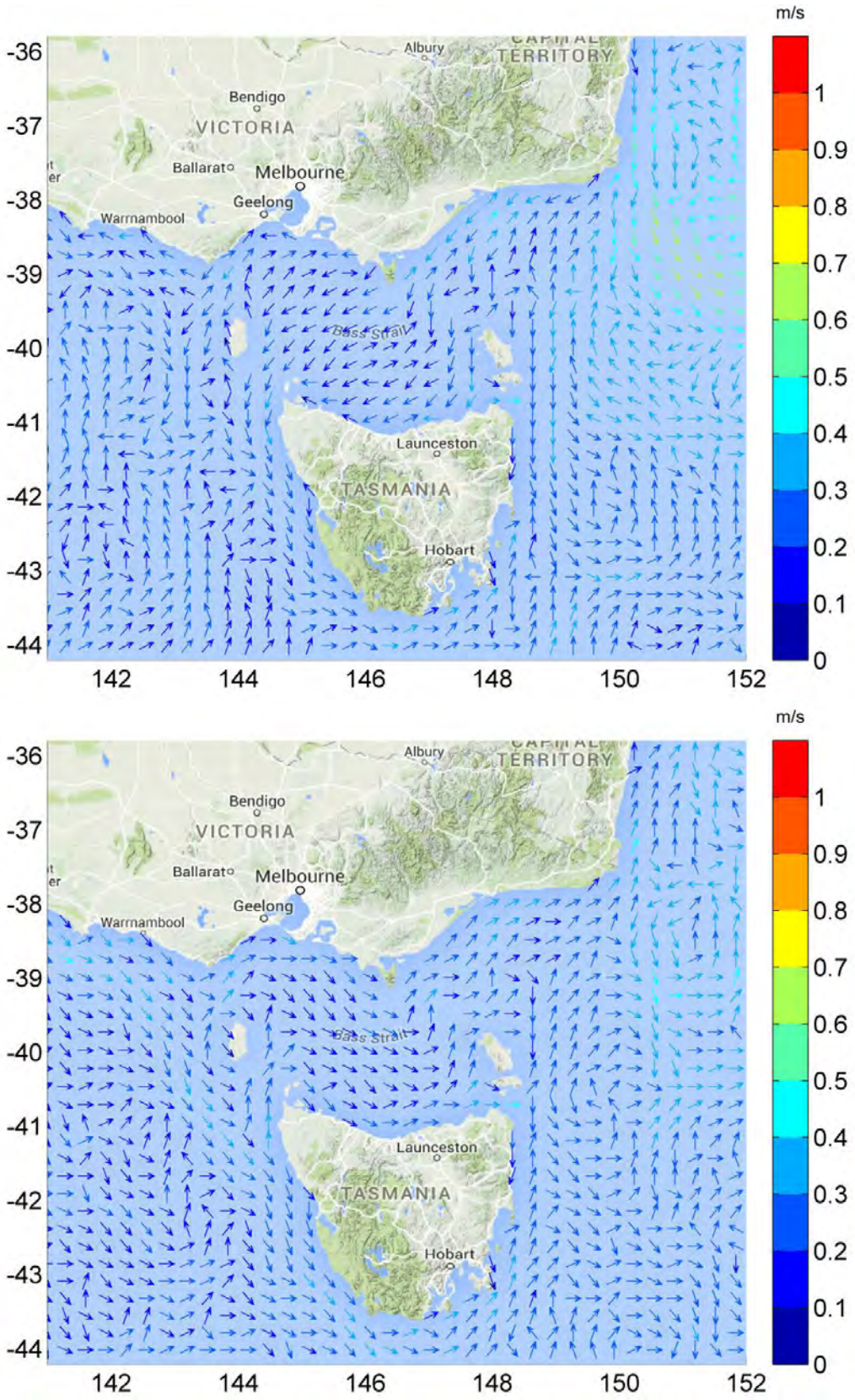



**Figure 3.1 HYCOM averaged seasonal surface drift currents during summer (upper image) and winter (lower image).**

## 3.1 Tidal currents

Tidal current data was generated using RPS's advanced ocean/coastal model, HYDROMAP. The HYDROMAP model has been thoroughly tested and verified through field measurements throughout the world for more than 30 years (Isaji & Spaulding, 1984; Isaji, et al., 2001; Zigic, et al., 2003). HYDROMAP tidal current data has been used as input to forecast (in the future) and hindcast (in the past) pollutant spills in Australian waters and forms part of the Australian National Oil Spill Emergency Response System operated by AMSA (Australian Maritime Safety Authority).

HYDROMAP employs a sophisticated sub-gridding strategy, which supports up to six levels of spatial resolution, halving the grid cell size as each level of resolution is employed. The sub-gridding allows for higher resolution of currents within areas of greater bathymetric and coastline complexity, and/or of interest to a study.

The numerical solution methodology follows that of Davies (1977a and 1977b) with further developments for model efficiency by Owen (1980) and Gordon (1982). A more detailed presentation of the model can be found in Isaji and Spaulding (1984) and Isaji et al. (2001).

### 3.1.1 Grid Setup

The tidal model domain is sub-gridded to a resolution of 500 m for shallow and coastal regions, starting from an offshore (or deep water) resolution of 8 km. The finer grids are progressively allocated in a step-wise fashion to more accurately resolve flows along the coastline, around islands and over regions with more complex bathymetry. Figure 3.2 shows the tidal model grid covering the study domain.

A combination of datasets was used and merged to describe the shape of the seabed within the grid domain (Figure 3.3). These included spot depths and contours which were digitised from nautical charts released by the hydrographic offices as well as Geoscience Australia database and depths extracted from the Shuttle Radar Topography Mission (SRTM30_PLUS) Plus dataset (see Becker et al., 2009).

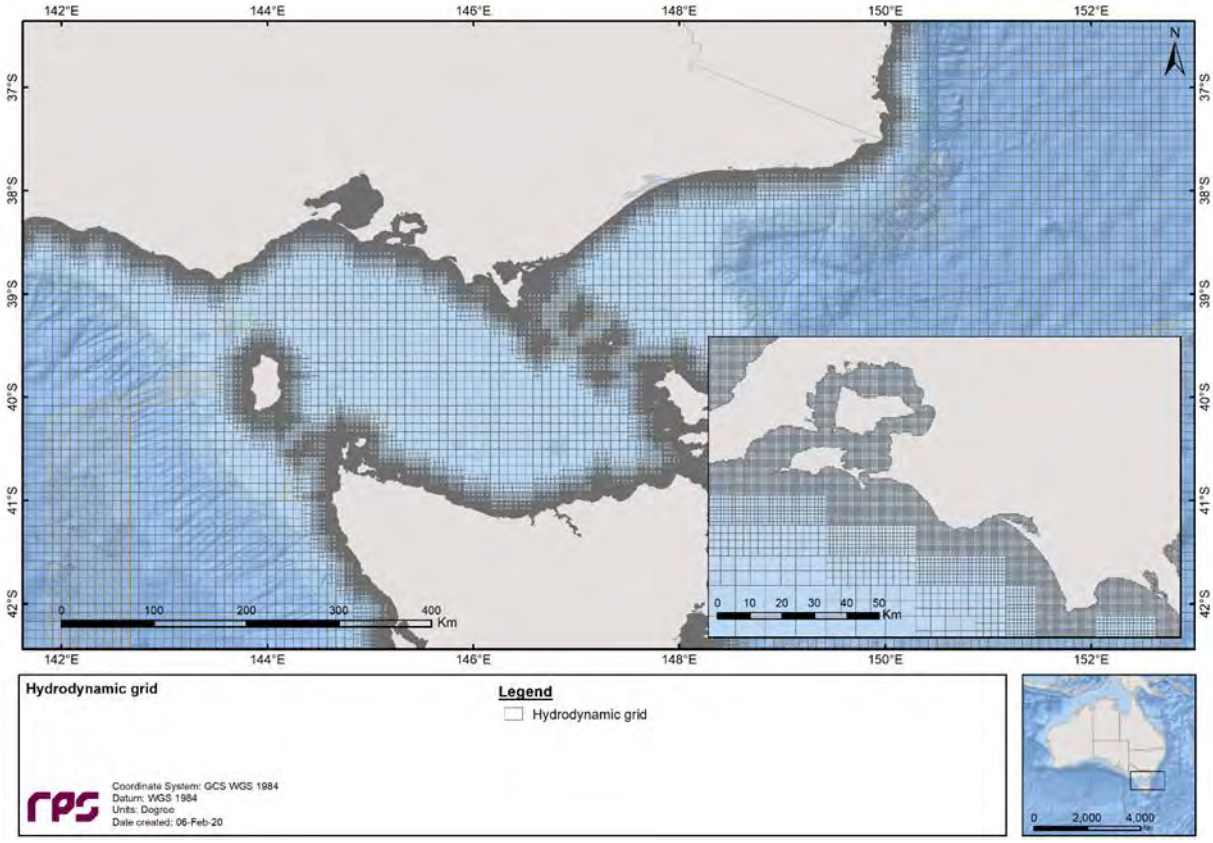



**Figure 3.2 Sample of the model grid used to generate the tidal currents for the study region. Higher resolution areas are shown by the denser mesh.**

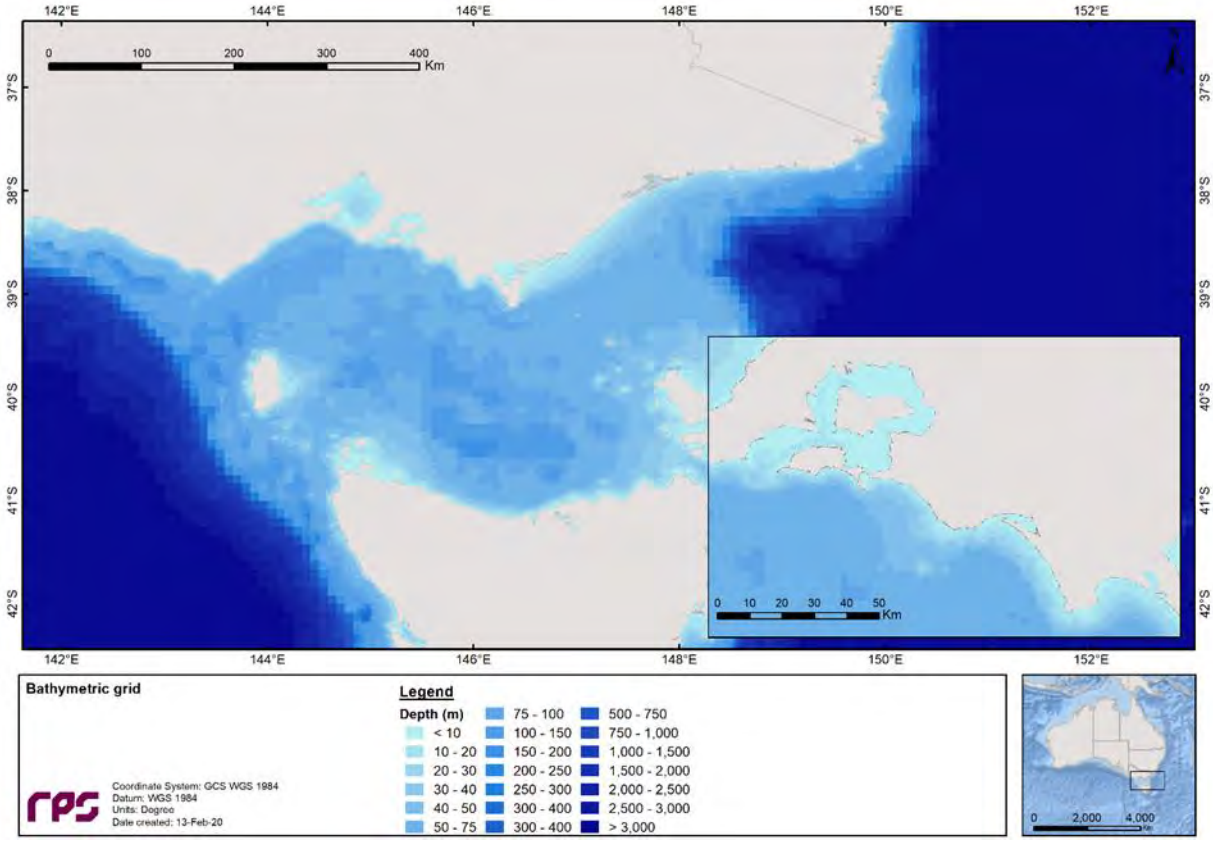



**Figure 3.3 Bathymetry defined throughout the tidal model domain.**

### 3.1.2 Tidal Conditions

The ocean boundary data for the regional model was obtained from satellite measured altimetry data (TOPEX/Poseidon 8.0) which provided estimates of the eight dominant tidal constituents at a horizontal scale of approximately 0.25 degrees. The eight major tidal constituents used were $K_2$, $S_2$, $M_2$, $N_2$, $K_1$, $P_1$, $O_1$ and $Q_1$. Using the tidal data, time series surface heights were calculated along the open boundaries for the simulation period.

The Topex/Poseidon satellite data has a resolution of 0.25 degrees globally, with higher resolution in coastal regions, and is produced and quality controlled by NASA (National Aeronautics and Space Administration). The data capturing satellites, equipped with two altimeters capable of taking sea level measurements accurate to less than ± 5 cm, measured oceanic surface elevations (and the resultant tides) for the period 1992–2005. In total these satellites carried out 62,000 orbits of the planet. The Topex/Poseidon tidal data has been widely used amongst the oceanographic community, being refereced in more than 2,100 research publications (e.g. Andersen, 1995; Ludicone et al., 1998; Matsumoto et al., 2000; Kostianoy et al., 2003; Yaremchuk & Tangdong, 2004; Qiu & Chen 2010). The Topex/Poseidon tidal data is considered suitably accurate for this study.

### 3.1.3 Surface Elevation Validation

To ensure that tidal predictions were accurate, predicted surface elevations were compared to data observed at a location situated within the study area (Figure 3.4).

To provide a statistical measure of the model performance, the Index of Agreement (IOA – Willmott, 1981) and the Mean Absolute Error (MAE – Willmott, 1982; Willmott & Matsuura, 2005) were used.

The MAE (Eq.1) is simply the average of the absolute values of the difference between the model-predicted (P) and observed (O) variables. It is a more natural measure of the average error (Willmott and Matsuura, 2005) and more readily understood. The MAE is determined by:

$$MAE = N^{-1} \sum_{i=1}^{N} |P_i - O_i| \qquad \text{Eq.1}$$

Where: $N$ = Number of observations

$P_i$ = Model predicted surface elevation

$O_i$ = Observed surface elevation

The Index of Agreement (IOA; Eq. 2) in contrast, gives a non-dimensional measure of model accuracy or performance. A perfect agreement between the model predicted and observed surface elevations exists if the index gives an agreement value of 1, and complete disagreement between model and observed surface elevations will produce an index measure of 0 (Wilmott, 1981). Willmott et al. (1985) also suggests that values larger than 0.5 may represent good model performance. The IOA is determined by:

$$IOA = 1 - \frac{\sum |X_{model} - X_{obs}|^2}{\sum (|X_{model} - \overline{X_{obs}}| + |X_{obs} - \overline{X_{obs}}|)^2} \qquad \text{Eq.2}$$

Where: $X_{model}$ = Model predicted surface elevation

$X_{obs}$ = Observed surface elevation

Clearly, a greater IOA and lower MAE represent a better model performance.

Figure 3.5 and Figure 3.6 illustrate a comparison of the predicted and observed surface elevations in February 2014. As shown on the graph, the model accurately reproduced the phase and amplitudes throughout the spring and neap tidal cycles.

Table 3-1 shows the IOA and MAE values for the selected tide station locations indicating that the model is performing well.

**Table 3-1 Statistical comparison between the observed and HYDROMAP predicted surface elevations.**

| Tide Station | IOA | MAE (m) |
|---|---|---|
| Gabo Island | 0.98 | 0.08 |
| Port MacDonnell | 0.98 | 0.05 |
| Port Welshpool | 0.92 | 0.30 |
| Portland | 0.97 | 0.07 |
| Stack Island | 0.96 | 0.22 |

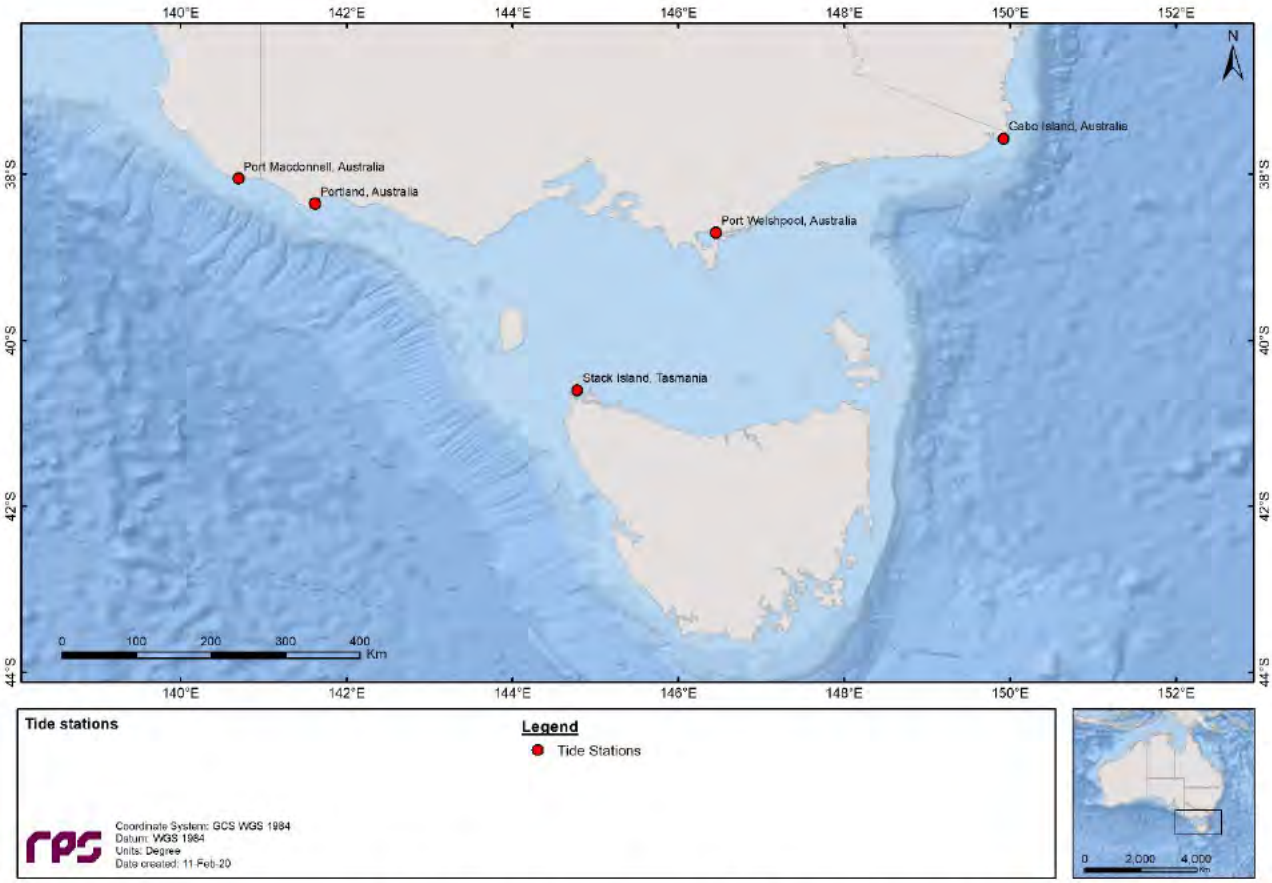



**Figure 3.4 Location of the tide stations used in the surface elevation validation.**

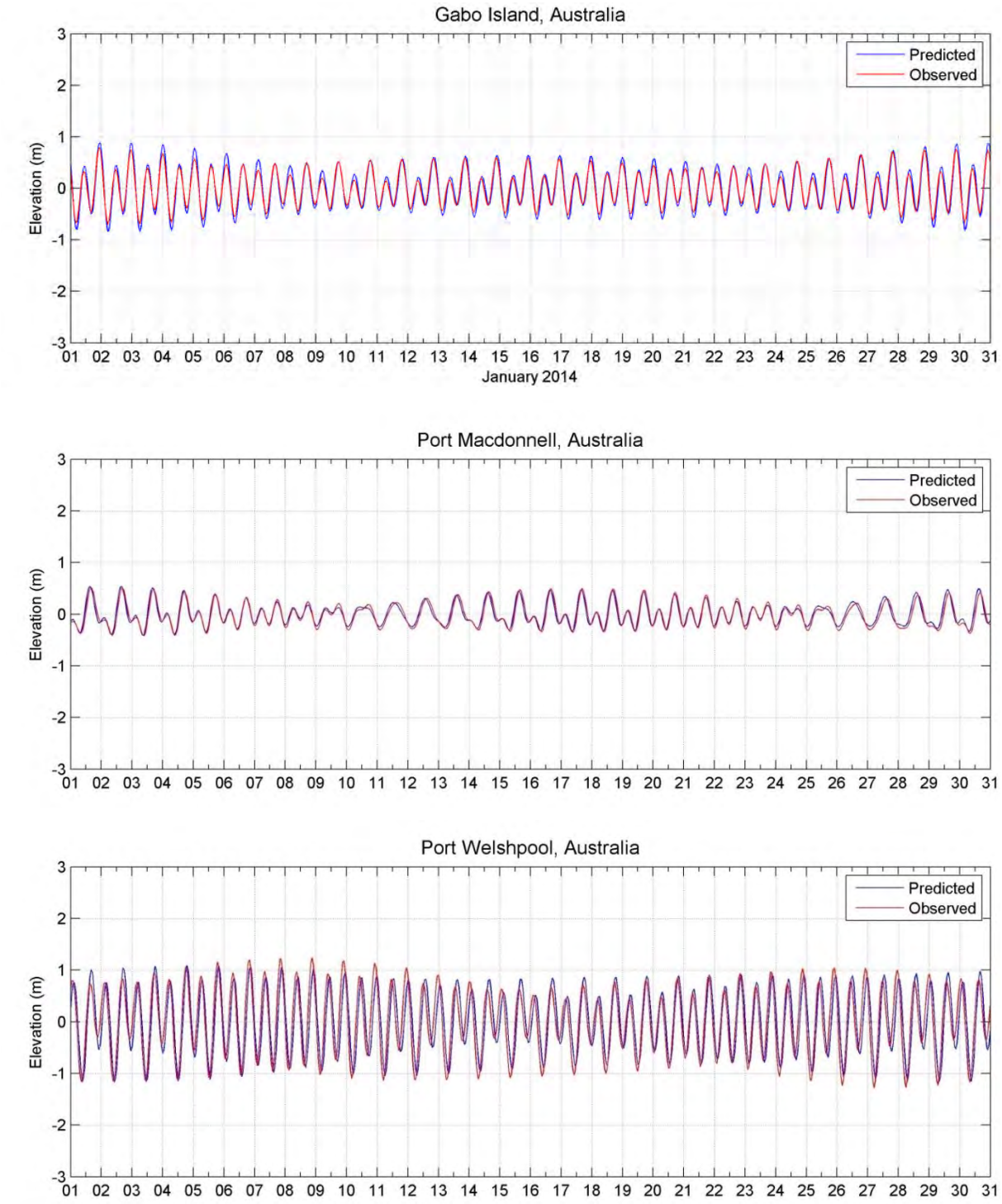



**Figure 3.5 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation at tidal stations Gabo Island (upper image), Port MacDonnell (middle image) and Port Welshpool (lower image).**

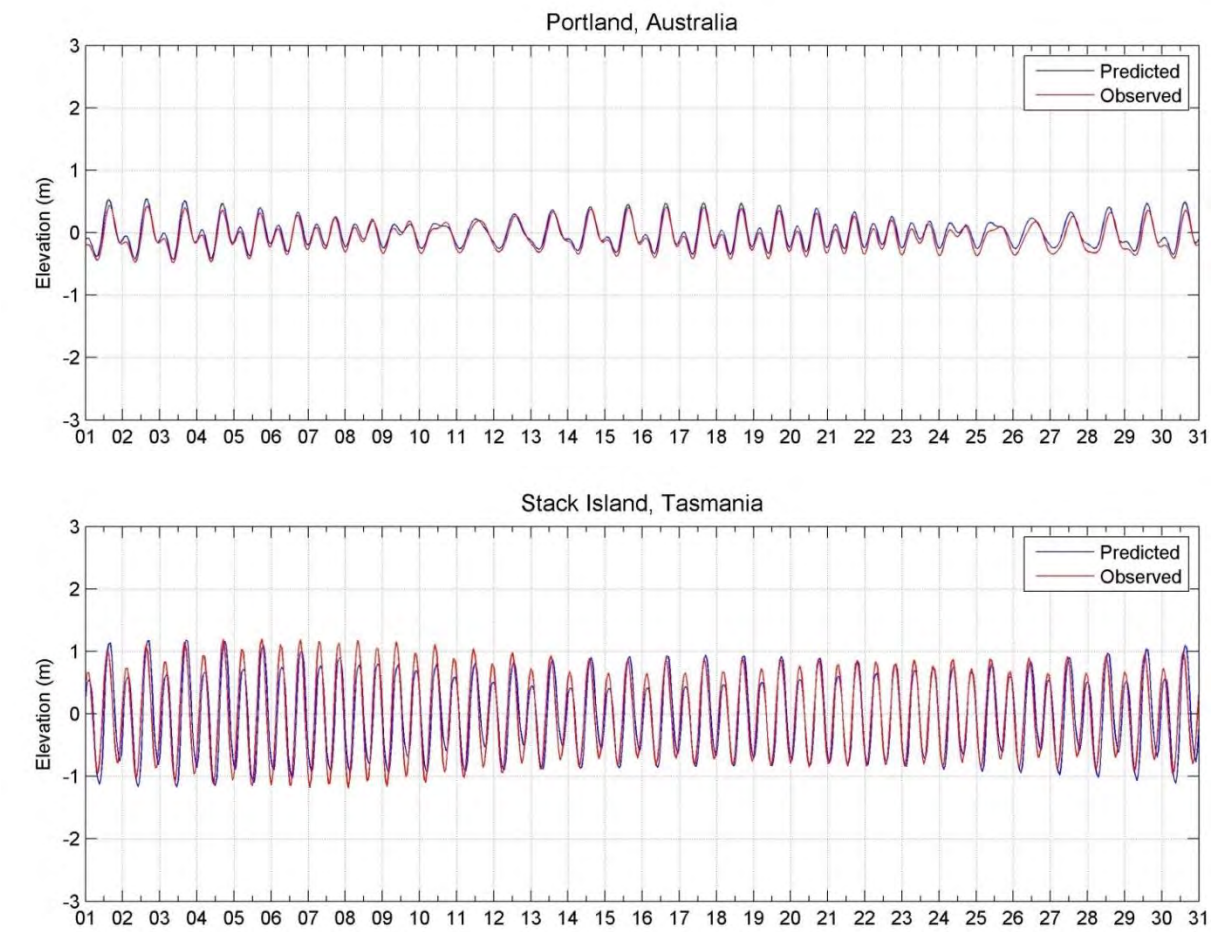



**Figure 3.6 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation at tidal stations Portland (upper image) and Stack Island (lower image).**

## 3.2 Ocean Currents

Data describing the flow of ocean currents for the years 2010 to 2019 (inclusive) was obtained from HYCOM (Hybrid Coordinate Ocean Model, (Chassignet et al., 2007), which is operated by the HYCOM Consortium, sponsored by the Global Ocean Data Assimilation Experiment (GODAE). HYCOM is a data-assimilative, three-dimensional ocean model that is run as a hindcast (for a past period), assimilating time-varying observations of sea surface height, sea surface temperature and in-situ temperature and salinity measurements (Chassignet et al., 2009). The HYCOM predictions for drift currents are produced at a horizontal spatial resolution of approximately 8.25 km (1/12$^{th}$ of a degree) over the region, at a frequency of once per day. HYCOM uses isopycnal layers in the open, stratified ocean, but uses the layered continuity equation to make a dynamically smooth transition to a terrain-following coordinate in shallow coastal regions, and to z-level coordinates in the mixed layer and/or unstratified seas.

## 3.3 Surface Currents

Table 3-2 presents the average and maximum net surface current speeds nearby the release location by combining the ocean and tidal currents. Current speeds varied throughout the year with maximum current speeds ranging between approximately 0.72 m/s (February) and 1.10 m/s (September). The dominant surface current directions throughout the year were identified as (towards) the west during summer months and east during the winter months.

Figure 3.7 and Figure 3.8 show the monthly and total surface current rose distributions for the selected location.

Note the convention for defining current direction is the direction the current flows towards, which is used to reference current direction throughout this report. Each branch of the rose represents the currents flowing to that direction, with north to the top of the diagram. Sixteen directions are used. The branches are divided into segments of different colour, which represent the current speed ranges for each direction. Speed intervals of 0.1 m/s are predominantly used in these current roses. The length of each coloured segment is relative to the proportion of currents flowing within the corresponding speed and direction.

**Table 3-2 Predicted monthly average and maximum surface current speeds for the selected location. The data was derived by combining the HYCOM ocean data and HYDROMAP tidal data from 2010–2019 (inclusive).**

| Month | Average current speed (m/s) | Maximum current speed (m/s) | General direction(s) (Towards) |
|---|---|---|---|
| January | 0.17 | 0.77 | West |
| February | 0.19 | 0.72 | West |
| March | 0.18 | 0.92 | West |
| April | 0.15 | 0.83 | East and West |
| May | 0.19 | 0.90 | East |
| June | 0.19 | 1.07 | East |
| July | 0.24 | 1.07 | East |
| August | 0.23 | 1.05 | East |
| September | 0.20 | 1.10 | East |
| October | 0.19 | 0.88 | East |
| November | 0.18 | 0.82 | East and West |
| December | 0.18 | 0.92 | East and West |
| **Minimum** | **0.15** | **0.72** | |
| **Maximum** | **0.24** | **1.10** | |

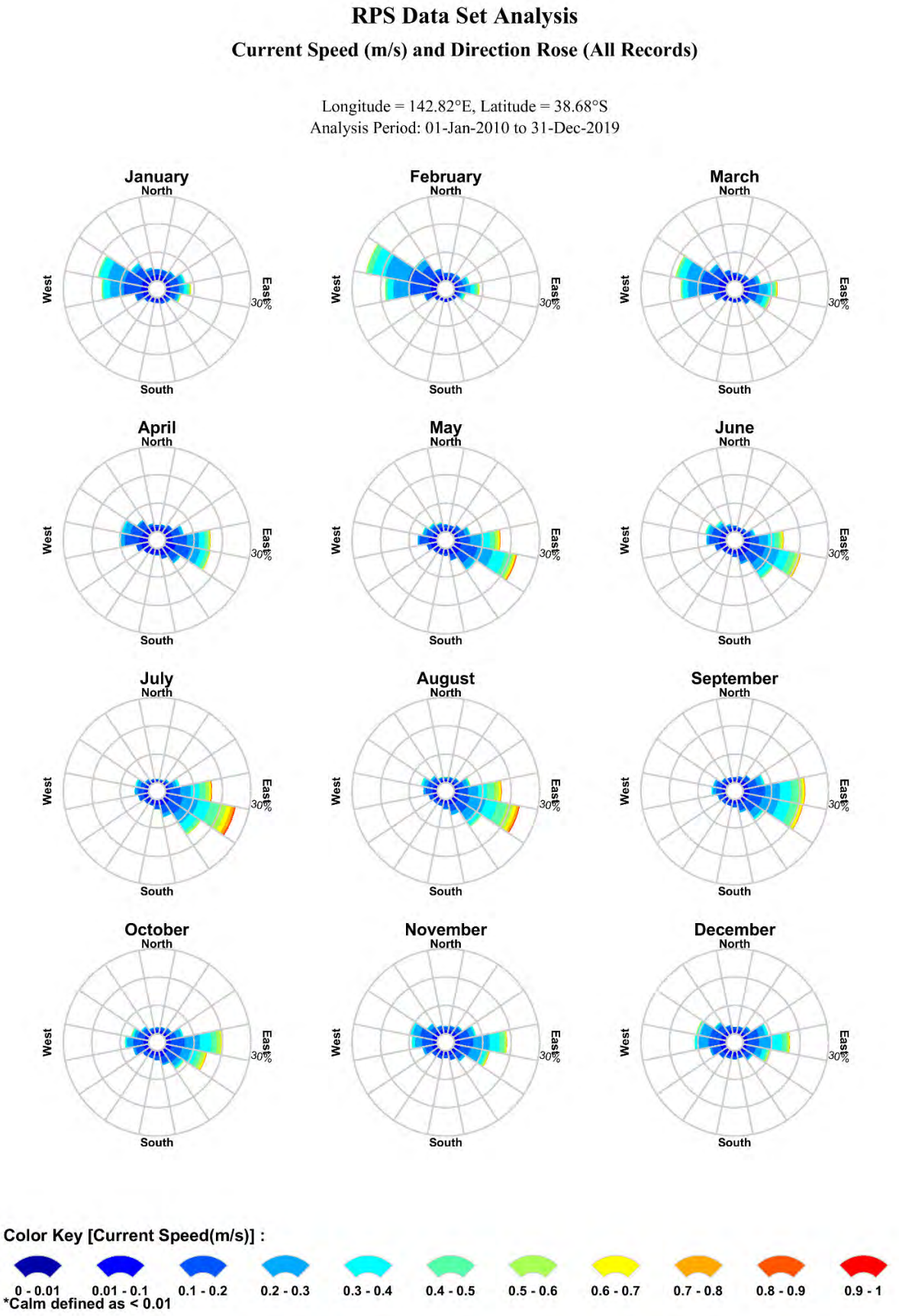



**Figure 3.7 Monthly surface current rose plots nearby the release location (derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

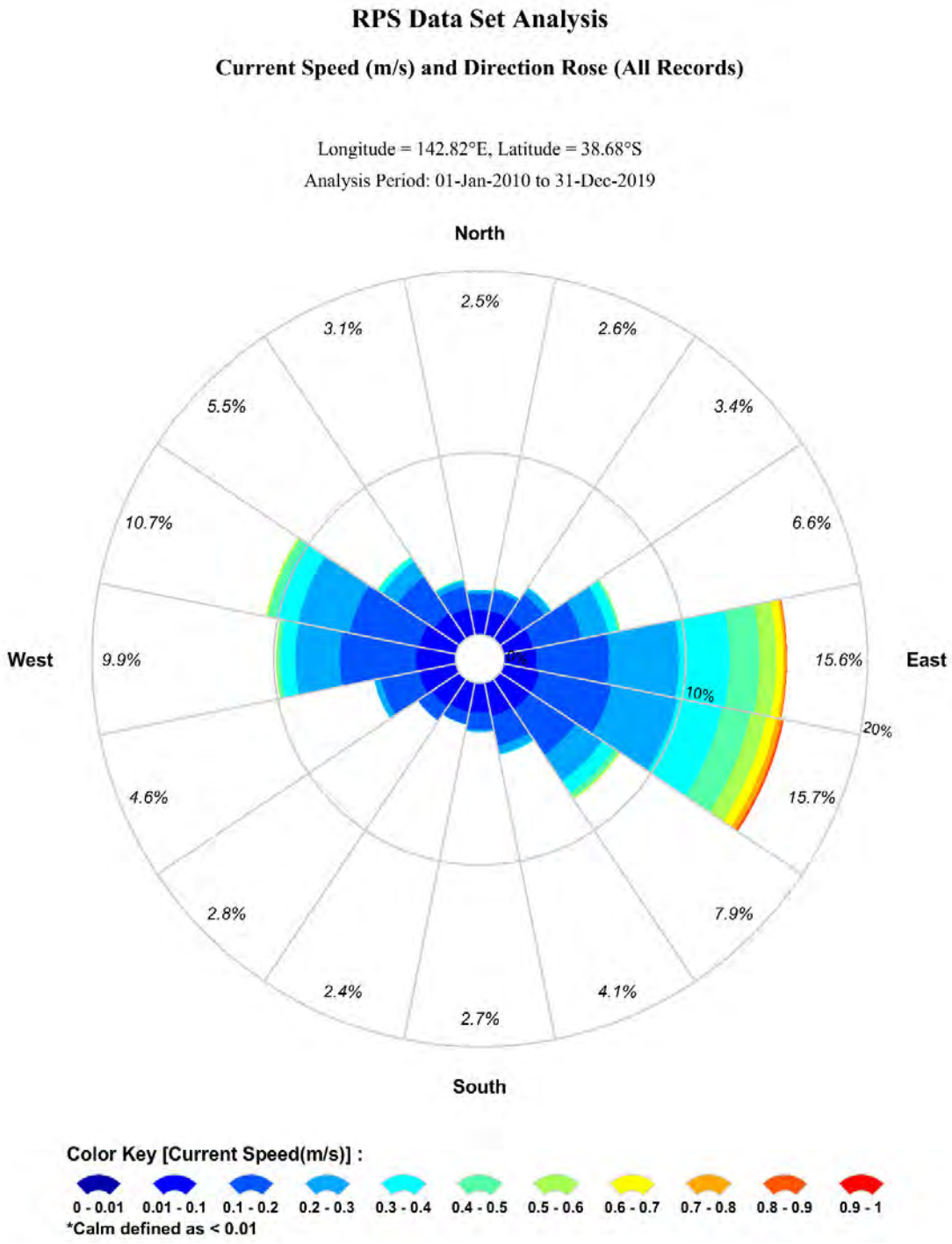



**Figure 3.8 Total surface current rose plot nearby the release location (derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2010–2019 (inclusive).**

# 4 WIND DATA

High resolution wind data for the years 2010 to 2019 (inclusive) was sourced from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis dataset (CFSR; see Saha et al., 2010). The CFSR wind model is a fully coupled, data-assimilative hindcast model representing the interaction between the earth's oceans, land and atmosphere. The gridded wind data output is available at ¼ of a degree resolution (~33 km) and 1-hourly time intervals. Figure 4.1 shows the spatial resolution of the wind field used as input into the oil spill model.

Table 4-1 presents the monthly average and maximum winds derived from a CFSR wind node nearby the release location. The wind data demonstrated average monthly wind speeds ranging from 10 knots during summer to 13 knots during winter, with maximums ranging between 30 knots (January and November) and 42 knots (June). The dominant wind direction throughout the year ranged from the southeast in summer, through the westerly sectors to the northwest for winter, before returning to the southeast at the end of the year.

Figure 4.2 and Figure 4.3 show the monthly and total wind rose distributions derived from the CFSR data for the selected node nearby the release location.

Note that the atmospheric convention for defining wind direction, that is, the direction the wind blows from, is used to reference wind direction throughout this report. Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Sixteen directions are used. The branches are divided into segments of different colour, which represent wind speed ranges from that direction. Speed ranges of 5 knots are typically used in these wind roses. The length of each segment within a branch is proportional to the frequency of winds blowing within the corresponding range of speeds from that direction.

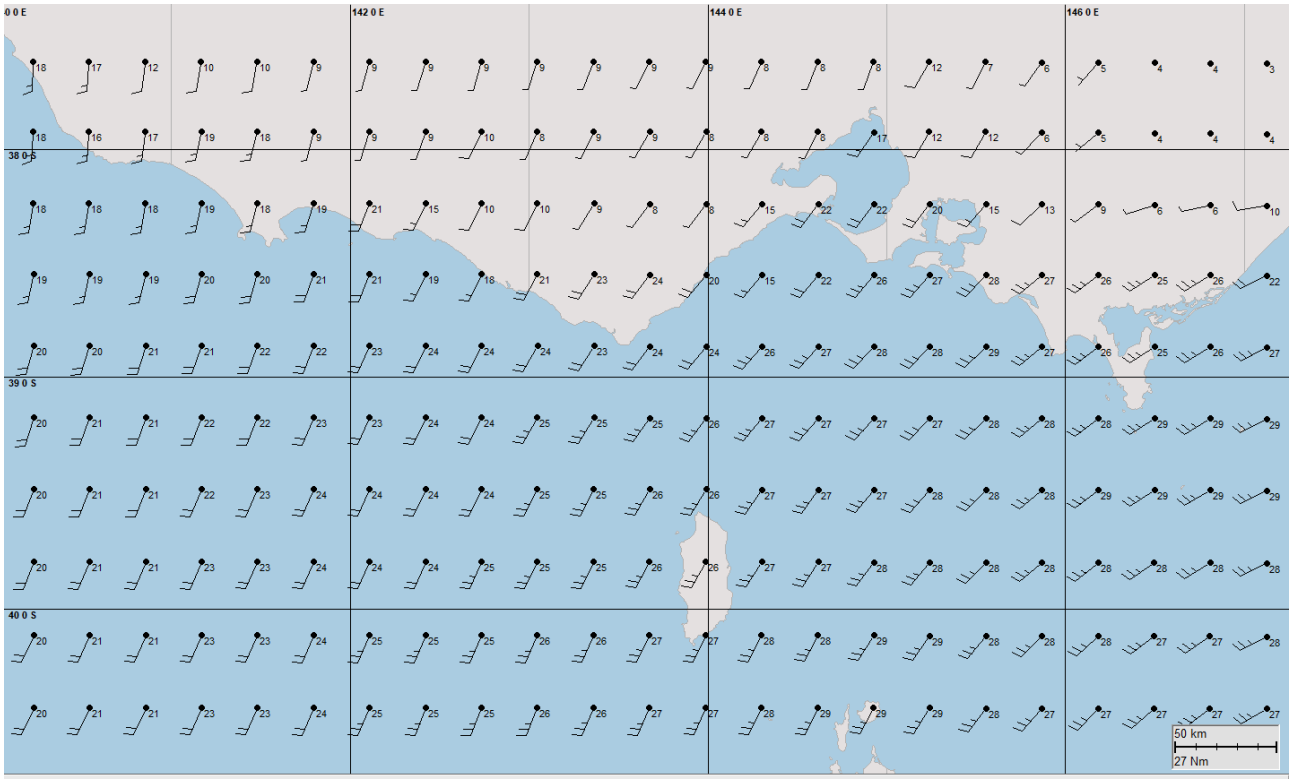



**Figure 4.1 Spatial resolution of the CFSR modelled wind data used as input into the oil spill model.**

**Table 4-1 Predicted average and maximum winds representative for the selected node nearby the release location. Data derived from CFSR hindcast model from 2010–2019 (inclusive).**

| Month | Average wind speed (knots) | Maximum wind speed (knots) | General direction(s) (From) |
|---|---|---|---|
| January | 10 | 30 | South-Southeast |
| February | 10 | 31 | South-Southeast |
| March | 10 | 34 | Southeast |
| April | 10 | 33 | West |
| May | 11 | 32 | West |
| June | 11 | 42 | Northwest |
| July | 13 | 35 | Northwest |
| August | 13 | 39 | Northwest |
| September | 12 | 41 | West |
| October | 11 | 31 | West |
| November | 10 | 30 | West |
| December | 10 | 31 | West and Southeast |
| **Minimum** | **10** | **30** | |
| **Maximum** | **13** | **42** | |

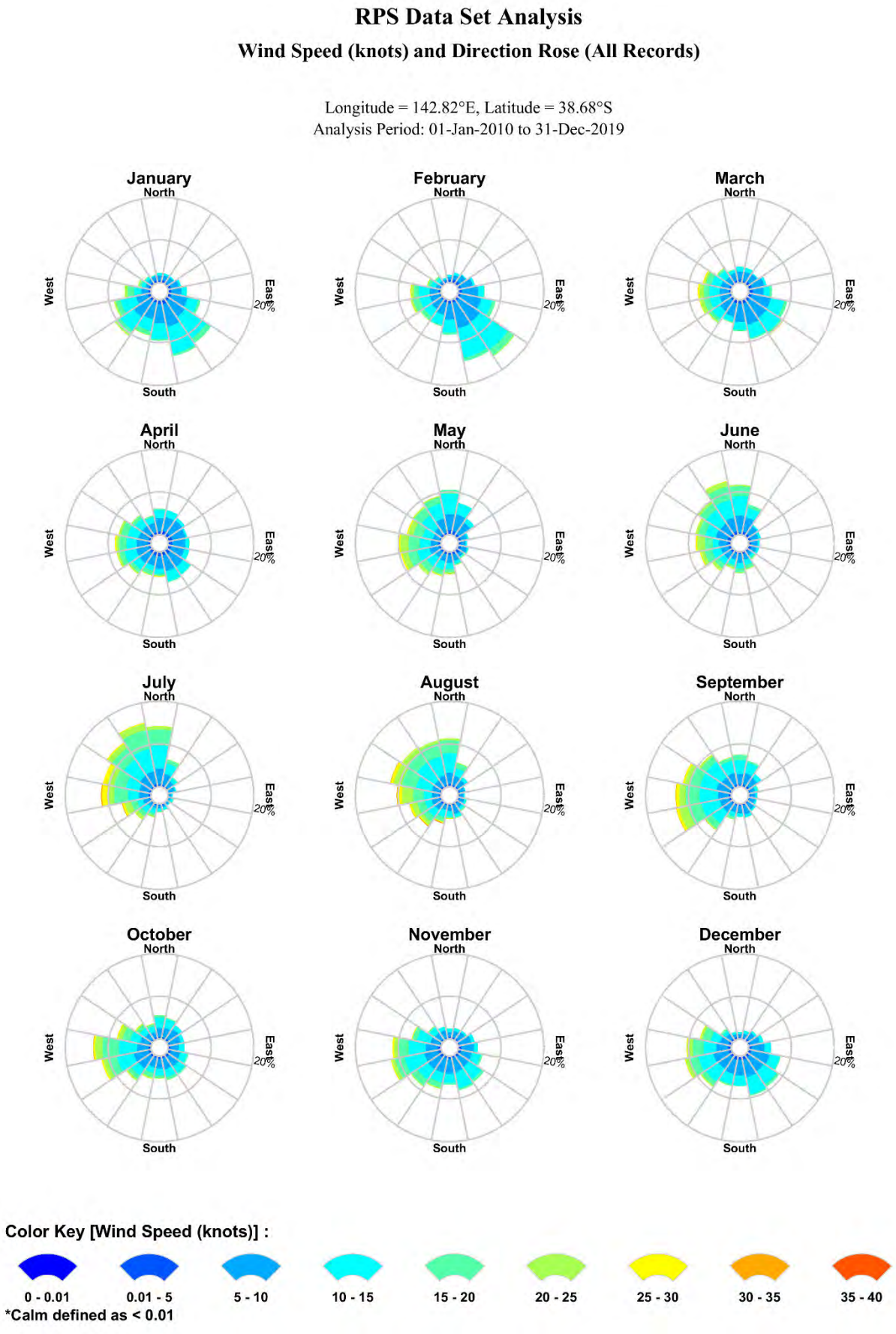



**Figure 4.2 Modelled monthly wind rose distributions from 2010–2019 (inclusive) for the node nearby the release location.**

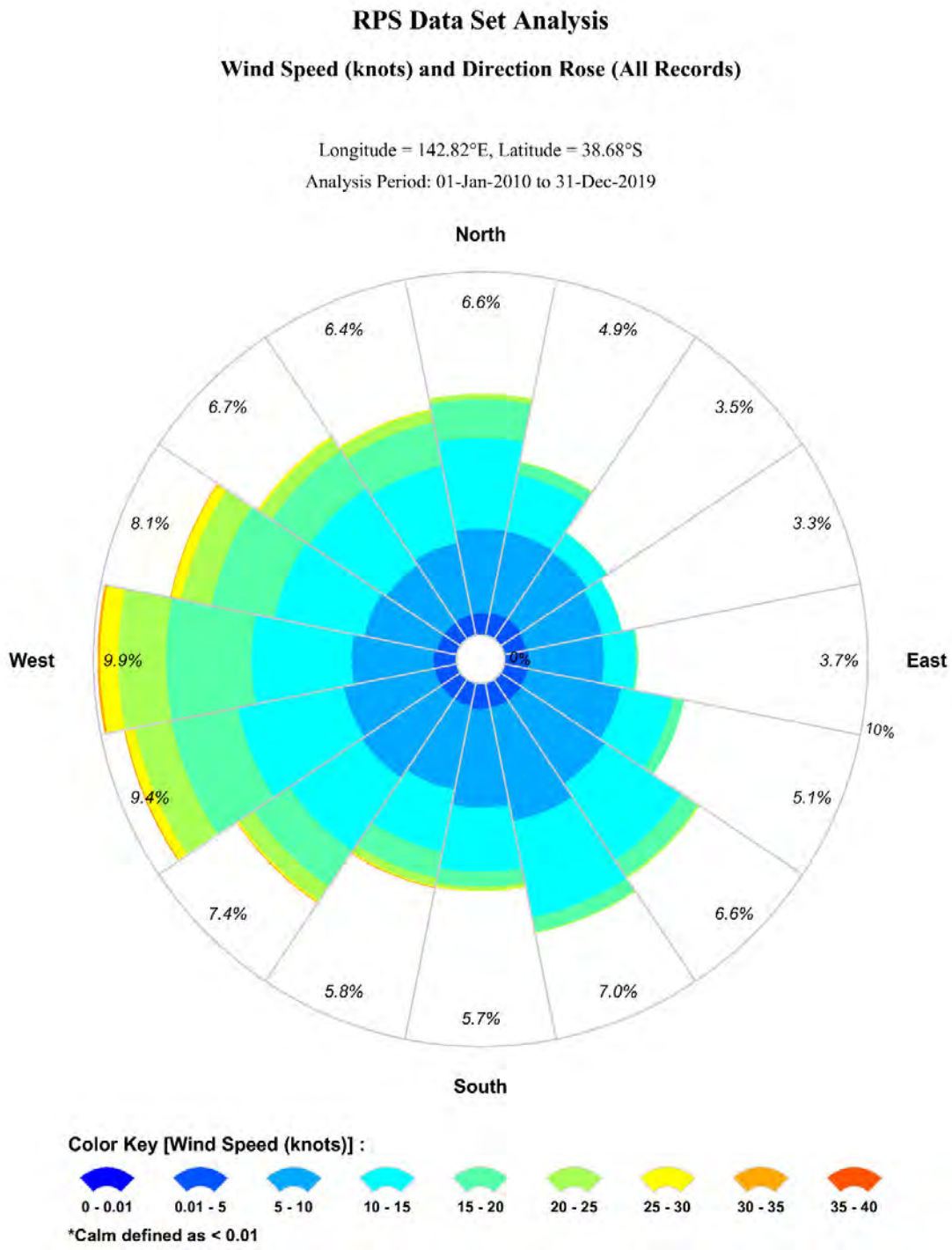



**Figure 4.3 Modelled total wind rose distributions from 2010–2019 (inclusive) for the node nearby the release location.**

# 5 WATER TEMPERATURE AND SALINITY

The monthly sea temperature and salinity profiles of the water column within the study was obtained from the World Ocean Atlas 2013 database produced by the National Oceanographic Data Centre (National Oceanic and Atmospheric Administration) and its co-located World Data Center for Oceanography (see Levitus et al., 2013). These parameters were used as factors to inform the weathering, movement and evaporative loss of hydrocarbon spills in the surface and sub-surface layers.

Table 5-1 presents the sea temperature and salinity of the surface layer nearby the selected location. The monthly average sea surface temperatures ranged between 13.4°C (September) and 18.2°C (March). The monthly average surface salinity values remain relatively consistent ranging between 35.4 psu and 35.6 psu.

**Table 5-1 Monthly average sea surface temperature and salinity in the study area.**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature (°C)** | 18.0 | 17.8 | 18.2 | 16.7 | 16.4 | 15.8 | 15.0 | 14.7 | 13.4 | 14.6 | 15.2 | 17.5 |
| **Salinity (psu)** | 35.5 | 35.4 | 35.6 | 35.4 | 35.5 | 35.5 | 35.6 | 35.5 | 35.4 | 35.4 | 35.5 | 35.5 |

# 6 OIL SPILL MODEL – SIMAP

Modelling of the fate of oil was performed using the Spill Impact Mapping Analysis Program (SIMAP). SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for both the surface and subsurface releases (Spaulding et al., 1994; French et al., 1999; French-McCay, 2003, 2004; French-McCay et al., 2004).

SIMAP has been used to predict the weathering and fate of oil spills during and after major incidents including: Montara (Australia) well blowout August 2009 in the Timor Sea (Asia-Pacific ASA, 2010); Macondo (USA) well blowout April 2010 in the Gulf of Mexico; Bohai Bay (China) oil spill August 2011; and the pipeline oil spill July 2013 in the Gulf of Thailand.

The SIMAP model calculates the transport, spreading, entrainment, evaporation and decay of surface hydrocarbon slicks as well as the entrained and dissolved oil components in the water column, either from surface slicks or from oil discharged subsea. The movement and weathering of the spilled oil is calculated for specific oil types. Input specifications for oil mixtures include the density, viscosity, pour point, distillation curve (volume lost versus temperature) and the aromatic/aliphatic component ratios within given boiling point (BP) ranges.

SIMAP is a three-dimensional model that allows for various response actions to be modelled including oil removal from skimming, burning, or collection booms, and surface and subsurface dispersant application.

The SIMAP oil spill model includes advanced weathering algorithms, specifically focussed on unique oils that tend to form emulsions and/or tar balls. The weathering algorithms are based on 5 years of extensive research conducted in response to the Deepwater Horizon oil spill in the Gulf of Mexico (French-McCay et al., 2015).

Biodegradation is included in the oil spill model. In the model, SIMAP, degradation is calculated for the surface slick, deposited oil on the shore, the entrained oil and dissolved constituents in the water column, and oil in the sediments. For surface oil, water column oil and sedimented oil a first order degradation rate is specified. Biodegradation rates are relatively high for hydrocarbons in dissolved state or in dispersed small droplets.

## 6.1 Stochastic Modelling

For the stochastic modelling presented herein, 100 oil spills were modelled for the scenarios using the same spill information (release location, spill volume, duration and oil type) but with varied start dates. During each simulation, the model records whether any grid cells are exposed to any oil concentrations, the concentrations involved and the elapsed time before exposure. The results of all 100 oil spill simulations were analysed to determine the following statistics for every grid cell:

- Exposure load (concentrations and volumes);
- Minimum time before exposure;
- Probability of contact above defined concentrations;
- Volume of oil that may accumulate on shorelines from any single simulation;
- Concentration that might occur on sections of individual shorelines;
- Exposure (instantaneous and/or over a specified duration) to dissolved hydrocarbons in the water column; and
- Exposure (instantaneous and/or over a specified duration) to entrained hydrocarbons in the water column.

## 6.2 Floating, Shoreline and In-Water Thresholds

The thresholds and their relationship to exposure for the sea surface, shoreline and water column (entrained and dissolved hydrocarbons) are presented in Sections 6.2.1 to 6.2.3. Supporting justifications of the adopted thresholds applied during the study and additional context relating to the area of potential exposure are also provided. It is important to note that the thresholds herein are based on NOPSEMA (2019).

### 6.2.1 Floating Oil Exposure Thresholds

The modelling results can be presented to any levels; therefore, thresholds have been specified (based on scientific literature) to record floating oil exposure to the sea-surface at meaningful levels only, described in the following paragraphs.

The low threshold to assess the potential for floating oil exposure, was 1 g/m$^2$, which equates approximately to an average thickness of 1 µm, referred to as visible oil. Oil of this thickness is described as rainbow sheen in appearance, according to the Bonn Agreement Oil Appearance Code (Bonn Agreement, 2009; AMSA, 2014) (see Table 6-1). Figure 6.1 shows photographs highlighting the difference in appearance between a silvery sheen, rainbow sheen and metallic sheen. This threshold is considered below levels which would cause environmental harm and it is more indicative of the areas perceived to be affected due to its visibility on the sea surface and potential to trigger temporary closures of areas (i.e. fishing grounds) as a precautionary measure. Table 6-1 provides a description of the appearance in relation to exposure zone thresholds used to classify the zones of floating oil exposure.

Ecological impact has been estimated to occur at 10 g/m$^2$ (a film thickness of approximately 10 µm or 0.01 mm) according to French et al. (1996) and French-McCay (2009) as this level of fresh oiling has been observed to mortally impact some birds through adhesion of oil to their feathers, exposing them to secondary effects such as hypothermia. The appearance of oil at this average thickness has been described as a metallic sheen (Bonn Agreement, 2009).

Scholten et al. (1996) and Koops et al. (2004) indicated that at oil concentrations on the sea surface of 25 g/m$^2$ (or greater), would be harmful for all birds that have landed in an oil film due to potential contamination of their feathers, with secondary effects such as loss of temperature regulation and ingestion of oil through preening. The appearance of oil at this thickness is also described as metallic sheen (Bonn Agreement, 2009). For this study the high exposure threshold was set to 50 g/m$^2$ and above based on NOPSEMA (2019). This threshold can also be used to inform response planning.

Table 6-2 defines the thresholds used to classify the zones of floating oil exposure reported herein.

**Table 6-1 The Bonn Agreement Oil Appearance Code.**

| Code | Description Appearance | Layer Thickness Interval (g/m$^2$ or µm) | Litres per km$^2$ |
|---|---|---|---|
| 1 | Sheen (silvery/grey) | 0.04 – 0.30 | 40 – 300 |
| 2 | Rainbow | 0.30 – 5.0 | 300 – 5,000 |
| 3 | Metallic | 5.0 – 50 | 5,000 – 50,000 |
| 4 | Discontinuous True Oil Colour | 50 – 200 | 50,000 – 200,000 |
| 5 | Continuous True Oil Colour | ≥ 200 | ≥ 200,000 |

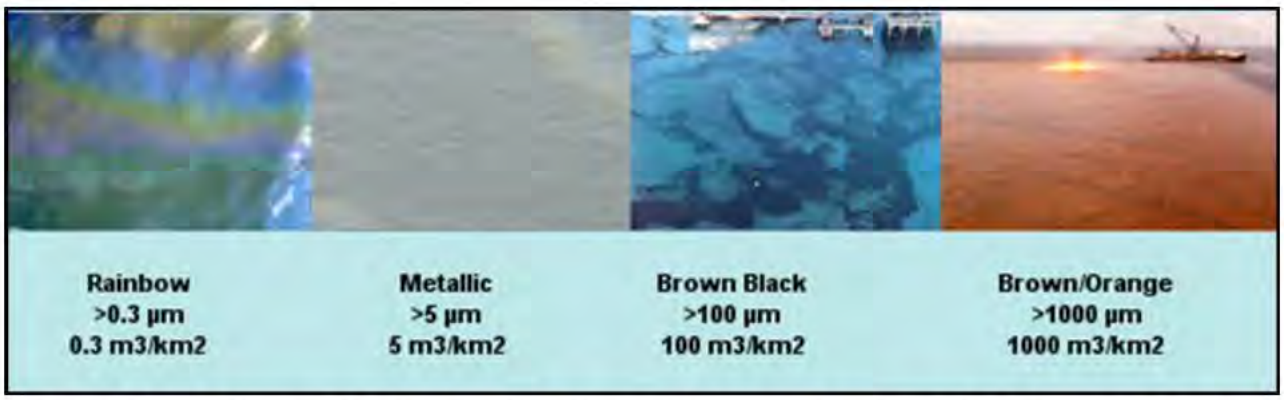



**Figure 6.1 Photographs showing the difference between oil colour and thickness on the sea surface (source: adapted from Oil Spill Solutions, 2015).**

**Table 6-2 Floating oil exposure thresholds used in this report (in alignment with NOPSEMA (2019)).**

| Threshold level | Floating oil (g/m$^2$) | Description |
|---|---|---|
| Low | 1 | Approximates range of socioeconomic effects and establishes planning area for scientific monitoring |
| Moderate | 10 | Approximates lower limit for harmful exposures to birds and marine mammals |
| High | 50 | Approximates surface oil slick and informs response planning |

### 6.2.2 Shoreline Accumulation Thresholds

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 accumulation. This is a conservative threshold used to define regions of socio-economic impact, such as triggering temporary closures of adjoining fisheries or the need for shore clean-up on beaches or man-made features/amenities (breakwaters, jetties, marinas, etc.). It would equate to approximately 2 teaspoons of hydrocarbon per square meter of shoreline accumulation. The appearance is described as a stain/film. On that basis, the 10 g/m$^2$ shoreline accumulation threshold has been selected to define the zone of potential "low shoreline accumulation".

French et al. (1996) and French-McCay (2009) define a shoreline oil accumulation threshold of 100 g/m$^2$, or above, would potentially harm shorebirds and wildlife (furbearing aquatic mammals and marine reptiles on or along the shore) based on studies for sub-lethal and lethal impacts. This threshold has been used in previous environmental risk assessment studies (see French-McCay, 2003; French-McCay et al., 2004, French-McCay et al., 2011; 2012; NOAA, 2013). Additionally, a shoreline concentration of 100 g/m$^2$, or above, is the minimum limit that the oil can be effectively cleaned according to the AMSA (2015) guideline. This threshold equates to approximately ½ a cup of oil per square meter of shoreline accumulation. The appearance is described as a thin oil coat. Therefore, 100 g/m$^2$ has been selected to define the zone of potential "moderate shoreline accumulation".

Observations by Lin & 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 accumulation". It equates to approximately 1 litre of hydrocarbon per square meter of shoreline accumulation. The appearance is described as a hydrocarbon cover.

It is worth noting that the shoreline accumulation thresholds derived from extensive literature review (outlined in Table 6-3) agree with the commonly used threshold values for oil spill modelling specified in NOPSEMA (2019).

**Table 6-3 Thresholds used to assess shoreline accumulation.**

| Threshold level | Shoreline loading (g/m$^2$) | Description |
|---|---|---|
| Low (socioeconomic/sublethal) | 10 | Predicts potential for some socio-economic impact |
| Moderate | 100 | Loading predicts area likely to require clean-up effort |
| High | > 1,000 | Loading predicts area likely to require intensive clean-up effort |

### 6.2.3 In-water Exposure Thresholds

Oil is a mixture of thousands of hydrocarbons of varying physical, chemical, and toxicological characteristics, and therefore, demonstrate varying fates and impacts on organisms. As such, for in-water exposure, the SIMAP model provides separate outputs for dissolved and entrained hydrocarbons from oil droplets. The consequences of exposure to dissolved and entrained components will differ because they have different modes and magnitudes of effect.

Entrained hydrocarbon concentrations were calculated based on oil droplets that are suspended in the water column, though not dissolved. The composition of this oil would vary with the state of weathering (oil age) and may contain soluble hydrocarbons when the oil is fresh. Calculations for dissolved hydrocarbons specifically calculates oil components which are dissolved in water, which are known to be the primary source of toxicity exerted by oil.

#### 6.2.3.1 Dissolved Hydrocarbons

Laboratory studies have shown that dissolved hydrocarbons exert most of the toxic effects of oil on aquatic biota (Carls et al., 2008; Nordtug et al., 2011; Redman, 2015). The mode of action is a narcotic effect, which is positively related to the concentration of soluble hydrocarbons in the body tissues of organisms (French-McCay, 2002). Dissolved hydrocarbons are taken up by organisms directly from the water column by absorption through external surfaces and gills, as well as through the digestive tract. Thus, soluble hydrocarbons are termed “bioavailable”.

Hydrocarbon compounds vary in water-solubility and the toxicity exerted by individual compounds is inversely related to solubility, however bioavailability will be modified by the volatility of individual compounds (Nirmalakhandan & Speece, 1988; Blum & Speece, 1990; McCarty, 1986; McCarty et al., 1992a, 1992b; Mackay et al., 1992; McCarty & Mackay, 1993; Verhaar et al., 1992, 1999; Swartz et al., 1995; French-McCay, 2002; McGrath and Di Toro, 2009). Of the soluble compounds, the greatest contributor to toxicity for water-column and benthic organisms are the lower-molecular-weight aromatic compounds, which are both volatile and soluble in water. Although they are not the most water-soluble hydrocarbons within most oil types, the polynuclear aromatic hydrocarbons (PAHs) containing 2-3 aromatic ring structures typically exert the largest narcotic effects because they are semi-soluble and not highly volatile, so they persist in the environment long enough for significant accumulation to occur (Anderson et al., 1974, 1987; Neff & Anderson, 1981; Malins & Hodgins, 1981; McAuliffe, 1987; NRC, 2003). The monoaromatic hydrocarbons (MAHs), including the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), and the soluble alkanes (straight chain hydrocarbons) also contribute to toxicity, but these compounds are highly volatile, so that their contribution will be low when oil is exposed to evaporation and higher when oil is discharged at depth where volatilisation does not occur (French-McCay, 2002).

French-McCay (2002) reviewed available toxicity data, where marine biota was exposed to dissolved hydrocarbons prepared from oil mixtures, finding that 95% of species and life stages exhibited 50% population mortality ($LC_{50}$) between 6 and 400 ppb total PAH concentration after 96 hrs exposure, with an average of 50 ppb. Hence, concentrations lower than 6 ppb total PAH value should be protective of 97.5% of species and life stages even with exposure periods of days (at least 96 hours). Early life-history stages of fish appear to be more sensitive than older fish stages and invertebrates.

Exceedances of 10, 50 or 400 ppb over a 1 hour timestep (see Table 6-4) was applied to indicate increasing potential for sub-lethal to lethal toxic effects (or low to high), based on NOPSEMA (2019).

#### 6.2.3.2 Entrained Hydrocarbons

Entrained hydrocarbons consist of oil droplets that are suspended in the water column and insoluble. As such, insoluble compounds in oil cannot be absorbed from the water column by aquatic organisms, hence are not bioavailable through absorption of compounds from the water. Exposure to these compounds would require routes of uptake other than absorption of soluble compounds. The route of exposure of organisms to whole oil alone include direct contact with tissues of organisms and uptake of oil by direct consumption, with potential for biomagnification through the food chain (NRC, 2005).

The 10 ppb threshold represents the very lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC & ARMCANZ (2000) water quality guidelines. Due to the requirement for relatively long exposure times (> 24 hours) for these concentrations to be significant, they are likely to be more meaningful for juvenile fish, larvae and planktonic

organisms that might be entrained (or otherwise moving) within the entrained plumes, or when entrained hydrocarbons adhere to organisms or trapped against a shoreline for periods of several days or more.

This exposure zone is not considered to be of significant biological impact and is therefore outside the adverse exposure zone. This exposure zone represents the area contacted by the spill. This area does not define the area of influence as it is considered that the environment will not be affected by the entrained hydrocarbon at this level.

Thresholds of 10 ppb and 100 ppb were applied over a 1-hour time exposure (Table 6-4), to cover the range of thresholds outlined in ANZECC & ARMCANZ (2000) water quality guidelines, the incremental change for greater potential effect and is per NOPSEMA (2019).

A complicating factor that should be considered when assessing the consequence of dissolved and entrained oil distributions is that there will be some areas where both physically entrained oil droplets and dissolved hydrocarbons co-exist. Higher concentrations of each will tend to occur close to the source where sea conditions can force mixing of relatively unweathered oil into the water column, resulting in more rapid dissolution of soluble compounds.

**Table 6-4 Dissolved and entrained hydrocarbon exposure values assessed over a 1-hour time step, as per NOPSEMA (2019).**

| | Exposure level | In-water threshold (ppb) | Description |
|---|---|---|---|
| Dissolved hydrocarbons | Low | 10 | Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers |
| | Moderate | 50 | Approximates potential toxic effects, particularly sublethal effects to sensitive species |
| | High | 400 | Approximates toxic effects including lethal effects to sensitive species |
| Entrained hydrocarbons | Low | 10 | Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers |
| | High | 100 | As appropriate given oil characteristics for informing risk evaluation |

# 7 HYDROCARBON PROPERTIES

## 7.1 Physical Properties

Table 7-1 and Table 7-2 present the physical properties and boiling point ranges of the MDO.

The MDO has an API of 24 and a density of 890 kg/m$^3$ (at 25 ºC) with a viscosity value (14.0 cP at 25 ºC) classifying it as a Group II (light-persistent) oil according to the International Tankers Owners Pollution Federation (ITOPF, 2014) and US EPA/USCG classifications.

The MDO is a mixture of volatile and persistent hydrocarbons with high proportions of semi- and low-volatile components. In favourable evaporation conditions, about 4.0% of the oil mass should evaporate within the first 12 hours (BP < 180°C), a further 32% should evaporate within the first 24 hours (180°C < BP < 265°C) and a further 54% should evaporate over several days (265°C < BP < 380°C). Approximately 10% of the oil is shown to be persistent.

The boiling points (BP) are dictated by the length of the carbon chains, with the longer and more complex compounds having a higher boiling point, and therefore lower volatility and evaporation rate. Typical evaporation times once the hydrocarbons reach the surface and are exposed to the atmosphere are:

- Up to 12 hours for the $C_4$ to $C_{10}$ compounds (BP <180 °C).
- Up to 24 hours for the $C_{11}$ to $C_{15}$ compounds (BP 180-265 °C).
- Several days for the $C_{16}$ to $C_{20}$ compounds (BP 265-380 °C).
- Not applicable for the residual compounds (BP >380°C), which will resist evaporation, persist in the marine environment for longer periods, and be subject to relatively slow degradation.

**Table 7-1 Physical properties of MDO.**

| Characteristic | MDO |
|---|---|
| Density (kg/m$^3$) | 890 (@ 25 °C) |
| API | 24 |
| Dynamic viscosity (cP) | 14.0 (@ 25 °C) |
| Pour point (°C) | -9 |
| Hydrocarbon property category | Group II |
| Hydrocarbon property classification | Light - Persistent |

**Table 7-2 Boiling point ranges of MDO.**

| Oil Type | Component | Volatile (%) | Semi-volatile (%) | Low-volatility (%) | Residual (%) |
|---|---|---|---|---|---|
| | Boiling point (°C) | <180 $C_4$ to $C_{10}$ | 180-265 $C_{11}$ to $C_{15}$ | 265-380 $C_{16}$ to $C_{20}$ | >380 >$C_{20}$ |
| **MDO** | % of total | 4.0 | 32.0 | 54.0 | 10.0 |

## 7.2 Weathering Properties

### 7.2.1 MDO

A series of model weathering tests were conducted to illustrate the potential behaviour of the MDO when exposed to idealised and representative environmental conditions:

- A 50 $m^3$ surface release over 1-hour under calm wind conditions (constant 5 knots), assuming low seasonal water temperature (15°C) and ambient tidal and drift currents.
- A 50 $m^3$ surface release over 1-hour under variable wind conditions (1-23. knots, drawn from representative data files), assuming low seasonal water temperature (15°C) and ambient tidal and drift currents.

The first case is indicative conditions that would not generate entrainment, while the second case represents conditions that would likely cause entrainment. Both scenarios provide examples of potential behaviour during a spill once the oil is on the sea surface.

The mass balance for the MDO under the constant 5 knot wind case (Figure 7.1) shows that 34.3% of the oil is shown to evaporate within 24 hours. Under calm conditions, the majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the low volatile, longer-chain compounds. Evaporation shall cease when the residual compounds remain, and they will be subject to more gradual decay through biological and photochemical processes.

Under the variable-wind case (Figure 7.2), where the winds are of greater strength on average, entrainment of MDO into the water column is shown to increase. Approximately 24 hours after the spill, 83.1% of the oil mass is shown to have entrained and a further 11.4% is shown to have evaporated, leaving only a small proportion of the oil floating on the water surface (1.3%).

The increased level of entrainment in the variable-wind case result in a higher percentage decaying at an approximate rate of 3% per day with 22% after 7 days, compared to 0.4% per day and a total of 2.6% after 7 days for the constant-wind case. Given the proportion of entrained oil and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over time scales of several weeks.

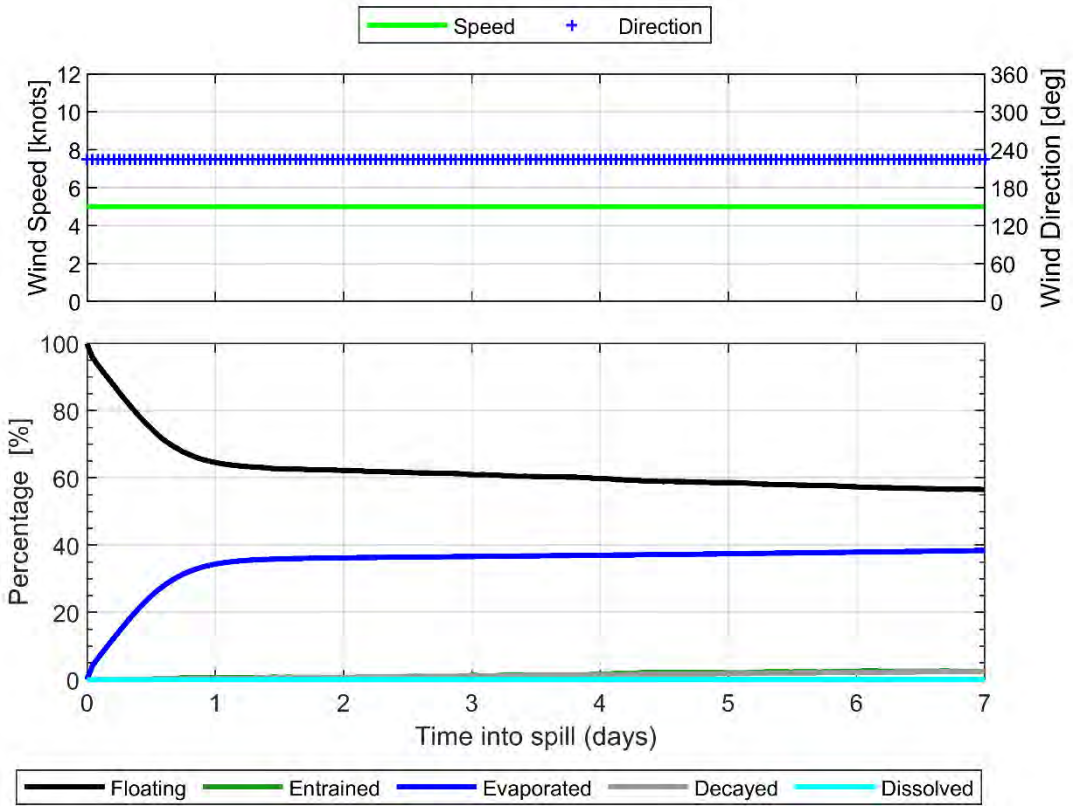



**Figure 7.1 Proportional mass balance plot representing the weathering of MDO spilled onto the water surface over 1 hour and subject to a constant 5 knots wind speed at 15°C water temperature.**

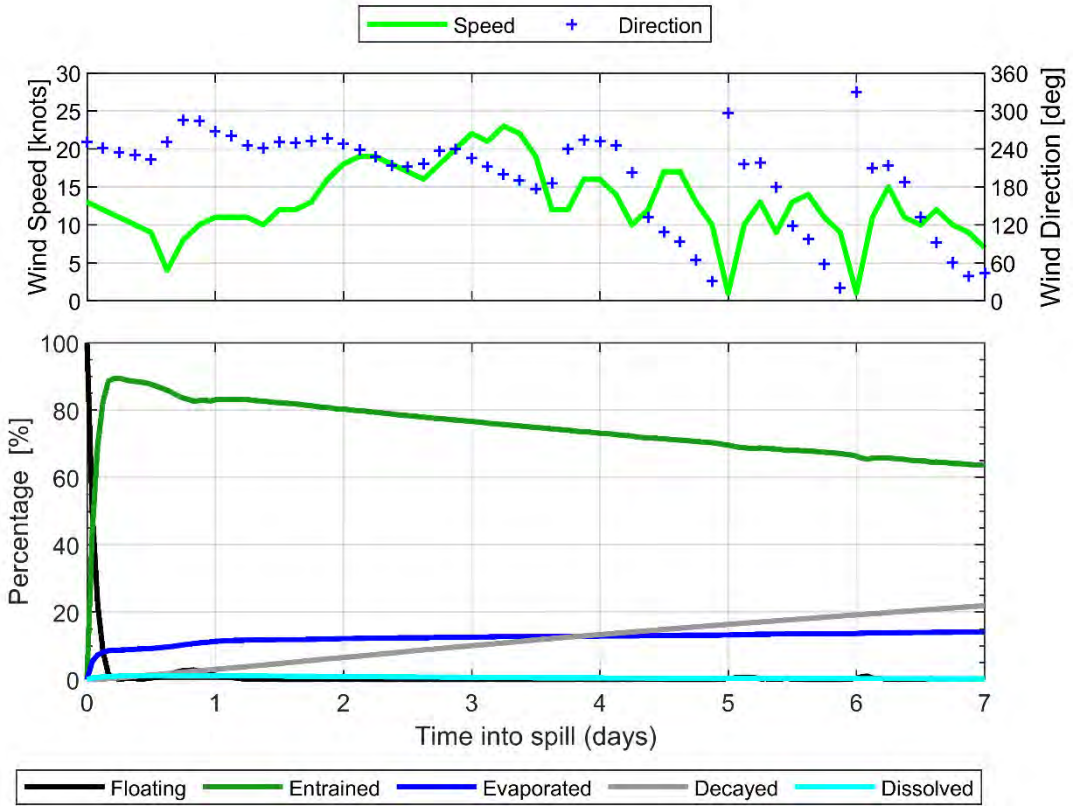



**Figure 7.2 Proportional mass balance plot representing the weathering of MDO spilled onto the water over 1 hour and subject to variable wind speeds (1-23 knots) at 15°C water temperature.**

# 8 MODEL SETTINGS

Table 8-1 provides a summary of the oil spill model settings.

**Table 8-1 Summary of the oil spill model settings and thresholds used in this assessment.**

| Parameter | Scenario |
|---|---|
| Description | Vessel Collision |
| Number of randomly selected spill start times | 100 |
| Model period | Annual |
| Oil type | MDO |
| Spill volume | 250 $m^3$ |
| Release type | Surface |
| Release duration | 6 hours |
| Simulation length (days) | 30 |
| Surface oil concentration thresholds ($g/m^2$) ^ | 1 (low); 10 (moderate); 50 (high) |
| Shoreline oil accumulation thresholds ($g/m^2$) ^ | 10 (low); 100 (moderate); 1,000 (high) |
| Dissolved hydrocarbon concentrations (ppb) ^ | 10 (low); 50 (moderate); 400 (high) |
| Entrained hydrocarbon concentrations (ppb) ^ | 10 (low); 100 (high) |

^Thresholds based on NOPSEMA (2019)

# 9 PRESENTATION AND INTERPRETATION OF MODEL RESULTS

The results from the modelling study are presented in a number of tables and figures, which aim to provide an understanding of potential sea-surface and water column exposure and shoreline accumulation.

## 9.1 Annual Analysis

The statistics are based on the following principles:

- The ***greatest distance travelled by a spill trajectory*** – is determined by a) recording the maximum and b) second greatest distance travelled (or 99$^{th}$ percentile) by a single trajectory, within a scenario, from the release location to the identified exposure thresholds.
- The ***probability of oil exposure to a receptor*** – is determined by recording the number of spill trajectories to reach a specified sea surface or subsea threshold within a receptor polygon, divided by the total number of spill trajectories within that scenario.
- The ***minimum time before oil exposure to a receptor*** – is determined by ranking the elapsed time before sea surface exposure, at a specified threshold, to grid cells within a receptor polygon and recording the minimum value.
- The ***maximum residence time for oil exposure within a receptor*** – is determined by recording the longest continuous length of time a grid cell is exposed to either floating, entrained or dissolved hydrocarbon above each threshold, within a receptor.
- The ***probability of oil accumulation at a receptor*** – is determined by recording the number of spill trajectories to reach a specified shoreline accumulation threshold within a receptor polygon, divided by the total number of spill trajectories within that scenario.
- The ***maximum (total) volume of oil ashore*** – is the total volume of oil stranded on the shorelines throughout the duration of the simulation.
- The ***maximum potential oil loading within a receptor*** – is determined by identifying the maximum loading to any grid cell within a receptor polygon, for a scenario.
- The ***dissolved and entrained hydrocarbon exposure*** – is determined by recording the maximum instantaneous concentrations at each grid cell.

## 9.2 Deterministic Trajectories

The stochastic modelling results were assessed for each scenario, and the deterministic runs were identified and are presented in the result section based on the following criteria;

a. Largest swept area for surface oil above 10 g/m$^2$
b. Largest swept area for surface oil above 50 g/m$^2$
c. Largest (total) volume of oil ashore
d. Longest length of shoreline with oil accumulation above 100 g/m$^2$
e. Largest area of entrained hydrocarbon exposure above 100 ppb
f. Largest area of dissolved hydrocarbon exposure above 50 ppb

## 9.3 Receptors Assessed

A range of environmental receptors and shorelines were assessed for floating oil exposure, shoreline accumulation and water column exposure as part of the study (see Figure 9.1 to Figure 9.11). Receptor categories (see Table 9-1) include sections of shorelines which are defined by local government areas (LGAs), sub-LGAs and offshore islands. All other sensitive receptors other than submerged reefs, shoals and banks (RSB) were sourced from Australian Government Department of Climate Change, Energy, the Environment and Water (http://www.environment.gov.au/).

Risks of exposure were separately calculated for each sensitive receptor area and have been tabulated.

Table 9-2 summarises the receptors that the release locations reside within.

**Table 9-1 Summary of receptors used to assess floating oil, shoreline and in-water exposure to hydrocarbons.**

| Receptor Category | Acronym | Hydrocarbon Exposure Assessment | | | Figure reference |
|---|---|---|---|---|---|
| | | Water Column | Floating oil | Shoreline | |
| Australian Marine Park | AMP | ✓ | ✓ | × | Figure 9.1 |
| Integrated Marine and Coastal Regionalisation Areas | IMCRA | ✓ | ✓ | × | Figure 9.2 |
| Marine National Park | MNP | ✓ | ✓ | × | Figure 9.3 |
| Marine Park | MP | ✓ | ✓ | × | Figure 9.4 |
| Nature Reserve | NR | ✓ | ✓ | × | Figure 9.5 |
| Ramsar | Ramsar | ✓ | ✓ | ✓ | Figure 9.6 |
| Reefs, Shoals and Banks | RSB | ✓ | ✓ | × | Figure 9.7 |
| Key Ecological Feature | KEF | ✓ | ✓ | × | Figure 9.8 |
| State Waters | State Waters | ✓ | ✓ | × | |
| Local and Sub-Local Government Area | LGA and Sub-LGA | ✓ (Reported as: Nearshore Waters) | ✓ (Reported as: Nearshore Waters) | ✓ (Reported as: Shore) | Figure 9.9 to Figure 9.11 |

**Table 9-2 Summary of the receptors that the release locations reside within.**

| Acronym | Receptor |
|---|---|
| BIA | Antipodean Albatross – Foraging |
| | Black-browed Albatross – Foraging |
| | Buller's Albatross – Foraging |
| | Campbell Albatross – Foraging |
| | Common Diving-petrel – Foraging |
| | Indian Yellow-nosed Albatross – Foraging |
| | Pygmy Blue Whale – Distribution |
| | Pygmy Blue Whale – Foraging (annual high use area) |
| | Shy Albatross – Foraging |
| | Wandering Albatross – Foraging |
| | Wedge-tailed Shearwater – Foraging |
| | White Shark – Distribution |
| IMCRA | Otway |

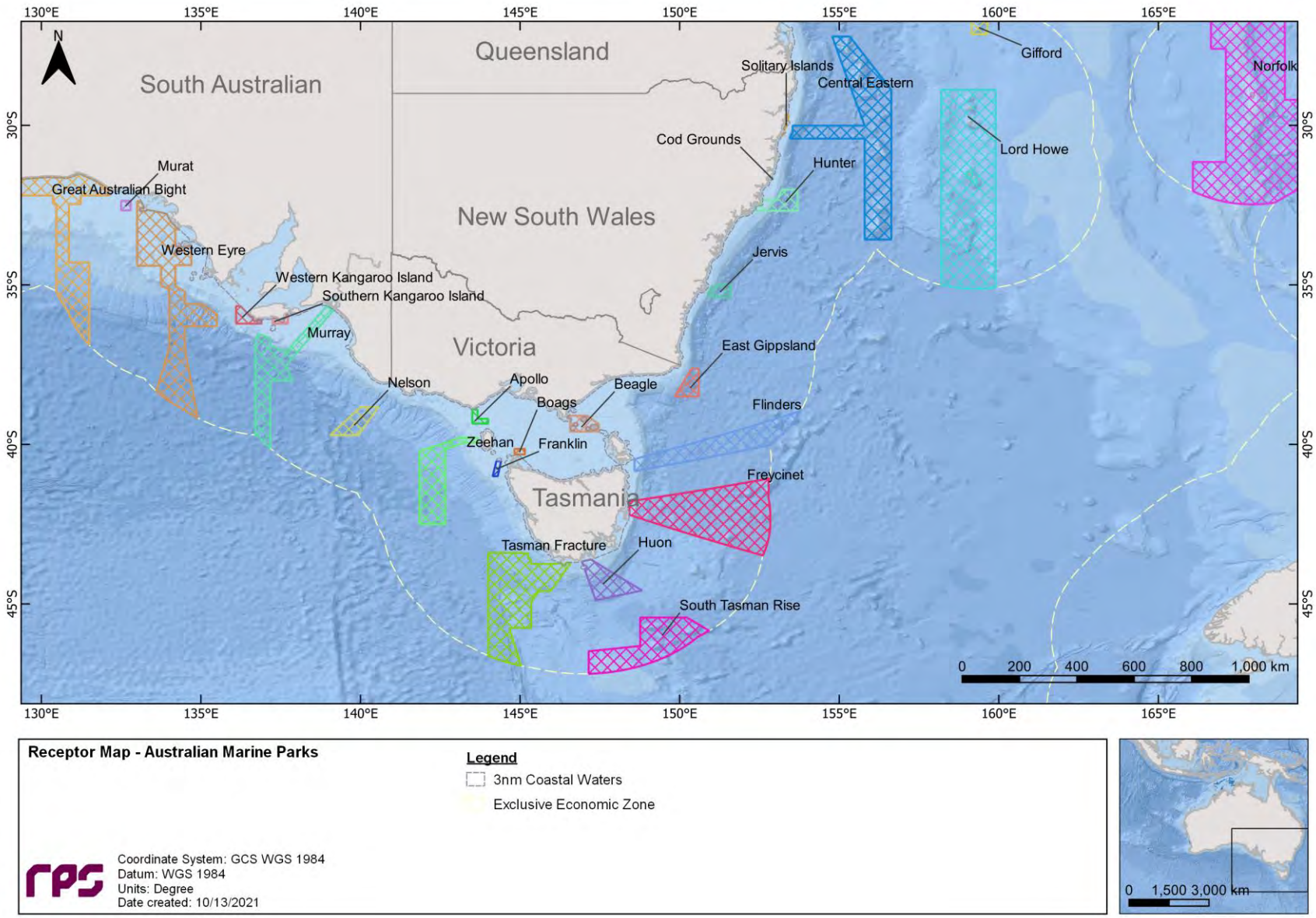



**Figure 9.1 Receptor map for Australian Marine Parks (AMP).**

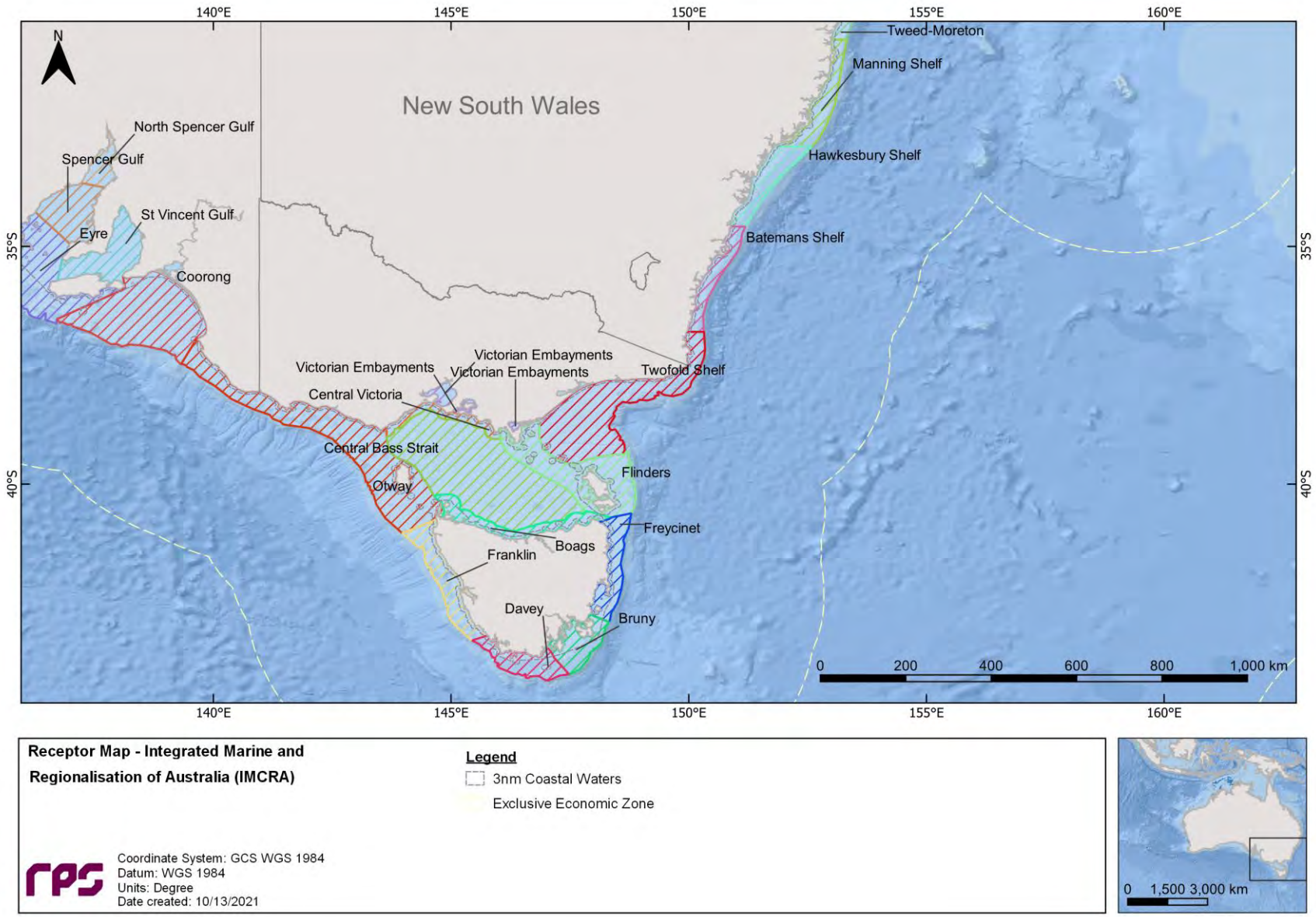



**Figure 9.2 Receptor map for integrated marine and coastal regionalisation (IMCRA) areas.**

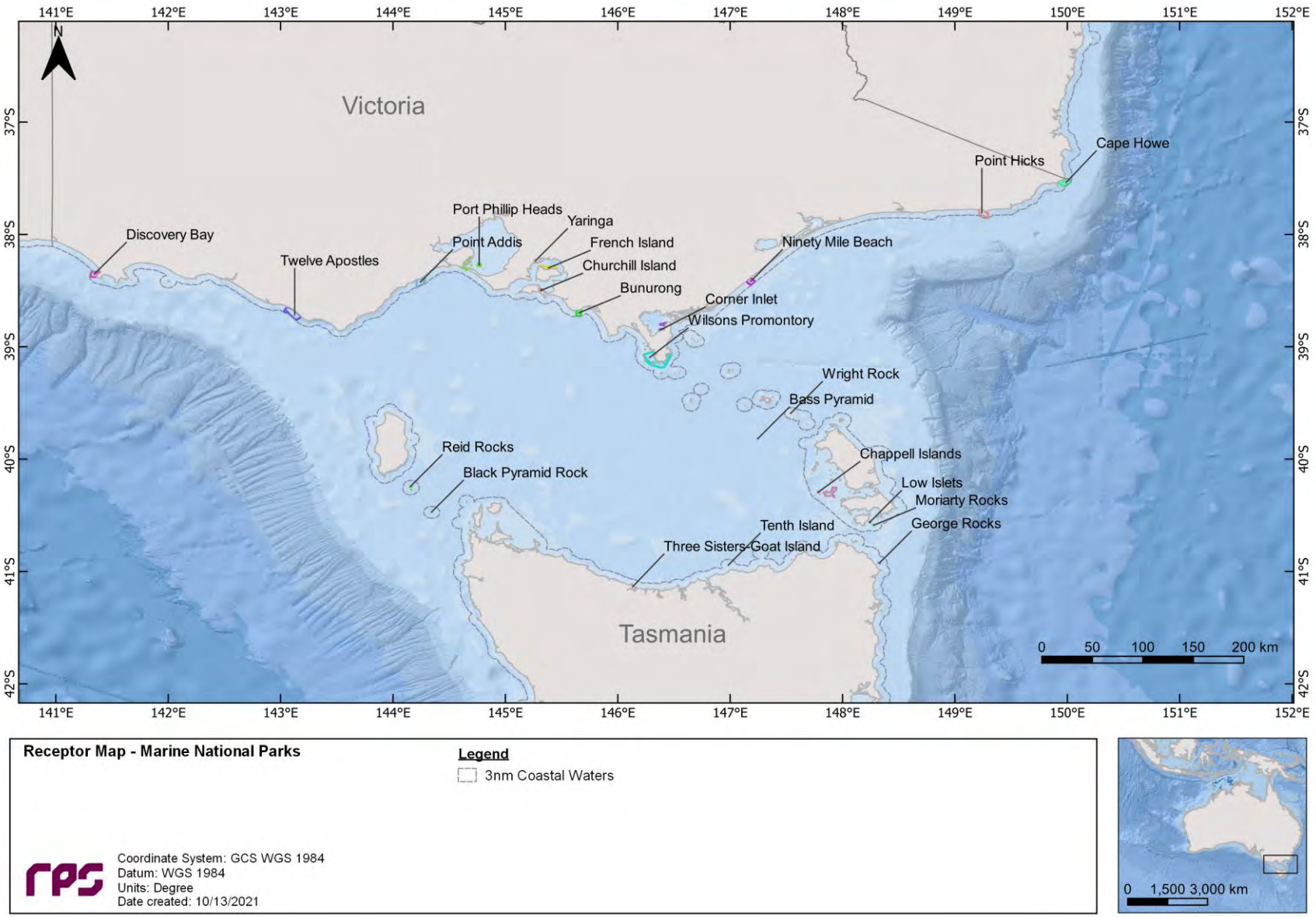



**Figure 9.3 Receptor map for Marine National Parks (MNP).**

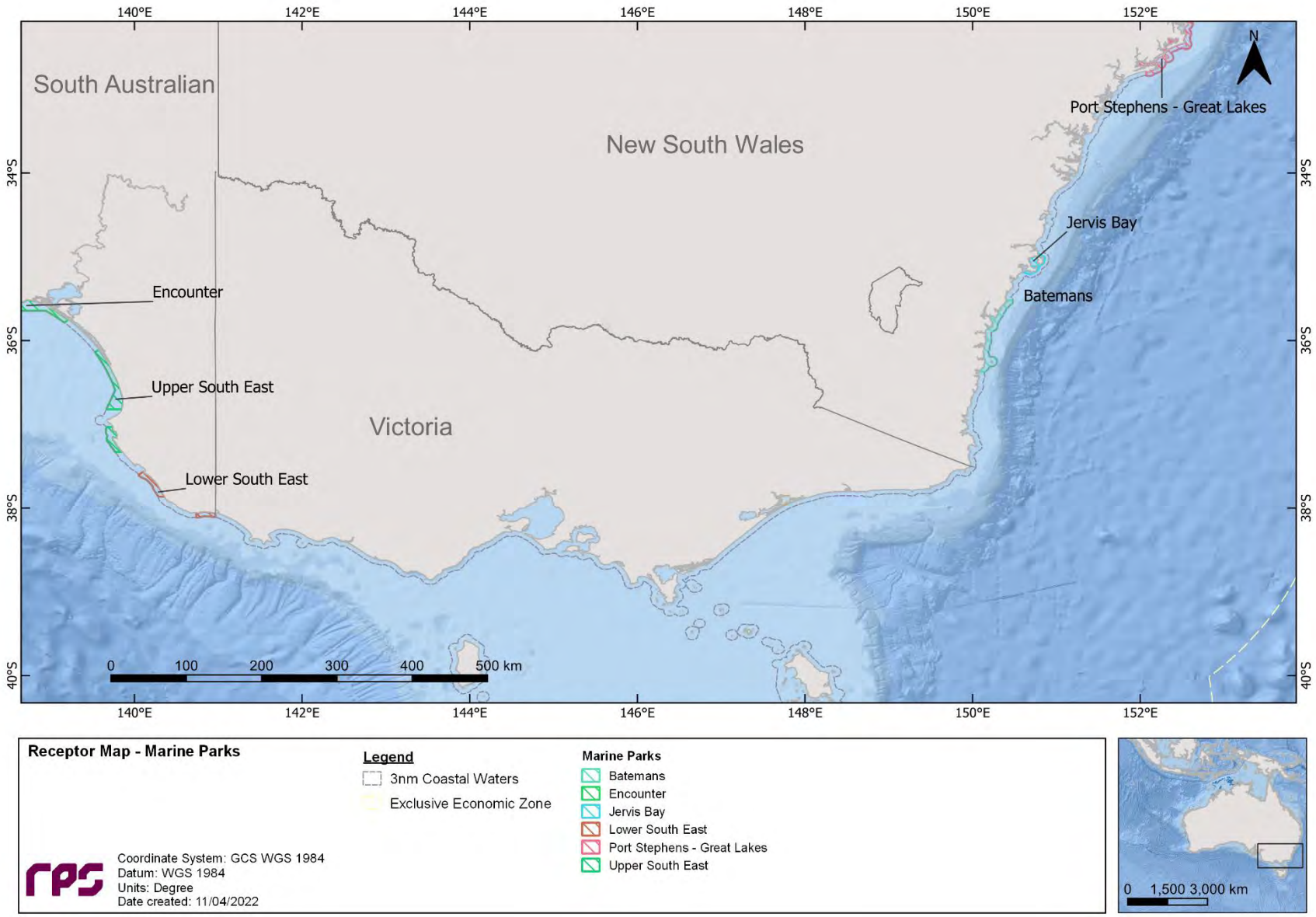



**Figure 9.4 Receptor map for Marine Parks (MP).**

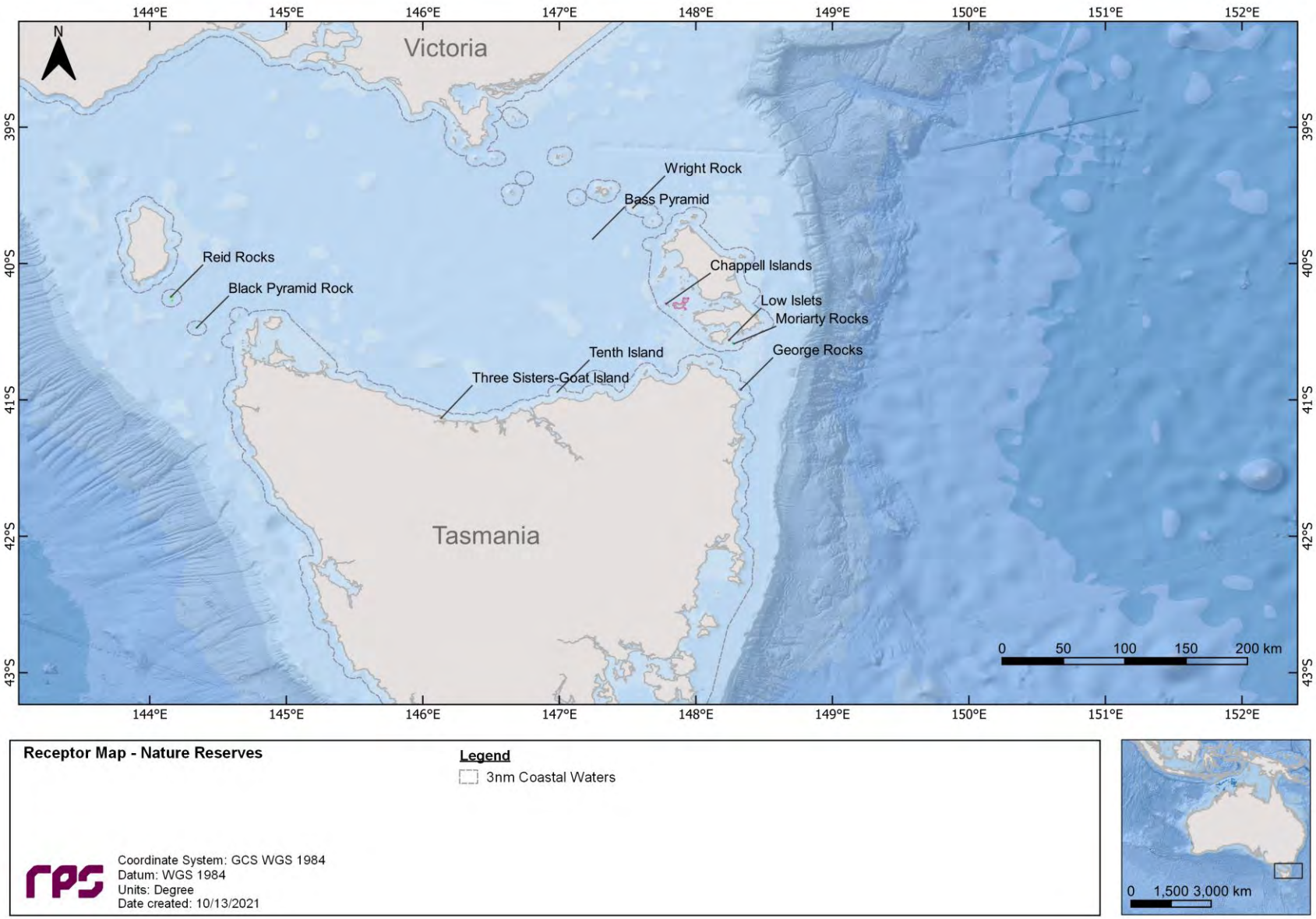



**Figure 9.5 Receptor map for Nature Reserves (NR).**

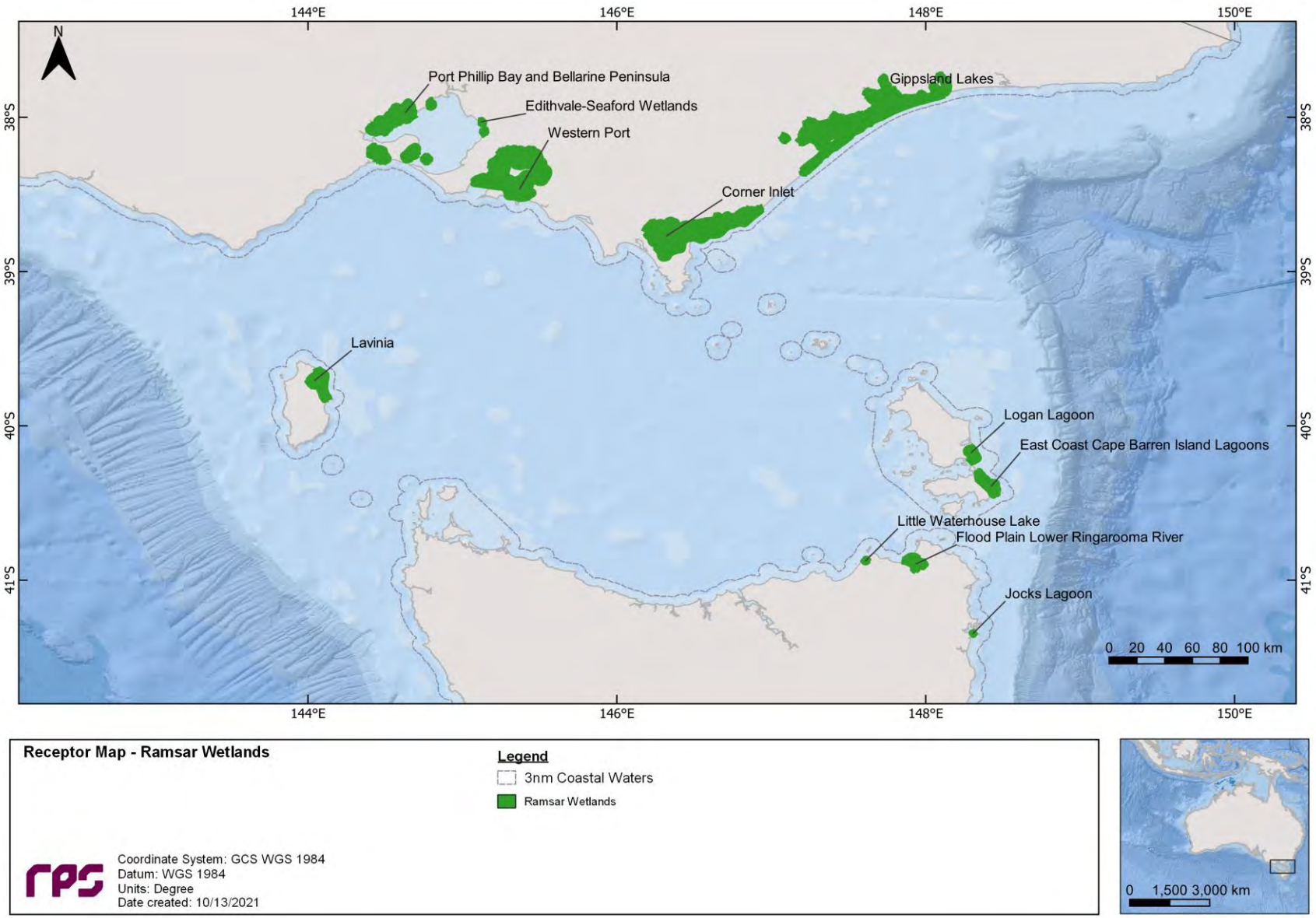



**Figure 9.6 Receptor map for Ramsar Sites (Ramsar).**

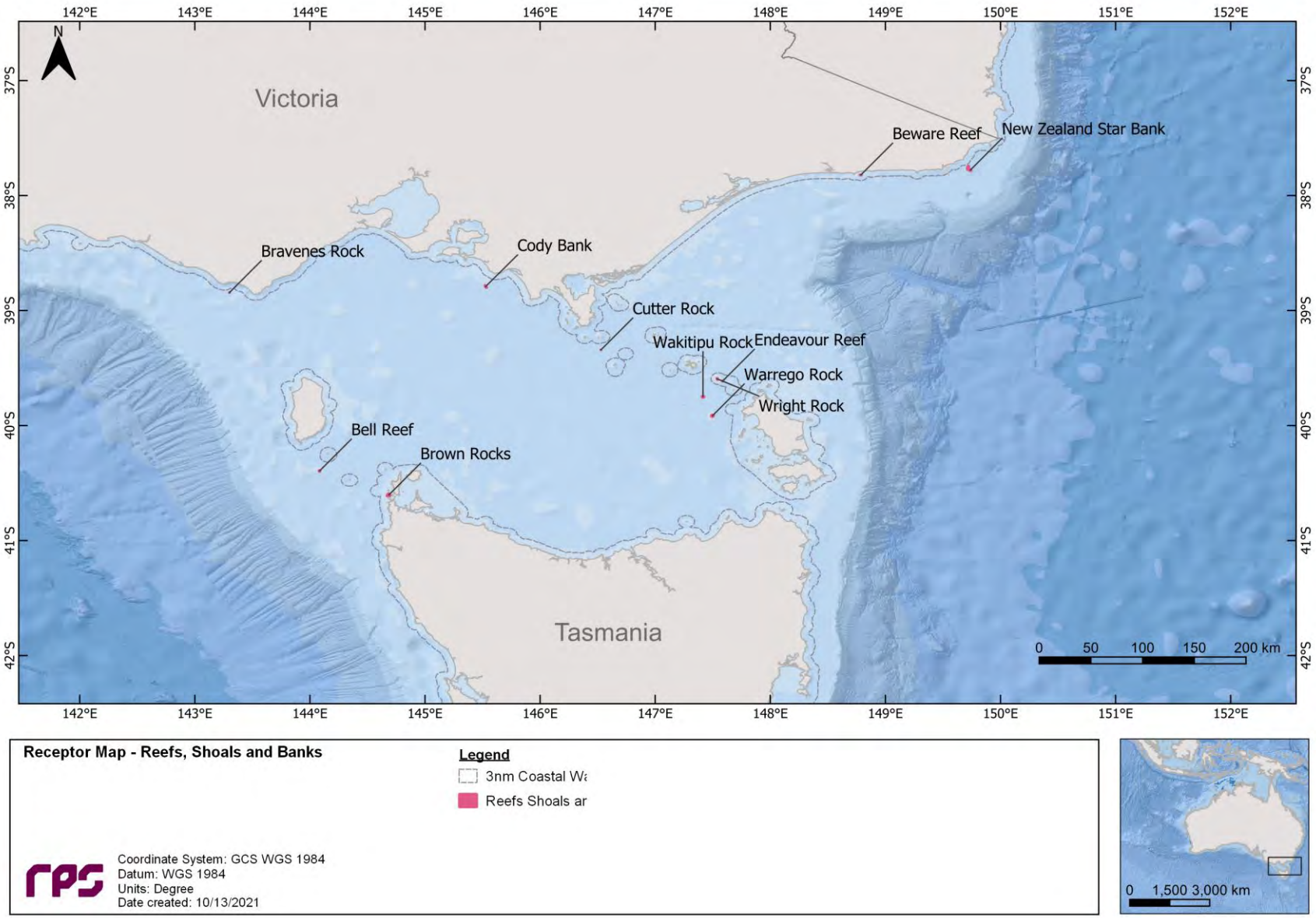



**Figure 9.7 Receptor map for Reefs, Shoals and Banks (RSB).**

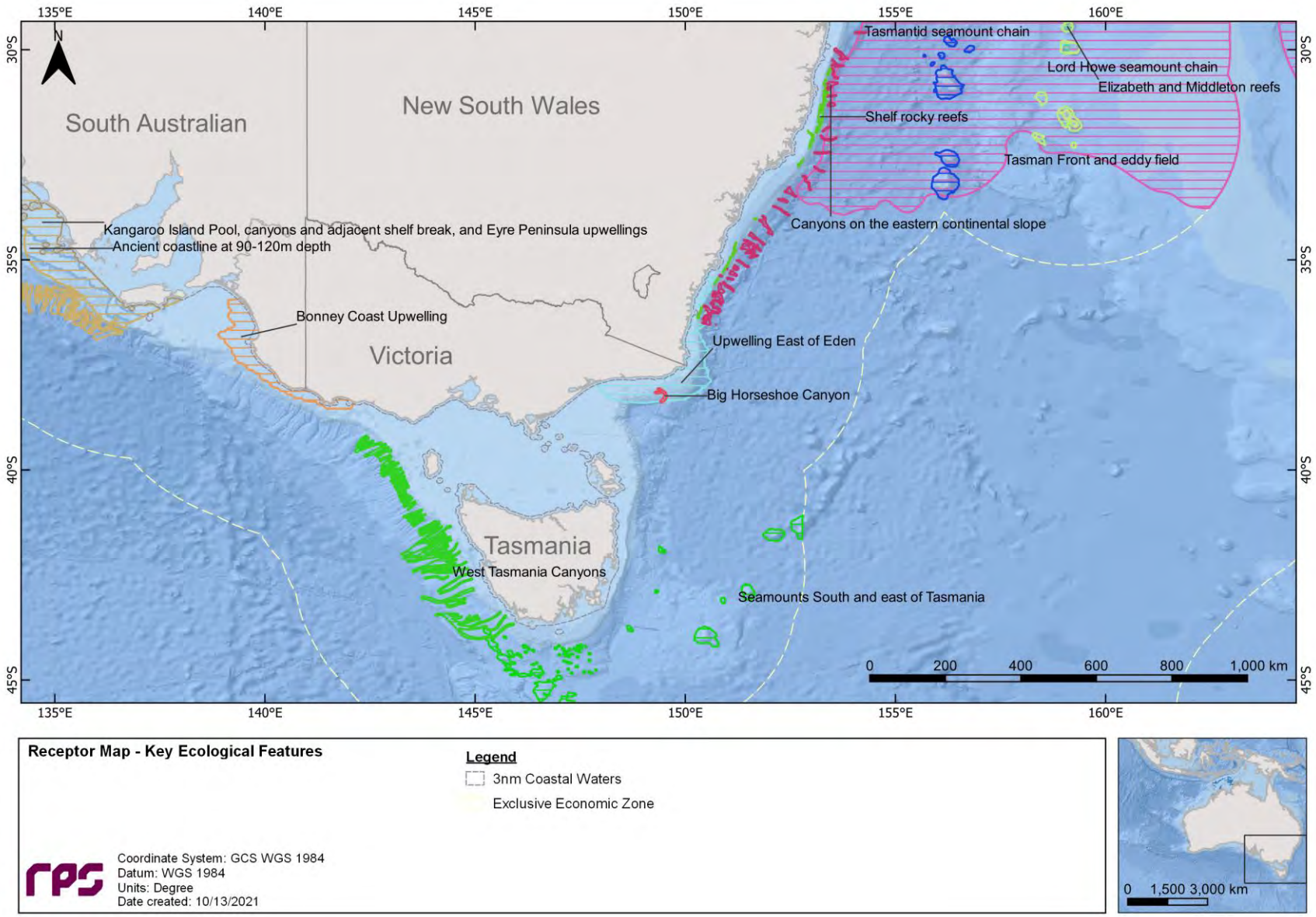



**Figure 9.8 Receptor map for Key Ecological Features (KEF).**

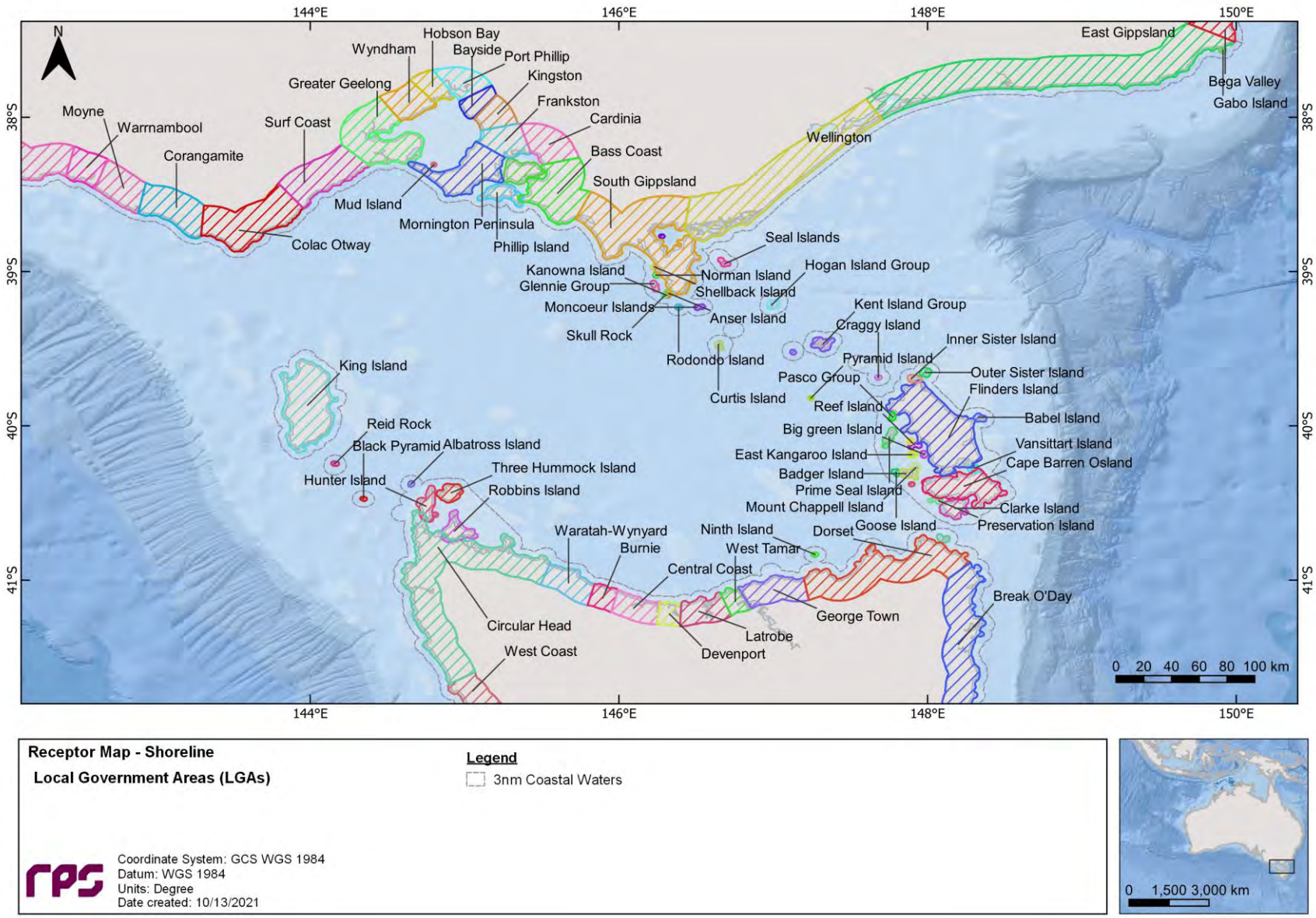



**Figure 9.9 Receptor map for shorelines (1 of 3).**

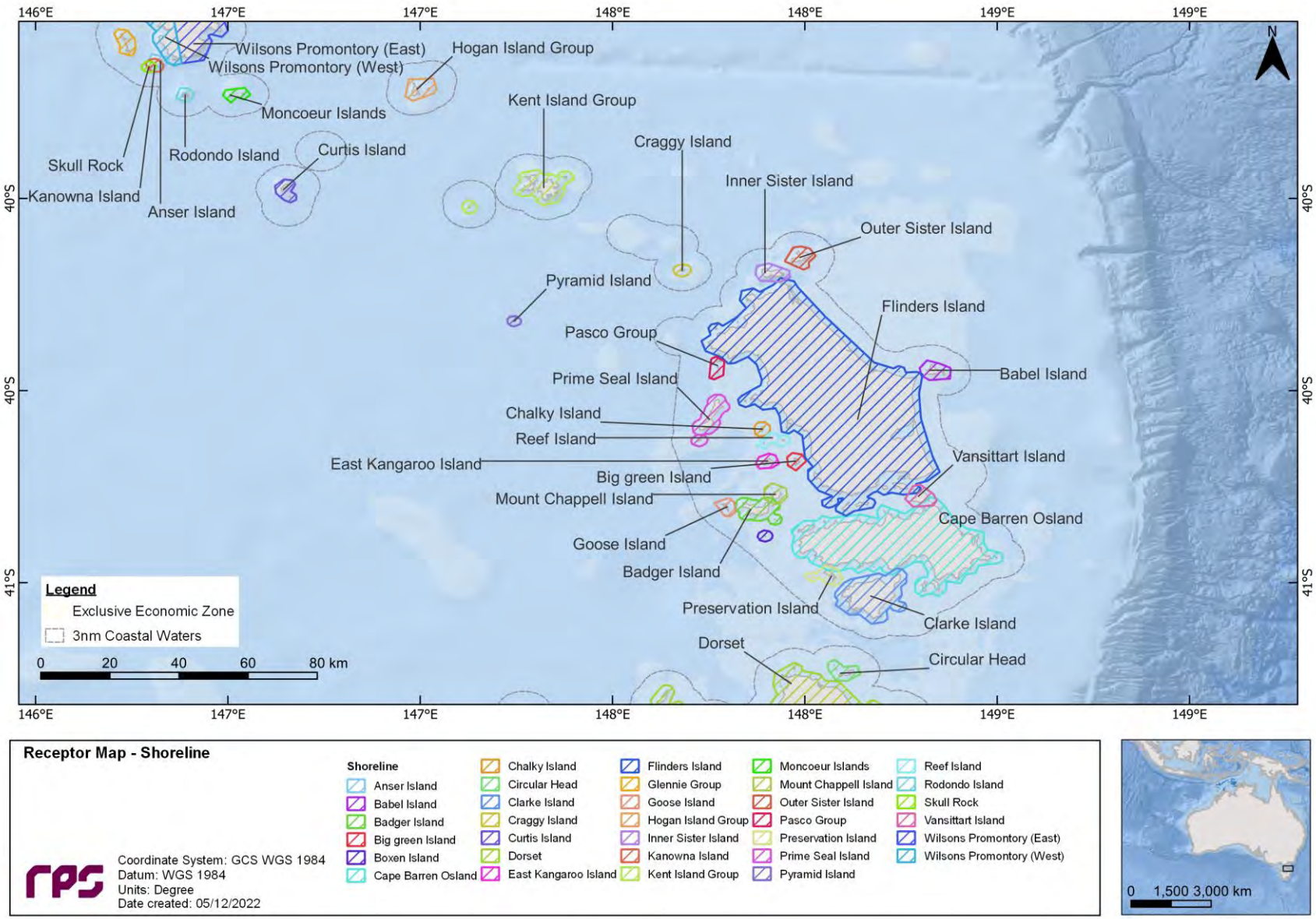



**Figure 9.10 Receptor map for shorelines (2 of 3).**

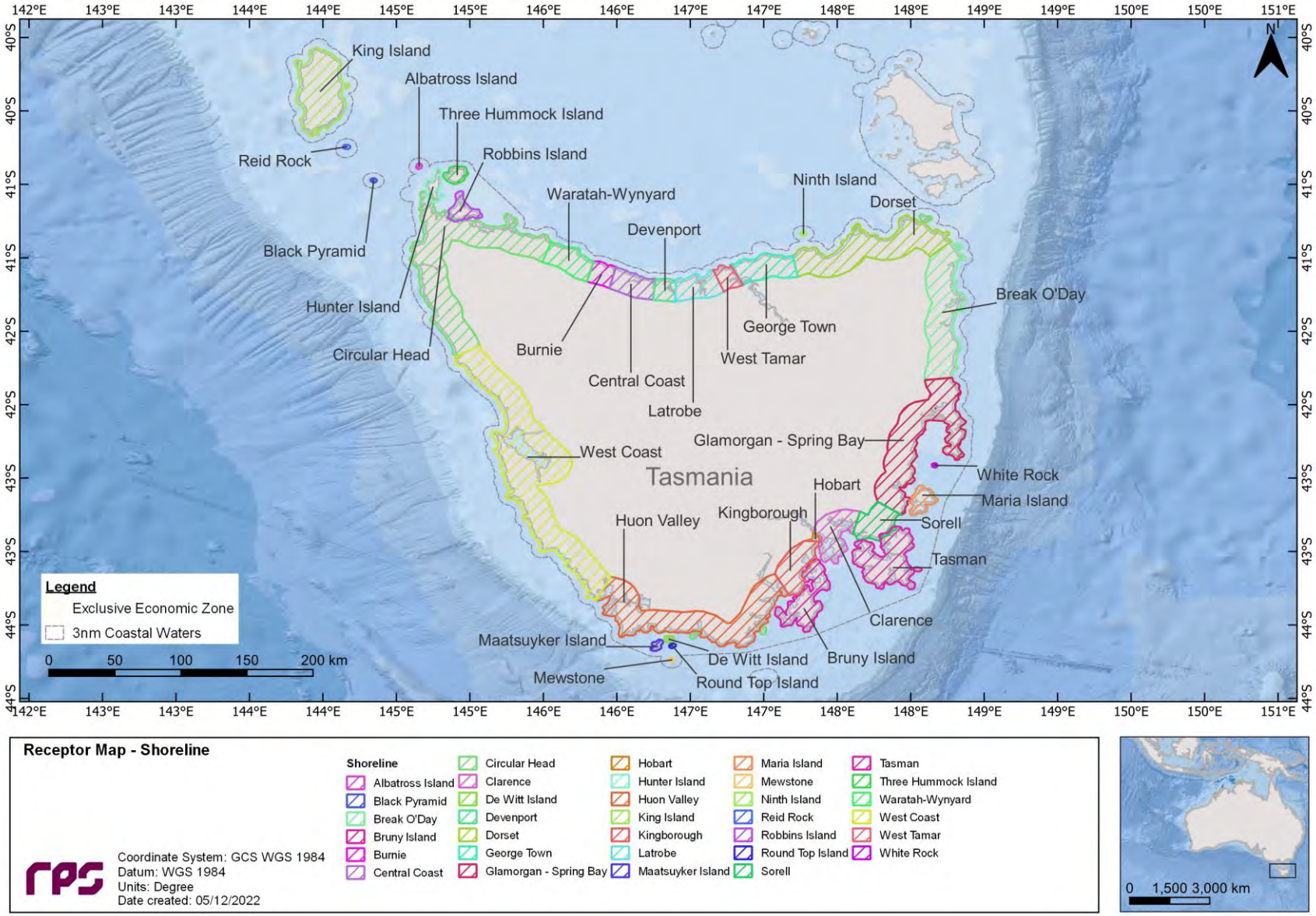



**Figure 9.11 Receptor map for shorelines (3 of 3).**

# 10 RESULTS – 250 m³ LOSS OF CONTAINMENT FROM A VESSEL COLLISION

This scenario examined a 250 $m^3$ surface release of MDO over 6 hours to represent a loss of containment from a vessel collision. A total of 100 spill simulations were run and tracked for 30 days. The results for all 100 simulations were combined and are presented on an annual basis.

Sections 10.1 and 10.2 present the annual stochastic analysis and deterministic analysis results, respectively.

## 10.1 Stochastic Analysis

### 10.1.1 Area of Exposure

Figure 10.1 presents the area of exposure based on the low thresholds produced by overlaying the results from all 100 simulations.

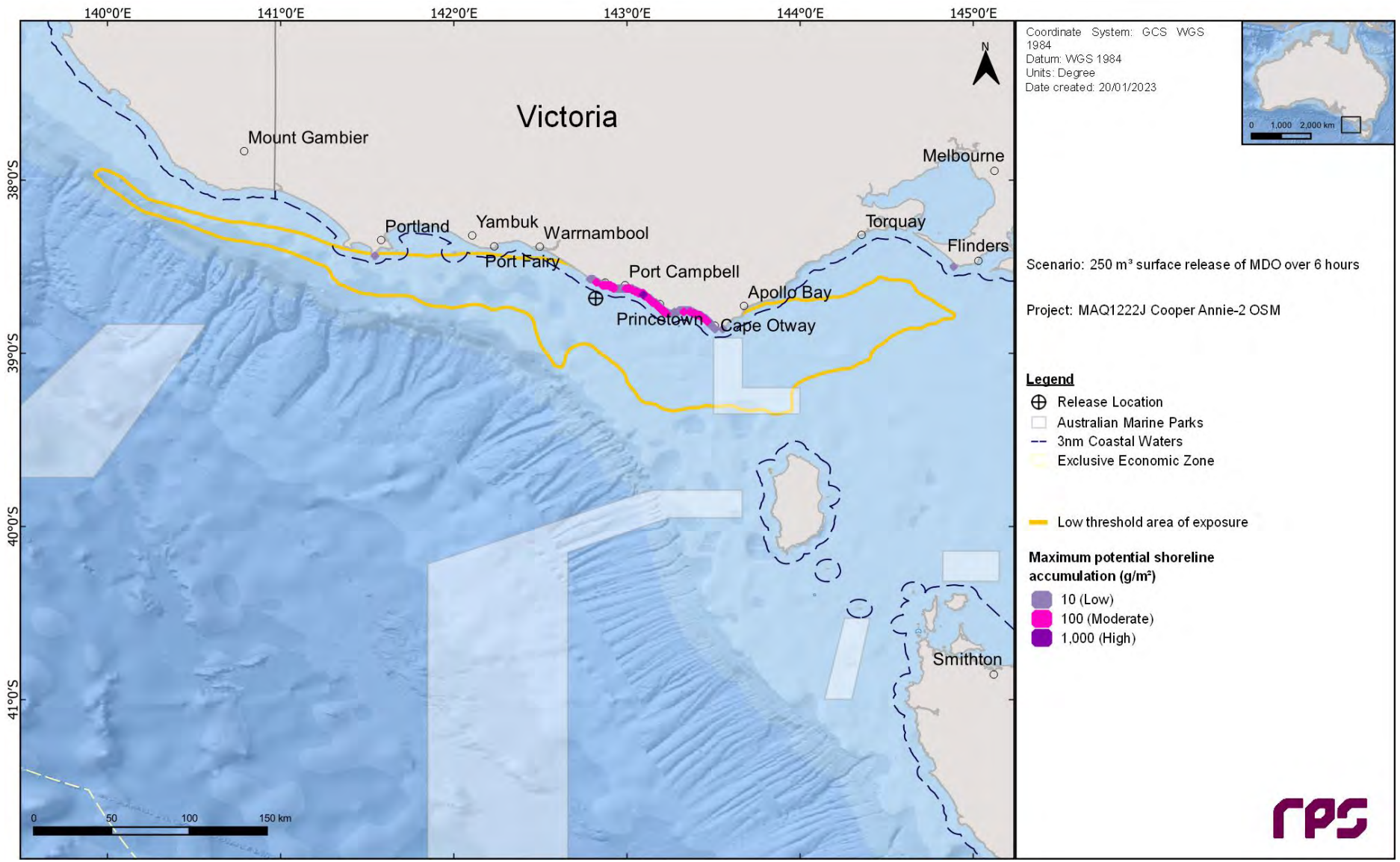



**Figure 10.1 Predicted area of exposure for low thresholds produced by overlaying the results from 100 simulations of a 250 m³ surface release of MDO over 6 hours.**

### 10.1.2 Floating Oil Exposure

Table 10-1 summarises the maximum distance travelled by floating oil on the sea surface at each threshold. The maximum distance from the release location to the low (1–10 g/m$^2$), moderate (10–50 g/m$^2$) and high (> 50 g/m$^2$) exposure zones was 32.5 km (west), 10.3 km (west) and 2.8 km (east-southeast), respectively.

Table 10-2 summarises the potential floating oil exposure to individual receptors.

A total of 14 Biologically Important Areas (BIAs) were predicted to be exposed to floating oil at, or above, the low threshold. Excluding the 13 BIAs that the release location resides within (see Section 9.3), the highest probability (3%) of low exposure were predicted at the Southern Right Whale – Aggregation BIA. The minimum time before low exposure to the Southern Right Whale – Aggregation ranged between 28 hours.

Additionally, Twelve Apostles MNP, Corangamite LGA and Moonlight Head sub-LGA recorded a probability of low floating oil exposure of 2%.

Table 10.3 presents the maximum residence time of floating oil exposure for each individual grid cell within each individual receptor.

Figure 10.2 presents the zones of potential floating oil exposure whilst Figure 10.3 to Figure 10.4 present the maximum residence time of floating oil exposure for the NOPSEMA thresholds.

**Table 10-1 Maximum distance and direction from the release location to the edge of floating oil exposure. Results are based on a 250 m$^3$ surface release of MDO over 6 hours. The results were calculated from 100 spill simulations.**

| Distance and direction travelled | Zones of potential floating oil exposure | | |
|---|---|---|---|
| | Low | Moderate | High |
| Maximum distance (km) from release location | 32.5 | 10.3 | 2.8 |
| Maximum distance (km) from release location (99$^{th}$ percentile) | 30.3 | 10.3 | 2.8 |
| Direction | W | W | ESE |

**Table 10-2 Summary of the potential floating oil exposure to individual receptors. Results are based on a 250 $m^3$ surface release of MDO over 6 hours. The results were calculated from 100 spill simulations.**

| Receptor | | Probability of floating oil exposure (%) | | | Minimum time before floating oil exposure (hours) | | |
|---|---|---|---|---|---|---|---|
| | | Low | Moderate | High | Low | Moderate | High |
| BIA | Antipodean Albatross – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | Black-browed Albatross – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | Buller's Albatross – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | Campbell Albatross – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | Common Diving-petrel – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | Indian Yellow-nosed Albatross – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | Pygmy Blue Whale – Distribution* | 4 | - | - | 23 | 1 | 1 |
| | Pygmy Blue Whale – Foraging (annual high use area) * | 100 | 100 | 38 | 1 | 1 | 1 |
| | Shy Albatross – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | Southern Right Whale – Aggregation | 4 | - | - | 23 | - | - |
| | Southern Right Whale – Migration and resting on migration | 100 | 100 | 38 | 1 | 1 | 1 |
| | Wandering Albatross – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | Wedge-tailed Shearwater – Foraging* | 100 | 100 | 38 | 1 | 1 | 1 |
| | White Shark – Distribution* | 100 | 100 | 38 | 1 | 1 | 1 |
| IMCRA | Otway* | 100 | 100 | 38 | 1 | 1 | 1 |
| MNP | Twelve Apostles | 2 | - | - | 32 | - | - |
| Nearshore Waters (LGA) | Corangamite | 2 | - | - | 36 | - | - |
| Nearshore Waters (Sub-LGA) | Moonlight Head | 2 | - | - | 35 | - | - |
| State Waters | Victoria State Waters* | 10 | 2 | - | 6 | 16 | - |

*The release location resides within the receptor boundaries.

**Table 10.3 Summary of the maximum residence time of floating oil exposure for each individual grid cell within each individual receptor. Results are based on a 250 $m^3$ surface release of MDO over 6 hours. The results were calculated from 100 spill simulations.**

| Receptor | | Maximum residence time of floating oil exposure (hours) | | |
|---|---|---|---|---|
| | | Low | Moderate | High |
| BIA | Antipodean Albatross – Foraging* | 31.92 | 18 | 6.96 |
| | Black-browed Albatross – Foraging* | 31.92 | 18 | 6.96 |
| | Buller's Albatross – Foraging* | 31.92 | 18 | 6.96 |
| | Campbell Albatross – Foraging* | 31.92 | 18 | 6.96 |
| | Common Diving-petrel – Foraging* | 31.92 | 18 | 6.96 |
| | Indian Yellow-nosed Albatross – Foraging* | 31.92 | 18 | 6.96 |
| | Pygmy Blue Whale – Distribution* | 31.92 | 18 | 6.96 |
| | Pygmy Blue Whale – Foraging* | 31.92 | 18 | 6.96 |
| | Shy Albatross – Foraging* | 31.92 | 18 | 6.96 |
| | Southern Right Whale - Aggregation | 9.12 | - | - |
| | Southern Right Whale – Migration and resting on migration | 31.92 | 18 | 6.96 |
| | Wandering Albatross – Foraging* | 31.92 | 18 | 6.96 |
| | Wedge-tailed Shearwater – Foraging* | 31.92 | 18 | 6.96 |
| | White Shark – Distribution* | 31.92 | 18 | 6.96 |
| IMCRA | Otway* | 31.92 | 18 | 6.96 |
| MNP | Twelve Apostles | 3.12 | - | - |
| Nearshore Waters (LGA) | Corangamite | 3.12 | - | - |
| Nearshore Waters (Sub-LGA) | Moonlight Head | 3.12 | - | - |
| State Waters* | Victoria State Waters | 19.92 | 3.12 | - |

*The release location resides within the receptor boundaries.

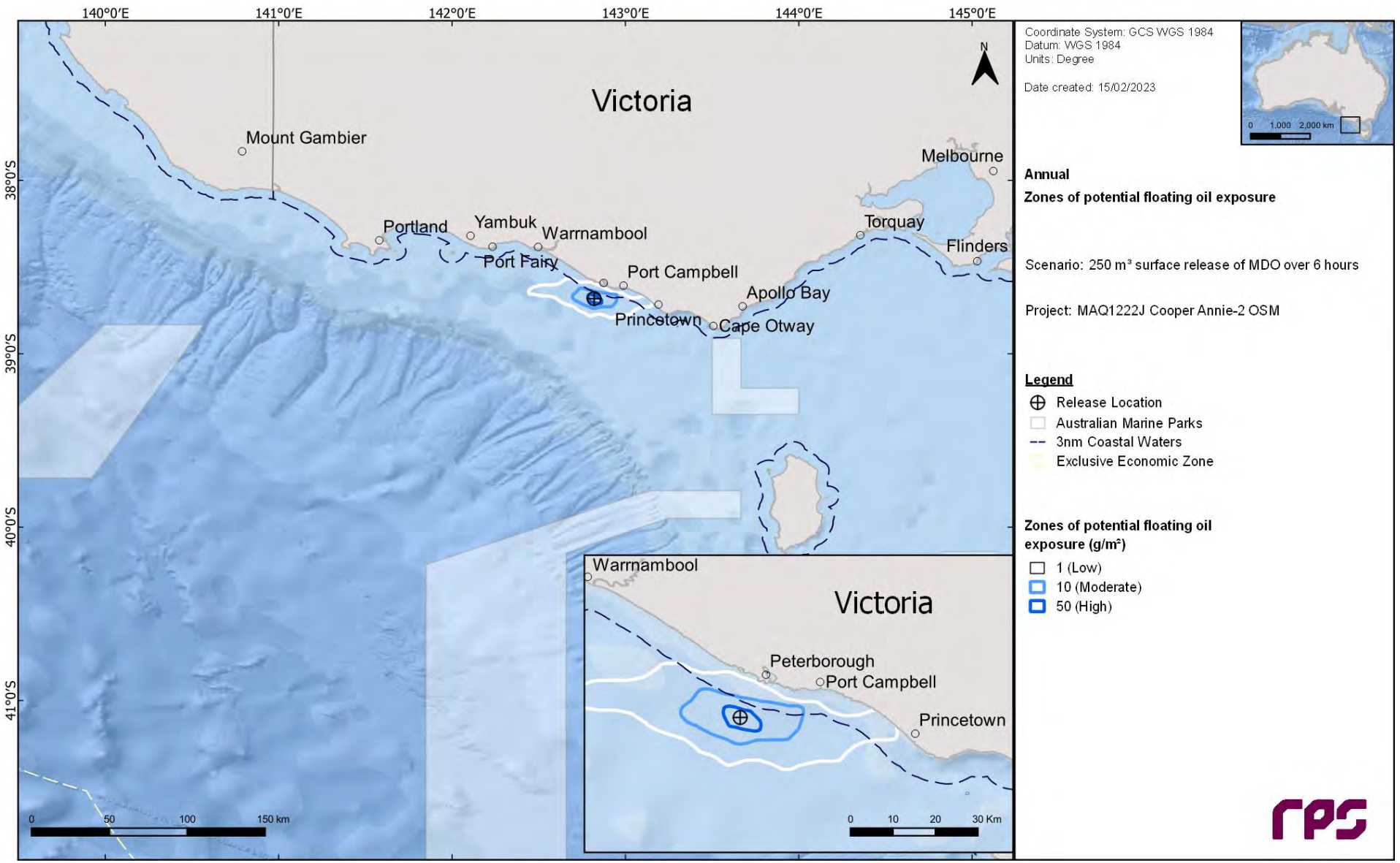



**Figure 10.2 Zones of potential floating oil exposure in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

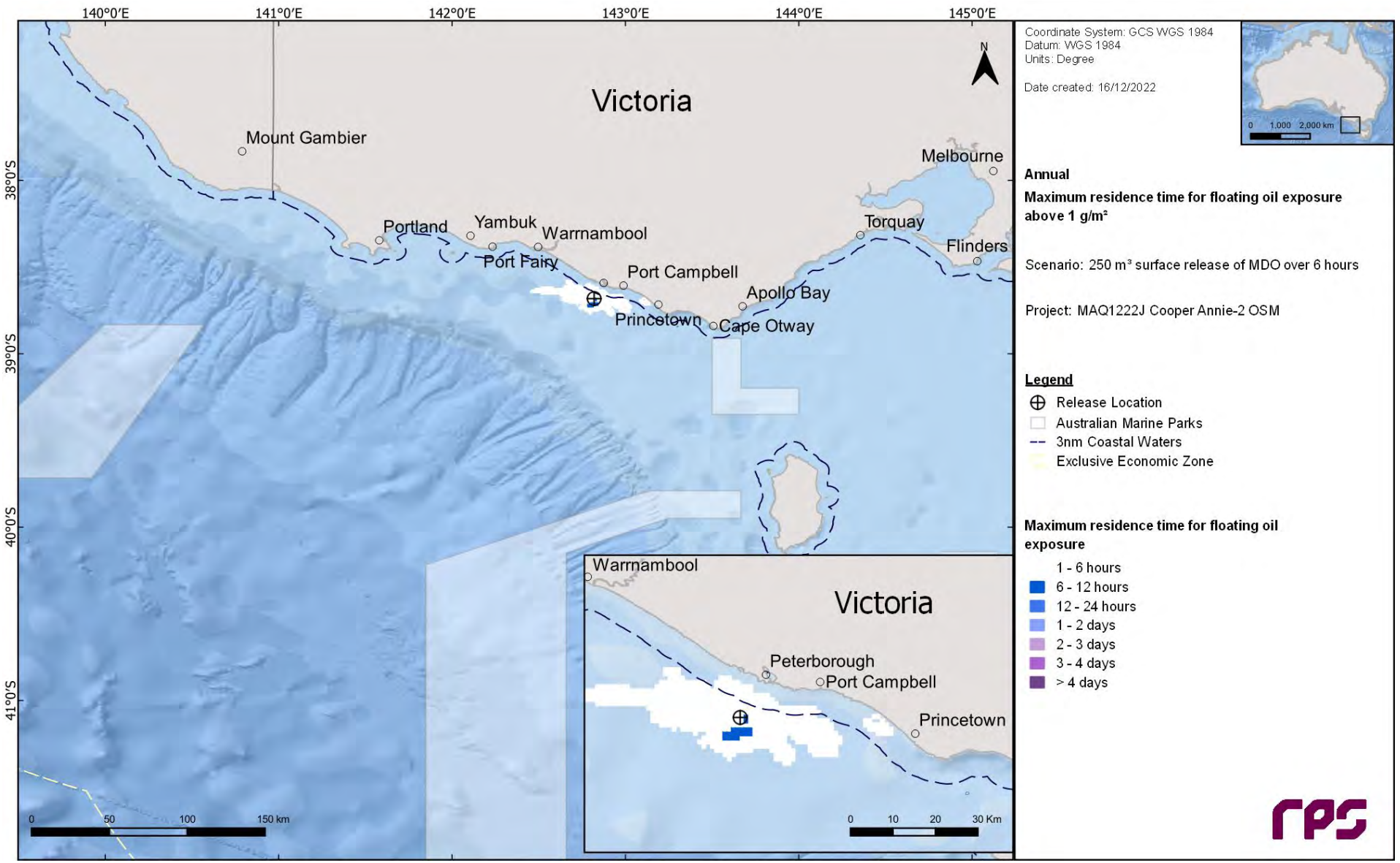



**Figure 10.3 Maximum residence time of floating oil exposure above 1 g/m², in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

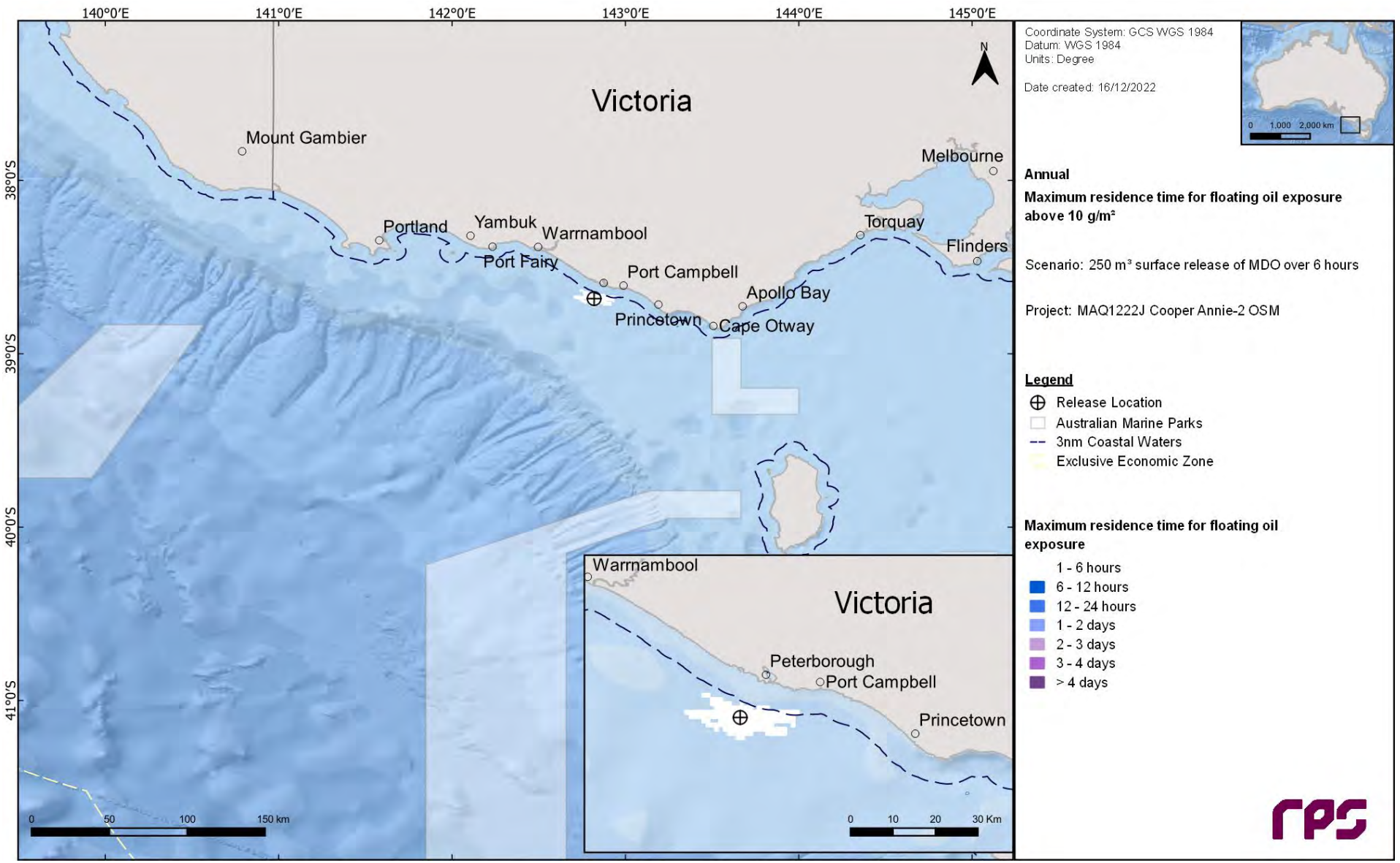



**Figure 10.4 Maximum residence time of floating oil exposure above 10 g/m², in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

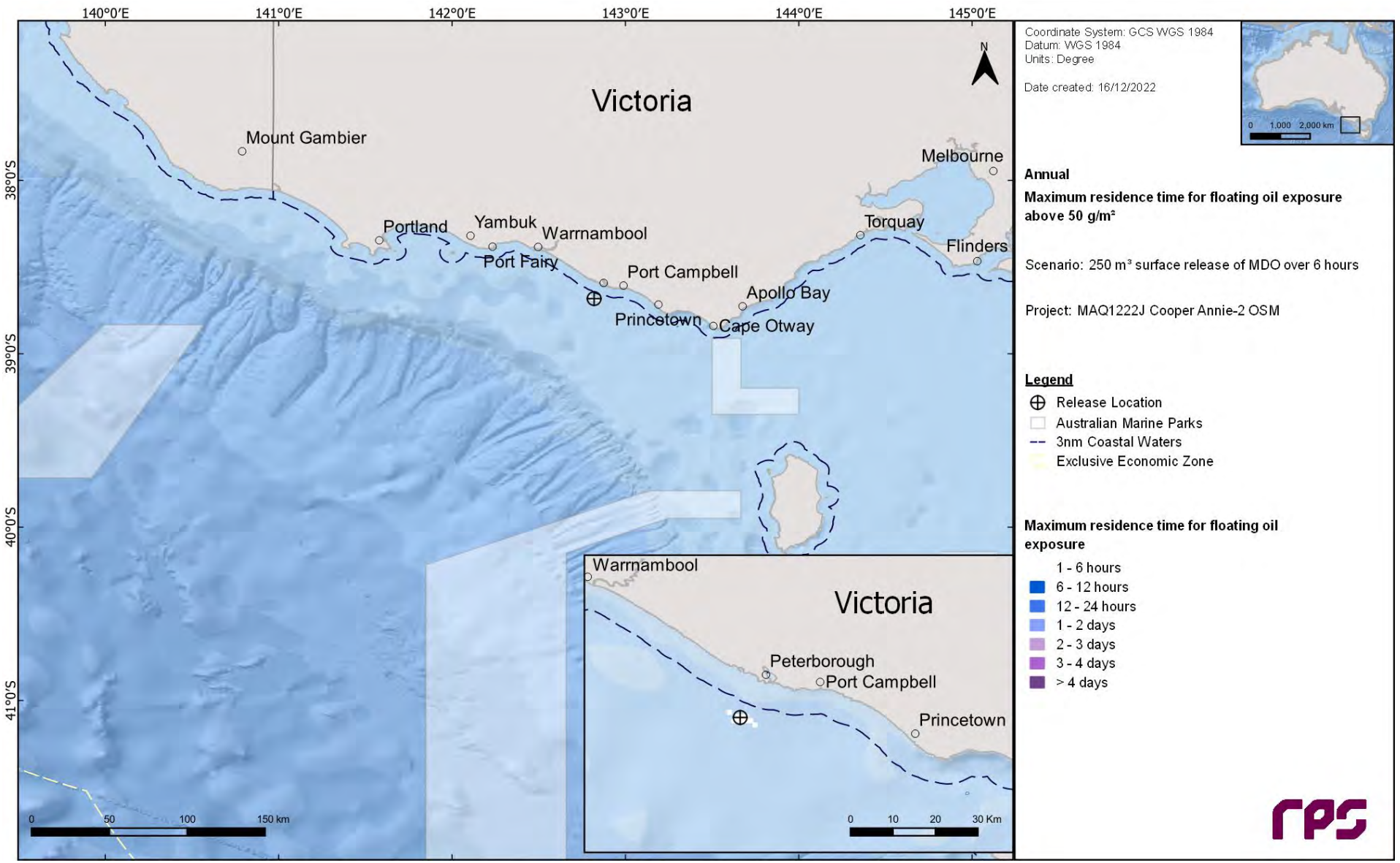



**Figure 10.5 Maximum residence time of floating oil exposure above 50 g/m², in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

### 10.1.3 Shoreline Accumulation

Table 10-4 presents a summary of the potential shoreline accumulation. The probability of accumulation to any shoreline at, or above, the low (10 g/m$^2$) threshold was 60%. The minimum time before oil accumulation at, or above, the low threshold was 22 hours. The maximum total volume ashore for a single spill trajectory was 43.2 m$^3$, and the maximum length of shoreline with accumulation above the low, moderate and high thresholds were 32 km, 11 km and 1 km, respectively.

Table 10-5 summarises the shoreline accumulation on individual receptors.

The shoreline segment of Corangamite had the highest probability of accumulation above all three thresholds. The minimum time for low threshold shoreline accumulation was less than 1 day for several shoreline segments and Sub-LGAs.

The maximum potential shoreline loading above each shoreline thresholds is presented in Figure 10.6.

**Table 10-4 Summary of oil accumulation across all shorelines. Results are based on a 250 m$^3$ surface release of MDO over 6 hours. The results were calculated from 100 spill simulations.**

| Shoreline Statistics | Annual |
|---|---|
| Probability of accumulation on any shoreline (%) | 60 |
| Absolute minimum time for visible oil to shore (hours) | 22 |
| Maximum total volume of hydrocarbons ashore (m$^3$) | 43.2 |
| Average total volume of hydrocarbons ashore (m$^3$) | 7.5 |
| Maximum length of the shoreline at **10 g/m$^2$** (km) | 32 |
| Average shoreline length (km) at **10 g/m$^2$** (km) | 13 |
| Maximum length of the shoreline at **100 g/m$^2$** (km) | 11 |
| Average shoreline length (km) at **100 g/m$^2$** (km) | 4.8 |
| Maximum length of the shoreline at **1,000 g/m$^2$** (km) | 1 |
| Average shoreline length (km) at **1,000 g/m$^2$** (km) | 1 |

**Table 10-5 Summary of oil accumulation on individual shoreline receptors. Results are based on a 250 $m^3$ surface release of MDO over 6 hours. The results were calculated from 100 spill simulations.**

| Shoreline Receptor | | Maximum probability of shoreline loading (%) | | | Minimum time before shoreline accumulation (days) | | | Load on shoreline ($g/m^2$) | | Volume on shoreline ($m^3$) | | Mean length of shoreline accumulation (km) | | | Maximum length of shoreline accumulation (km) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | Mod | High | Low | Mod | High | Mean | Peak | Mean | Peak | Low | Mod | High | Low | Mod | High |
| LGA | Colac Otway | 26 | 5 | - | 2 | 3 | - | 5 | 272 | 1.3 | 25.1 | 8.1 | 3.3 | - | 24.5 | 7.3 | - |
| | Corangamite | 47 | 28 | 1 | 1 | 1 | 4 | 19 | 1,015 | 5.4 | 43.1 | 10.1 | 4.3 | 0.9 | 24.5 | 10 | 0.9 |
| | Glenelg | 1 | - | - | 8 | - | - | < 1 | 13 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| | Mornington Peninsula | 1 | - | - | 13 | - | - | < 1 | 15 | < 0.1 | 0.8 | 0.9 | - | - | 0.9 | - | - |
| | Moyne | 6 | 2 | - | 1 | 2 | - | 4 | 160 | 0.2 | 6.8 | 3.9 | 2.3 | - | 8.2 | 3.6 | - |
| Sub-LGA | Apollo Bay | 2 | - | - | 5 | - | - | < 1 | 33 | < 0.1 | 0.5 | 0.9 | - | - | 0.9 | - | - |
| | Bay of Islands | 6 | 2 | - | 1 | 2 | - | 4 | 160 | 0.2 | 6.8 | 3.9 | 2.3 | - | 8.2 | 3.6 | - |
| | Cape Nelson | 1 | - | - | 8 | - | - | < 1 | 13 | < 0.1 | 0.3 | 0.9 | - | - | 0.9 | - | - |
| | Cape Otway West | 26 | 5 | - | 2 | 3 | - | 5 | 272 | 1.3 | 24.8 | 8 | 3.3 | - | 24.5 | 7.3 | - |
| | Moonlight Head | 43 | 23 | - | 1 | 1 | - | 18 | 793 | 4 | 40.9 | 8.4 | 3.9 | - | 17.3 | 8.2 | - |
| | Mornington Peninsula (S) | 1 | - | - | 13 | - | - | 1 | 15 | < 0.1 | 0.5 | 0.9 | - | - | 0.9 | - | - |
| | Port Campbell | 16 | 8 | 1 | 1 | 2 | 4 | 16 | 1,015 | 1.4 | 34.7 | 7.1 | 3.7 | 0.9 | 16.4 | 7.3 | 0.9 |

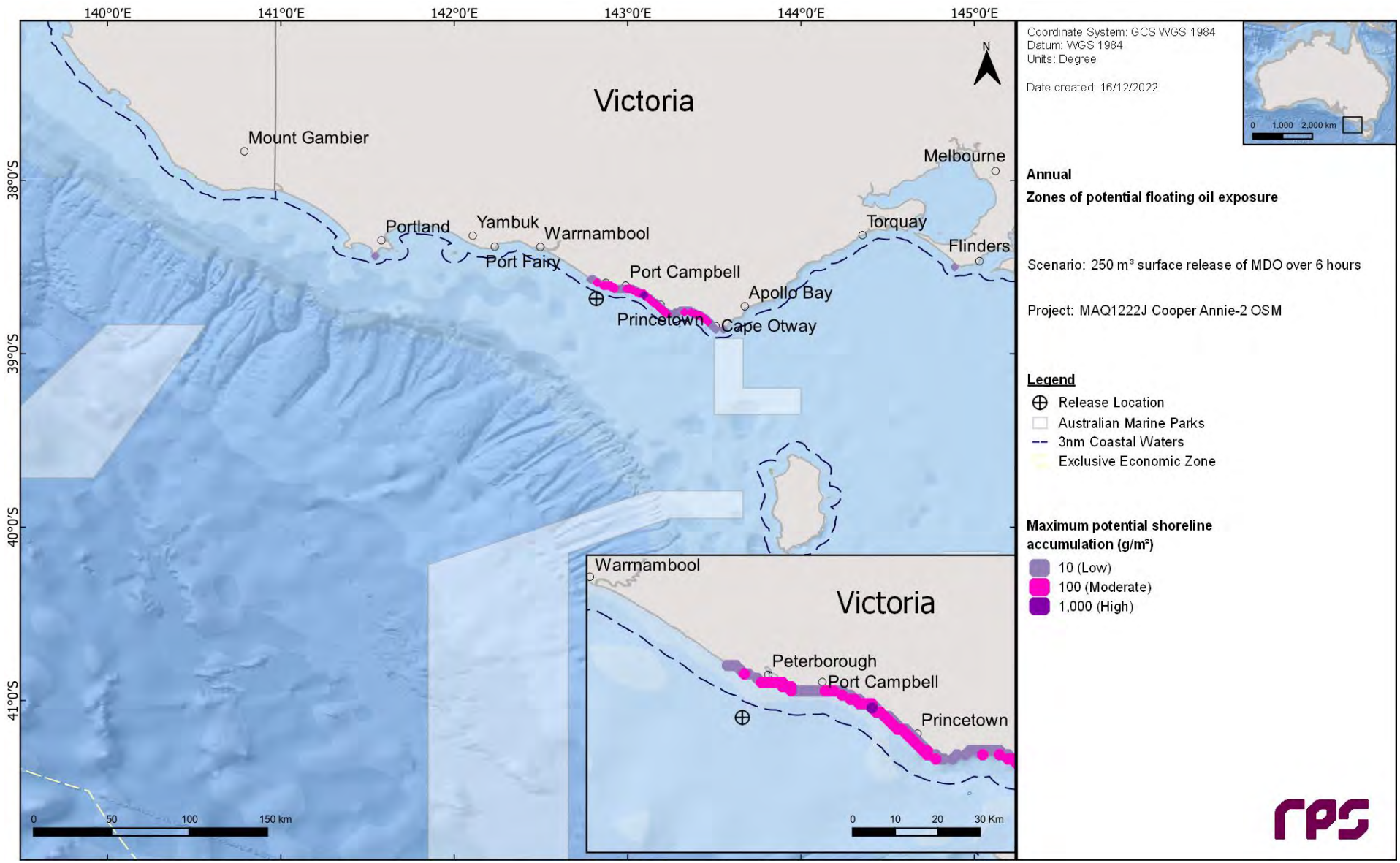



**Figure 10.6 Maximum potential shoreline loading in the event of a 250 m$^3$ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

## 10.1.4 In-water exposure

### 10.1.4.1 Dissolved Hydrocarbons

Table 10-6 summarises the potential in-water exposure to individual receptors from dissolved hydrocarbons in the 0-10 m layer.

A total of 15 BIAs were predicted to be exposed to dissolved hydrocarbon at, or above, the low threshold. Excluding the 13 BIAs that the release location resides within (see Section 9.3), the highest probability of low exposure ranged between 1% (Short-tailed Shearwater - Foraging) and 2% (Southern Right Whale - Aggregation).

Additionally, the Twelve Apostles MNP recorded a probability of low dissolved hydrocarbon exposure of 1%.

The maximum dissolved hydrocarbon concentration at any given receptor(s) was shown to be 77 ppb.

Table 10.7 presents the predicted minimum time to dissolved hydrocarbon exposure and maximum residence time for dissolved hydrocarbon exposure to individual receptors, in the 0-10 m depth layer, for all thresholds assessed.

Figure 10.7 presents the zones of potential dissolved hydrocarbon exposure for the 0-10 m depth layer whilst Figure 10.8 to Figure 10.9 present the maximum residence time of dissolved hydrocarbon exposure for the NOPSEMA thresholds.

**Table 10-6 Probability of dissolved hydrocarbons exposure to marine based receptors in the 0–10 m depth. Results are based on a 250 $m^3$ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill simulations.**

| Receptor | | Maximum dissolved hydrocarbon exposure (ppb) | Probability of dissolved hydrocarbon exposure | | |
|---|---|---|---|---|---|
| | | | Low | Moderate | High |
| BIA | Antipodean Albatross – Foraging* | 77 | 29 | 3 | - |
| | Black-browed Albatross – Foraging* | 77 | 29 | 3 | - |
| | Buller's Albatross – Foraging* | 77 | 29 | 3 | - |
| | Campbell Albatross – Foraging* | 77 | 29 | 3 | - |
| | Common Diving-petrel – Foraging* | 77 | 29 | 3 | - |
| | Indian Yellow-nosed Albatross – Foraging* | 77 | 29 | 3 | - |
| | Pygmy Blue Whale – Distribution * | 77 | 29 | 3 | - |
| | Pygmy Blue Whale – Foraging | 20 | 1 | - | - |
| | Pygmy Blue Whale – Foraging (annual high use area) * | 77 | 29 | 3 | - |
| | Short-tailed Shearwater - Foraging | 12 | 1 | - | - |
| | Shy Albatross – Foraging* | 77 | 29 | 3 | - |
| | Southern Right Whale – Aggregation | 18 | 2 | - | - |
| | Southern Right Whale – Migration and resting on migration | 77 | 29 | 3 | - |
| | Wandering Albatross – Foraging* | 77 | 29 | 3 | - |
| | Wedge-tailed Shearwater – Foraging* | 77 | 29 | 3 | - |
| | White Shark – Distribution* | 77 | 29 | 3 | - |
| IMCRA | Otway* | 77 | 29 | 3 | - |
| MNP | Twelve Apostles | 12 | 1 | - | - |
| State Waters | Victoria State Waters* | 18 | 2 | - | - |

*The release location resides within the receptor boundaries.

**Table 10.7 Predicted minimum time to dissolved hydrocarbon exposure and maximum residence time for dissolved hydrocarbon exposure to individual receptors in the 0-10 m depth layer. Results are based on a 250 $m^3$ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill simulations.**

| Receptor | | Minimum time before dissolved hydrocarbon exposure (hours) | | | Maximum residence time for dissolved hydrocarbon exposure (hours) | | |
|---|---|---|---|---|---|---|---|
| | | Low | Moderate | High | Low | Moderate | High |
| BIA | Antipodean Albatross – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | Black-browed Albatross – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | Buller's Albatross – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | Campbell Albatross – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | Common Diving-petrel – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | Indian Yellow-nosed Albatross – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | Pygmy Blue Whale – Distribution * | 2 | 5 | - | 16 | 3 | - |
| | Pygmy Blue Whale – Foraging | 39 | - | - | 1 | - | - |
| | Pygmy Blue Whale – Foraging (annual high use area) * | 2 | 5 | - | 16 | 3 | - |
| | Short-tailed Shearwater - Foraging | 39 | - | - | 1 | - | - |
| | Shy Albatross – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | Southern Right Whale – Aggregation | 34 | - | - | 16 | 3 | - |
| | Southern Right Whale – Migration and resting on migration | 2 | 5 | - | 16 | 3 | - |
| | Wandering Albatross – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | Wedge-tailed Shearwater – Foraging* | 2 | 5 | - | 16 | 3 | - |
| | White Shark – Distribution* | 2 | 5 | - | 16 | 3 | - |
| IMCRA | Otway* | 2 | 5 | - | 16 | 3 | - |
| MNP | Twelve Apostles | 34 | - | - | 1 | - | - |
| State Waters | Victoria State Waters* | 18 | - | - | 2 | - | - |

*The release location resides within the receptor boundaries.

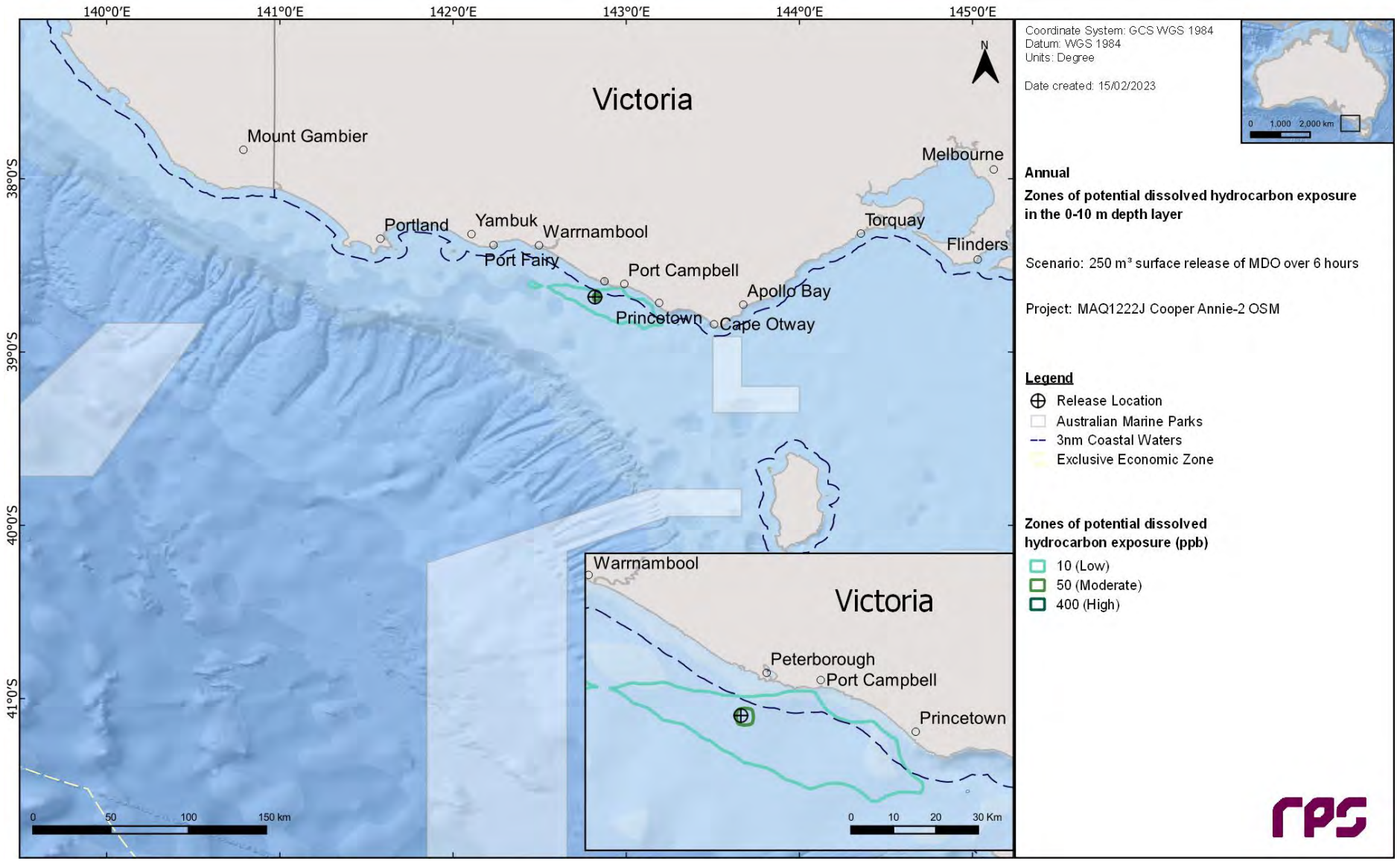



**Figure 10.7 Zones of potential dissolved hydrocarbon exposure at 0-10 m below the sea in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

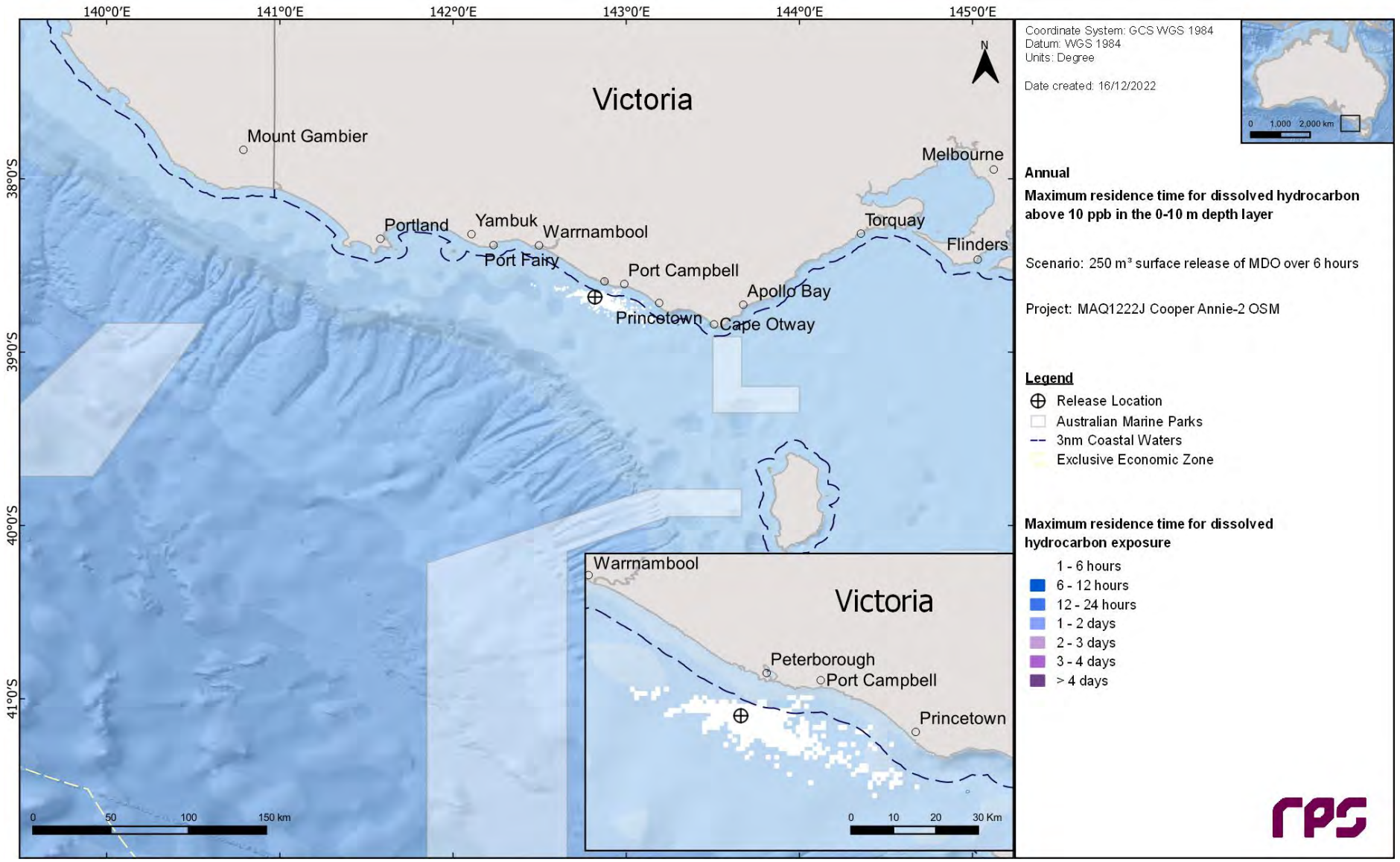



**Figure 10.8 Maximum residence time for dissolved hydrocarbon exposure above 10 ppb, at 0-10 m below the sea surface in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

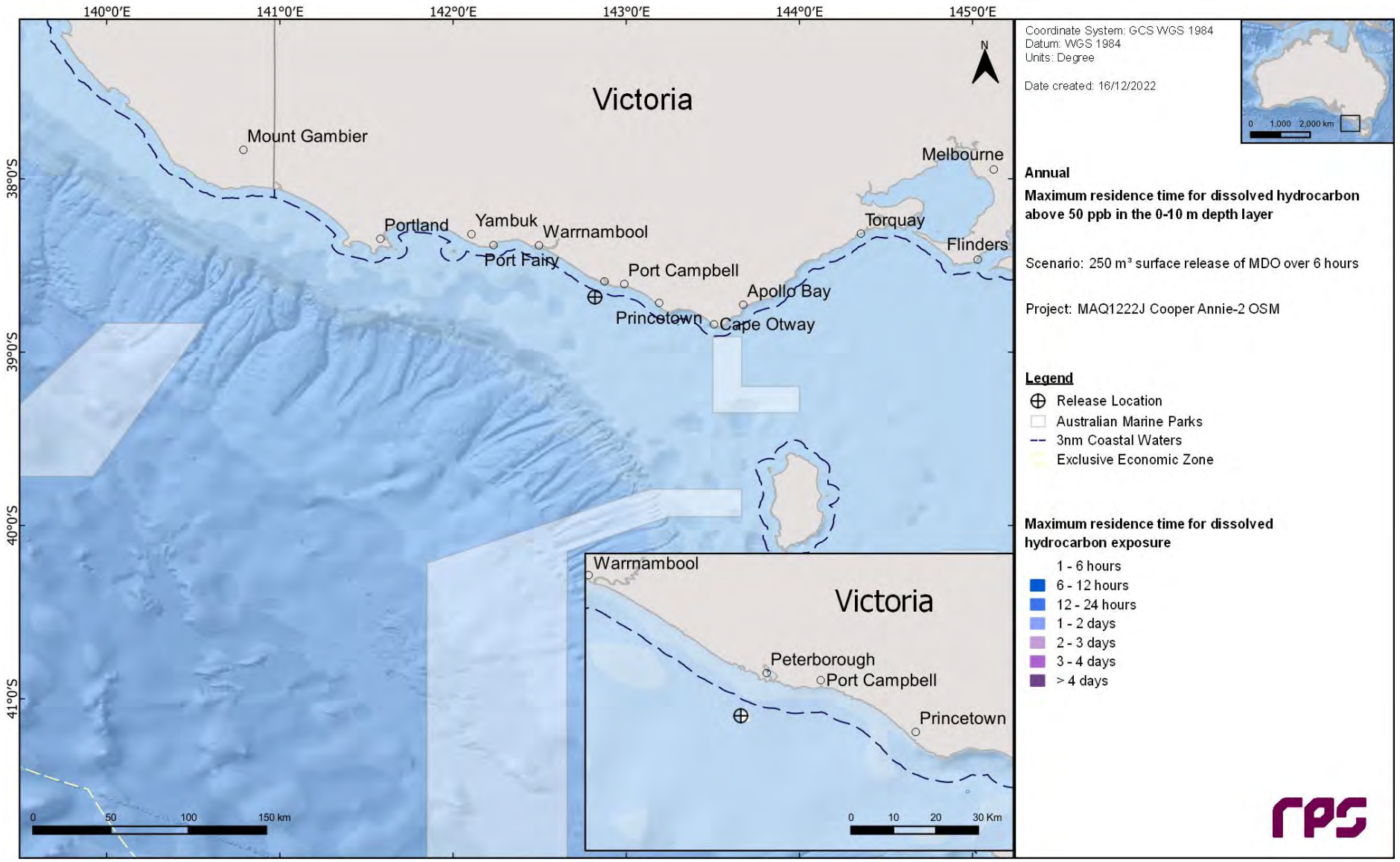



**Figure 10.9 Maximum residence time for dissolved hydrocarbon exposure above 50 ppb, at 0-10 m below the sea surface in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

### 10.1.4.2 Entrained Hydrocarbons

Table 10-8 summarises the potential in-water exposure to individual receptors from entrained hydrocarbons in the 0-10 m depth layer.

Many receptors were exposed above the low and high thresholds, however the majority of these receptors coincided with the release location.

The highest probability of low entrained hydrocarbon exposure was recorded for the Twelve Apostles MNP (65%) and Short-tailed Shearwater – Foraging BIA (64%). Additional receptors including LGAs, sub-LGAs, and AMPs were predicted with entrained hydrocarbon exposure (refer to Table 10-8).

Table 10.9 presents the predicted minimum time to entrained hydrocarbon exposure and maximum residence time for entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer, for all thresholds assessed.

Figure 10.10 presents the zones of potential entrained hydrocarbon exposure for the 0-10 m depth layer whilst Figure 10.11 and Figure 10.12 present the maximum residence time of entrained hydrocarbon exposure for the NOPSEMA thresholds.

**Table 10-8 Probability of entrained hydrocarbons exposure to marine based receptors in the 0–10 m depth layer. Results are based on a 250 $m^3$ surface release of MDO over 6 hours. The results were calculated from 100 spill simulations.**

| Receptor | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
|---|---|---|---|---|
| | | | Low | High |
| AMP | Apollo | 80 | 25 | - |
| BIA | Antipodean Albatross – Foraging* | 5,819 | 94 | 75 |
| | Australasian Gannet - Foraging | 56 | 9 | - |
| | Black-browed Albatross – Foraging* | 5,819 | 94 | 75 |
| | Buller's Albatross – Foraging* | 5,819 | 94 | 75 |
| | Campbell Albatross – Foraging* | 5,819 | 94 | 75 |
| | Common Diving-petrel – Foraging* | 5,819 | 94 | 75 |
| | Indian Yellow-nosed Albatross – Foraging* | 5,819 | 94 | 75 |
| | Pygmy Blue Whale – Distribution * | 5,819 | 94 | 75 |
| | Pygmy Blue Whale – Foraging | 666 | 68 | 21 |
| | Pygmy Blue Whale – Foraging (annual high use area) * | 5,819 | 94 | 75 |
| | Short-tailed Shearwater - Foraging | 463 | 64 | 15 |
| | Shy Albatross – Foraging* | 5,819 | 94 | 75 |
| | Southern Right Whale – Aggregation | 644 | 20 | 11 |
| | Southern Right Whale – Migration and resting on migration | 5,819 | 94 | 75 |
| | Wandering Albatross – Foraging* | 5,819 | 94 | 75 |
| | Wedge-tailed Shearwater – Foraging* | 5,819 | 94 | 75 |
| | White Shark – Distribution* | 5,819 | 94 | 75 |
| | White Shark - Foraging | 109 | 12 | 1 |
| | White-faced Storm-petrel - Foraging | 101 | 25 | 1 |
| IMCRA | Central Bass Strait | 55 | 12 | - |
| | Central Victoria | 95 | 25 | - |
| | Otway* | 5,819 | 94 | 75 |
| KEF | Bonney Coast Upwelling | 55 | 8 | - |
| MNP | Twelve Apostles | 843 | 65 | 29 |
| RSB | Bravenes Rock | 162 | 40 | 2 |
| Nearshore Waters (LGA) | Colac Otway | 326 | 41 | 5 |
| | Corangamite | 685 | 61 | 18 |

| Receptor | | Maximum entrained hydrocarbon exposure (ppb) | Probability of entrained hydrocarbon exposure (%) | |
|---|---|---|---|---|
| | | | Low | High |
| | Glenelg | 14 | 1 | - |
| | Moyne | 282 | 14 | 3 |
| Nearshore Waters (Sub-LGA) | Apollo Bay | 76 | 17 | - |
| | Bay of Islands | 282 | 14 | 3 |
| | Cape Nelson | 14 | 1 | - |
| | Cape Otway West | 324 | 41 | 5 |
| | Childers Cove | 12 | 1 | - |
| | Moonlight Head | 666 | 61 | 18 |
| | Port Campbell | 685 | 38 | 10 |
| State Waters | Victoria State Waters* | 2,164 | 68 | 30 |

*The release location resides within the receptor boundaries.

**Table 10.9 Predicted minimum time to entrained hydrocarbon exposure and maximum residence time for entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer. Results are based on a 250 $m^3$ surface release of MDO over 6 hours. The results were calculated from 100 spill simulations.**

| Receptor | | Minimum time before entrained hydrocarbon exposure (hours) | | Maximum residence time for entrained hydrocarbon exposure (hours) | |
|---|---|---|---|---|---|
| | | Low | High | Low | High |
| AMP | Apollo | 50 | - | 67 | - |
| BIA | Antipodean Albatross – Foraging* | 1 | 1 | 333 | 86 |
| | Australasian Gannet - Foraging | 92 | - | 67 | - |
| | Black-browed Albatross – Foraging* | 1 | 1 | 333 | 86 |
| | Buller's Albatross – Foraging* | 1 | 1 | 354 | 86 |
| | Campbell Albatross – Foraging* | 1 | 1 | 333 | 86 |
| | Common Diving-petrel – Foraging* | 1 | 1 | 420 | 117 |
| | Indian Yellow-nosed Albatross – Foraging* | 1 | 1 | 333 | 86 |
| | Pygmy Blue Whale – Distribution * | 1 | 1 | 420 | 117 |
| | Pygmy Blue Whale – Foraging | 14 | 15 | 388 | 117 |
| | Pygmy Blue Whale – Foraging (annual high use area) * | 1 | 1 | 420 | 117 |
| | Pygmy Blue Whale – Known Foraging Area | 59 | 60 | 106 | 1 |
| | Short-tailed Shearwater - Foraging | 16 | 17 | 420 | 68 |
| | Shy Albatross – Foraging* | 1 | 1 | 420 | 117 |
| | Southern Right Whale – Aggregation | 13 | 15 | 388 | 117 |
| | Southern Right Whale – Migration and resting on migration | 1 | 1 | 420 | 117 |
| | Wandering Albatross – Foraging* | 1 | 1 | 333 | 86 |
| | Wedge-tailed Shearwater – Foraging* | 1 | 1 | 420 | 117 |
| | White Shark – Distribution* | 1 | 1 | 333 | 86 |
| | White Shark - Foraging | 59 | 78 | 120 | 5 |
| | White-faced Storm-petrel - Foraging | 60 | 61 | 106 | 1 |
| IMCRA | Central Bass Strait | 82 | - | 106 | - |
| | Central Victoria | 60 | - | 64 | - |
| | Otway* | 1 | 1 | 420 | 117 |
| KEF | Bonney Coast Upwelling | 89 | - | 71 | - |
| MNP | Twelve Apostles | 11 | 13 | 388 | 110 |

| Receptor | | Minimum time before entrained hydrocarbon exposure (hours) | | Maximum residence time for entrained hydrocarbon exposure (hours) | |
|---|---|---|---|---|---|
| | | Low | High | Low | High |
| RSB | Bravenes Rock | 27 | 47 | 144 | 9 |
| Nearshore Waters (LGA) | Colac Otway | 23 | 38 | 420 | 67 |
| | Corangamite | 13 | 17 | 388 | 117 |
| | Glenelg | 131 | - | 5 | - |
| | Moyne | 20 | 25 | 317 | 40 |
| Nearshore Waters (Sub-LGA) | Apollo Bay | 59 | - | 86 | - |
| | Bay of Islands | 20 | 25 | 317 | 40 |
| | Cape Nelson | 131 | - | 5 | - |
| | Cape Otway West | 23 | 39 | 420 | 67 |
| | Childers Cove | 193 | - | 19 | - |
| | Moonlight Head | 17 | 19 | 388 | 117 |
| | Port Campbell | 13 | 17 | 314 | 89 |
| State Waters | Victoria State Waters* | 4 | 4 | 420 | 117 |

*The release location resides within the receptor boundaries.

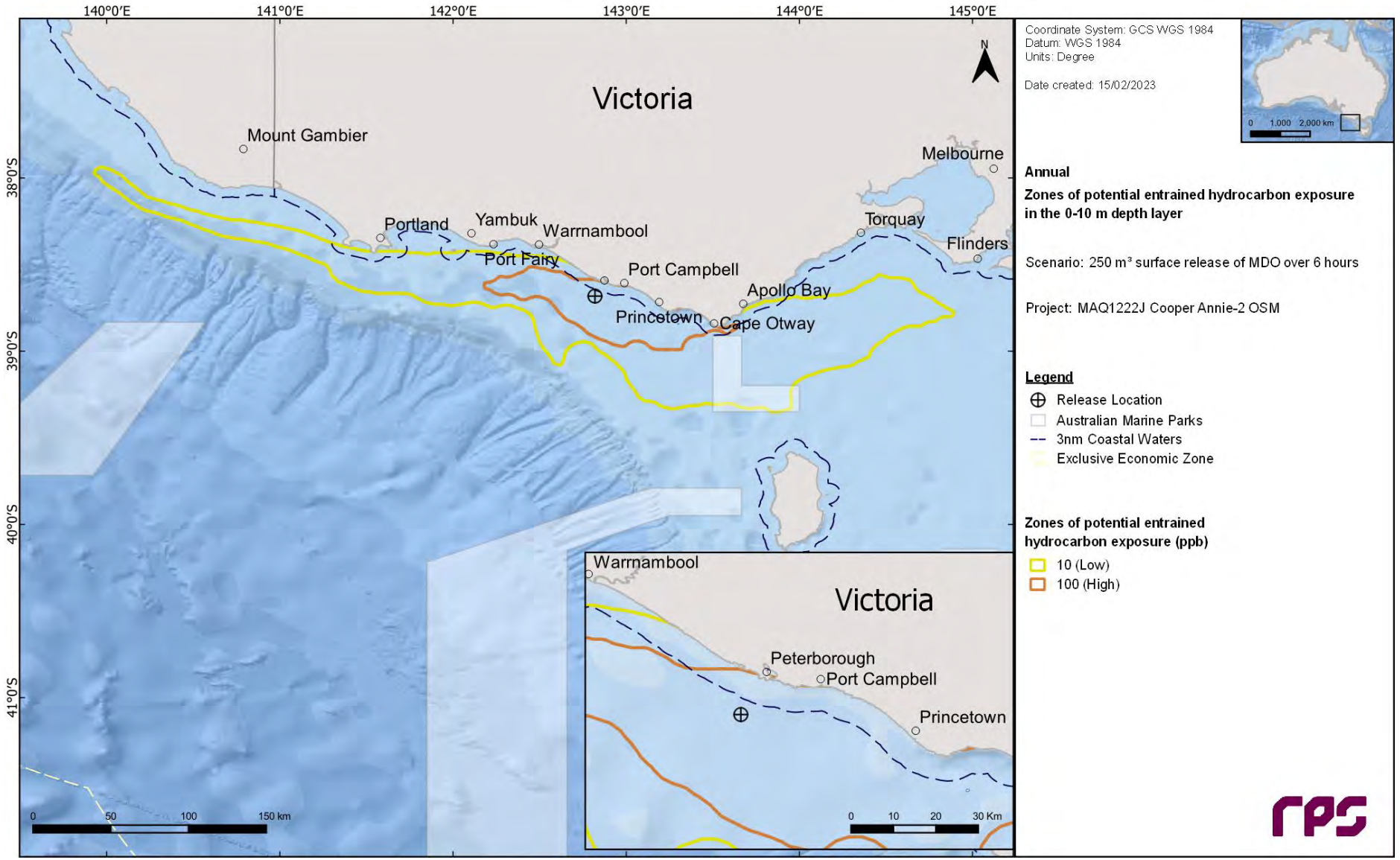



**Figure 10.10 Zones of potential entrained hydrocarbon exposure at 0-10 m below the sea surface in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

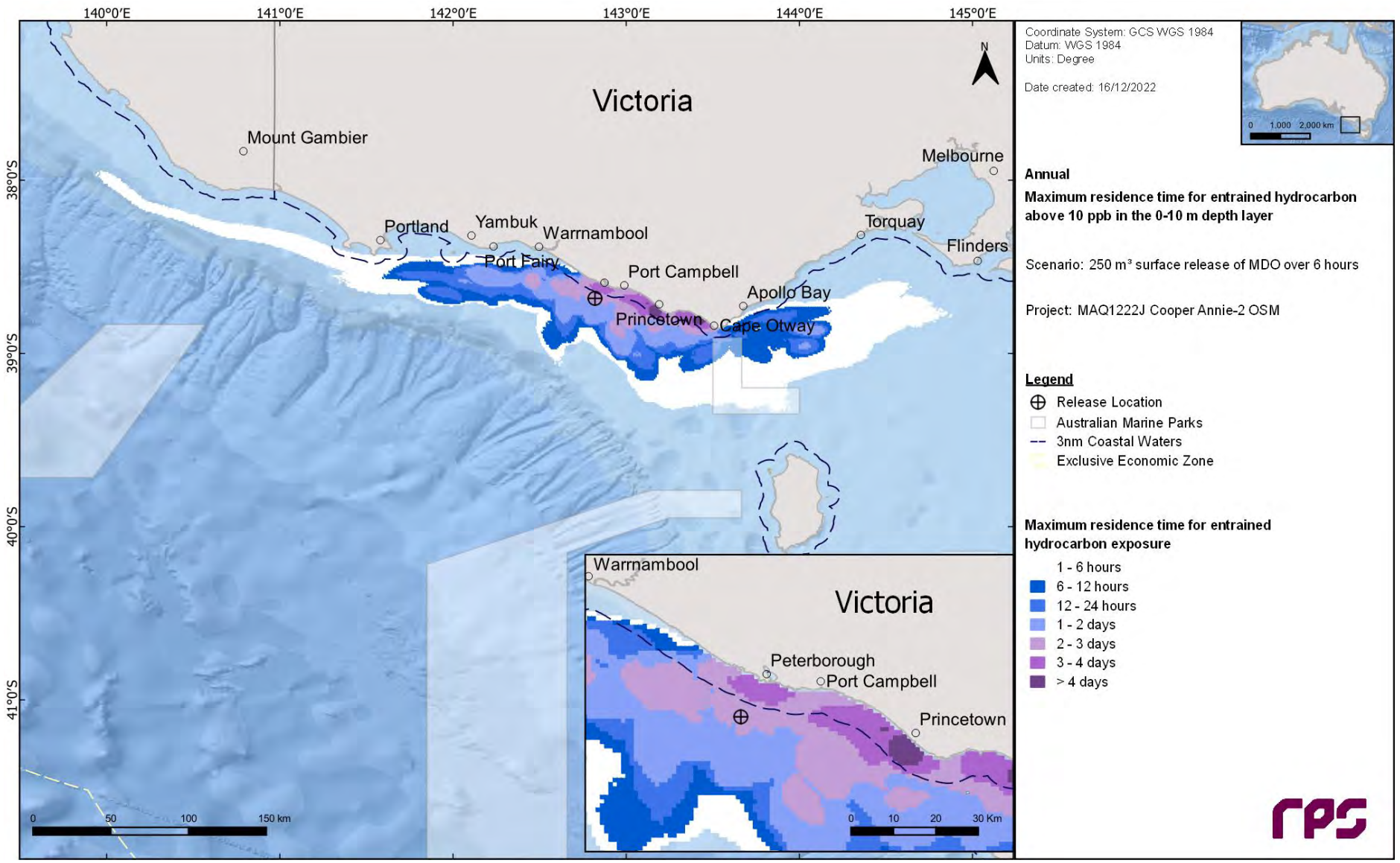



**Figure 10.11 Maximum residence time for entrained hydrocarbon exposure above 10 ppb, at 0-10 m below the sea in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

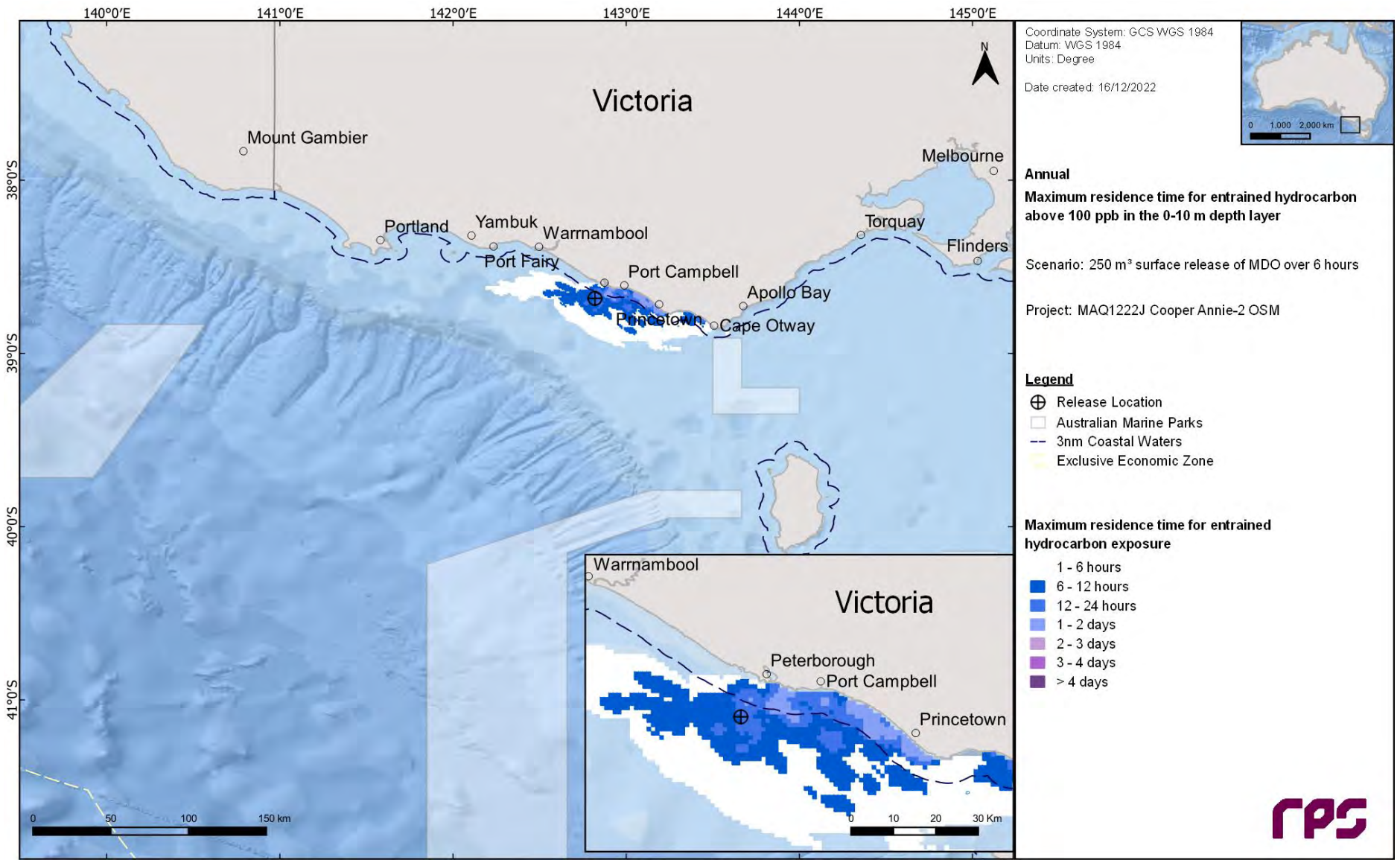



**Figure 10.12 Maximum residence time for entrained hydrocarbon exposure above 100 ppb, at 0-10 m below the sea in the event of a 250 m³ of MDO containment loss over 6 hours tracked for 30 days. The results were calculated from 100 spill simulations.**

## 10.2 Deterministic Analysis

The stochastic modelling results were assessed, and the “worst case” deterministic runs were identified and are presented below for the following criteria:

a. Largest swept area for surface oil above 10 g/m$^2$
b. Largest swept area for surface oil above 50 g/m$^2$
c. Largest (total) volume of oil ashore
d. Longest length of shoreline with oil accumulation above 100 g/m$^2$
e. Largest area of entrained hydrocarbon exposure above 100 ppb
f. Largest area of dissolved hydrocarbon exposure above 50 ppb

Table 10-10 presents a summary of sea surface and in-water exposure and shoreline accumulation at the assessed thresholds for the identified deterministic simulations.

**Table 10-10 Summary of the worst-case deterministic analysis based on the scenario presented in the Stochastic Analysis Section.**

| Variable | Threshold | Deterministic Analysis Criteria | | | | | |
|---|---|---|---|---|---|---|---|
| | | Largest swept area of floating oil >10 g/m² | Largest swept area of floating oil >50 g/m² | Largest volume of oil ashore | Longest length of shoreline with accumulation >100 g/m² | Largest area of entrained hydrocarbon exposure >100 ppb | Largest area of dissolved hydrocarbon exposure >50 ppb |
| **Run Number** | | **91** | **20** | **50** | **50** | **36** | **39** |
| **Total area of floating Oil exposure (km²)** | 1 g/m² | 149 | 57 | 4 | 4 | 8 | 18 |
| | 10 g/m² | **29** | 27 | 1 | 1 | 2 | 2 |
| | 50 g/m² | 2 | **5** | 0 | 0 | 0 | 1 |
| **Total length of shoreline accumulation (km)** | 10 g/m² | 0 | 14 | 24 | 24 | 0 | 0 |
| | 100 g/m² | 0 | 1 | 11 | **11** | 0 | 0 |
| | 1,000 g/m² | 0 | 0 | 0 | 0 | 0 | 0 |
| **Minimum time before accumulation on any shoreline (hours)** | 10 g/m² | - | 55 | 45 | 45 | - | - |
| | 100 g/m² | - | 185 | 59 | 59 | - | - |
| | 1,000 g/m² | - | - | 0 | 0 | - | - |
| **Total volume of oil ashore (m³)** | | 1 | 9 | **43** | 43 | - | 1 |
| **Total area of entrained hydrocarbon exposure (km²)** | 10 ppb | 1,062 | 513 | 383 | 383 | 2,044 | 1,066 |
| | 100 ppb | 83 | 236 | 165 | 165 | **636** | 215 |
| **Total area of dissolved hydrocarbon exposure (km²)** | 10 ppb | - | - | - | - | 43 | 18 |
| | 50 ppb | - | - | - | - | - | **2** |
| | 400 ppb | - | - | - | - | - | - |
| **Start Date** | | 21 July 2012 | 9 January 2017 | 11 May 2012 | 11 May 2012 | 28 June 2016 | 18 September 2016 |

NC = No contact at, or above the specified shoreline accumulation threshold.

### 10.2.1 Deterministic Case: Largest swept area of floating oil above 10 g/m$^2$

The deterministic trajectory that resulted in the largest swept area of floating oil above 10 g/m$^2$ was identified as run number 91, which started on 21st July 2012.

Figure 10.13 illustrates the floating oil exposure and shoreline accumulation over the 30-day simulation.

Figure 10.14 displays the time series of the area of sea surface exposure above the low (1 g/m$^2$), moderate (10 g/m$^2$) and high (50 g/m$^2$) thresholds over the 30-day simulation.

Figure 10.15 presents the fates and weathering graph for the corresponding single spill trajectory and Table 10.11 summarises the mass balance peaks and at the end of the simulation.

**Table 10.11 Summary of the mass balance for the trajectory with the largest swept area of floating oil above 10 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 30 |
|---|---|---|---|
| Surface (m$^3$) | 168.6 | 0.3 | 0.0 |
| Entrained (m$^3$) | 124.4 | 2.8 | 41.1 |
| Dissolved (m$^3$) | 0.3 | 4.7 | 0.0 |
| Evaporation (m$^3$) | 123.8 | 29.7 | 123.8 |
| Decay (m$^3$) | 86.8 | 30.0 | 86.8 |
| Ashore (m$^3$) | 0.5 | 11.2 | 0.1 |

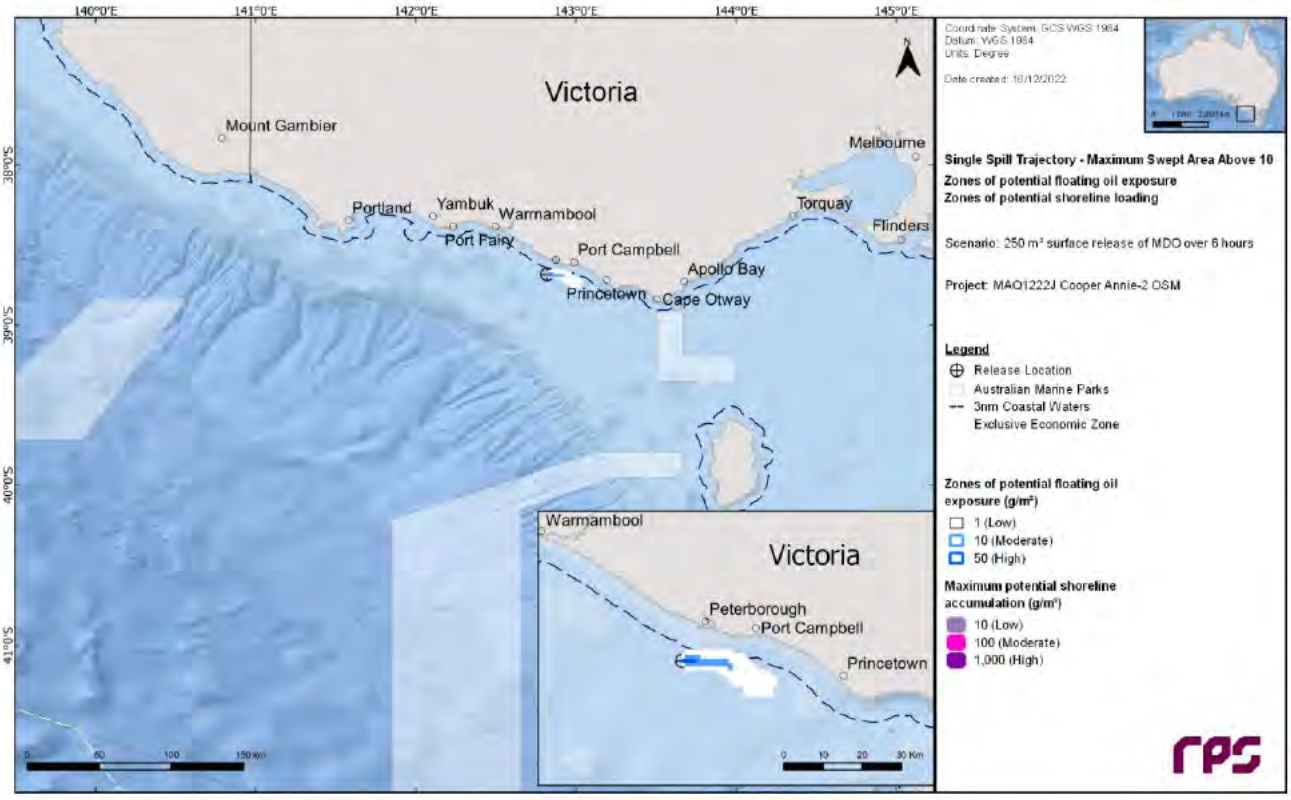



**Figure 10.13 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest swept area of floating oil above 10 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

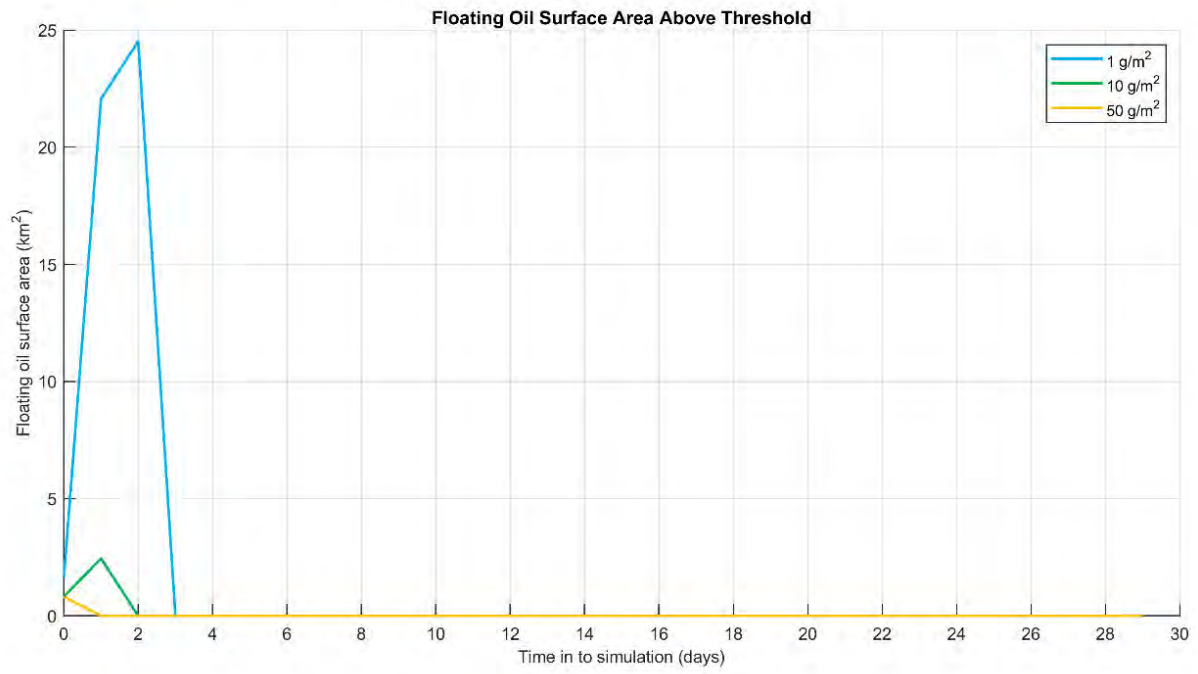



**Figure 10.14 Time series of the sea surface exposure above each threshold for the trajectory with the largest swept area of floating oil above 10 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

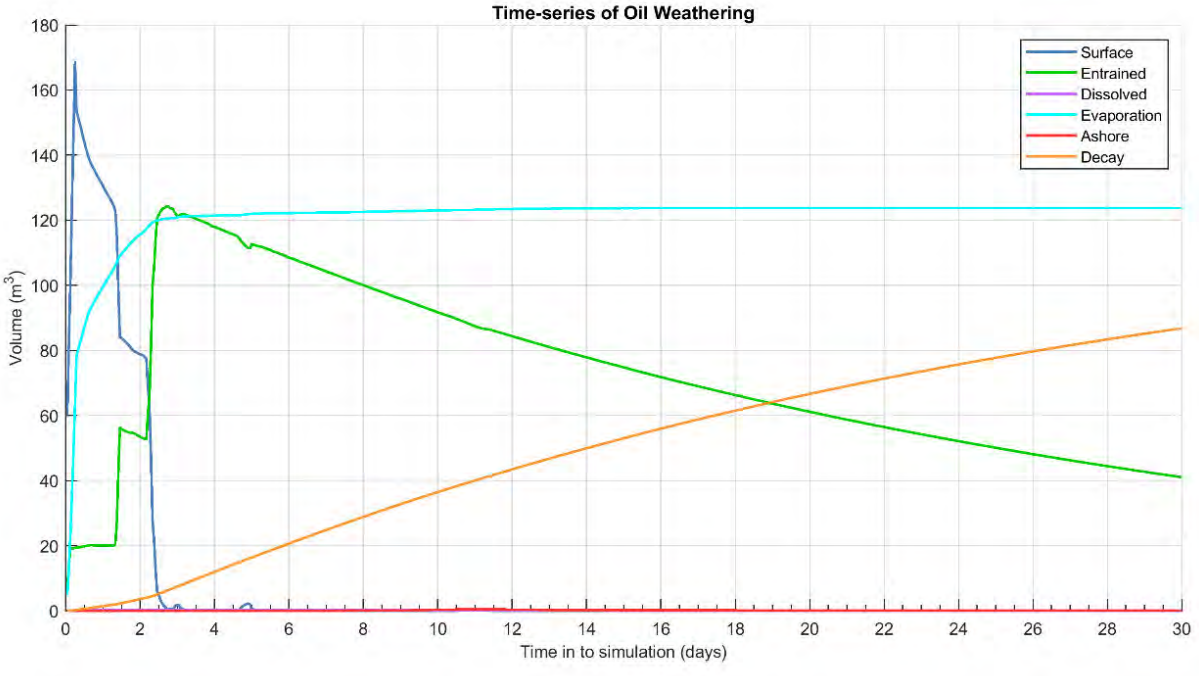



**Figure 10.15 Predicted weathering and fates graph for the trajectory with the largest swept area of floating oil above 10 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

## 10.2.2 Deterministic Case: Largest swept area of floating oil above 50 g/m$^2$

The deterministic trajectory that resulted in the largest swept area of floating oil above 50 g/m$^2$ was identified as run number 20, which started on 9th January 2017.

Figure 10.13 illustrates the floating oil exposure and shoreline accumulation over the 30-day simulation.

Figure 10.14 displays the time series of the area of sea surface exposure above the low (1 g/m$^2$), moderate (10 g/m$^2$) and high (50 g/m$^2$) thresholds over the 30-day simulation.

Figure 10.15 presents the fates and weathering graph for the corresponding single spill trajectory and Table 10.11 summarises the mass balance peaks and at the end of the simulation.

**Table 10.12 Summary of the mass balance for the trajectory with the largest swept area of floating oil above 50 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 30 |
|---|---|---|---|
| Surface (m$^3$) | 183 | 0 | 0 |
| Entrained (m$^3$) | 140 | 1 | 40 |
| Dissolved (m$^3$) | 0 | 5 | 0 |
| Evaporation (m$^3$) | 120 | 30 | 120 |
| Decay (m$^3$) | 88 | 30 | 88 |
| Ashore (m$^3$) | 7 | 8 | 3 |

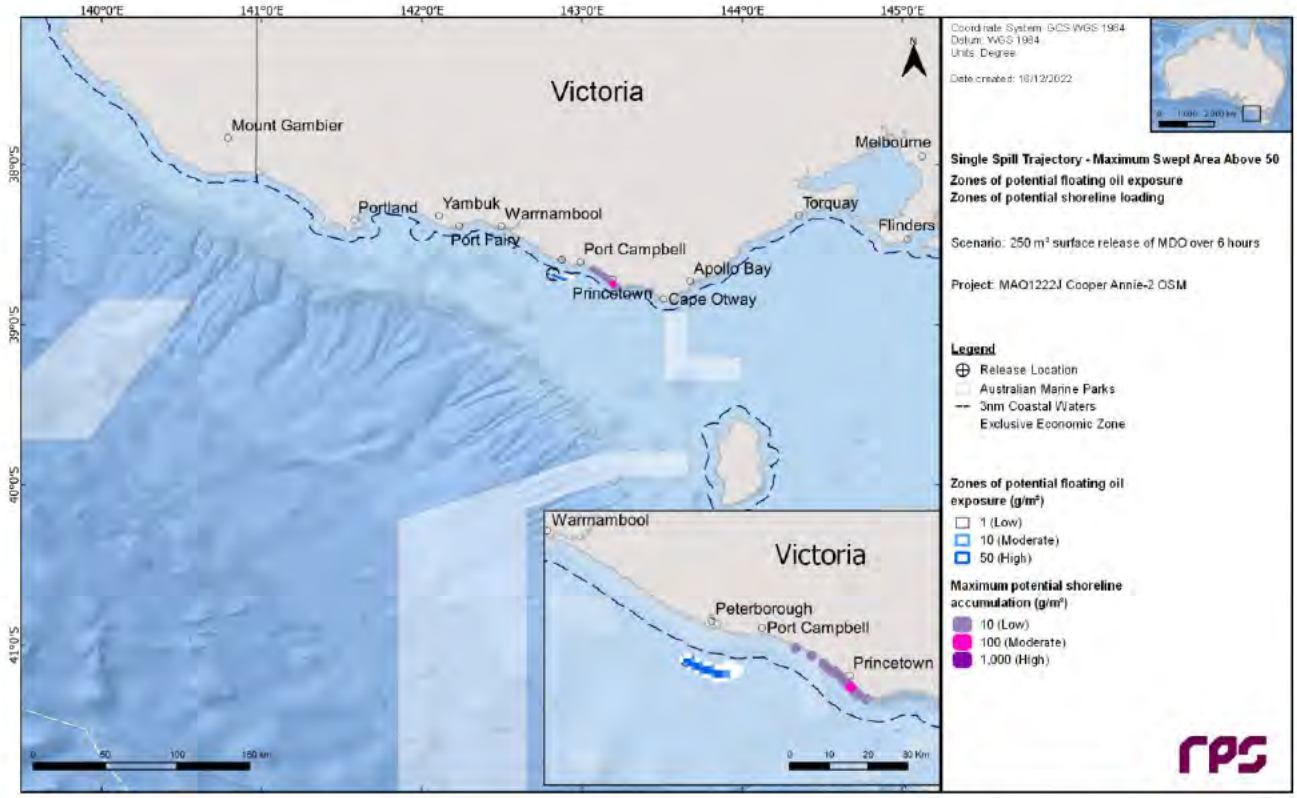



**Figure 10.16 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest swept area of floating oil above 50 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

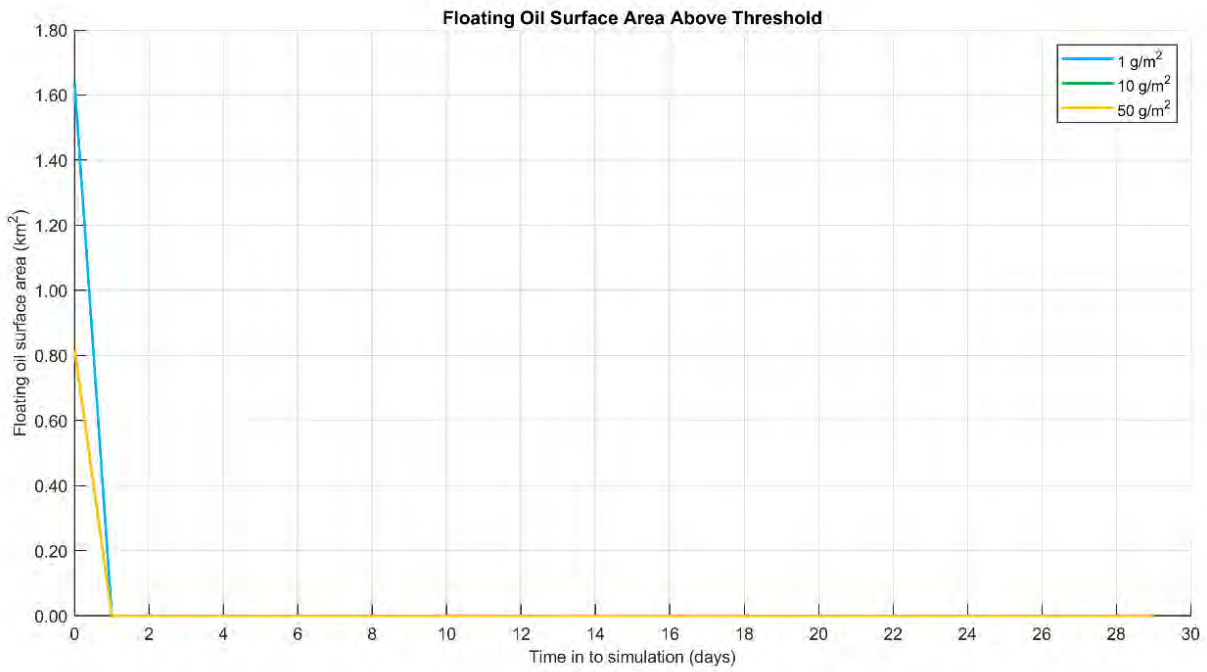



**Figure 10.17 Time series of the sea surface exposure above each threshold for the trajectory with the largest swept area of floating oil above 50 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

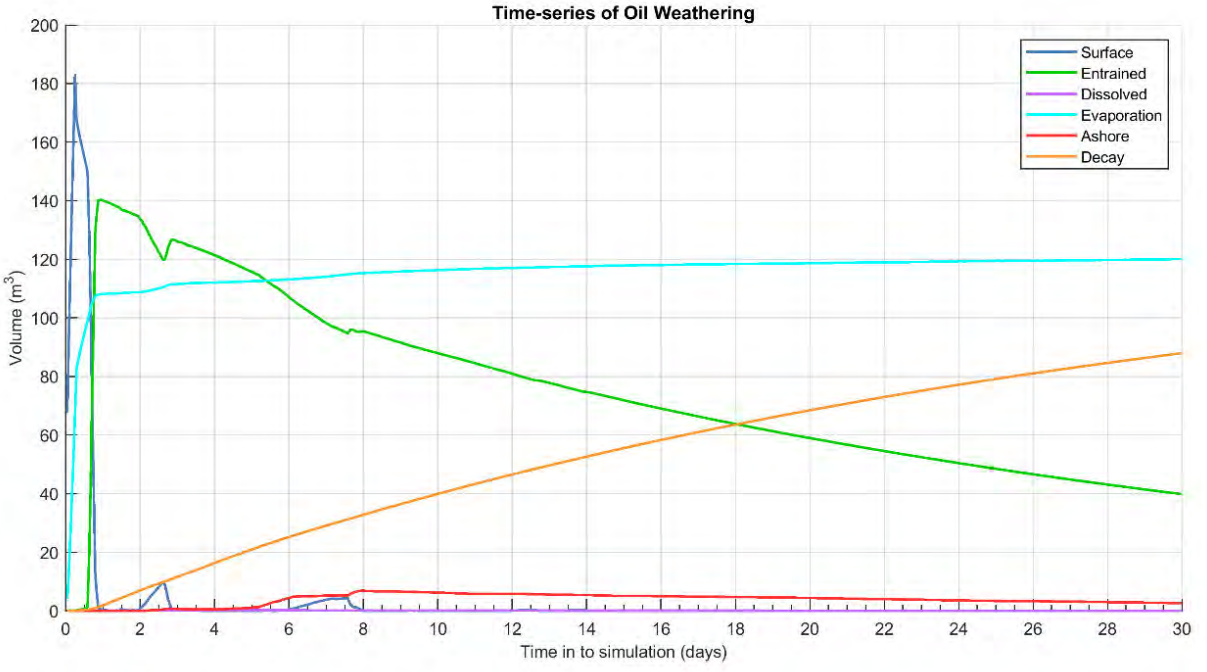



**Figure 10.18 Predicted weathering and fates graph for the trajectory with the largest swept area of floating oil above 50 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

### 10.2.3 Deterministic Case: Largest volume of oil ashore and longest length of shoreline with accumulation above 100 g/m$^2$

The deterministic trajectory that resulted in the largest volume ashore and longest length of shoreline with accumulation above 100 g/m$^2$ was identified as run number 50, which started on 11$^{th}$ May 2012.

Figure 10.19 illustrates the floating oil exposure and shoreline accumulation over the 30-day simulation.

Figure 10.20 displays the time series of the length of shoreline with accumulation at the low (10 g/m$^2$), moderate (100 g/m$^2$) and high (1,000 g/m$^2$) thresholds over the 30-day simulation.

Figure 10.22 presents the fates and weathering graph for the corresponding single spill trajectory and Table 10.13 summarises the mass balance peaks and at the end of the simulation.

**Table 10.13 Summary of the mass balance for the trajectory with the largest volume ashore and longest length of shoreline with accumulation above 100 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 30 |
|---|---|---|---|
| Surface (m$^3$) | 39 | 0 | 0 |
| Entrained (m$^3$) | 193 | 0 | 36 |
| Dissolved (m$^3$) | 0 | 2 | 0 |
| Evaporation (m$^3$) | 92 | 30 | 92 |
| Decay (m$^3$) | 96 | 30 | 96 |
| Ashore (m$^3$) | 37 | 9 | 28 |

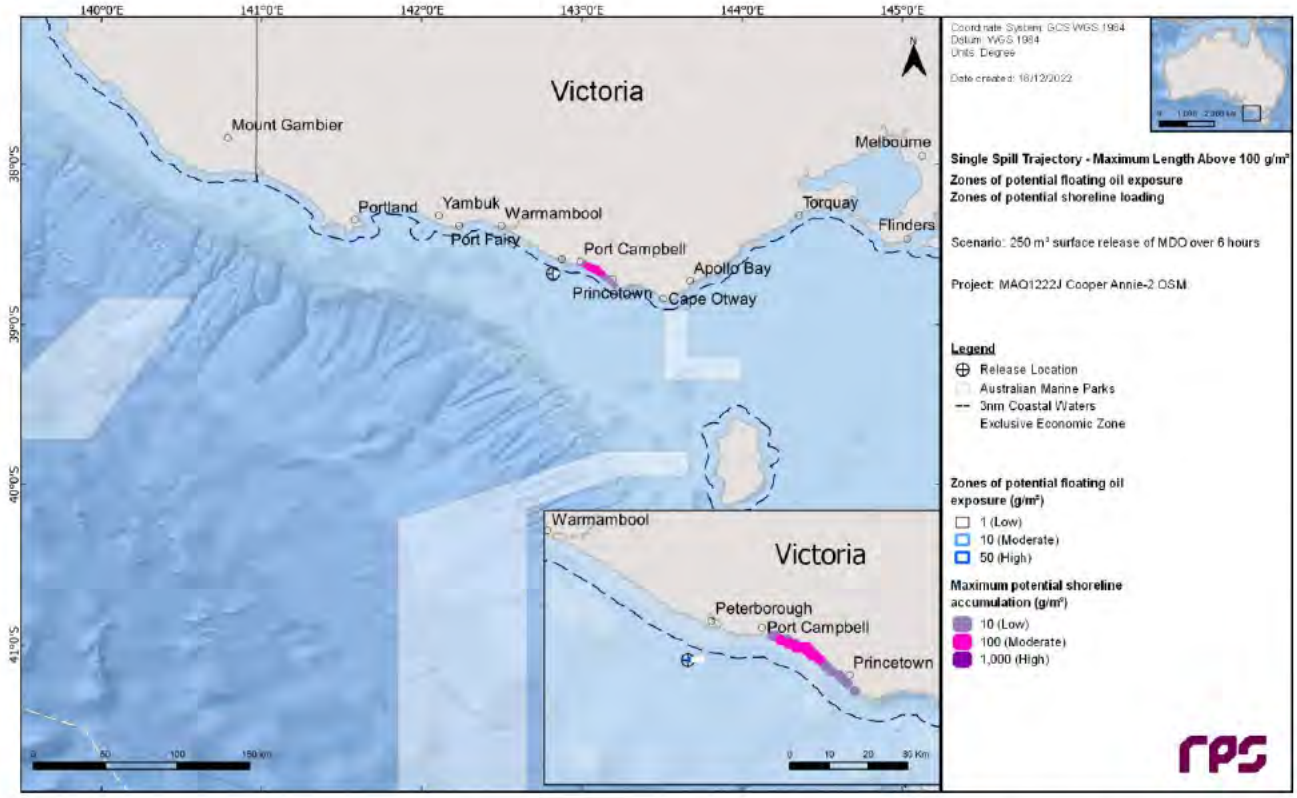



**Figure 10.19 Zones of potential floating oil exposure and shoreline accumulation, for the trajectory with the largest volume ashore and longest length of shoreline with accumulation above 100 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

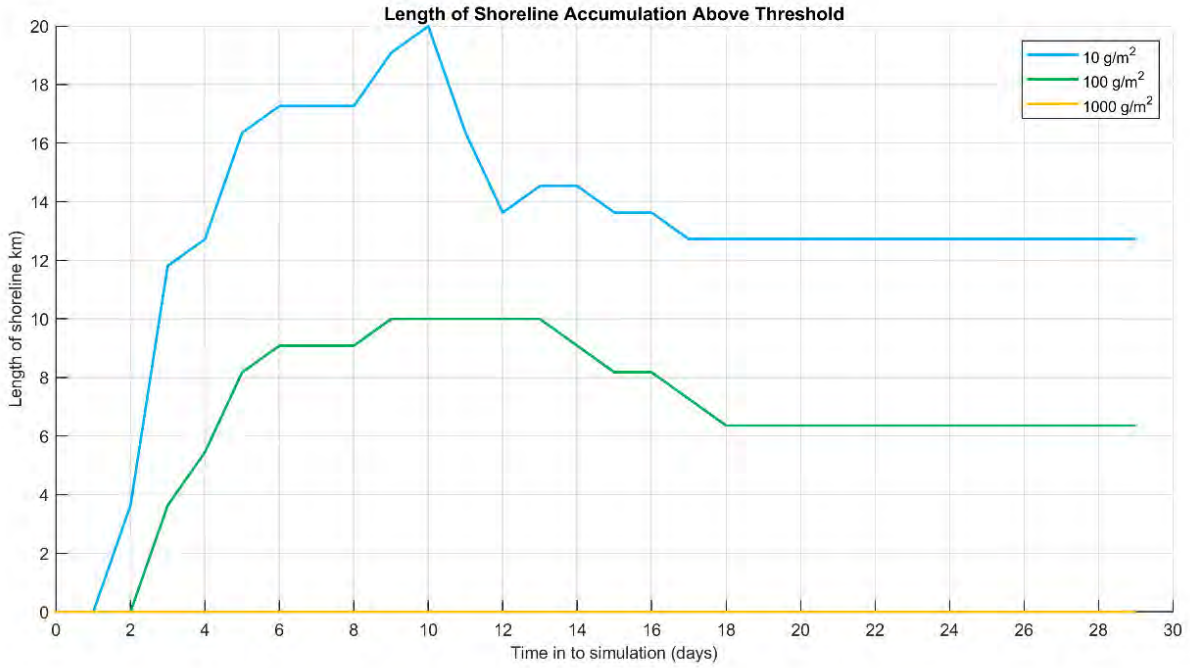



**Figure 10.20 Time series of the length of shoreline with accumulation above each threshold for the trajectory with the largest volume ashore and longest length of shoreline with accumulation above 100 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

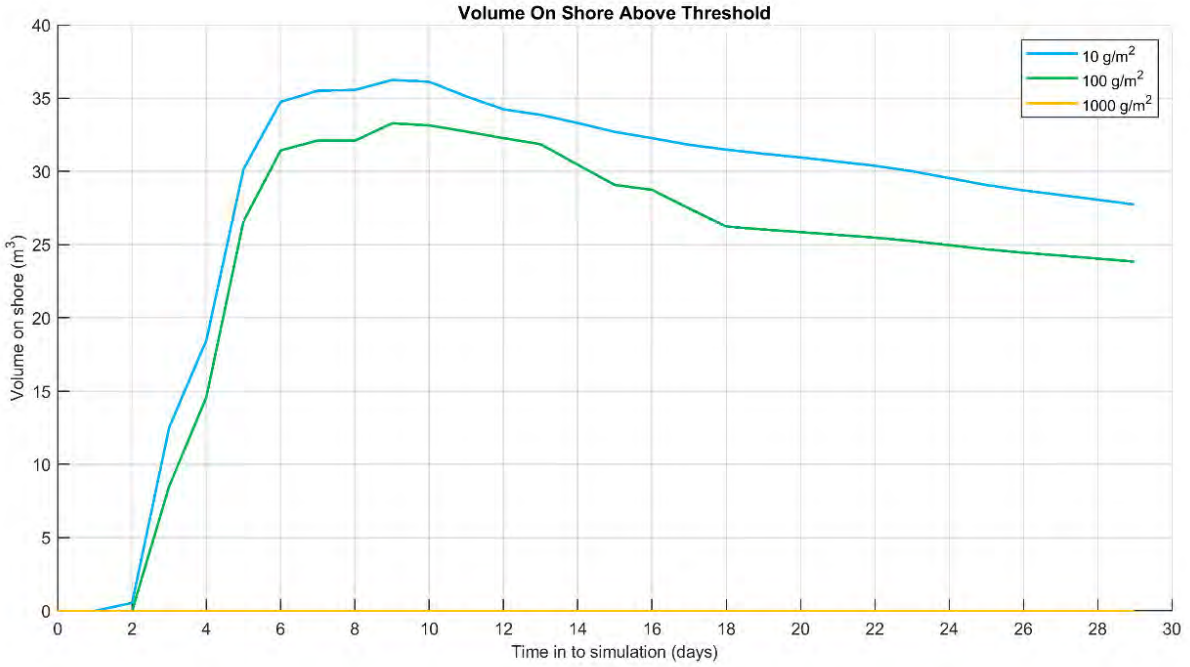



**Figure 10.21 Time series of oil accumulation on the shoreline above each threshold for the trajectory with the largest volume ashore and longest length of shoreline with accumulation above 100 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

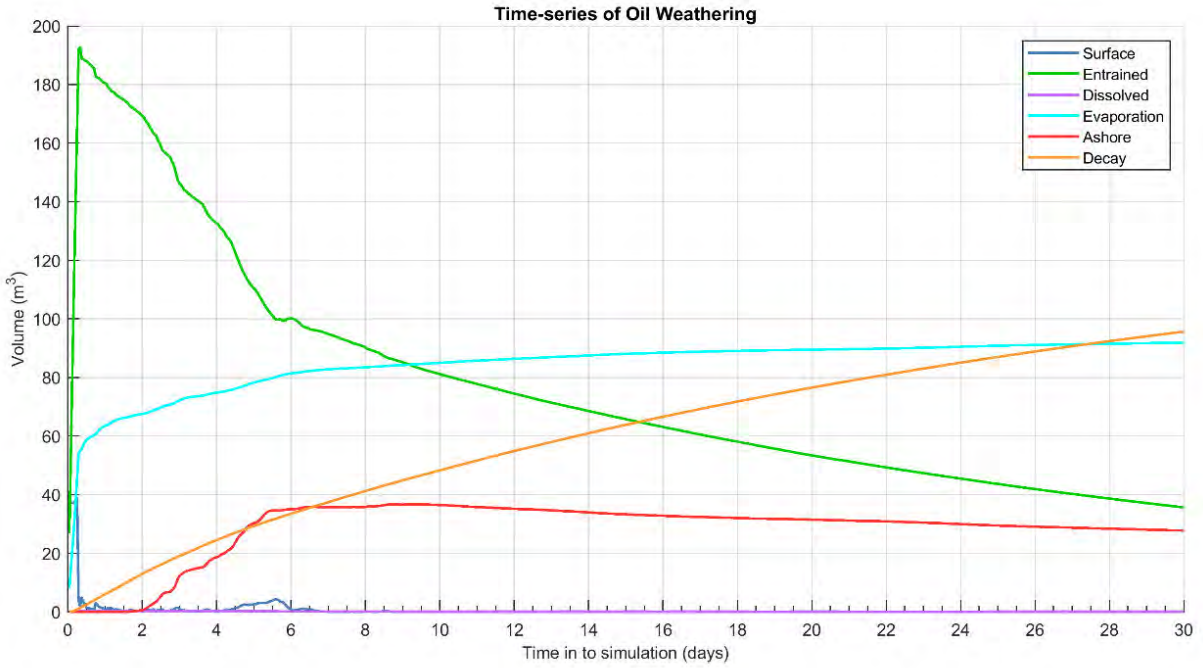



**Figure 10.22 Predicted weathering and fates graph for the trajectory with the largest volume ashore and longest length of shoreline with accumulation above 100 g/m$^2$. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

### 10.2.4 Deterministic Case: Largest area of entrained hydrocarbon exposure above 100 ppb

The deterministic trajectory that resulted in the largest area of entrained hydrocarbon exposure above 100 ppb was identified as run number 36, which started on 28th June 2016.

Figure 10.23 illustrates the floating oil exposure and shoreline accumulation over the 30-day simulation.

Figure 10.24 displays the time series of the area of entrained hydrocarbon exposure at the low (10 ppb) and high (100 ppb) thresholds over the 30-day simulation.

Figure 10.25 presents the fates and weathering graph for the corresponding single spill trajectory and Table 10.14 summarises the mass balance peaks and at the end of the simulation.

**Table 10.14 Summary of the mass balance for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 30 |
|---|---|---|---|
| Surface (m$^3$) | 59 | 0 | 0 |
| Entrained (m$^3$) | 209 | 0 | 52 |
| Dissolved (m$^3$) | 2 | 0 | 0 |
| Evaporation (m$^3$) | 65 | 30 | 65 |
| Decay (m$^3$) | 134 | 30 | 134 |
| Ashore (m$^3$) | 0 | 5 | 0 |

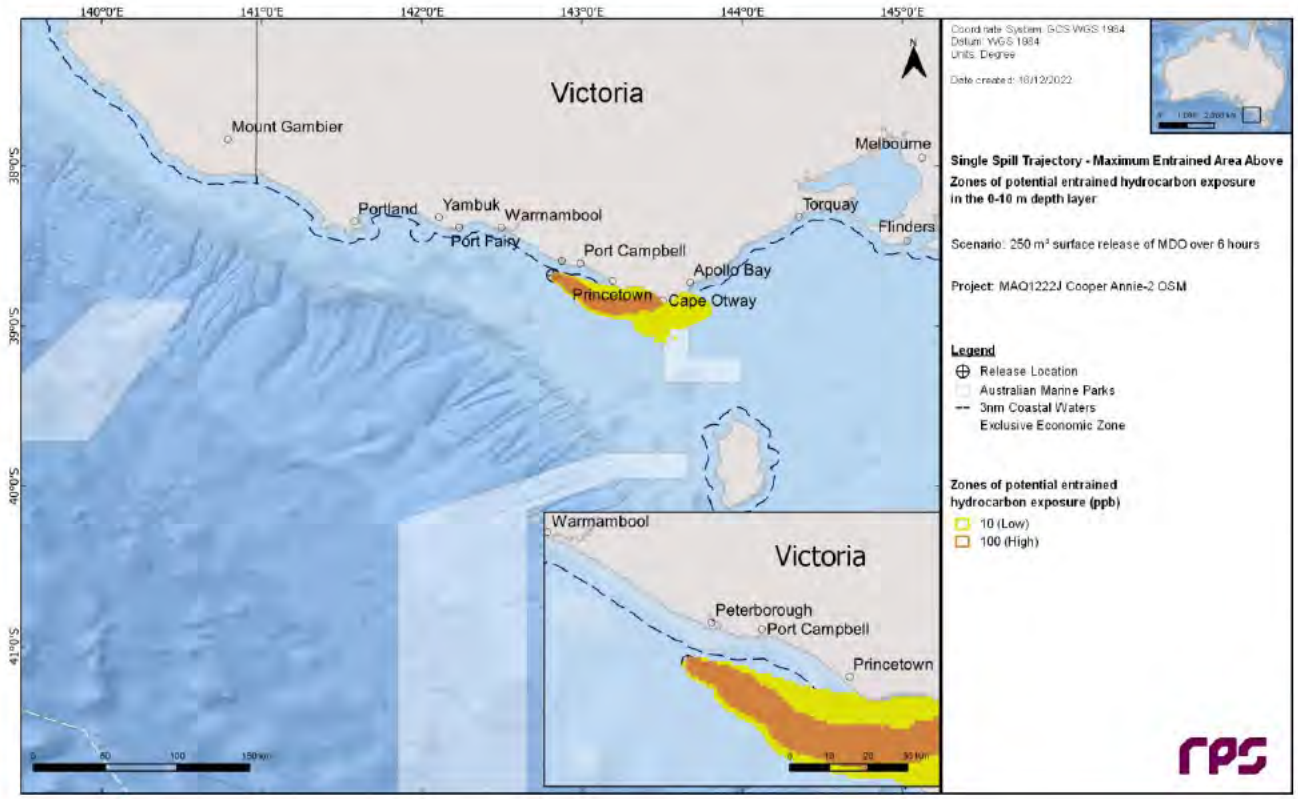


**Figure 10.23 Zones of potential entrained hydrocarbon exposure, for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

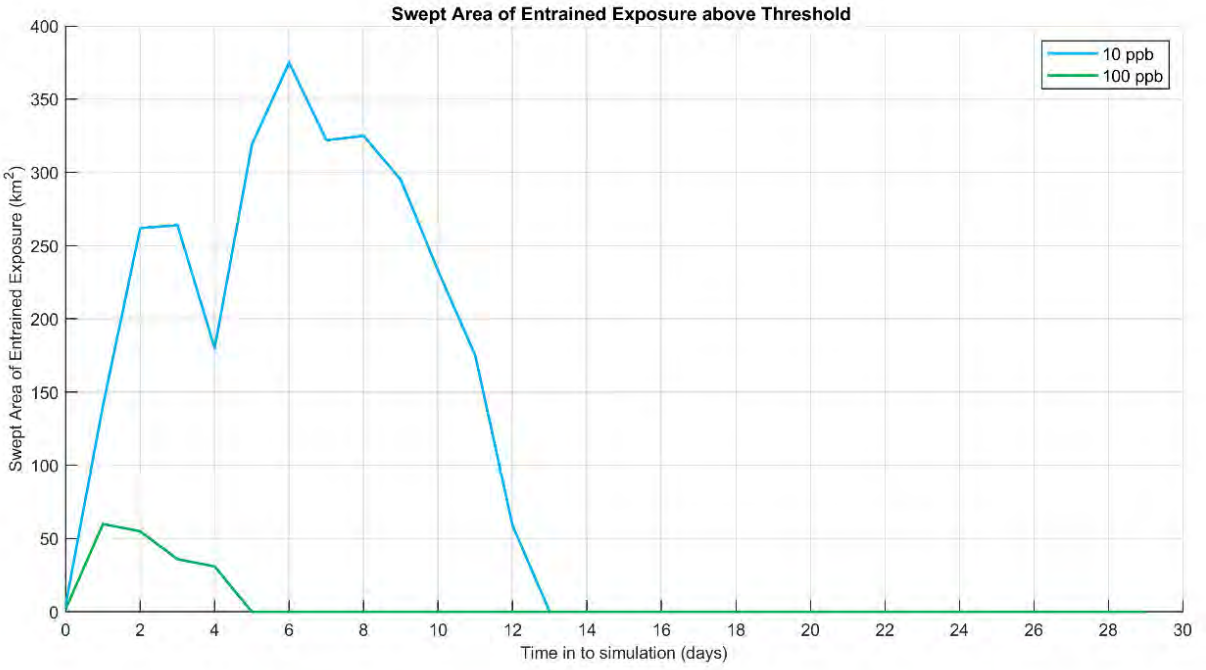



**Figure 10.24 Time series of the entrained hydrocarbon exposure area above each threshold for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

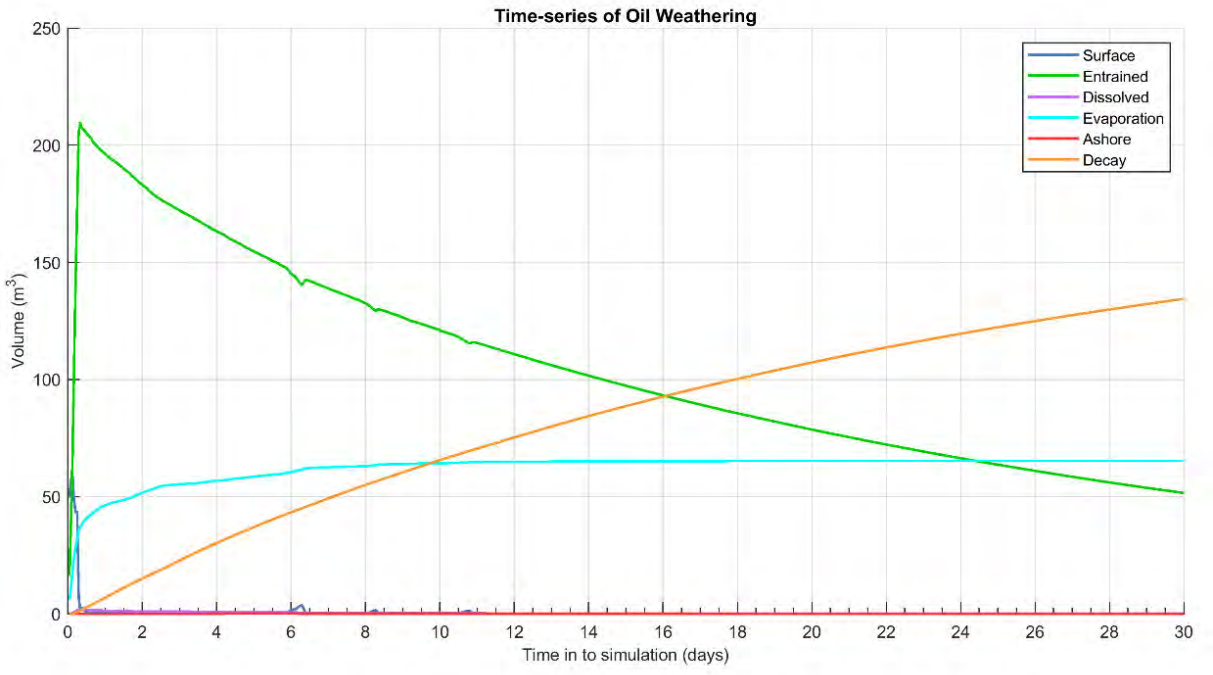



**Figure 10.25 Predicted weathering and fates graph for the trajectory with the largest area of entrained hydrocarbon exposure above 100 ppb. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

### 10.2.5 Deterministic Case: Largest area of dissolved hydrocarbon exposure above 50 ppb

The deterministic trajectory that resulted in the largest area of dissolved hydrocarbon exposure above 50 ppb was identified as run number 39, which started on 18th September 2016.

Figure 10.26 illustrates the floating oil exposure and shoreline accumulation over the 30-day simulation.

Figure 10.27 displays the time series of the area of dissolved hydrocarbon exposure at the low (10 ppb), moderate (50 ppb) and high (400 ppb) thresholds over the 30-day simulation.

Figure 10.28 presents the fates and weathering graph for the corresponding single spill trajectory and Table 10.15 summarises the mass balance peaks and at the end of the simulation.

**Table 10.15 Summary of the mass balance for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb. Results are based on a 250 $m^3$ surface release of MDO over 6 hours.**

| Exposure Metrics | Peak Volume | Day of occurrence | Volume at day 30 |
|---|---|---|---|
| Surface ($m^3$) | 61 | 0 | 0 |
| Entrained ($m^3$) | 210 | 0 | 49 |
| Dissolved ($m^3$) | 2 | 0 | 0 |
| Evaporation ($m^3$) | 83 | 30 | 83 |
| Decay ($m^3$) | 120 | 30 | 120 |
| Ashore ($m^3$) | 0 | 10 | 0 |

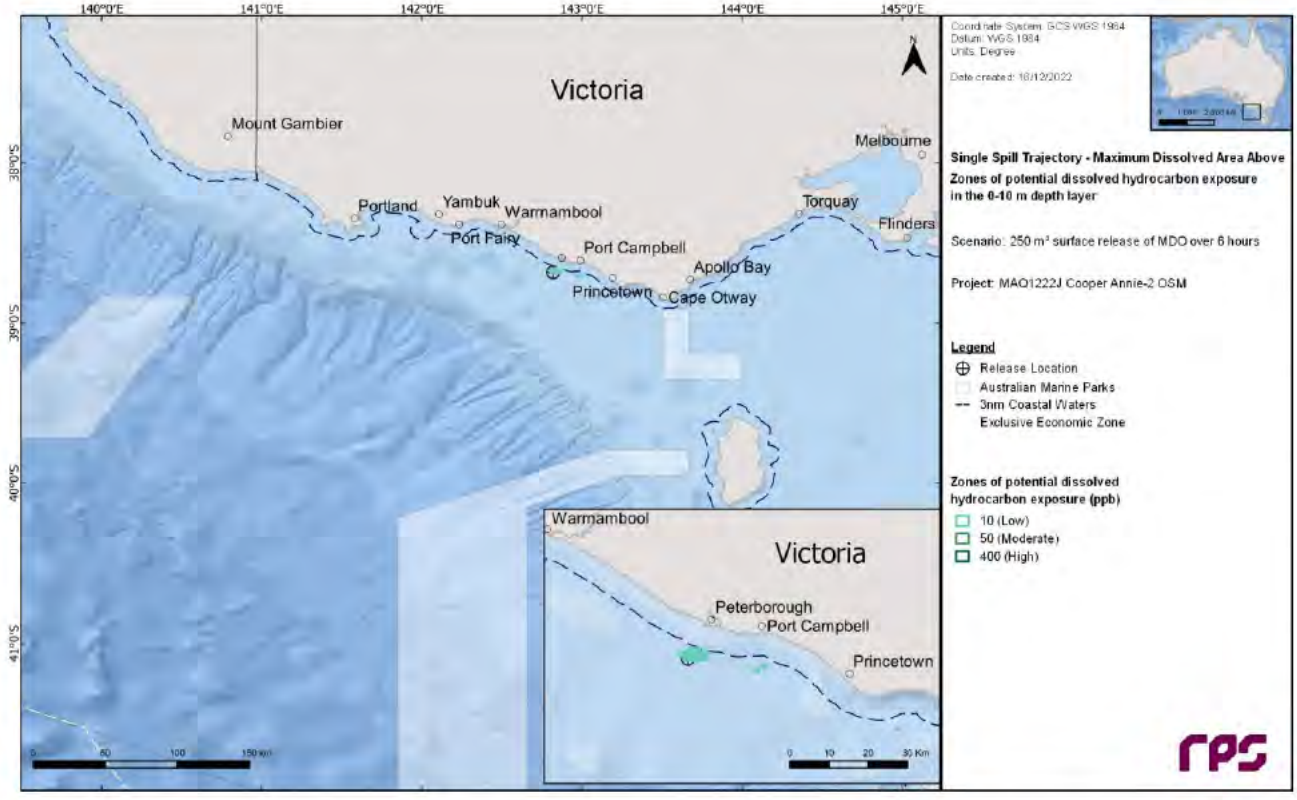



**Figure 10.26 Zones of potential dissolved hydrocarbon exposure, for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb. Results are based on a 250 $m^3$ surface release of MDO over 6 hours, tracked for 30 days.**

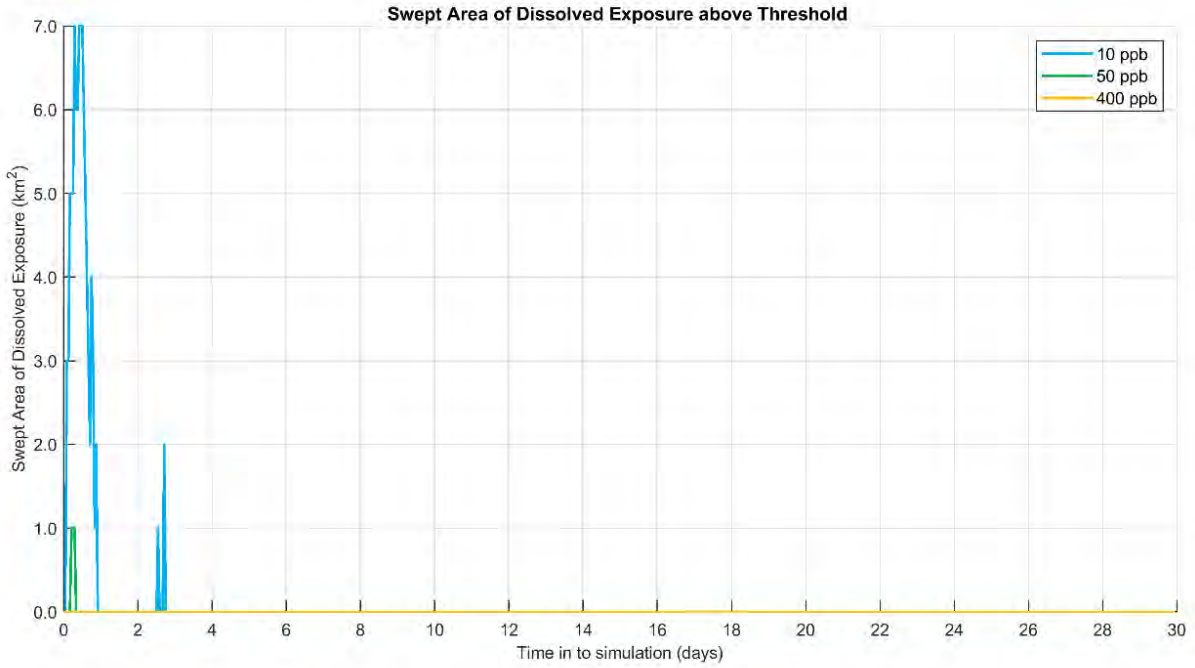



**Figure 10.27 Time series of the dissolved hydrocarbon exposure area above each threshold for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

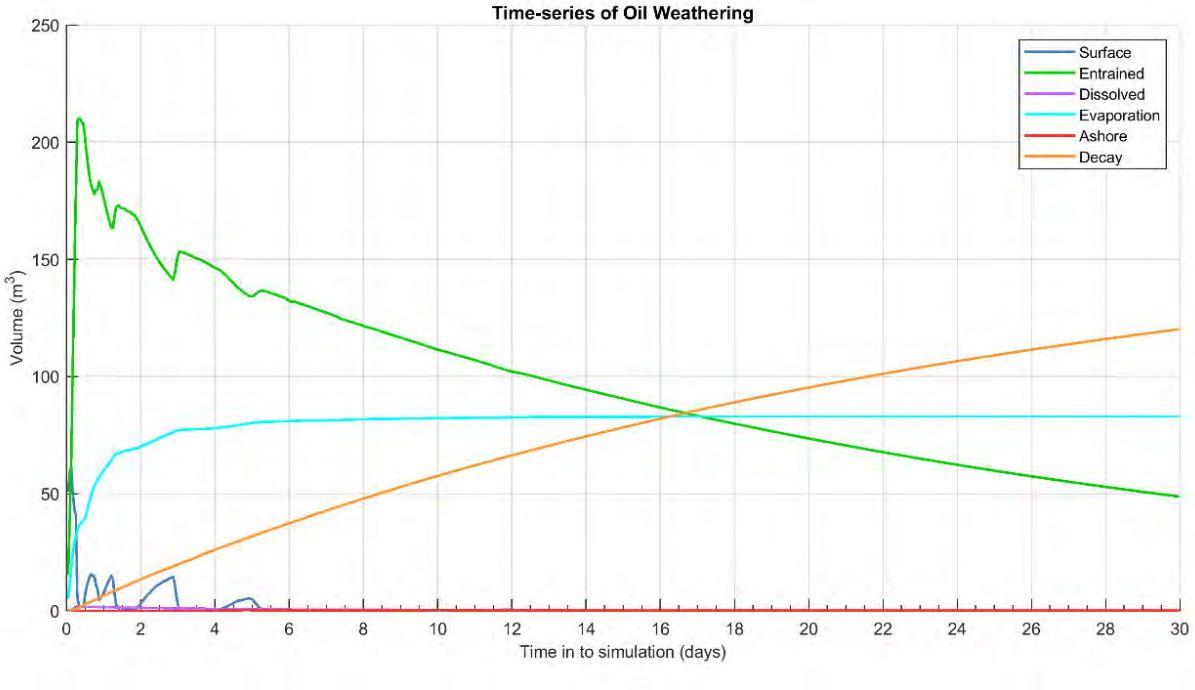



**Figure 10.28 Predicted weathering and fates graph for the trajectory with the largest area of dissolved hydrocarbon exposure above 50 ppb. Results are based on a 250 m$^3$ surface release of MDO over 6 hours, tracked for 30 days.**

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# Appendix 4. Subsea Noise Modelling

# Amplitude Energy Otway Subsea Noise Modelling

## Acoustic Modelling for Assessing Marine Fauna Sound Exposures

JASCO Applied Sciences (Australia) Pty Ltd

27 May 2025

Submitted to:

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# Executive Summary

JASCO Applied Sciences (JASCO) performed a modelling study of underwater sound levels associated with Amplitude Energy's Otway current and potential future offshore activities.

The modelling study considers the activities associated with drilling and vessel operations. These operations include a Mobile Offshore Drilling Unit (MODU) under dynamic positioning (DP), an anchored MODU conducting drilling operations, and an associated Anchor Handling Tug and Supply Vessel (AHTS), conducting re-supply of the MODU under DP, and standing by near the MODU, as well as pre-lay, pipelaying and dive support scenarios. This study considered scenarios to represent operations, which could occur within Amplitude Energy's Title holdings. The representative modelled scenarios are located at the Annie-2 and Elanora-1 locations along with pipelay between Annie-2 and Casino-5. A concurrent operations scenario was also considered involving simultaneous drilling activities at Elanora-1 and pipelay operations between Annie-2 and Casino-5.

The study assessed distances from operations to where underwater sound levels reached thresholds corresponding to various levels of potential impact to marine fauna. The animals considered here included marine mammals, turtles, and fish. Due to the variety of species considered, there are several different thresholds for evaluating effects, including: mortality, injury, temporary reduction in hearing sensitivity, and behavioural disturbance.

The modelling methodology considered scenario specific source levels and range-dependent environmental properties. Estimated underwater acoustic levels for non-impulsive (continuous) noise sources presented as sound pressure levels (SPL, $L_p$), and as accumulated sound exposure levels (SEL, $L_E$) as appropriate for different noise effect criteria. In this report, the duration of the SEL accumulation is defined as integrated over an 8- or 24-hour period.

The SPL metric is the root-mean-square pressure level over a stated frequency band over a specified time window. In this study, for continuous noise, a time window of 1 s was used. An animal travelling within the threshold can be exposed to a sound level could be exposed to behavioural disturbance. The $SEL_{24h}$ is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixed position. The corresponding $SEL_{24h}$ radii represent an unlikely worst-case scenario. More realistically, marine mammals (as well as fish and turtles) would not stay in the same location for 24 hours. Therefore, a reported radius for $SEL_{24h}$ criteria does not mean that marine fauna travelling within this radius of the source will be injured, but rather that an animal could be exposed to the sound level associated with impairment if it remained in that location for 24 hours.

Maps are provided in the report to assist with contextualising tabulated distances. The key results of this modelling study are summarised in Tables 1 and 6.

**Marine mammals:**

The maximum distances to the (NOAA) (2024) marine mammal behavioural response criterion of 120 dB re 1 µPa (SPL) are presented in Table 1. The results for the criteria from NMFS (2024) for marine mammal Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) for MODU and vessel operations are assessed at in-field, the maximum distances and total ensonified areas are presented in Table 2. PTS is a form of auditory injury as it is referred to in NMFS (2024) (using the acronym AUD INJ), however in this report for consistency with previous work the term PTS is used.

Table 1. Maximum ($R_{max}$) and 95% ($R_{95\%}$) horizontal distances (in km) to the marine mammal behavioural response criterion of 120 dB re 1 µPa (SPL) from the most appropriate location for considered sources per scenario. MODU: Mobile Offshore Drilling Unit, OSV: Offshore Supply Vessel

| Location | Operation | Description | $R_{max}$ (km) | $R_{95\%}$ (km) |
|---|---|---|---|---|
| Annie-2 | Drilling Prelays | 1x anchor handler within 2km of location DP/slow transit | 0.44 | 0.41 |
| | Mooring | Moored MODU idle (no noise)<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 7.87 | 7.32 |
| | MODU Drilling | Anchored MODU Drilling | 1.10 | 1.02 |
| | MODU Drilling + OSV Under Standby | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust) | 1.13 | 1.03 |
| | MODU Drilling Operations with Standby OSV and resupply | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust)<br>1x anchor Handler at rig doing resupply | 7.46 | 7.11 |
| | MODU on DP | MODU on DP | 5.36 | 4.83 |
| | Mooring with MODU on DP | MODU on DP<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 8.02 | 7.46 |
| Elanora-1 | Drilling Prelays | 1x anchor handler within 2km of location DP/slow transit | 0.75 | 0.72 |
| | Mooring | Moored Semi Sub idle (no noise)<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 21.7 | 18.8 |
| | MODU Drilling | Anchored MODU Drilling | 1.89 | 1.79 |
| | MODU Drilling + OSV Under Standby | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust) | 2.91 | 2.58 |
| | MODU Drilling Operations with Standby OSV and resupply | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust)<br>1x anchor Handler at rig doing resupply | 21.7 | 18.7 |
| | MODU on DP | MODU on DP | 12.0 | 11.3 |
| | Mooring with MODU on DP | MODU on DP<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 24.8 | 21.7 |
| Between Annie-2 & Casino-5† | Pipeline/Umbilical installation (ISV) Annie EHU | Laying Pipes and umbilicals - 600m/hour | 5.97 | 5.41 |
| Annie-2 | Installation (DSV) | DSV + HRV (no noise) stationary on location | 2.56 | 2.30 |
| Between Annie-2 & Casino-5, with Elanora-1† | MODU Drilling Operations, Standby OSV, OSV resupply and<br>Pipeline/Umbilical installation (ISV) Annie EHU | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust)<br>1x anchor Handler at rig doing resupply<br>Laying Pipes and umbilicals - 600m/hour | 30.7 | 28.2 |

† These scenarios consider several source locations, the presented distances in the summary table are the largest. Results in Section 4.1 provide additional detail.

Table 2. Summary: Maximum ($R_{max}$) horizontal distances (in km) and ensonified area (km$^2$) for the frequency-weighted LF-cetacean $SEL_{24h}$ TTS threshold of 177 dB re 1 µPa$^2$·s from the most appropriate location for the considered scenario. MODU: Mobile Offshore Drilling Unit, OSV: Offshore Supply Vessel

| Location | Operation | Description | $R_{max}$ (km) | Area (km$^2$) |
|---|---|---|---|---|
| Annie-2 | Drilling Prelays | 1x anchor handler within 2km of location DP/slow transit | – | – |
| | Mooring | Moored Semi Sub idle (no noise)<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 3.60 | 28.2 |
| | MODU Drilling | Anchored MODU Drilling | 0.48 | 0.66 |
| | MODU Drilling + OSV Under Standby | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust) | 0.48 | 0.66 |
| | MODU Drilling Operations with Standby OSV and resupply | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust)<br>1x anchor Handler at rig doing resupply | 2.16 | 7.61 |
| | MODU on DP | MODU on DP | 1.73 | 8.50 |
| | Mooring with MODU on DP | MODU on DP<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 3.88 | 39.7 |
| Elanora-1 | Drilling Prelays | 1x anchor handler within 2km of location DP/slow transit | – | – |
| | Mooring | Moored Semi Sub idle (no noise)<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 7.54 | 131 |
| | MODU Drilling | Anchored MODU Drilling | 0.59 | 0.99 |
| | MODU Drilling + OSV Under Standby | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust) | 0.63 | 1.00 |
| | MODU Drilling Operations with Standby OSV and resupply | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust)<br>1x anchor Handler at rig doing resupply | 3.84 | 37.6 |
| | MODU on DP | MODU on DP | 2.85 | 23.9 |
| | Mooring with MODU on DP | MODU on DP<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 7.92 | 176 |
| Between Annie-2 & Casino-5 | Installation (ISV) Annie EHU | Laying Pipes and umbilicals - 600m/hour | 0.63 | 11.5 |
| Annie-2 | Installation (DSV) | DSV + HRV (no noise) stationary on location | 0.94 | 2.53 |
| Between Annie-2 & Casino-5, with Elanora-1† | MODU Drilling Operations, Standby OSV, OSV resupply and Pipeline/Umbilical installation (ISV) Annie EHU† | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (not DP, minimal thrust)<br>1x anchor Handler at rig doing resupply<br>Laying Pipes and umbilicals - 600m/hour | 7.50 | 148 |

† This scenario is a combination of Scenario 5 at Elanora-1 and Scenario 6 to represent concurrent operations.

**Sea Turtles:**

The threshold criteria from Accomando et al. (2025) was used to assess PTS and TTS for sea turtles. Similar to marine mammals, PTS is a form of auditory injury as it is referred to in Accomando et al. (2025) (using the acronym AINJ), however in this report for consistency with previous work the term PTS is used. Across all scenarios the maximum distance to threshold for Annie and Elanora is shown in Table 3.

Table 3. Summary, $SEL_{24h}$: Maximum ($R_{max}$) horizontal distances (in km) to sound pressure level (SPL) criteria (Accomando et al. 2025) from most appropriate location for considered sources per scenario.

| Location | Maximum ($R_{max}$) distance to threshold (km) | |
|---|---|---|
| | TTS | PTS |
| Annie-2 | 2.26 | 0.50 |
| Elanora-1 | 4.45 | 0.49 |

**Fish:**

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 (Table 4), but in order for the thresholds to be exceeded, the fish must remain at those distances for either 12 or 48 h.

Table 4. Summary: *SPL*: Maximum ($R_{max}$) horizontal distances (in km) to sound pressure level (SPL) criteria (Popper et al. 2014) from most appropriate location for considered sources per scenario.

| Location | Maximum ($R_{max}$) distance to threshold (km) | |
|---|---|---|
| | TTS (12 h) | Recoverable injury (48 h) |
| Annie-2 | 0.13 | 0.03 |
| Elanora-1 | 0.13 | 0.03 |

# 1. Introduction

JASCO Applied Sciences (JASCO) performed a modelling study of underwater acoustic noise levels associated with Amplitude Energy's Otway activities. The modelling study specifically predicted the distances from operations at which underwater sound levels reached noise effect thresholds and criteria. The corresponding marine mammal thresholds include levels associated with behavioural response, permanent threshold shift (PTS) and temporary threshold shift (TTS). The marine mammal functional hearing groups considered were low-, high-, very high-frequency cetaceans, and otariid seals. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, $L_p$), and accumulated sound exposure levels (over 24 hours) ($SEL_{24h}$, $L_{E,24h}$), as appropriate for non-impulsive (continuous) noise sources.

This report is further structured as follows, the remainder of Section 1 provides details on the scenarios considered for modelling, Section 2 explains the metrics used to represent underwater acoustic fields and the effect criteria considered. Section 3 details the methodology for predicting the source levels and modelling the sound propagation, including the specifications of the considered sound sources and the environmental parameters. Section 4.1 presents the acoustic results as tabulated ranges to thresholds, Section 4.2 provides sound level contour maps. The acoustic modelling results are then discussed in Section 5.

## 1.1. Modelling Scenarios

Three well locations, Elanora-1, Annie-2, and Casino-5, were considered in this report to capture, and be representative of, the different geographic locations where activities may occur. Figure 1 displays an overview of the modelling area showing locations, the southern right whale BIA, the pygmy blue whale BIA, and the regional bathymetry. This study considered the following sound-producing activities:

- Drilling noise from an anchored Mobile Offshore Drilling Unit (MODU),
- Thruster noise from a MODU under dynamic positioning (DP),
- Vessel noise from an Anchor Handling Tug Supply (AHTS) on slow transit in prelay and hookup operations which was modelled as following a random track in a 2x2 km box centred around either Annie-2 or Elanora-1,
- Vessel noise from an Anchor Handling Tug Supply (AHTS) on slow transit in standby operation which was modelled as following a random track and was confined to a 2x4 km area approximately 2 km from either Annie-2 or Elanora-1,
- Vessel noise from an AHTS conducting resupply operations under DP,
- Vessel noise from an Infield Support Vessel (ISV) conducting pipelay operations following a track and making headway at a rate 600 m/hr,
- Vessel noise from a Dive Support Vessel (DSV) under DP and a Hyperbaric Rescue Vessel (HRV). . After reviewing the vessel specifications, the HRV was considered to be significantly quieter than the DSV such that noise from the DSV would dominate the sound field. Hence the HRV is listed here for completeness but was not modelled.
- Concurrent operations involving drilling activities at Elanora-1 and pipelay operations between Annie-2 and Casino-5.

These activities are typical and representative of operations that may be conducted within Amplitude Energy's Title areas. Table 5 and Table 6 outline the modelling locations and scenarios. The scenario

numbering in Table 6 refers to a unique activity, which may occur at a stated location. Hence results are presented with the scenario number together with a location as a unique identifier.

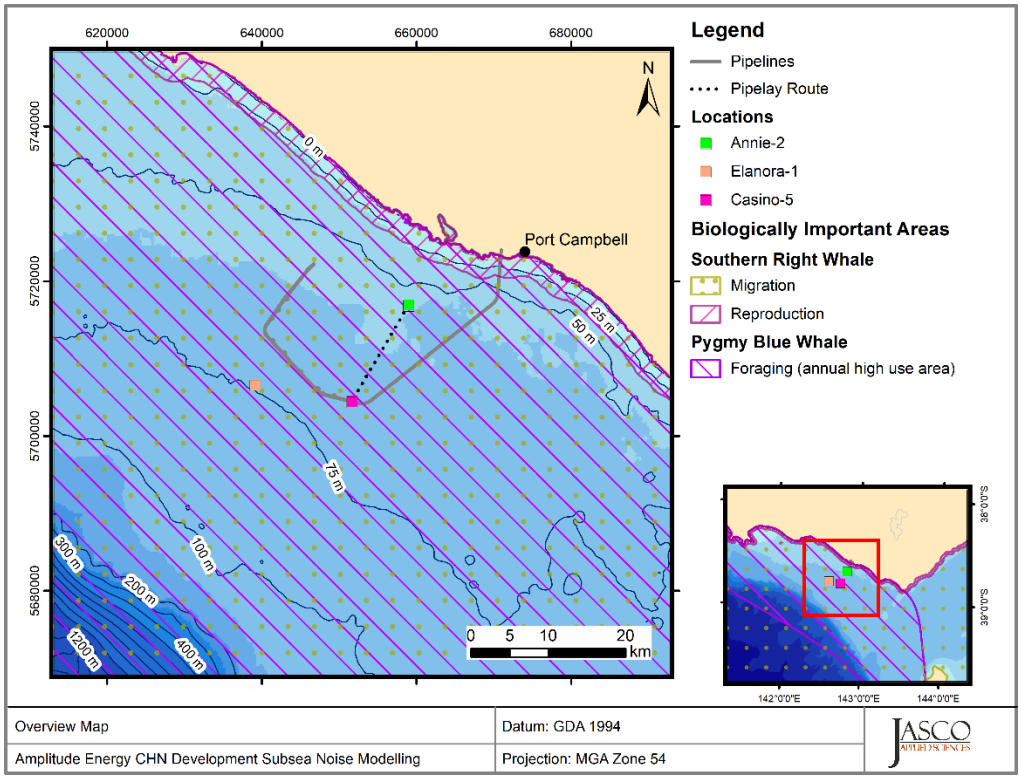



Figure 1. Overview map of the relevant features of the Amplitude Energy Otway Offshore Facilities.

Table 5. Modelled site locations and source information.

| Site | Source/Vessel | Location | Latitude (°S) | Longitude (°E) | MGA[1] Zone 54 | | Water depth (m) |
|---|---|---|---|---|---|---|---|
| | | | | | X (m) | Y (m) | |
| 1 | AHTS (Transit) | Annie-2 | 38° 40' 57.62" | 142° 48' 16.37" | 656960 | 5716892 | 55.8 |
| 2 | AHTS (DP) | | 38° 41' 12.43" | 142° 49' 39.68" | 658964 | 5716395 | 59.2 |
| 3 | AHTS (Transit) | | 38° 40' 53.76" | 142° 51' 01.78" | 660959 | 5716931 | 61.8 |
| 4 | MODU (Drilling) | | 38° 40' 56.22" | 142° 49' 39.10" | 658960 | 5716895 | 57.9 |
| 5 | AHTS (Transit) | | 38° 40' 57.62" | 142° 48' 16.37" | 656960 | 5716892 | 55.8 |
| 6 | AHTS (DP) | | 38° 40' 57.19" | 142° 49' 39.15" | 658961 | 5716865 | 58.0 |
| 7 | AHTS (Transit) | Elanora-1 | 38° 46' 43.61" | 142° 34' 41.43" | 637085 | 5706589 | 77.0 |
| 8 | AHTS (DP) | | 38° 46' 58.70" | 142° 36' 04.82" | 639089 | 5706089 | 75.7 |
| 9 | AHTS (Transit) | | 38° 46' 40.93" | 142° 37' 27.11" | 641085 | 5706602 | 74.0 |
| 10 | MODU (Drilling) | | 38° 46' 42.49" | 142° 36' 04.28" | 639085 | 5706589 | 75.0 |
| 11 | AHTS (Transit) | | 38° 46' 43.61" | 142° 34' 41.43" | 637085 | 5706589 | 77.0 |
| 12 | AHTS (DP) | | 38° 46' 43.46" | 142° 36' 04.29" | 639085 | 5706559 | 75.0 |
| 13 | ISV (Pipelay) | Between Annie-2 & Casino-5 | 38° 44' 19.97" | 142° 47' 12.03" | 655284 | 5710684 | 61.0 |
| 14 | ISV (Pipelay) | Annie-2 | 38° 40' 56.22" | 142° 49' 39.10" | 658960 | 5716895 | 57.9 |
| 15 | ISV (Pipelay) | Casino-5 | 38° 46' 42.49" | 142° 36' 04.28" | 639085 | 5706589 | 75.0 |
| 16 | DSV (Standby) | Annie-2 | 38° 40' 56.22" | 142° 49' 39.10" | 658960 | 5716895 | 58.0 |
| 17 | MODU (DP) | Annie-2 | 38° 40' 56.22" | 142° 49' 39.10" | 658960 | 5716895 | 57.9 |
| 18 | MODU (DP) | Elanora-1 | 38° 46' 42.49" | 142° 36' 04.28" | 639085 | 5706589 | 75.0 |

[1] Map Grid of Australia (MGA)

Table 6. Description of modelled scenarios.

| Scenario | Site(s) | Location | Operation Name | Operation Description | Operation Time | Vessel(s) |
|---|---|---|---|---|---|---|
| 1 | 1 | Annie-2 | Drilling Prelays | 1x anchor handler within 2km of location DP/slow transit | 24h | Anchor Handler |
| | 7 | Elanora-1 | | | 24h | Anchor Handler |
| 2 | 1,2,3 | Annie-2 | Mooring | Moored Semi Sub idle (no noise)<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 24h | Ocean Onyx<br>Anchor Handler x3 |
| | 7,8,9 | Elanora-1 | | | 24h | Ocean Onyx<br>Anchor Handler x3 |
| 3 | 4 | Annie-2 | MODU Drilling | Anchored MODU Drilling | 24h | Ocean Onyx |
| | 10 | Elanora-1 | MODU Drilling | Anchored MODU Drilling | 24h | Ocean Onyx |
| 4 | 4,5 | Annie-2 | MODU Drilling + OSV Under Standby | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (under minimal thrust) | 24h | Ocean Onyx<br>Anchor Handler |
| | 10,11 | Elanora-1 | | | 24h | Ocean Onyx<br>Anchor Handler |
| 5 | 4,5,6 | Annie-2 | MODU Drilling Operations with Standby OSV and resupply | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (under minimal thrust)<br>1x anchor Handler at rig doing resupply (under DP) | MODU: 24hr<br>OSV Standby: 24h<br>OSV Resupply: 8h | Ocean Onyx<br>Anchor Handler x2 |
| | 10,11,12 | Elanora-1 | | | MODU: 24hr<br>OSV Standby: 24h<br>OSV Resupply: 8h | Ocean Onyx<br>Anchor Handler x2 |
| 6 | 13,14,15 | Between Annie-2 & Casino-5 | Pipeline/Umbilical installation (ISV) Annie EHU | Laying Pipes and umbilicals – 600 m/hr | 24h | ISV |
| 7 | 16 | Annie-2 | Installation (DSV + HRV) | DSV + HRV stationary on location | 24h | DSV+HRV |
| 8† | 10,11,12, 13,14,15 | Between Annie-2 & Casino-5, with Elanora-1 | MODU Drilling Operations, Standby OSV, OSV resupply and Pipeline/Umbilical installation (ISV) Annie EHU† | Anchored MODU Drilling<br>1x Anchor Handler on standby within 2km (under minimal thrust)<br>1x anchor Handler at rig doing resupply (under DP)<br>& Laying Pipes and umbilicals – 600 m/hr | MODU: 24hr<br>OSV Standby: 24h<br>OSV Resupply: 8h<br>Pipelay: 24h | Ocean Onyx<br>Anchor Handler x2<br>ISV |
| 9 | 17 | Annie-2 | MODU on DP | MODU on DP | 24h | Transocean Equinox |
| | 18 | Elanora-1 | | | | |
| 10 | 1,2,3,17 | Annie-2 | Mooring with MODU on DP | MODU on DP<br>1x anchor handler on bridle<br>2x anchor handle within 2km of location (hooking up anchors) | 24h | Transocean Equinox<br>Anchor Handler x3 |
| | 7,8,9,18 | Elanora-1 | | | | |

† This scenario is a combination of Scenario 5 at Elanora-1 and Scenario 6 to represent concurrent operations.

# 2. Noise Effect Criteria

To assess the potential effects of a sound-producing activity, it is necessary to first establish exposure criteria (thresholds) for which sound levels may be expected to have an adverse effect on animals. Whether acoustic levels might injure or disturb marine fauna is an active research topic. Since 2007, several expert groups have developed SEL-based assessment approaches for evaluating auditory injury, with key works including Southall et al. (2007), Finneran and Jenkins (2012a), Popper et al. (2014), United States National Marine Fisheries Service (NMFS 2018), Southall et al. (2019), and NMFS (2024). The number of studies that investigate the level of behavioural disturbance to marine fauna by anthropogenic sound has also increased substantially.

Two sound level metrics, SPL and SEL, are commonly used to evaluate non-impulsive noise and its effects on marine life. In this report, the duration of the SEL accumulation is defined as integrated over a 24-hour period. Appropriate subscripts indicate any frequency weighting applied (see Appendix 0). The acoustic metrics in this report reflect the ANSI and ISO standards for acoustic terminology, ANSI S1.1 (S1.1-2013) and ISO 18405:2017 (2017).

The following thresholds and guidelines for this study were chosen because they represent the best available science:

- Frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from NMFS (2024) for the onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) in marine mammals for non-impulsive sound sources. PTS is a form of auditory injury as it is referred to in NMFS (2024) (using acronym AUD INJ), however in this report for consistency with previous work the term PTS is used.
- Marine mammal behavioural threshold based on the current US National Oceanic and Atmospheric Administration (NOAA) (2024) criterion for marine mammals of 120 dB re 1 µPa (SPL; $L_p$) for non-impulsive sound sources.
- Sound exposure guidelines for fish, fish eggs, and larvae (Popper et al. 2014).
- Frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from (Accomando et al. 2025) for the onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) (a form of auditory injury referred to as AINJ in Accomando et al. (2025)) in sea turtles.

Section 2.1, along with Appendices A.3 and A.4, expand on the relevant thresholds, guidelines, and sound levels applicable to marine mammals. Section 2.2 expands on the guidelines for fish and sea turtles.

## 2.1. Marine Mammals

The criteria applied in this study to assess possible effects of non-impulsive noise sources on marine mammals are summarised in Table 7. Cetaceans and otariids were identified as the marine mammals requiring assessment. As discussed within Accomando et al. (2025) and NMFS (2024), intense noise exposures can cause auditory injury (represented by either AUD INJ or AINJ) without PTS occurring. In this report, the terms PTS and auditory injury can be considered to be used interchangeably, however it is acknowledged that auditory injury may occur without PTS. Details on thresholds related to auditory threshold shifts or hearing loss and behavioural response are provided in Appendix A.3, with frequency weighting explained in detail in Appendix A.4.

Table 7. Criteria for effects of non-impulsive noise exposure, including vessel noise, for marine mammals: unweighted SPL and weighted $SEL_{24h}$ thresholds.

| Hearing group | NOAA (2024) | NMFS (2024) | |
|---|---|---|---|
| | Behaviour | TTS onset thresholds (received level) | PTS onset thresholds (received level) |
| | SPL ($L_p$; dB re 1 µPa) | Weighted SEL24h (LE,24h; dB re 1 µPa²·s) | Weighted SEL24h (LE,24h; dB re 1 µPa²·s) |
| Low-frequency (LF) cetaceans | 120 | 177 | 197 |
| High-frequency (HF) cetaceans | | 181 | 201 |
| Very High-frequency (VHF) cetaceans | | 161 | 181 |
| Otariid Seals | | 179 | 199 |

$L_p$ denotes sound pressure level and has a reference value of 1 µPa.
$L_E$ denotes cumulative sound exposure over a 24 h period and has a reference value of 1 µPa²·s.

### 2.1.1. Behavioural Response

The NOAA continuous noise criterion was selected for this assessment because it represents the most commonly applied behavioural response criterion by regulators. The distances at which behavioural responses could occur are therefore determined by areas ensonified above an unweighted SPL of 120 dB re 1 µPa (NOAA 2024). Appendix A.3 provides more information about the development of this criterion.

### 2.1.2. Injury and Hearing Sensitivity Changes

There are two categories of auditory threshold shifts or hearing loss: temporary threshold shift (TTS), a temporary reduction in an animal's hearing sensitivity as the result of receptor hair cells in the cochlea becoming fatigued; and permanent threshold shift (PTS), a physical injury to an animal's hearing organs.

To assist in assessing the potential for effect on marine mammals, this report applies the criteria recommended by NMFS (2024), considering both TTS and PTS (see Table 7). Appendix A.3 provides more information about the NMFS (2024) criteria.

## 2.2. Fish, Sea Turtles, Fish Eggs, and Fish Larvae

In 2006, the Working Group on the Effects of Sound on Fish and Turtles was formed to continue developing noise exposure criteria for fish and sea turtles based on work began by a NOAA panel two years earlier. The Working Group developed guidelines with specific thresholds for different levels of effects for several species groups (Popper et al. 2014). The guidelines define quantitative thresholds for three types of immediate effects:

- Mortality, including injury leading to death;
- Recoverable injury, including injuries unlikely to result in mortality, such as hair cell damage and minor haematoma;
- TTS.

Masking and behavioural effects can be assessed qualitatively, by assessing relative risk rather than by specific sound level thresholds. However, as these depend upon activity-based subjective ranges,

these effects are not addressed in this report, and are included in Table 8 for completeness only. Because the presence or absence of a swim bladder has a role in hearing, fish susceptibility to injury from noise exposure depends on the species and the presence and possible role of a swim bladder in hearing. Thus, different thresholds were proposed for fish without a swim bladder (also appropriate for sharks), fish with a swim bladder not used for hearing, and fish that use their swim bladders for hearing. Sea turtles, fish eggs, and fish larvae are considered separately.

Table 8 lists the relevant effects thresholds from Popper et al. (2014) for shipping and continuous noise. Some evidence suggests that fish sensitive to acoustic pressure show a recoverable loss in hearing sensitivity, or injury when exposed to high levels of noise (Scholik and Yan 2002, Amoser and Ladich 2003, Smith et al. 2006); this is reflected in the SPL thresholds for fish with a swim bladder involved in hearing (shaded cells in Table 8). Accomando et al. (2025) presented revised thresholds for sea turtle TTS and PTS onset from continuous noise sources, considering frequency weighted SEL, which have been applied in this study (Table 9).

Table 8. Criteria for vessel noise exposure for fish, adapted from Popper et al. (2014).

| Type of animal | Mortality and Potential mortal injury | Impairment | | | Behaviour |
|---|---|---|---|---|---|
| | | Recoverable injury | TTS | Masking | |
| Fish:<br>No swim bladder (particle motion detection) | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Moderate<br>(I) Low<br>(F) Low | (N) High<br>(I) High<br>(F) Moderate | (N) Moderate<br>(I) Moderate<br>(F) Low |
| Fish:<br>Swim bladder not involved in hearing (particle motion detection) | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Moderate<br>(I) Low<br>(F) Low | (N) High<br>(I) High<br>(F) Moderate | (N) Moderate<br>(I) Moderate<br>(F) Low |
| Fish:<br>Swim bladder involved in hearing (primarily pressure detection) | (N) Low<br>(I) Low<br>(F) Low | 170 dB SPL for 48 h | 158 dB SPL for 12 h | (N) High<br>(I) High<br>(F) High | (N) High<br>(I) Moderate<br>(F) Low |
| Sea Turtles | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Moderate<br>(I) Low<br>(F) Low | (N) High<br>(I) High<br>(F) Moderate | (N) High<br>(I) Moderate<br>(F) Low |
| Fish eggs and fish larvae | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) High<br>(I) Moderate<br>(F) Low | (N) Moderate<br>(I) Moderate<br>(F) Low |

Sound pressure level dB re 1 µPa.
Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Table 9. Acoustic effects of continuous noise on sea turtles, weighted $SEL_{24h}$, Accomando et al. (2025).

| TTS onset thresholds (received level) | PTS onset thresholds (received level) |
|---|---|
| Weighted $SEL_{24h}$ ($L_{E,24h}$; dB re 1 µPa²s) | Weighted $SEL_{24h}$ ($L_{E,24h}$; dB re 1 µPa²s) |
| 178 | 198 |

$L_E$ denotes cumulative sound exposure over a 24 h period and has a reference value of 1 µPa²s.

# 3. Methods and Parameters

The modelled sites for the operations considered in this study were located on the continental shelf of south-eastern Australian (refer to wide regional bathymetry in Appendix B.1.1). The modelled sites were situated in water depths of approximately 56 – 77 m and represent or are considered representative of Amplitude Energy's Otway activity locations.

To allow for operational flexibility, the sound speed profile considered for modelling was selected through a sensitivity analysis considering all months. The month of August was found to be the most favourable for sound propagation and was selected for modelling. Additional detail can be found in Appendix B.1.2.

The seabed beneath the modelled sites will likely consist of variably cemented calcarenite (Port Campbell Limestone), for some sites a thin veneer of overlying coarse sand on top of the variably cemented calcarenite may be present. The geologic and geoacoustic profiles of the seabed were generated using lithographic descriptions from geotechnical and geophysical reports supplied by the client and considering previous underwater acoustic modelling and measurement studies. Appendix B.1.3 provides additional detail.

The following sections provided a description of the inputs used for this underwater noise modelling study. The sections are divided into subsections detailing the source inputs for the MODU, AHTS, ISV and DSV (Section 3.1) with Sections 3.2–3.3 providing details on the applied modelling techniques and model configuration information.

## 3.1. Vessel and Drilling Noise Sources

For the MODU on DP, MODU Drilling, AHTS on DP, AHTS standby transiting, the ISV conducting pipelay operations and the DSV and HRV on DP, Figure 2 presents a summary plot of considered source spectra for comparison purposes; additional detail on the sources is provided in Sections 3.1.1–3.1.2.3.

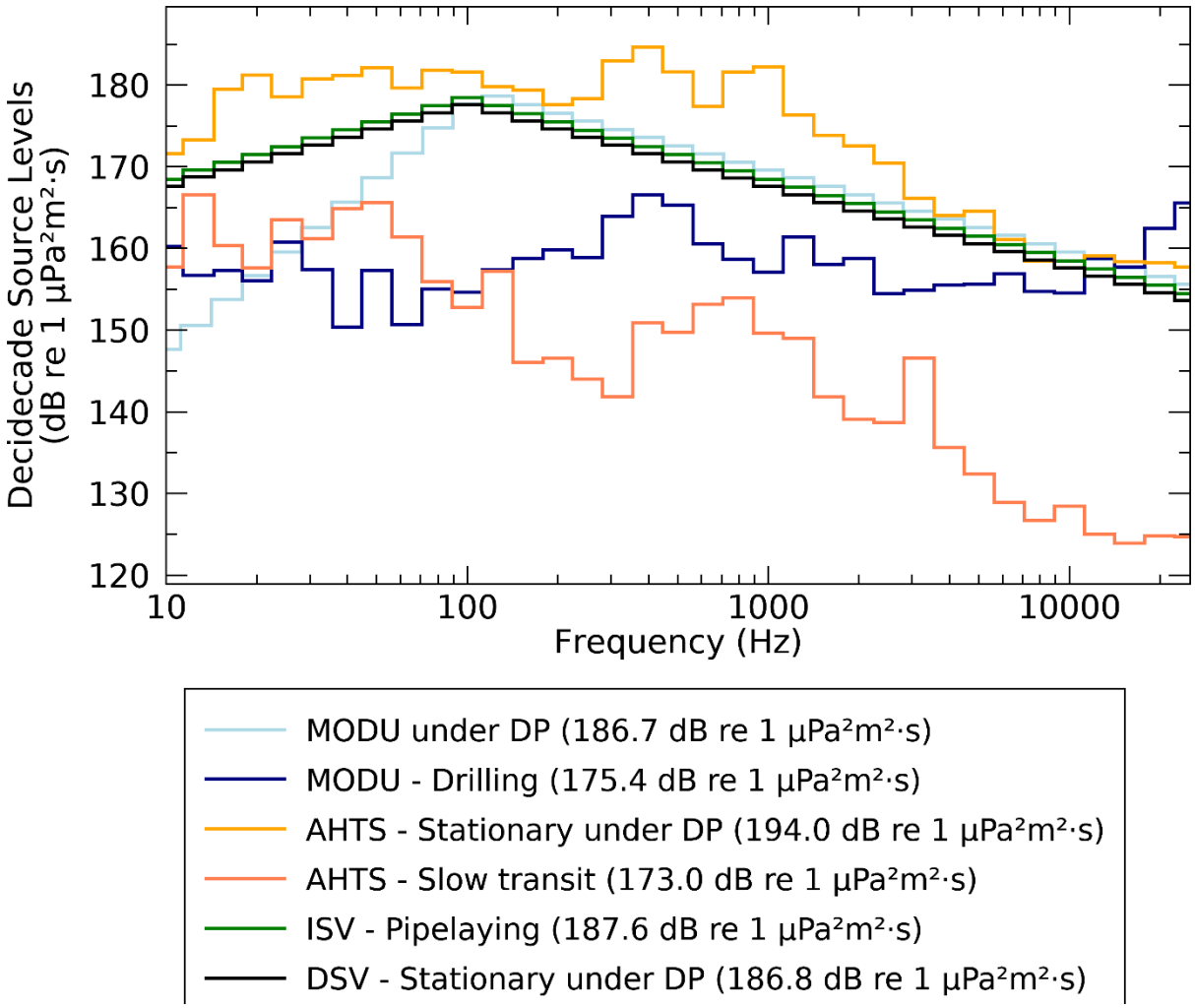



Figure 2. Source level (SL) spectra (in decidecade frequency-band) for all sound sources.

### 3.1.1. Mobile Offshore Drilling Unit (MODU)

The MODU, or semi-submersible platform, considered in this study is likely similar to the *Transocean Equinox*. While in operation, it will be held in position via anchors and chains, as opposed to using thrusters. Underwater sound from the MODU while drilling is expected to originate primarily from onboard equipment vibrations, while a smaller portion of the sound is expected to be transmitted directly into the water via the rotating drill string (Austin et al. 2018). Since the dominant vibration sources (e.g. pumps, generators, and machinery) are located on or below the main deck of the platform, the modelled depth of the point source representing the MODU was set to 11.6 m.

For drilling operations, the *Ocean Onyx* has been considered as a representative MODU for the *Transocean Equinox*. The *Ocean Onyx* (Figure 3) was measured by JASCO while anchored and drilling (McPherson et al. 2021), and had a broadband (10 Hz to 31 kHz) source level of 175.4 dB re 1 µPa m.



Figure 3. *Ocean Onyx* semi-submersible platform.

### 3.1.2. Vessel Radiated Noise

Underwater sound that radiates from vessels is produced mainly by propeller and thruster cavitation, with a smaller fraction of noise produced by sound transmitted through the hull, such as by engines, gearing, and other mechanical systems. Sound levels tend to be the highest when thrusters are used to position the vessel and when the vessel is transiting at high speeds. A vessel's sound signature depends on the vessel's size, power output, propulsion system (e.g., conventional propellers vs. Voith Schneider propulsion), and the design characteristics of the given system (e.g., blade shape and size). A vessel produces broadband acoustic energy with most of the energy emitted below a few kilohertz. Sound from onboard machinery, particularly sound below 200 Hz, dominates the sound spectrum before cavitation begins (Spence et al. 2007).

#### 3.1.2.1. MODU under DP

While the MODU is positioning and anchors are being setup it is expected to be under DP where the primary source of noise is expected to originate from thrusters. Estimates of the source levels for the MODU is based on the *Transocean Equinox* from Woodside Energy Limited (2024). This had a broadband (10 Hz to 25 kHz) source level of 186.7 dB re 1 µPa m.

#### 3.1.2.2. Anchor Handling Tug Supply (AHTS)

At this stage, the exact vessel specifications as well as the precise operational scenarios are not known. As such, estimates of the source levels for the Anchor Handling Tug Supply (AHTS) operations were based on a generic design AHTS vessel. The AHTS was based on the Siem VS491 CD design AHTS vessel (Figure 4) and it's specifications (Siem Offshore 2010) were used to form a basis for vessel source level estimation and source depth for acoustic modelling purposes. The general specification of these vessels is that they have a bollard pull of 285-310 t, and an overall length, beam, and draft of 91.0 m, 22.0 m and 7.95 m respectively.

The measured monopole source levels (MSLs) and spectra for the AHTS were taken from McPherson et al. (2021). For scenarios where the AHTS was under dynamic positioning (DP), the spectra from Section 5.5.2 in McPherson et al. (2021) were used.



Figure 4. Photo of an Anchor Handling Tug Supply (AHTS) vessel (Siem Offshore 2010).

### 3.1.2.3. Infield Support Vessel (ISV) and Dive Support Vessel (DSV)

As with the AHTS, at this stage the exact vessel specifications are not known. As such, estimates of the source levels for the ISV and DSV were based on a generic source spectrum and scaled based on thruster power comparisons.

#### 3.1.2.3.1. Generic Offshore Vessel Source Spectrum

At the time of this study, the ISV and DSV vessels to be used in the project were unconfirmed and generic source spectrum used the estimate of the acoustic source levels for the ISV and DSV. These were estimated by scaling the spectrum based on the maximum utilised thruster power. The modelled source levels or the ISV and DSV were adjusted using Equation (1).

$$\mathrm{SL} = \mathrm{SL}_{\mathrm{ref}} + 10\log_{10}\left(\frac{P}{P_{\mathrm{ref}}}\right) \quad (1)$$

Here the modelled broadband source level ($\mathrm{SL}$) was estimated from the broadband source level of the generic source ($\mathrm{SL}_{\mathrm{ref}}$) and the utilised thruster powers of the modelled ISV (or DSV) and generic sources ($P$ and $P_{\mathrm{ref}}$, respectively). The generic source spectrum for the was determined by the method described in Appendix B.2.

#### 3.1.2.3.2. Infield Support Vessel (ISV)

The estimates of the source levels for the ISV were based on a proxy vessel, the Skandi Acergy (Figure 5) which has a total installed thruster power rating of 16,840 kW, and overall length, beam and draft of 156.9 m, 27.0 m and 8.5 m respectively. The propulsion system of the Skandi Acergy contains the following:

- 2 x 1,920 kW tunnel thrusters,
- 2 x 1,500 kW retractable azimuths,
- 2 x 3,000 kW contra-rotating azimuths,

- 1 x 4,000 kW shaft propeller + rudder.

However, while under DP the single rear main is not likely to be in use; therefore, for power scaling it was omitted. The total maximum thruster power while the ISV was on DP of 12,840 kW was used with Equation (1) for scaling.



Figure 5. Photo of the Skandi Acergy - proxy for an Infield Support Vessel (ISV).

#### 3.1.2.3.3. Dive Support Vessel (DSV)

The estimates of the source levels for the ISV were based on a proxy vessel, the Skandi Singapore (Figure 6) which has a total installed thruster power rating of 10,500 kW, and overall length, beam and draft of 107.1 m, 21.0 m, and 6.6 m respectively. The propulsion system of the Skandi Singapore contains the following:

- 2 x 1500 kW bow tunnel thrusters,
- 1 x 1,500 kW retractable azimuth thruster,
- 2 x 3,000 kW stern azimuths thruster.

The total maximum thruster power while the DSV was on DP of 10,500 kW was used for with Equation (1) for scaling.



Figure 6. Photo of the Skandi Singapore proxy for a Dive Support Vessel (DSV).

## 3.2. Geometry and Modelled Regions

JASCO's Marine Operations Noise Model (MONM-BELLHOP; see Appendices B.3.2 and B.3.4) was used to predict the acoustic field at frequencies of 10 Hz to 25 kHz for all vessels. To supplement the MONM results, high-frequency results for propagation loss were modelled using Bellhop for frequencies from 1.26 to 25 kHz. The sound field modelling calculated propagation losses up to 80 km from the source, with a horizontal separation of 20 m between receiver points along the modelled radials. The sound fields were modelled with a horizontal angular resolution of $\Delta\theta = 2.5°$ for a total of N = 144 radial planes. Receiver depths were chosen to span the entire water column over the modelled areas, from 2 m to a maximum of 2600 m. To supplement the MONM results, high-frequency results for propagation loss were modelled using BELLHOP (Porter and Liu 1994) for frequencies from 1.25 to 10 kHz. The MONM and BELLHOP results were combined to produce results for the full frequency range of interest. For sites where the seabed geoacoustic model consisted of bare calcarenite, an additional broadband correction was applied to the results from MONM-BELLHOP to better account for the additional propagation loss associated with a limestone (calcarenite) seabed (see Appendix B.3.4).

To produce the maps of received sound level isopleths, and to calculate distances to specified sound level thresholds, the maximum-over-depth level was calculated at each sampling point within the modelled region. The radial grids of maximum-over-depth levels were then resampled (by linear triangulation) to produce a regular Cartesian grid. The contours and threshold ranges were calculated from these grids of the modelled acoustic fields.

## 3.3. Accumulated SEL

In this study, the sound sources were considered to be continuously operating with new sound energy constantly being introduced to the environment. The reported source levels are usually in terms of sound pressure levels (SPL), representing the average instantaneous acoustic level of a considered source. The evaluation of the cumulative sound field (i.e., in terms of $SEL_{24h}$) depends on the number of seconds of operation during the accumulation period.

For all stationary source (MODU and vessels), the SPL modelling results were converted to SEL by the duration of the measurement, which is appropriate for a non-impulsive noise source. As SEL was assessed over 24 h and for a stationary vessel over a day, the conversion from SPL was obtained by increasing the levels by $10*\log_{10}(T)$, where T is 86,400 (the number of seconds in 24 h). For scenarios where a vessel was transiting along a track a similar adjustment to the SPL was applied, however the time factor was determined based on the step size along the track and the vessel's speed. See Appendix B.2.2 for detail.

# 4. Results

The maximum-over-depth sound fields for the modelled scenarios are presented below in two formats: as tables of distances to sound levels and, where the distances are long enough, as contour maps showing the directivity and range to various sound levels.

For the results below, the distances to isopleths/thresholds were reported from either the centroid of several sources or from the most dominant single source. When an isopleth completely envelopes multiple sources the centroid was used. When several closed isopleths exist the most dominant source was used. Maps and are provided in Section 4.2 to assist in with contextualising tabulated distances.

## 4.1. Tabulated Results

Tables 10–13 present the maximum and 95% distances to SPL. The SPL sound footprints presented represent the instantaneous sound field and do not depend on time accumulation. Tables 14–17 present the maximum distances to frequency-weighted $SEL_{24h}$ thresholds, as well as total ensonified area.

Table 10. *Annie-2, SPL*: Maximum ($R_{max}$) and 95% ($R_{95\%}$) horizontal distances (in km) to sound pressure level (SPL) from most appropriate location for considered sources per scenario. Scenario descriptions are given in Table 5.

| SPL ($L_p$; dB re 1 µPa) | Annie-2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Scenario 1 | | Scenario 2 | | Scenario 3 | | Scenario 4 | | Scenario 5 | |
| | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) |
| 180 | – | – | – | – | – | – | – | – | – | – |
| 170[a] | – | – | 0.02 | 0.02 | – | – | – | – | 0.03 | 0.03 |
| 160 | – | – | 0.10 | 0.10 | – | – | – | – | 0.11 | 0.11 |
| 158[b] | – | – | 0.12 | 0.11 | – | – | – | – | 0.13 | 0.12 |
| 150 | – | – | 0.36 | 0.34 | 0.02 | 0.02 | 0.02 | 0.02 | 0.37 | 0.34 |
| 140 | 0.03 | 0.03 | 0.81 | 0.76 | 0.11 | 0.10 | 0.11 | 0.10 | 0.84 | 0.77 |
| 130 | 0.14 | 0.13 | 3.16 | 2.71 | 0.42 | 0.39 | 0.42 | 0.39 | 2.76 | 2.43 |
| 120[c] | 0.44 | 0.41 | 7.87 | 7.32 | 1.10 | 1.02 | 1.13 | 1.03 | 7.46 | 7.11 |
| 110 | 0.96 | 0.92 | 21.3 | 18.5 | 3.54 | 3.24 | 4.43 | 3.99 | 20.9 | 18.4 |
| 100 | 2.40 | 2.13 | 79.9 | 61.8 | 8.30 | 7.64 | 9.30 | 8.18 | 79.6 | 61.9 |

[a] 48 h threshold for recoverable injury for fish with a swim bladder involved in hearing (Popper et al. 2014).
[b] 12 h threshold for TTS for fish with a swim bladder involved in hearing (Popper et al. 2014).
[c] Threshold for LF, HF & VHF-cetacean behavioural response to non-impulsive noise (NOAA 2024).
A dash indicates the level was not reached within the limits of the modelled resolution (20 m).

Table 11. *Elanora-1, SPL*: Maximum ($R_{max}$) and 95% ($R_{95\%}$) horizontal distances (in km) to sound pressure level (SPL) from most appropriate location for considered sources per scenario. Scenario descriptions are given in Table 5.

| SPL ($L_p$; dB re 1 µPa) | Elanora-1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Scenario 1 | | Scenario 2 | | Scenario 3 | | Scenario 4 | | Scenario 5 | |
| | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) |
| 180 | – | – | – | – | – | – | – | – | – | – |
| 170[a] | – | – | – | – | – | – | – | – | 0.03 | 0.03 |
| 160 | – | – | 0.06 | 0.06 | 0.02 | 0.02 | 0.02 | 0.02 | 0.07 | 0.07 |
| 158[b] | – | – | 0.12 | 0.12 | 0.02 | 0.02 | 0.02 | 0.02 | 0.13 | 0.13 |
| 150 | 0.02 | 0.02 | 0.41 | 0.39 | 0.02 | 0.02 | 0.02 | 0.02 | 0.42 | 0.40 |
| 140 | 0.03 | 0.03 | 1.64 | 1.53 | 0.07 | 0.07 | 0.07 | 0.07 | 1.64 | 1.54 |
| 130 | 0.17 | 0.16 | 6.53 | 5.88 | 0.50 | 0.47 | 0.50 | 0.48 | 6.20 | 5.77 |
| 120[c] | 0.75 | 0.72 | 21.7 | 18.8 | 1.89 | 1.79 | 2.91 | 2.58 | 21.7 | 18.7 |
| 110 | 2.09 | 1.97 | 81.3 | 61.2 | 8.06 | 7.28 | 8.83 | 7.83 | 81.2 | 62.4 |
| 100 | 6.31 | 5.78 | >80.0 | / | 31.4 | 27.7 | 31.9 | 28.1 | >80.0 | / |

[a] 48 h threshold for recoverable injury for fish with a swim bladder involved in hearing (Popper et al. 2014).
[b] 12 h threshold for TTS for fish with a swim bladder involved in hearing (Popper et al. 2014).
[c] Threshold for LF, HF & VHF-cetacean behavioural response to non-impulsive noise (NOAA 2024).
A dash indicates the level was not reached within the limits of the modelled resolution (20 m).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the $R_{max}$ is greater than the maximum modelling extent.

Table 12. *Pipeline/Umbilical Lay between Annie-2 and Casino-5, ISV, and drilling operations at Elanoa-1, SPL*: Maximum ($R_{max}$) and 95% ($R_{95\%}$) horizontal distances (in km) to sound pressure level (SPL) from most appropriate location for considered sources per scenario. Scenario descriptions are given in Table 5.

| SPL ($L_p$;dB re 1 µPa) | Annie-2 and Casino-5 | | | | | | Annie-2 | | Annie-2, Casino-5, and Elanora-1 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Scenario 6 | | | | | | Scenario 7 | | Scenario 8[d] | |
| | Site 13 | | Site 14 | | Site 15 | | | | | |
| | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) |
| 180 | – | – | – | – | – | – | – | – | 0.02 | 0.02 |
| 170[a] | – | – | – | – | – | – | – | – | 0.03 | 0.03 |
| 160 | 0.04 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.07 | 0.07 |
| 158[b] | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.13 | 0.13 |
| 150 | 0.17 | 0.17 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.15 | 0.42 | 0.40 |
| 140 | 0.48 | 0.43 | 0.48 | 0.45 | 0.69 | 0.66 | 0.47 | 0.44 | 1.64 | 1.54 |
| 130 | 1.14 | 1.07 | 0.99 | 0.94 | 2.08 | 1.96 | 0.98 | 0.93 | 6.27 | 5.83 |
| 120[c] | 2.72 | 2.61 | 2.59 | 2.33 | 5.97 | 5.41 | 2.56 | 2.30 | 30.7 | 28.2 |
| 110 | 7.34 | 7.11 | 6.61 | 6.09 | 20.2 | 18.2 | 6.47 | 6.08 | 92.0 | 69.8 |
| 100 | 21.3 | 17.9 | 16.8 | 15.4 | 63.7 | 52.0 | 17.2 | 15.6 | >80.0 | \ |

[a] 48 h threshold for recoverable injury for fish with a swim bladder involved in hearing (Popper et al. 2014).
[b] 12 h threshold for TTS for fish with a swim bladder involved in hearing (Popper et al. 2014).
[c] Threshold for LF, HF & VHF-cetacean behavioural response to non-impulsive noise (NOAA 2024).
[d] Longest distance to threshold along the entire pipelay route is shown. See Figures 21–23 for contour maps at three points along pipelay route.
A dash indicates the level was not reached within the limits of the modelled resolution (20 m).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the $R_{max}$ is greater than the maximum modelling extent.

Table 13. *Vessel Scenarios for MODU under DP, SPL*: Maximum ($R_{max}$) and 95% ($R_{95\%}$) horizontal distances (in km) to sound pressure level (SPL) from most appropriate location for considered sources per scenario. Scenario descriptions are given in Table 5.

| SPL ($L_p$;dB re 1 µPa) | Annie-2 | | Elanora-1 | | Annie-2 | | Elanora-1 | |
|---|---|---|---|---|---|---|---|---|
| | Scenario 9 | | | | Scenario 10 | | | |
| | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) | $R_{max}$ (km) | $R_{95\%}$ (km) |
| 180 | – | – | – | – | – | – | – | – |
| 170[a] | – | – | – | – | – | – | – | – |
| 160 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.10 | 0.06 | 0.06 |
| 158[b] | 0.04 | 0.04 | 0.04 | 0.04 | 0.12 | 0.11 | 0.13 | 0.12 |
| 150 | 0.17 | 0.16 | 0.14 | 0.13 | 0.60 | 0.54 | 0.67 | 0.60 |
| 140 | 0.55 | 0.53 | 0.83 | 0.79 | 2.05 | 0.96 | 2.08 | 1.79 |
| 130 | 1.84 | 1.71 | 3.15 | 2.93 | 3.50 | 2.98 | 7.61 | 6.32 |
| 120[c] | 5.36 | 4.83 | 12.0 | 11.3 | 8.02 | 7.46 | 24.8 | 21.7 |
| 110 | 12.9 | 11.7 | 43.6 | 39.5 | 25.0 | 21.3 | 90.3 | 78.2 |
| 100 | 43.7 | 38.8 | >80.0 | \ | >80.0 | \ | >80.0 | \ |

[a] 48 h threshold for recoverable injury for fish with a swim bladder involved in hearing (Popper et al. 2014).
[b] 12 h threshold for TTS for fish with a swim bladder involved in hearing (Popper et al. 2014).
[c] Threshold for LF, HF & VHF-cetacean behavioural response to non-impulsive noise (NOAA 2024).
A dash indicates the level was not reached within the limits of the modelled resolution (20 m).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the $R_{max}$ is greater than the maximum modelling extent.

Table 14. *Vessel Scenarios at Annie-2, $SEL_{24h}$:* Maximum ($R_{max}$) horizontal distances (in km) to frequency-weighted $SEL_{24h}$ PTS and TTS thresholds based on NMFS (2024) and Accomando et al. (2025) from most appropriate location for considered sources per scenario and ensonified area ($km^2$).

| Hearing group | Frequency-weighted $SEL_{24h}$ threshold ($L_{E,24h}$; dB re 1 $\mu Pa^2 \cdot s$) | Annie-2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Scenario 1 | | Scenario 2 | | Scenario 3 | | Scenario 4 | | Scenario 5 | |
| | | $R_{max}$ (km) | Area ($km^2$) | $R_{max}$ (km) | Area ($km^2$) | $R_{max}$ (km) | Area ($km^2$) | $R_{max}$ (km) | Area ($km^2$) | $R_{max}$ (km) | Area ($km^2$) |
| **PTS** | | | | | | | | | | | |
| LF cetaceans | 197 | – | – | 0.40 | 0.43 | 0.03 | / | 0.03 | / | 0.27 | 0.17 |
| HF cetaceans | 201 | – | – | 0.03 | / | – | – | – | – | – | – |
| VHF cetaceans | 181 | – | – | 0.07 | 0.01 | 0.09 | 0.02 | 0.09 | 0.02 | 0.11 | 0.03 |
| Otariid Seals | 199 | – | – | 0.03 | / | – | – | – | – | – | – |
| Sea turtles | 198 | – | – | 0.29 | 0.23 | – | – | – | – | 0.13 | 0.04 |
| **TTS** | | | | | | | | | | | |
| LF cetaceans | 177 | – | – | 3.60 | 28.2 | 0.48 | 0.66 | 0.48 | 0.66 | 2.16 | 7.61 |
| HF cetaceans | 181 | – | – | 0.47 | 0.65 | 0.11 | 0.04 | 0.11 | 0.04 | 0.35 | 0.35 |
| VHF cetaceans | 161 | – | – | 0.59 | 1.06 | 0.64 | 1.23 | 0.64 | 1.23 | 0.69 | 1.44 |
| Otariid Seals | 179 | – | – | 0.44 | 0.57 | 0.10 | 0.03 | 0.10 | 0.03 | 0.33 | 0.29 |
| Sea turtles | 178 | – | – | 1.73 | 6.49 | 0.28 | 0.23 | 0.28 | 0.23 | 0.99 | 2.65 |

A dash indicates the level was not reached within the limits of the modelled resolution (20 m).
A slash indicates that the area is less than an area associated with the modelled resolution (0.0013 $km^2$).

Table 15. *Vessel Scenarios at Elanora-1, $SEL_{24h}$:* Maximum ($R_{max}$) horizontal distances (in km) to frequency-weighted $SEL_{24h}$ PTS and TTS thresholds based on NMFS (2024) and Accomando et al. (2025) from most appropriate location for considered sources per scenario and ensonified area ($km^2$).

| Hearing group | Frequency-weighted $SEL_{24h}$ threshold ($L_{E,24h}$; dB re 1 $\mu Pa^2 \cdot s$) | Elanora-1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Scenario 1 | | Scenario 2 | | Scenario 3 | | Scenario 4 | | Scenario 5 | |
| | | $R_{max}$ (km) | Area ($km^2$) | $R_{max}$ (km) | Area ($km^2$) | $R_{max}$ (km) | Area ($km^2$) | $R_{max}$ (km) | Area ($km^2$) | $R_{max}$ (km) | Area ($km^2$) |
| **PTS** | | | | | | | | | | | |
| LF cetaceans | 197 | – | – | 0.50 | 0.56 | 0.03 | / | 0.05 | / | 0.22 | 0.12 |
| HF cetaceans | 201 | – | – | 0.04 | / | – | – | – | – | – | – |
| VHF cetaceans | 181 | – | – | 0.06 | 0.01 | 0.08 | 0.02 | 0.10 | 0.02 | 0.09 | 0.02 |
| Otariid Seals | 199 | – | – | 0.03 | / | – | – | – | – | – | – |
| Sea turtles | 198 | – | – | 0.31 | 0.22 | – | – | – | – | 0.10 | 0.02 |
| **TTS** | | | | | | | | | | | |
| LF cetaceans | 177 | – | – | 7.54 | 131 | 0.59 | 0.99 | 0.63 | 1.00 | 3.84 | 37.6 |
| HF cetaceans | 181 | – | – | 0.66 | 1.18 | 0.09 | 0.03 | 0.12 | 0.03 | 0.38 | 0.37 |
| VHF cetaceans | 161 | – | – | 0.81 | 2.02 | 0.79 | 1.92 | 0.81 | 1.92 | 0.88 | 2.37 |
| Otariid Seals | 179 | – | – | 0.56 | 0.85 | 0.08 | 0.02 | 0.10 | 0.02 | 0.34 | 0.29 |
| Sea turtles | 178 | – | – | 3.53 | 33.2 | 0.25 | 0.19 | 0.28 | 0.19 | 1.86 | 10.3 |

A dash indicates the level was not reached within the limits of the modelled resolution (20 m).
A slash indicates that the area is less than an area associated with the modelled resolution (0.0013 $km^2$).

Table 16. *Vessel Scenarios for Pipeline/Umbilical Lay between Annie-2 and Casino-5 and ISV at Annie-2, SPL*: Maximum ($R_{max}$) horizontal distances (in km) to frequency-weighted $SEL_{24h}$ PTS and TTS thresholds based on NMFS (2024) and Accomando et al. (2025) from most appropriate location for considered sources per scenario and ensonified area (km²).

| Hearing group | Frequency-weighted $SEL_{24h}$ threshold ($L_{E,24h}$; dB re 1 µPa²·s) | Annie-2 and Casino-5 | | Annie-2 | | Annie-2, Casino-5, and Elanora-1 | |
|---|---|---|---|---|---|---|---|
| | | Scenario 6 | | Scenario 7 | | Scenario 8 | |
| | | $R_{max}$ (km) | Area (km²) | $R_{max}$ (km) | Area (km²) | $R_{max}$ (km) | Area (km²) |
| **PTS** | | | | | | | |
| LF cetaceans | 197 | – | – | 0.13 | 0.05 | 0.48 | 0.56 |
| HF cetaceans | 201 | – | – | – | – | 0.03 | / |
| VHF cetaceans | 181 | – | – | 0.05 | 0.01 | 0.12 | 0.03 |
| Otariid Seals | 199 | – | – | – | – | 0.03 | / |
| Sea turtles | 198 | – | – | 0.08 | 0.02 | 0.26 | 0.18 |
| **TTS** | | | | | | | |
| LF cetaceans | 177 | 0.63 | 11.5 | 0.94 | 2.53 | 7.50 | 148 |
| HF cetaceans | 181 | – | – | 0.17 | 0.09 | 0.90 | 1.20 |
| VHF cetaceans | 161 | 0.08 | 2.08 | 0.45 | 0.62 | 1.14 | 6.08 |
| Otariid Seals | 179 | – | – | 0.18 | 0.10 | 0.57 | 0.90 |
| Sea turtles | 178 | 0.37 | 7.71 | 0.78 | 1.77 | 3.47 | 41.8 |

A dash indicates the level was not reached within the limits of the modelled resolution (20 m).
A slash indicates that the area is less than an area associated with the modelled resolution (0.0013 km²).

Table 17. *Vessel Scenarios for MODU under DP, SPL*: Maximum ($R_{max}$) horizontal distances (in km) to frequency-weighted $SEL_{24h}$ PTS and TTS thresholds based on NMFS (2024) and Accomando et al. (2025) from most appropriate location for considered sources per scenario and ensonified area (km²).

| Hearing group | Frequency-weighted $SEL_{24h}$ threshold ($L_{E,24h}$; dB re 1 µPa²·s) | Annie-2 | | Elanora-1 | | Annie-2 | | Elanora-1 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Scenario 9 | | | | Scenario 10 | | | |
| | | $R_{max}$ (km) | Area (km²) | $R_{max}$ (km) | Area (km²) | $R_{max}$ (km) | Area (km²) | $R_{max}$ (km) | Area (km²) |
| **PTS** | | | | | | | | | |
| LF cetaceans | 197 | 0.15 | 0.06 | 0.13 | 0.05 | 0.61 | 0.57 | 0.67 | 0.78 |
| HF cetaceans | 201 | – | – | – | – | 0.03 | / | 0.04 | / |
| VHF cetaceans | 181 | 0.07 | 0.01 | 0.05 | 0.01 | 0.07 | 0.03 | 0.06 | 0.02 |
| Otariid Seals | 199 | – | – | – | – | 0.03 | / | 0.03 | / |
| Sea turtles | 198 | 0.12 | 0.04 | 0.08 | 0.02 | 0.50 | 0.29 | 0.49 | 0.23 |
| **TTS** | | | | | | | | | |
| LF cetaceans | 177 | 1.73 | 8.50 | 2.85 | 23.9 | 3.88 | 39.7 | 7.92 | 176 |
| HF cetaceans | 181 | 0.24 | 0.17 | 0.19 | 0.12 | 0.71 | 0.88 | 0.88 | 1.45 |
| VHF cetaceans | 161 | 0.59 | 1.05 | 0.71 | 1.54 | 0.87 | 1.94 | 1.15 | 3.46 |
| Otariid Seals | 179 | 0.24 | 0.18 | 0.19 | 0.12 | 0.68 | 0.79 | 0.82 | 1.17 |
| Sea turtles | 178 | 1.31 | 4.73 | 2.20 | 13.1 | 2.26 | 12.4 | 4.45 | 55.5 |

A dash indicates the level was not reached within the limits of the modelled resolution (20 m).
A slash indicates that the area is less than an area associated with the modelled resolution (0.0013 km²).

## 4.2. Sound Field Maps

Maps of the estimated sound fields, threshold contours, and isopleths of interest for SPL and $SEL_{24h}$ sound fields are presented for the modelled vessel scenarios. In some cases, the isopleths had several contours. This can occur as a result of the reflection of the sound field off the seafloor, creating an additional ring around the initial isopleth. The first isopleth is generally axially symmetric since it spreads without the influence of the bathymetry, while the second isopleth is more complex due to the interaction between the sound field and the seabed.

### 4.2.1. SPL Sound level Contour Maps

Maps of the estimated sound fields, threshold contours, and isopleths of interest for SPL and $SEL_{24h}$ sound fields are presented for the Amplitude Energy Otway subsea noise modelling.

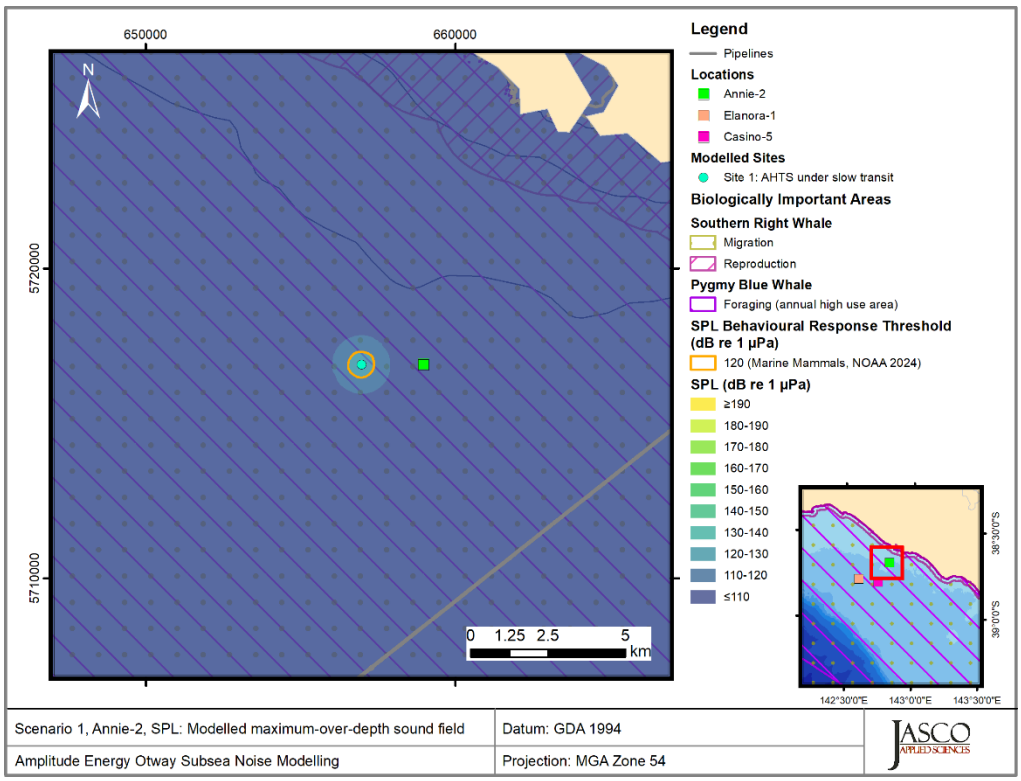



Figure 7. *Scenario 1, Drilling prelays, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

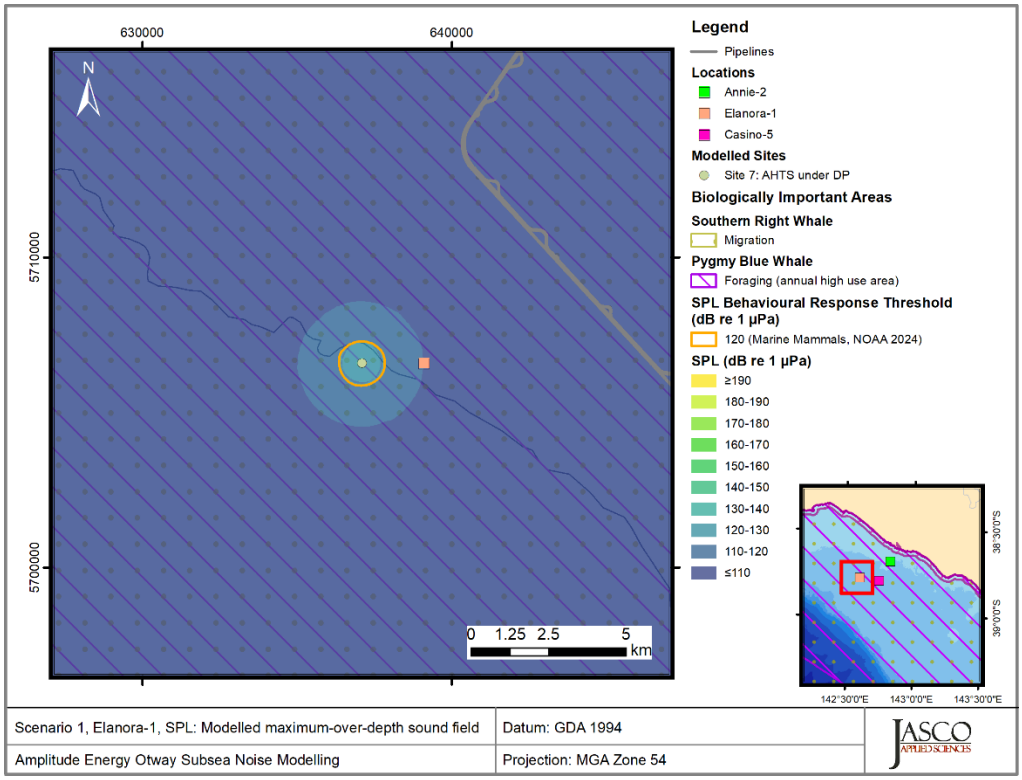



Figure 8. *Scenario 1, Drilling prelays, Elanora-1, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

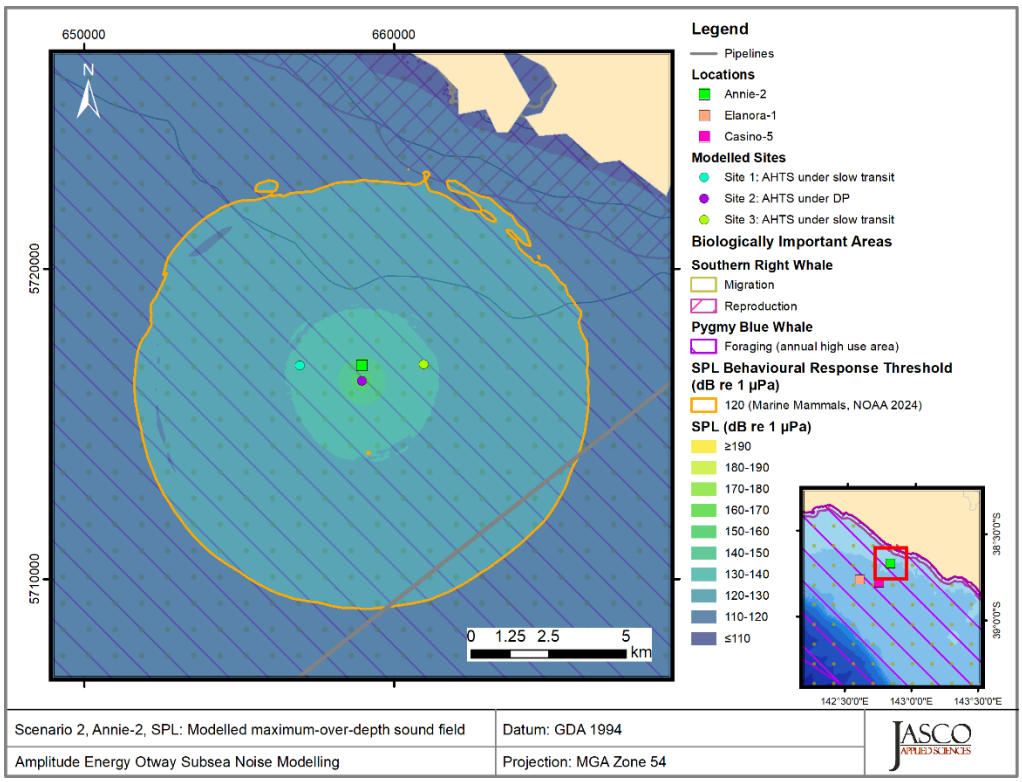



Figure 9. *Scenario 2, Mooring, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

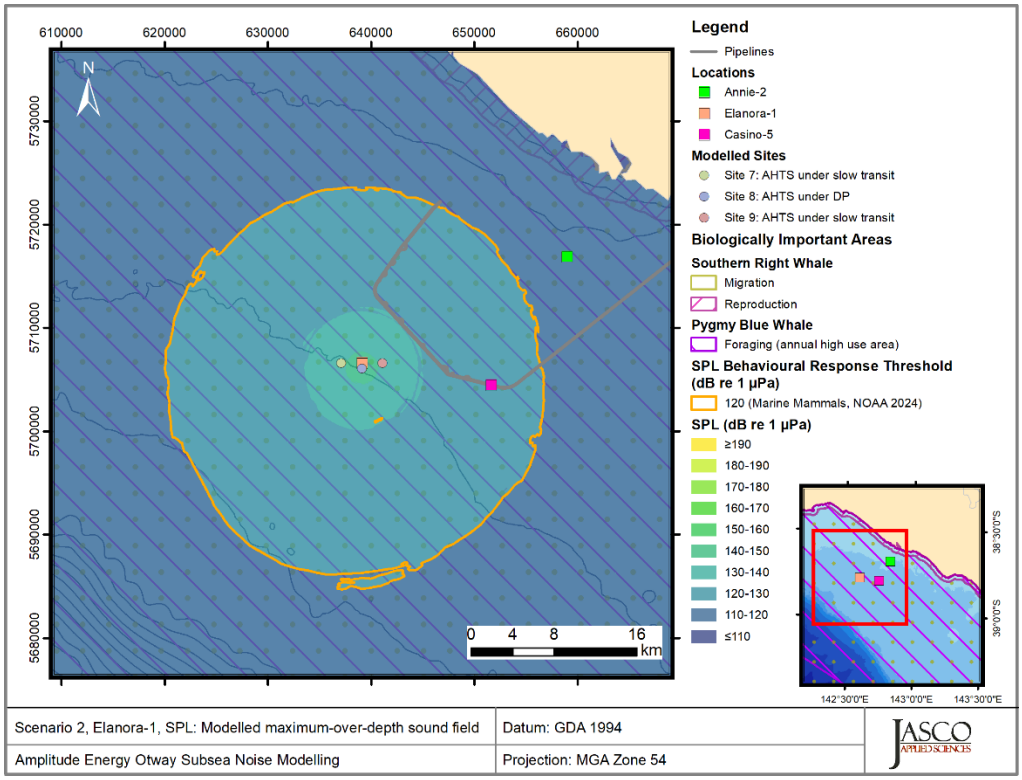



Figure 10. *Scenario 2, Mooring, Elanora-1, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

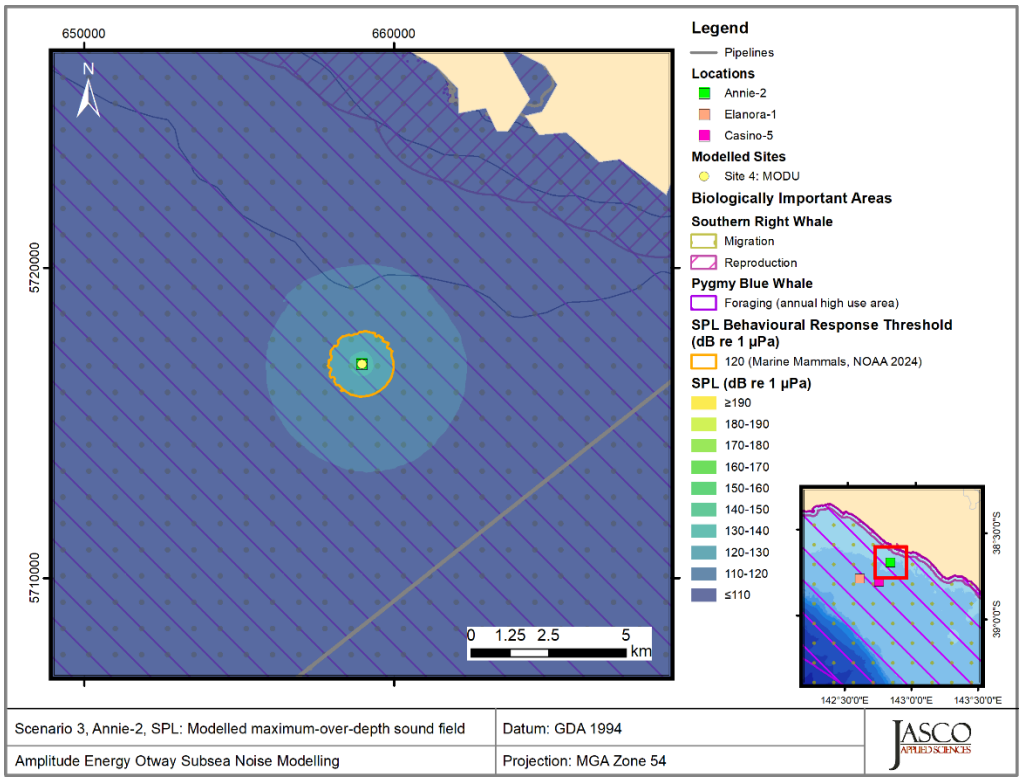



Figure 11. *Scenario 3, MODU Drilling, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

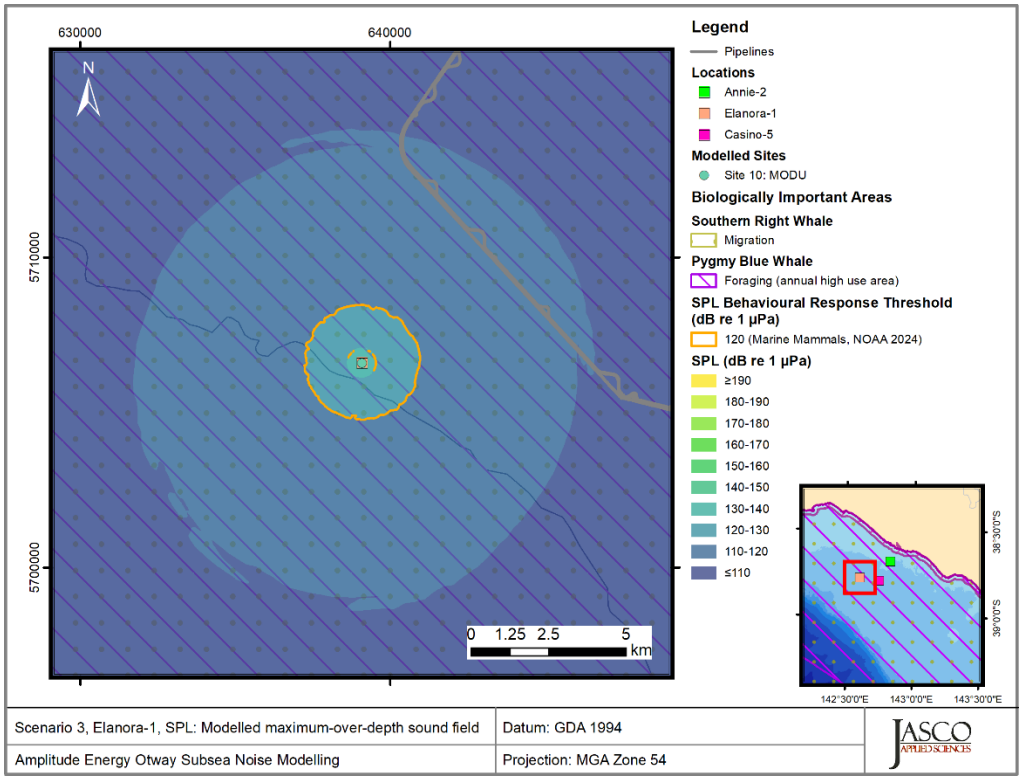



Figure 12. *Scenario 3, MODU Drilling, Elanora-1, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

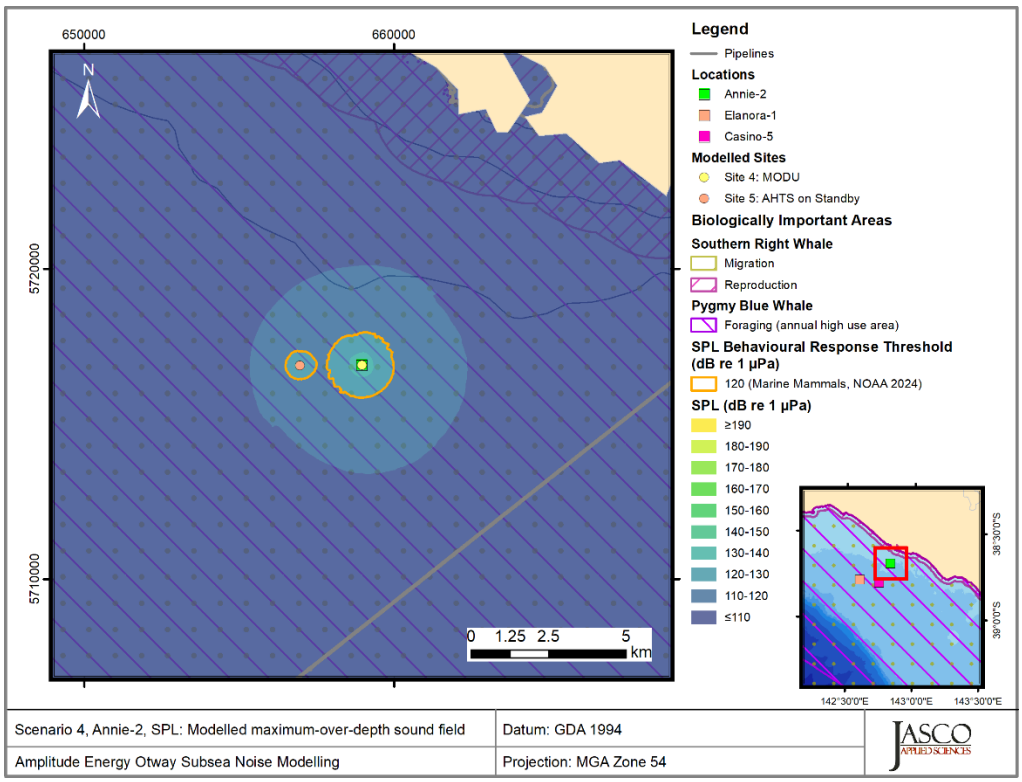



Figure 13. *Scenario 4, Drilling and standby OSV, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

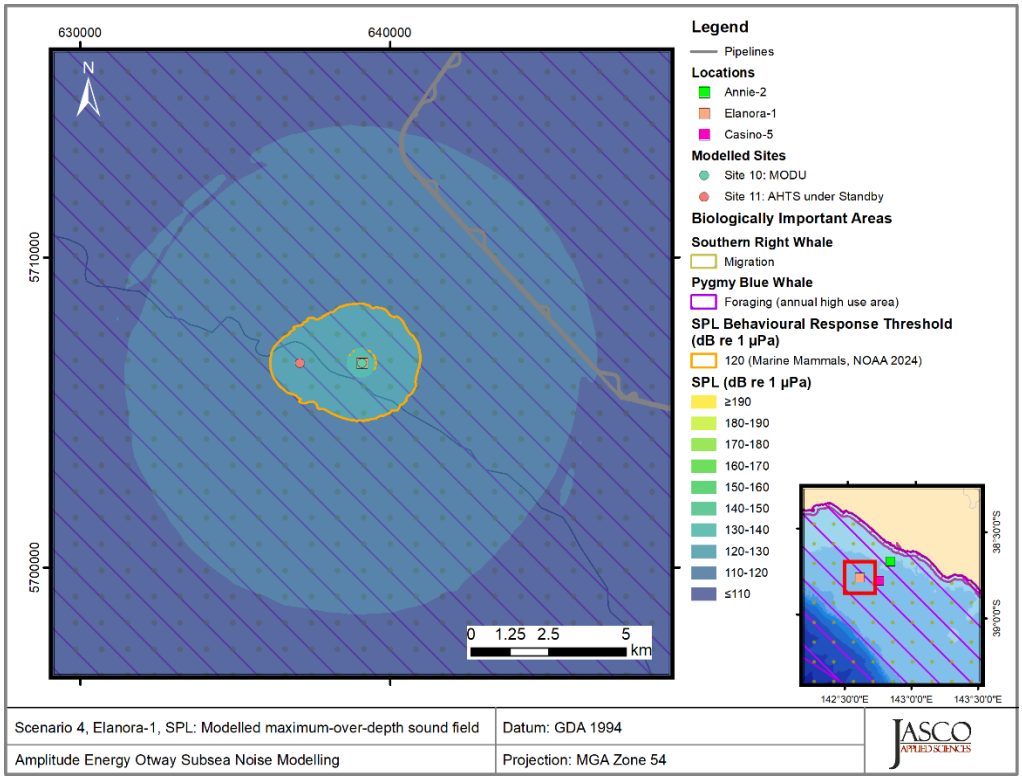



Figure 14. *Scenario 4, Drilling and standby OSV, Elanora-1, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

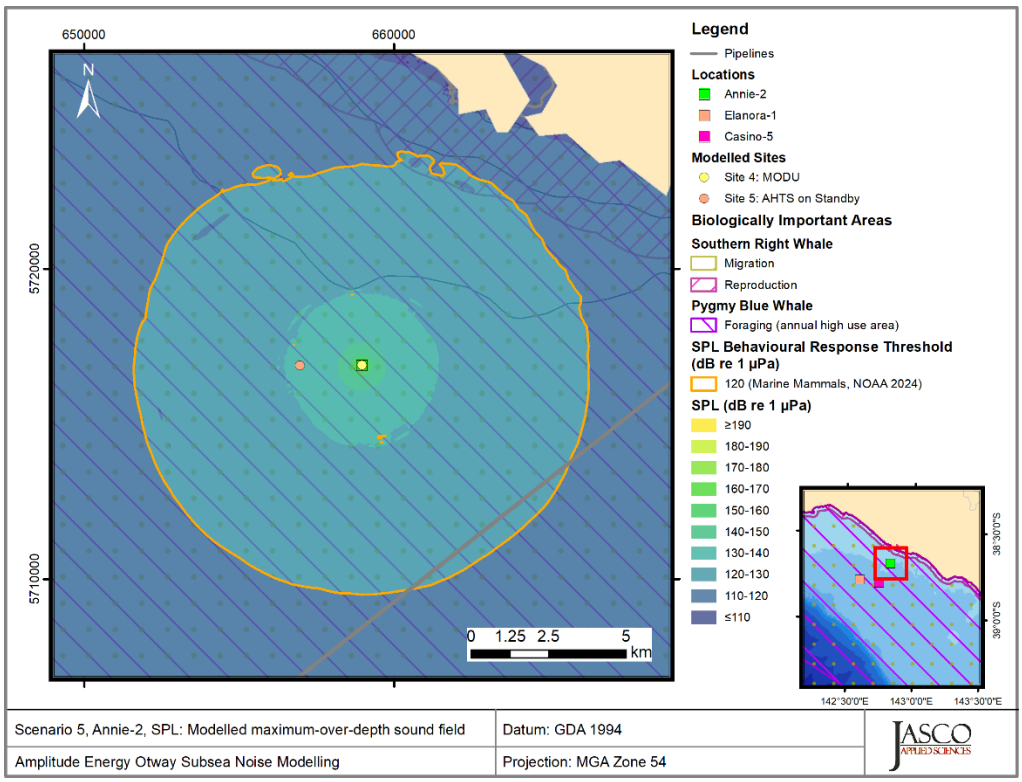



Figure 15. *Scenario 5, Drilling and standby OSV during resupply, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

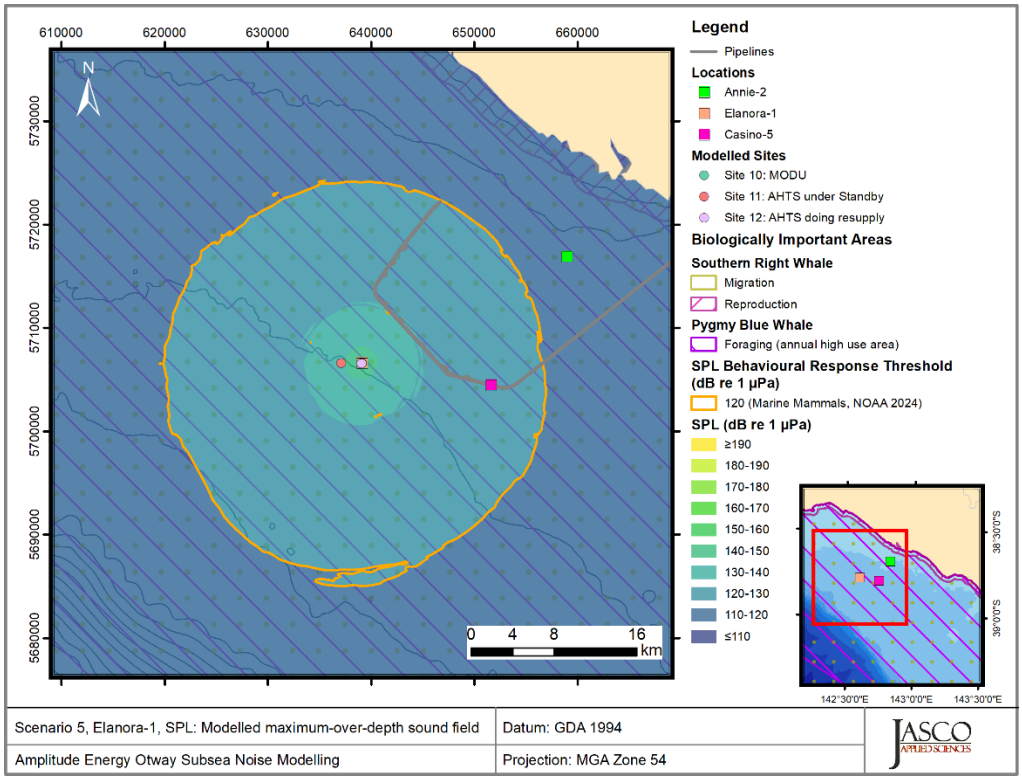



Figure 16. *Scenario 5, Drilling and standby OSV during resupply, Elanora-1, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

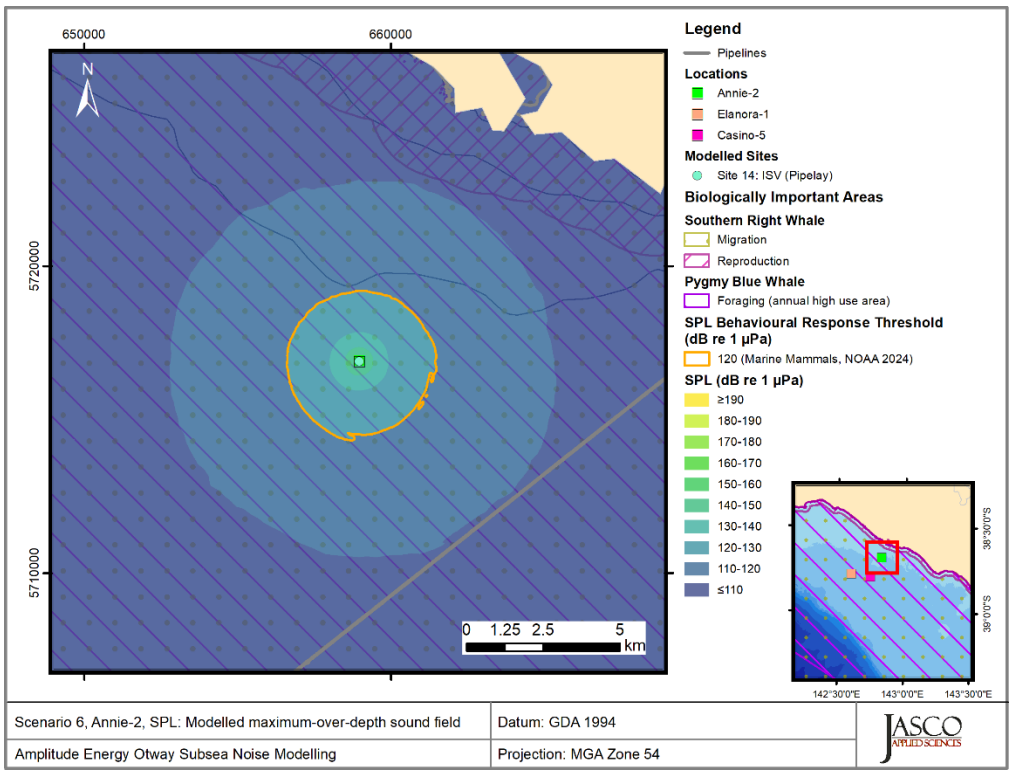



Figure 17. *Scenario 6, Pipelay installation – start, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

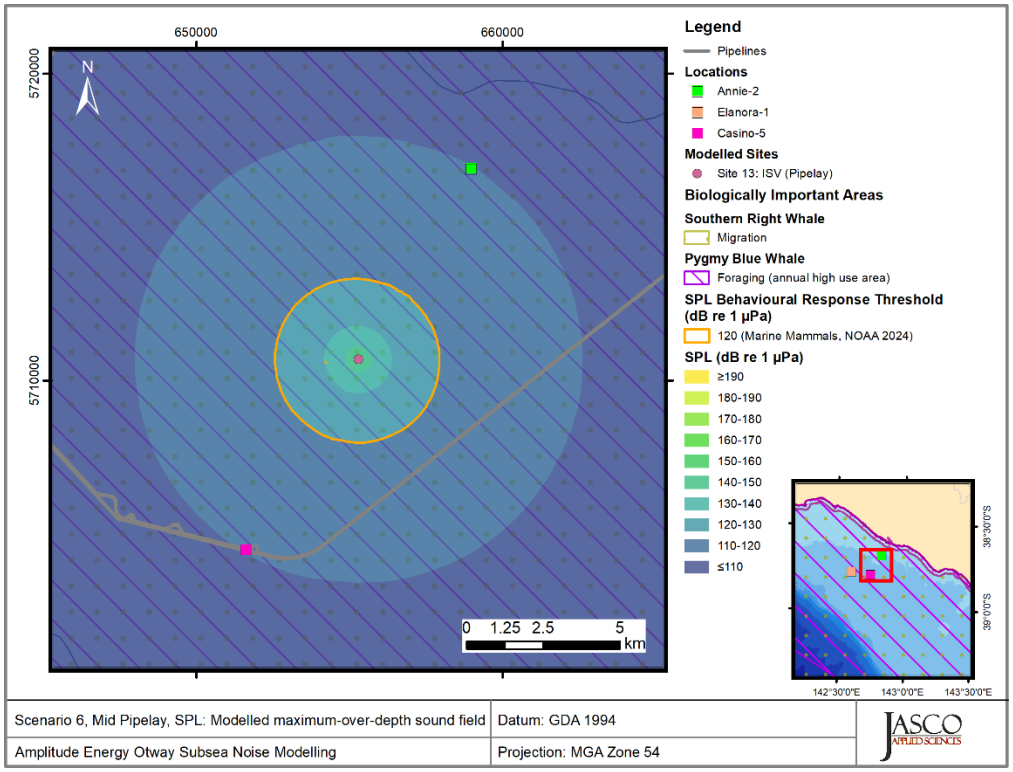



Figure 18. *Scenario 6, Pipelay installation – mid, Annie-2 and Casino-5, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

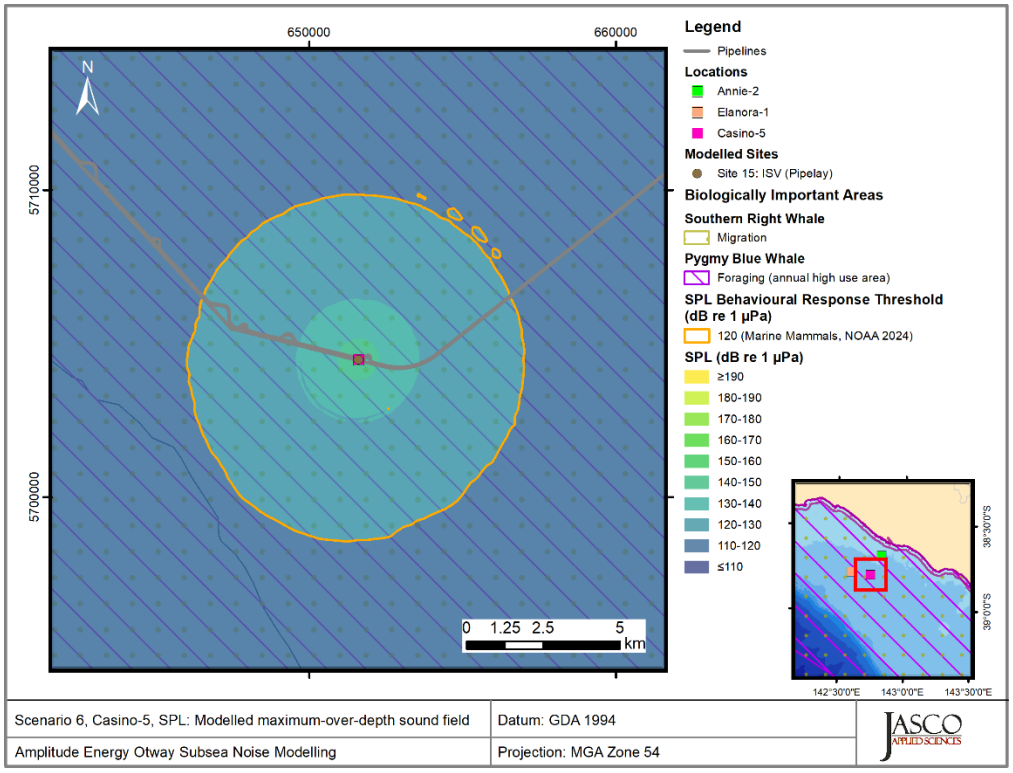



Figure 19. *Scenario 6, Pipelay installation – end, Casino-5, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

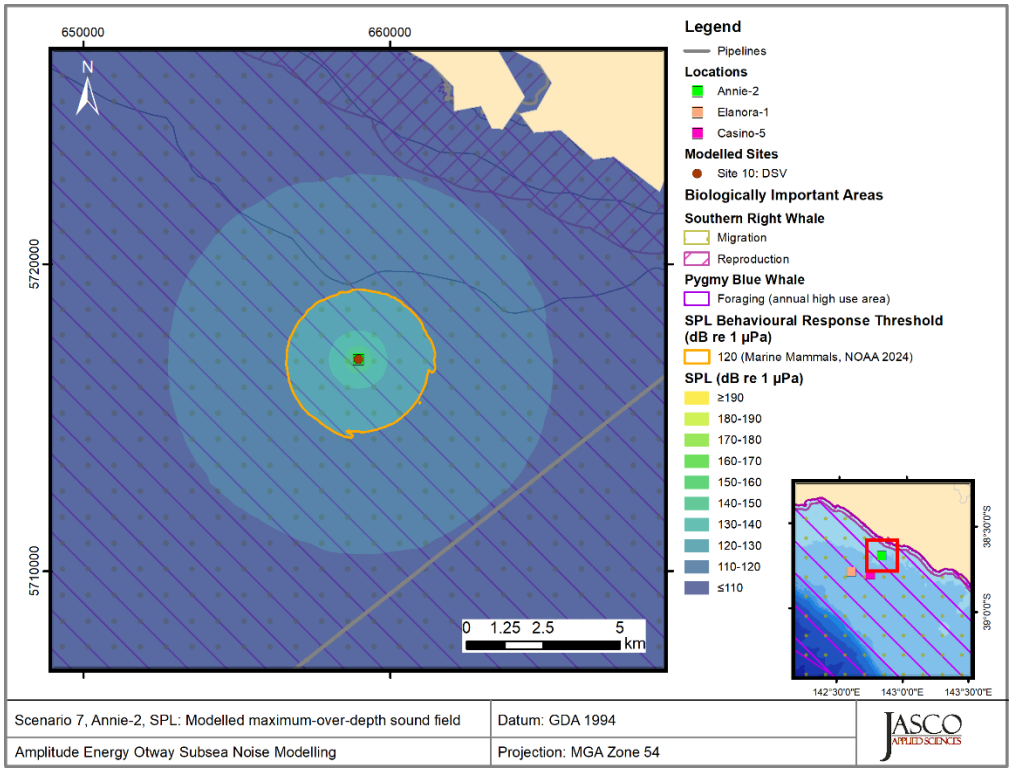



Figure 20. *Scenario 7, Installation, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

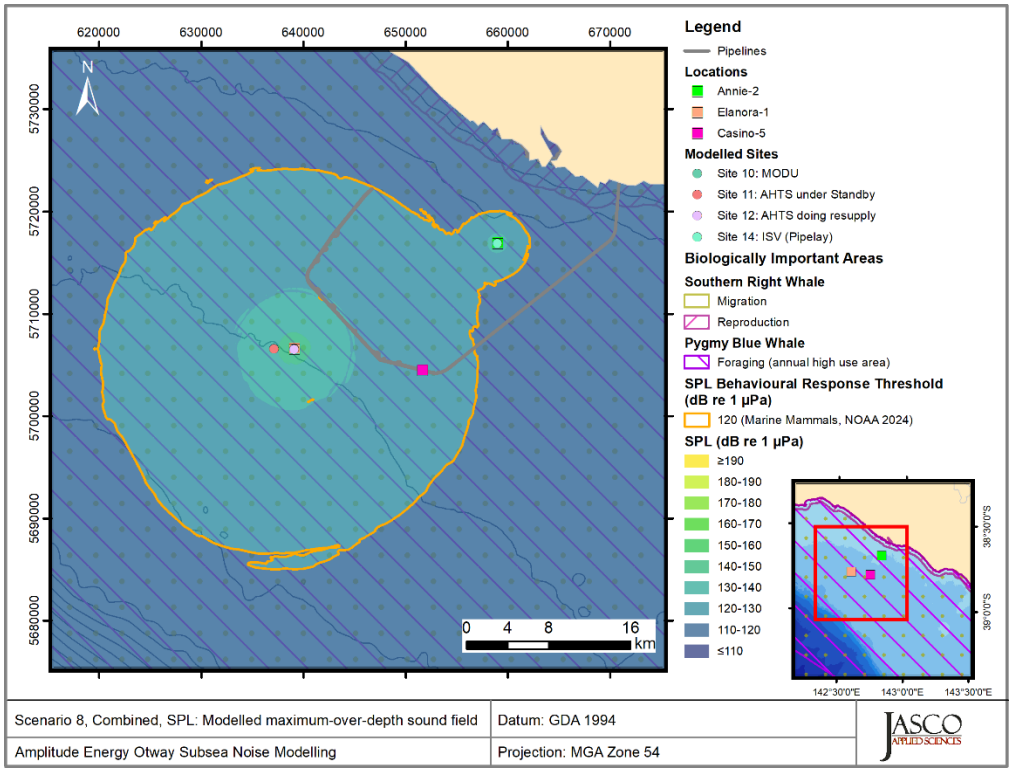



Figure 21. *Scenario 8, Drilling and standby OSV during resupply and pipelay – start, Elanora-1 and Casino-5, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

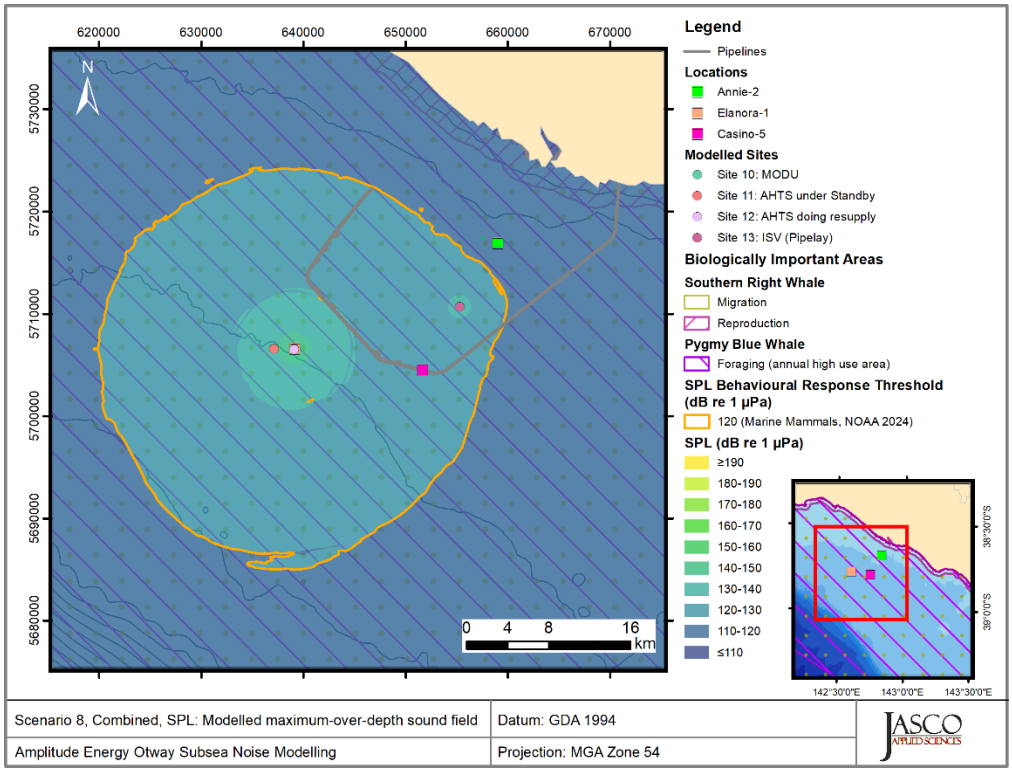



Figure 22. *Scenario 8, Drilling and standby OSV during resupply and pipelay – mid, Elanora-1 and Casino-5, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

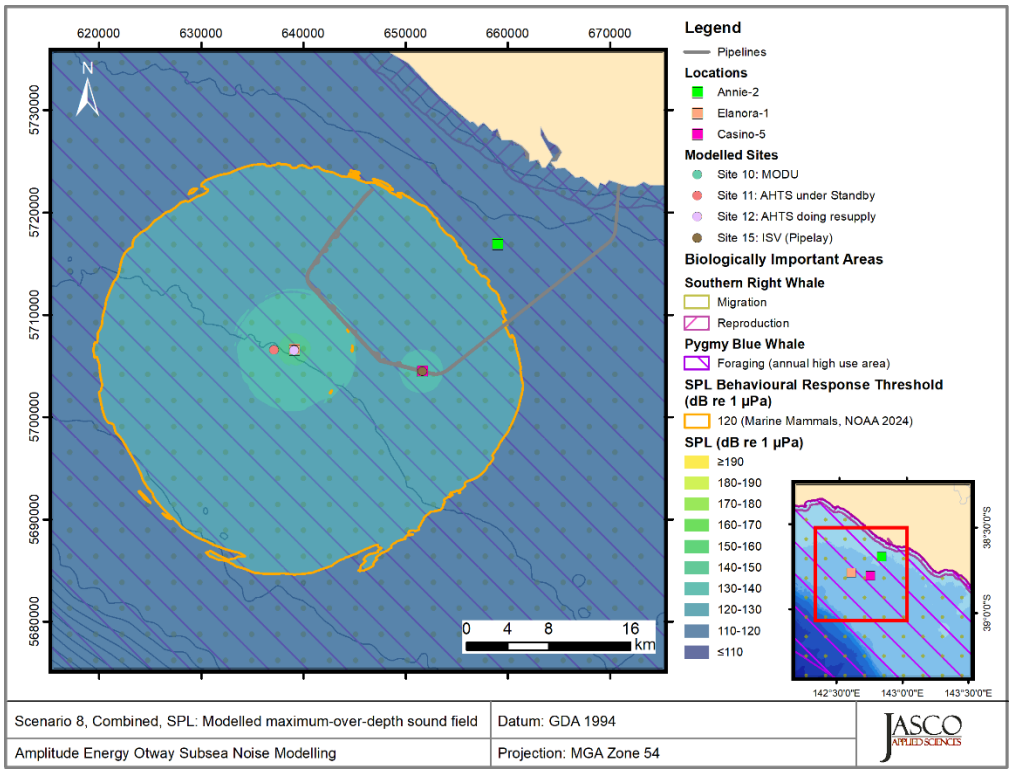



Figure 23. *Scenario 8, Drilling and standby OSV during resupply and pipelay – end, Elanora-1 and Casino-5, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

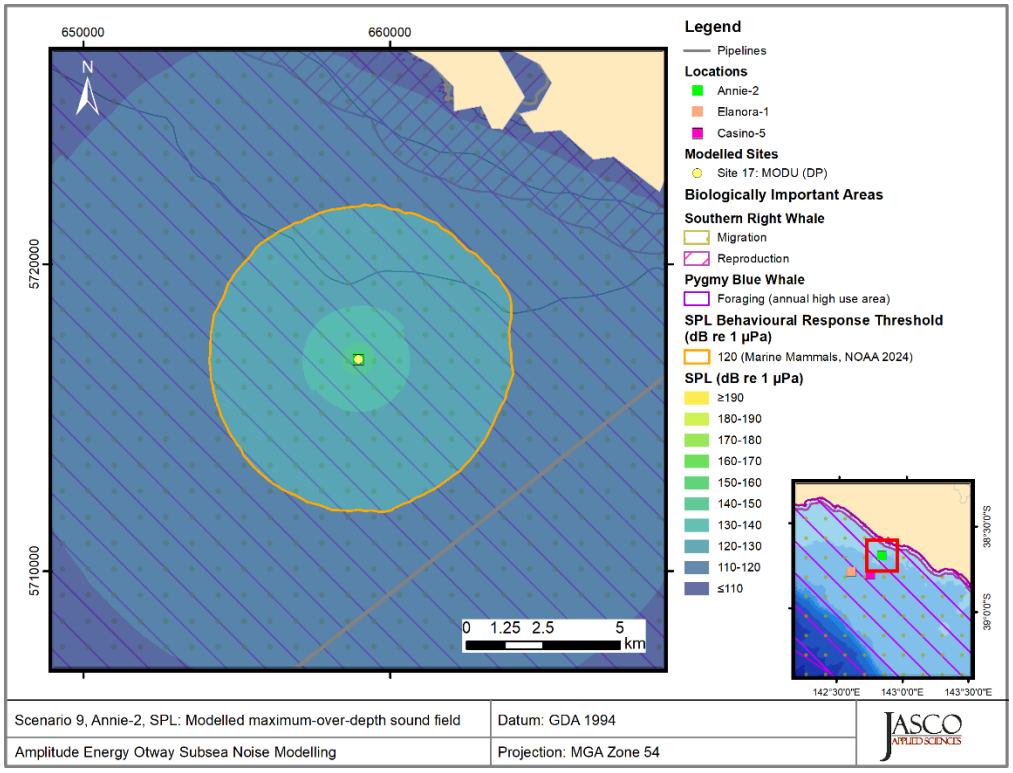



Figure 24. *Scenario 9, Modu on DP, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

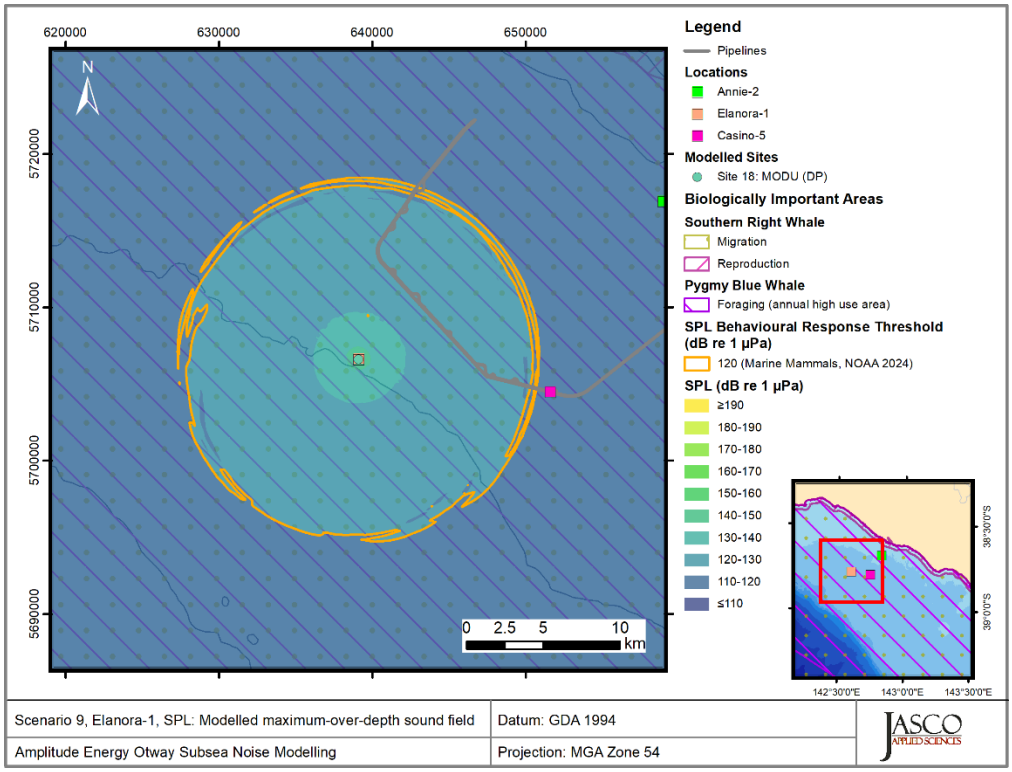



Figure 25. *Scenario 9, MODU on DP, Elanora-1, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

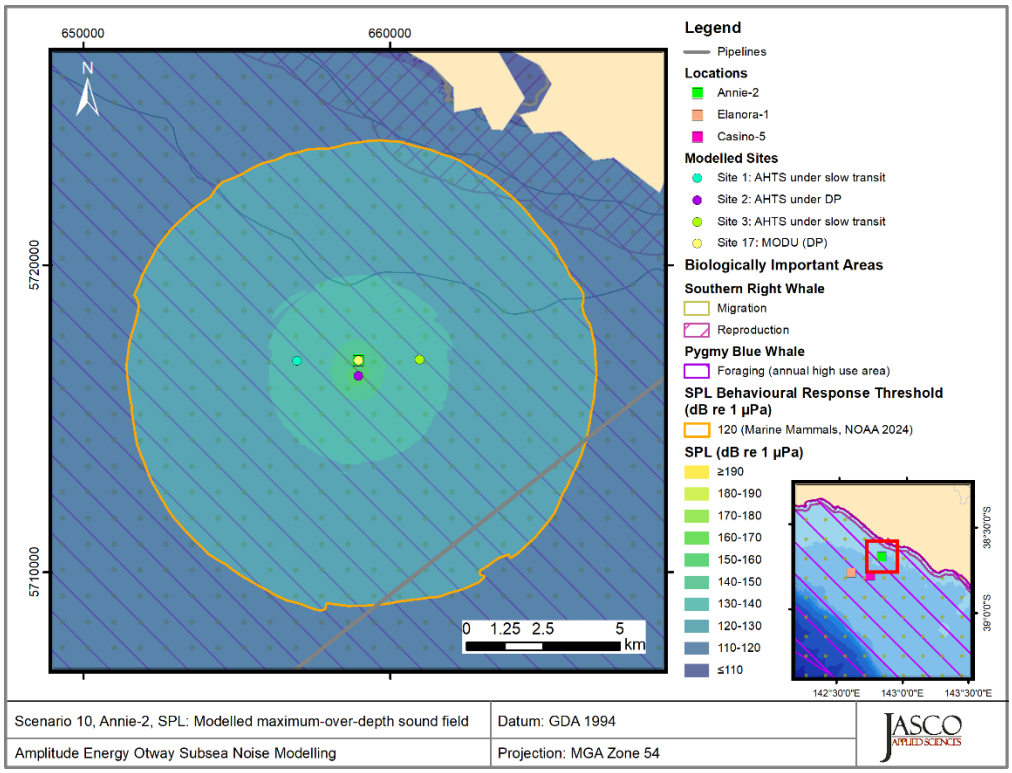



Figure 26. *Scenario 10, Mooring with Modu on DP, Annie-2, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

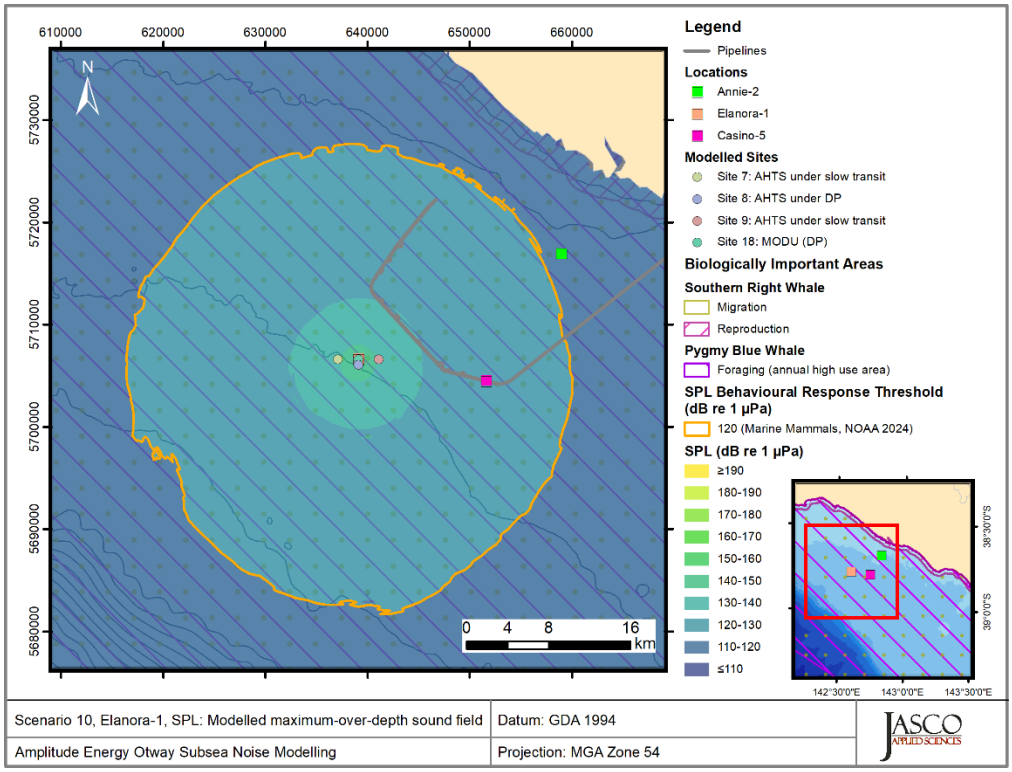



Figure 27. *Scenario 10, Mooring with MODU on DP, Elanora-1, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

## 4.2.2. Accumulated $SEL_{24h}$ Sound level Contour Maps

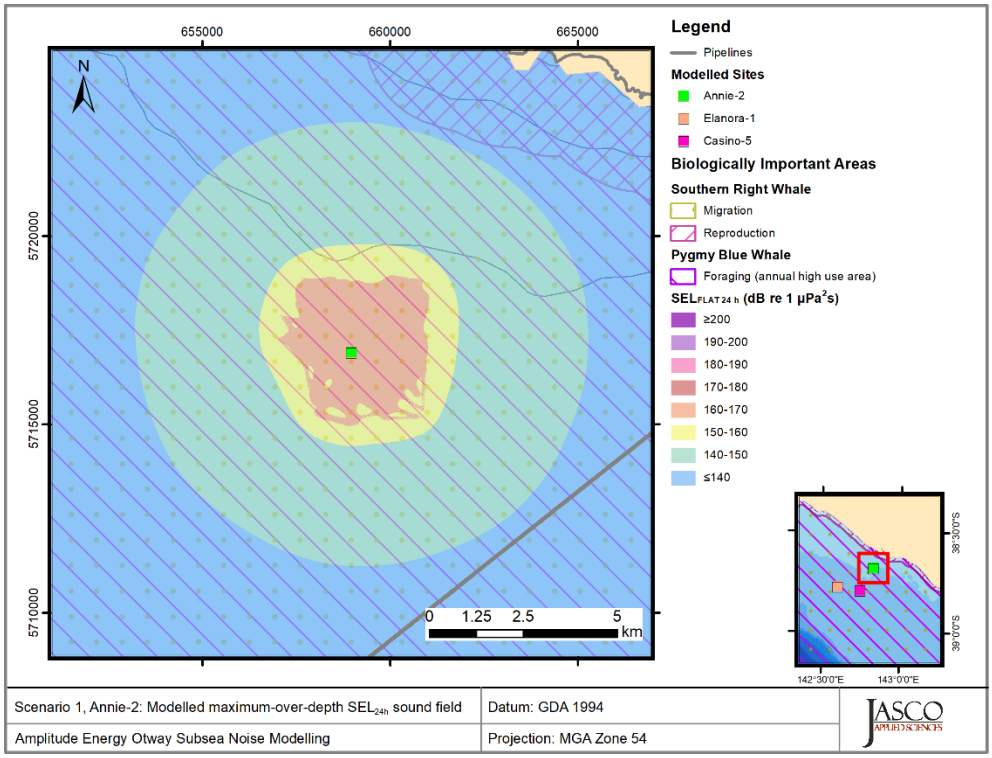



Figure 28. *Scenario 1, Drilling prelays, Annie-2, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

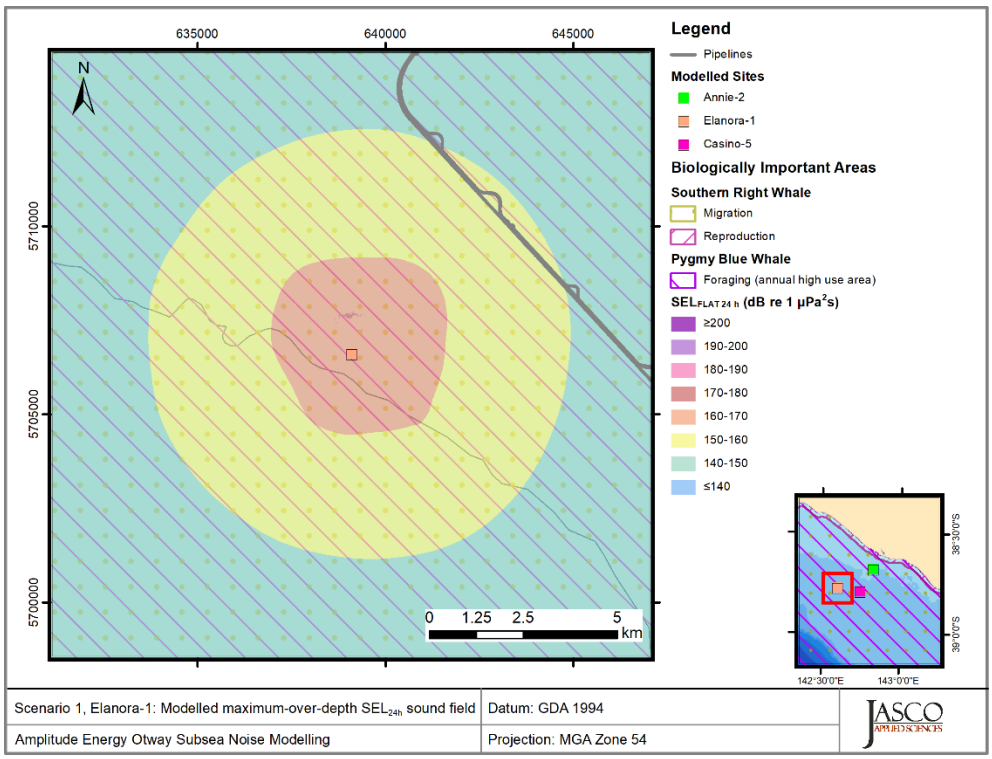



Figure 29. *Scenario 1, Drilling Prelays, Elanora-1, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

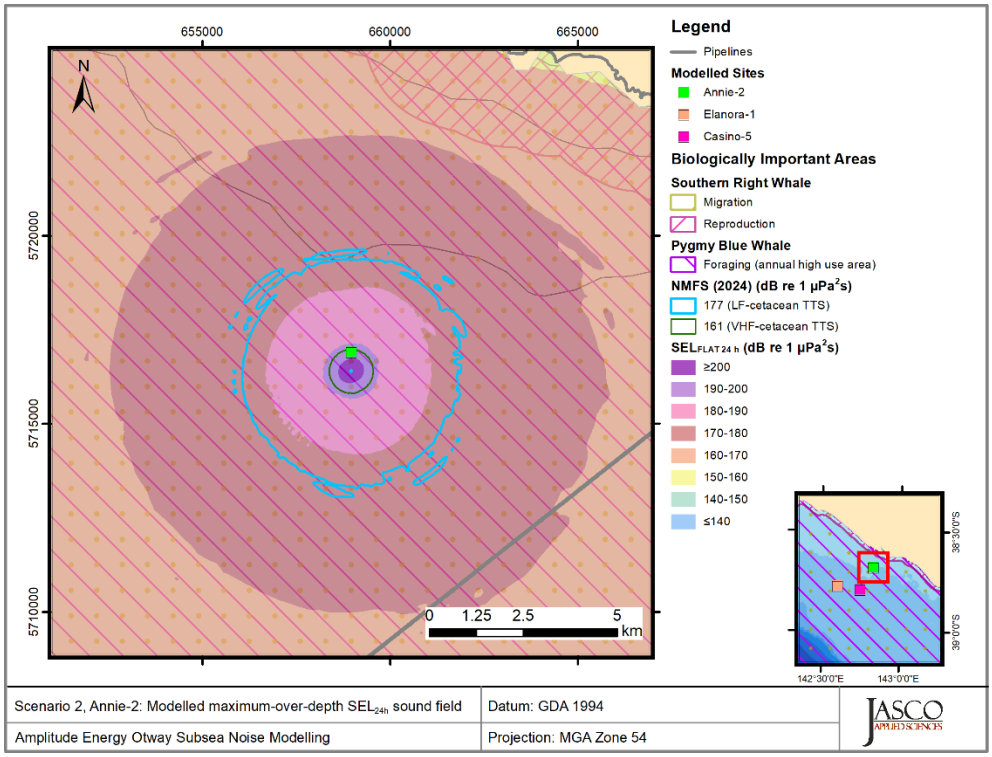



Figure 30. *Scenario 2, Mooring, Annie-2, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

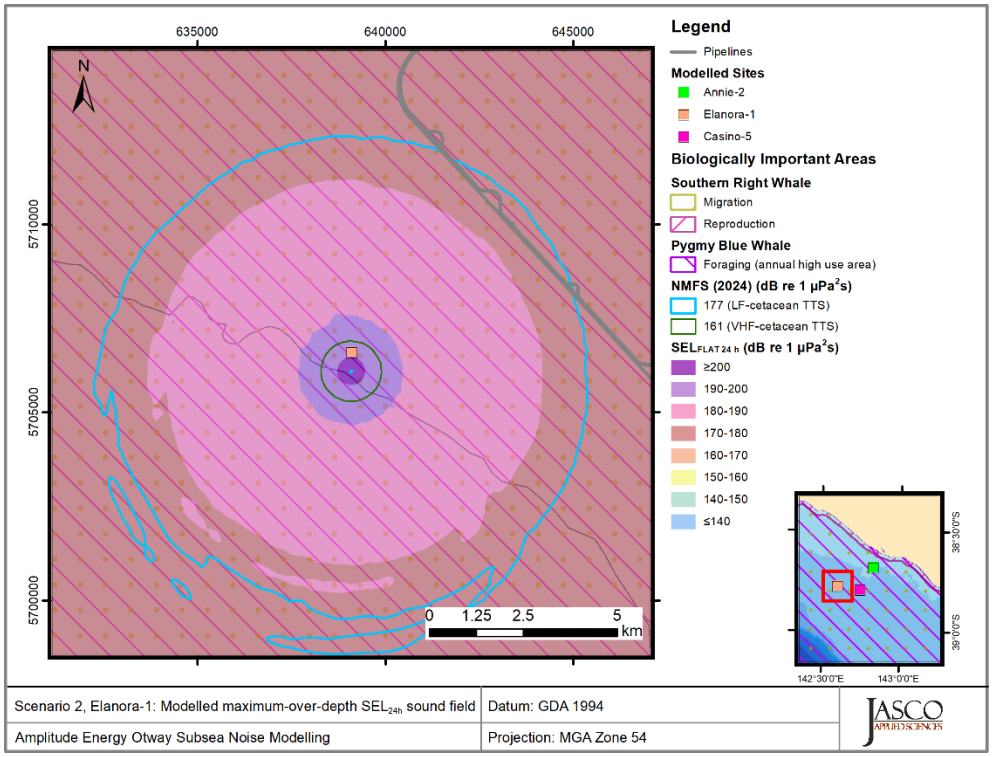



Figure 31. *Scenario 2, Mooring, Elanora-1, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

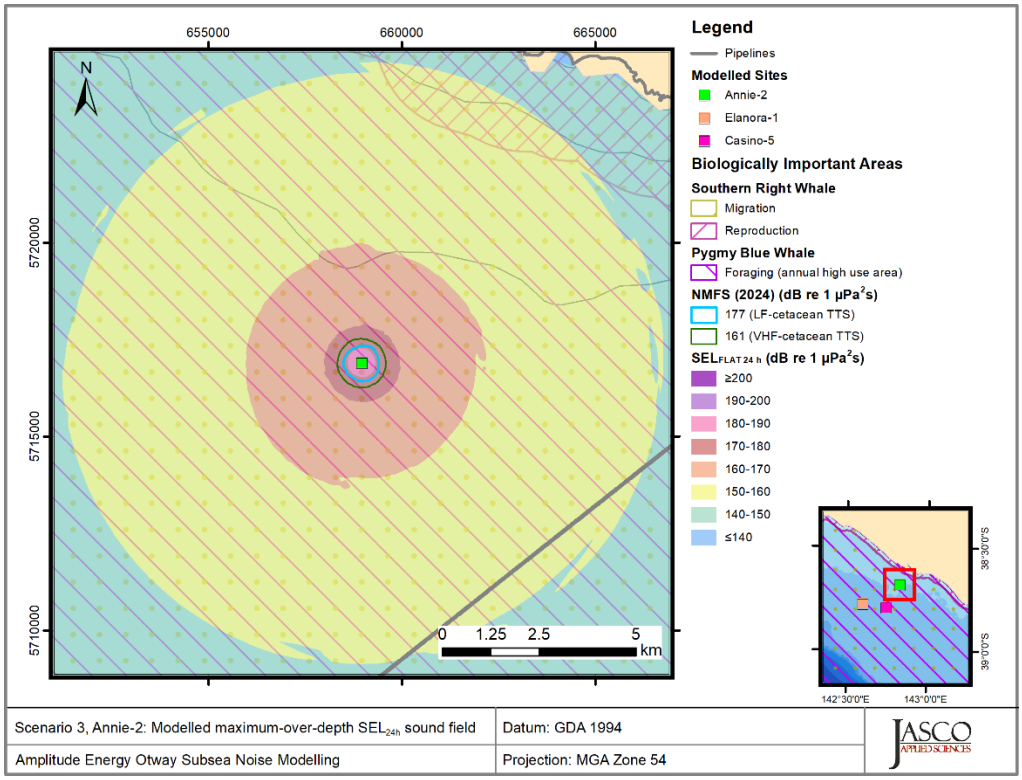



Figure 32. *Scenario 3, MODU Drilling, Annie-2, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

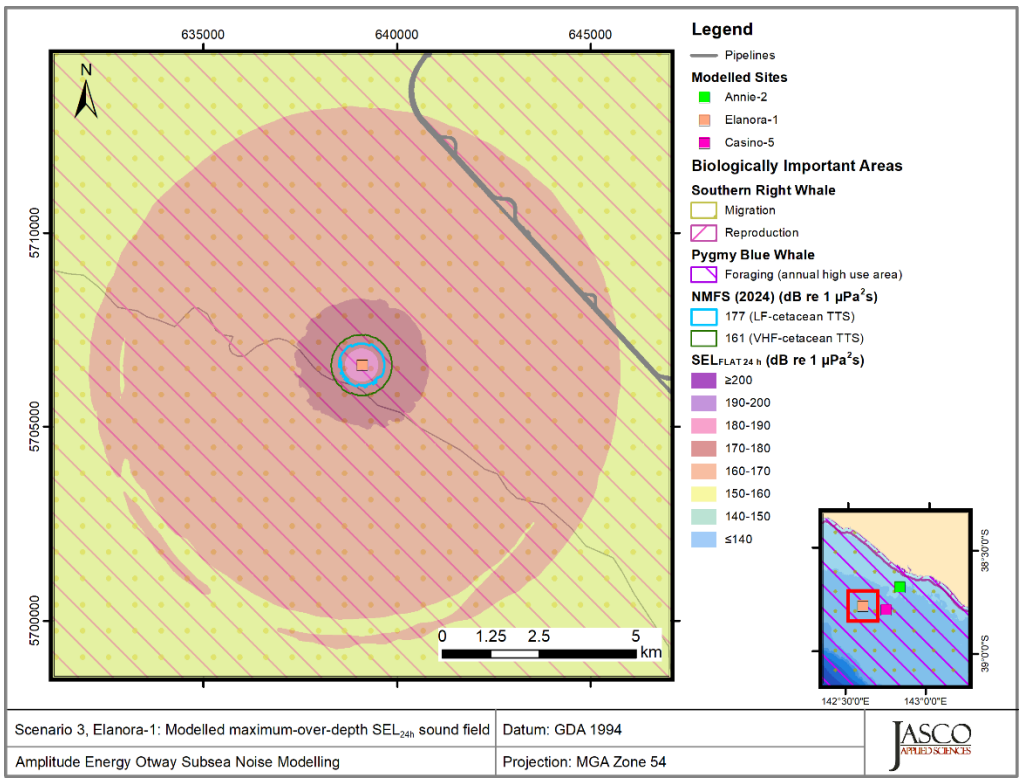



Figure 33. *Scenario 3, MODU Drilling, Elanora-1, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

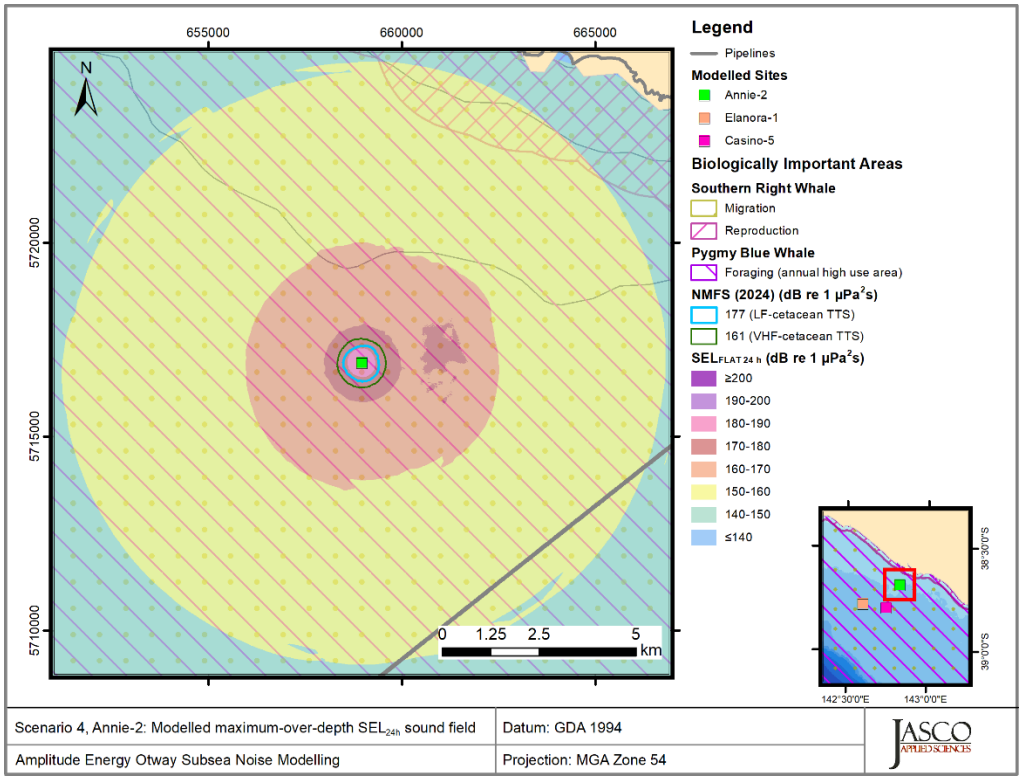



Figure 34. *Scenario 4, Drilling and standby OSV, Annie-2, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

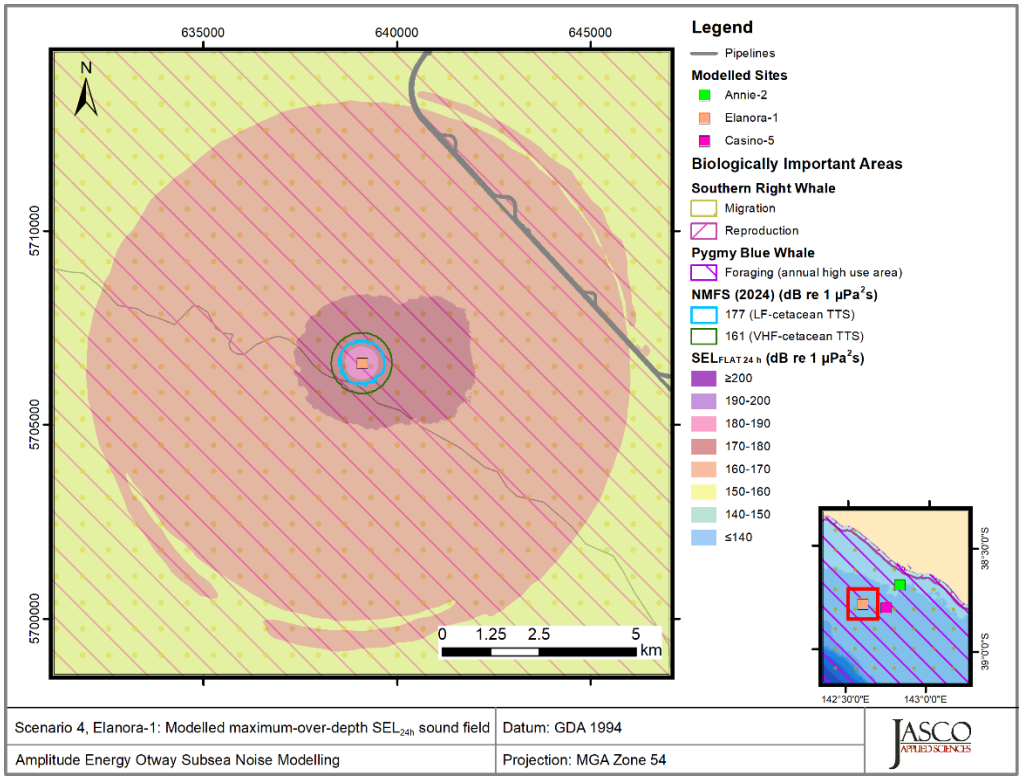



Figure 35. *Scenario 4, Drilling and standby OSV, Elanora-1, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

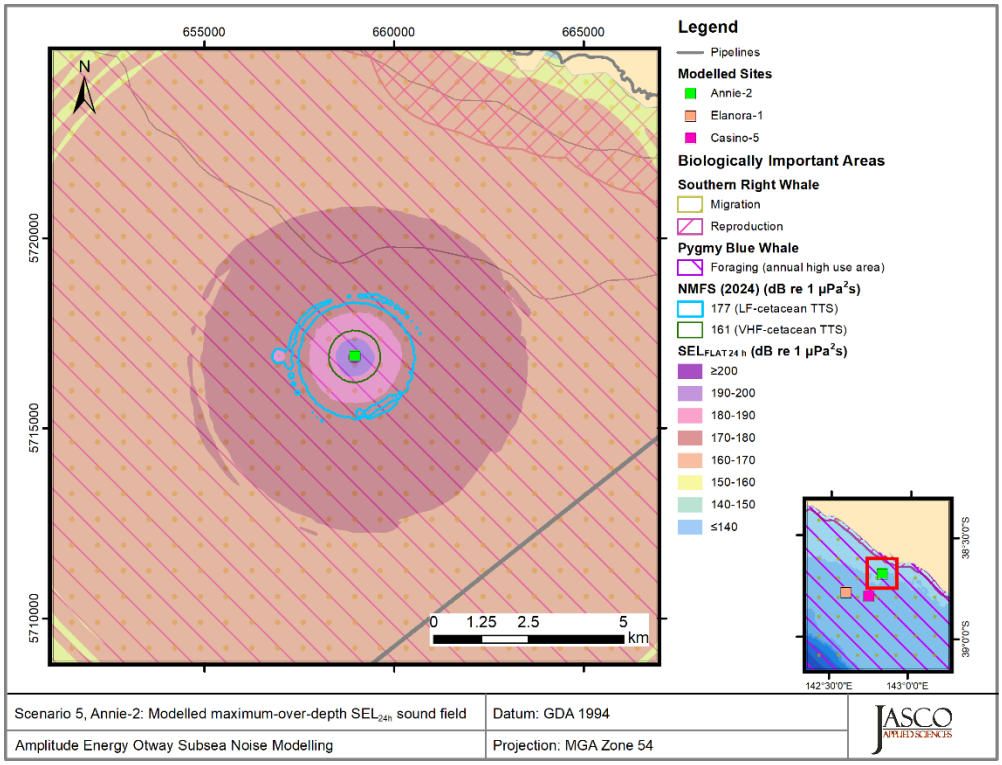



Figure 36. *Scenario 5, Drilling and standby OSV during resupply, Annie-2, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

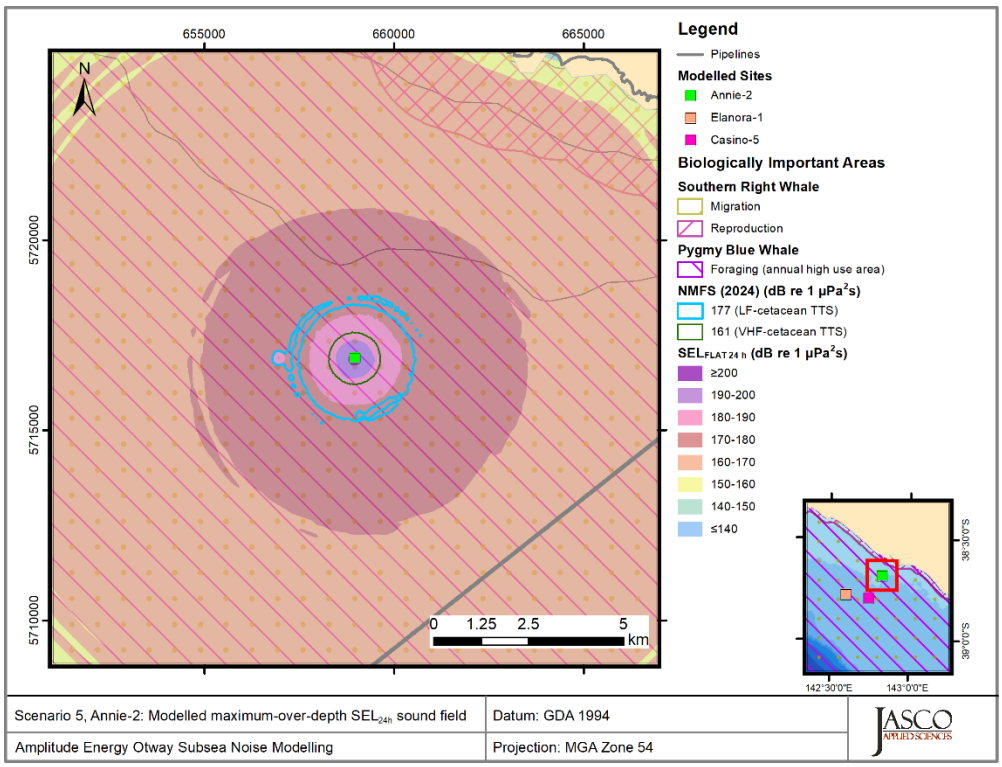



Figure 37. *Scenario 5, Drilling and standby OSV during resupply, Elanora-1, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

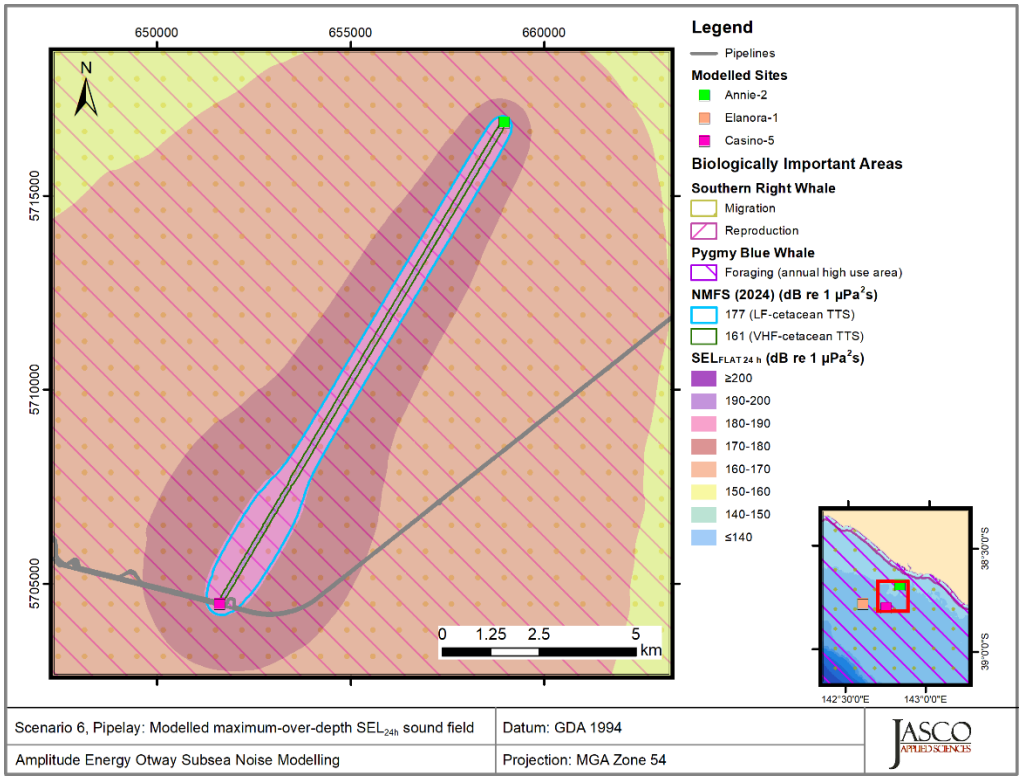



Figure 38. *Scenario 6, Pipeline/Umbilical installation*, Annie-2 & Casino-5, *accumulated SEL24h*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

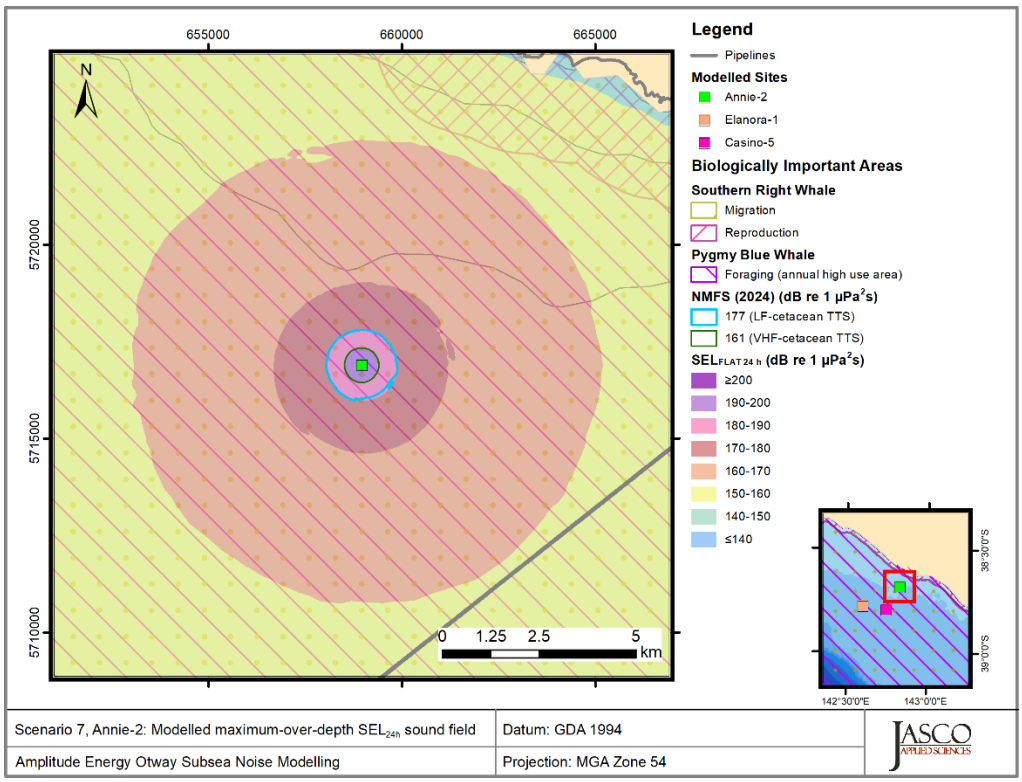



Figure 39. *Scenario 7, Installation, Annie-2, accumulated SEL24h*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

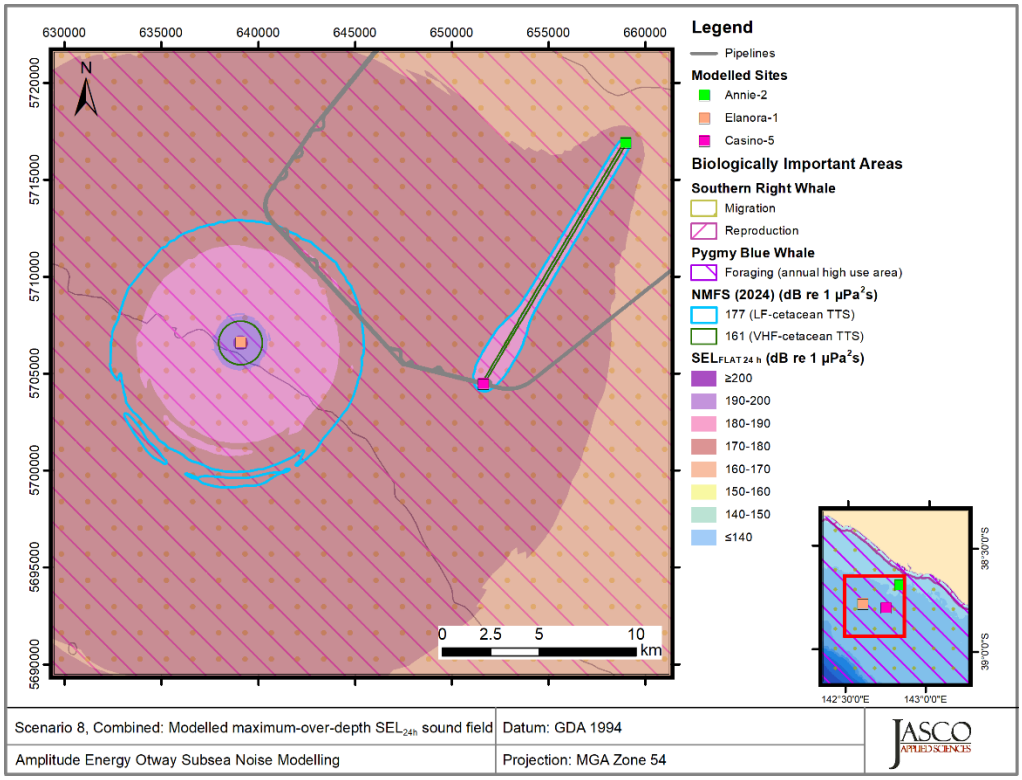



Figure 40. *Scenario 8, Drilling and standby OSV during resupply and pipelay, Elanora-1 and between Annie-2 and Casino-5, accumulated SEL$_{24h}$*: Sound level contour map showing weighted maximum-over-depth SEL$_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

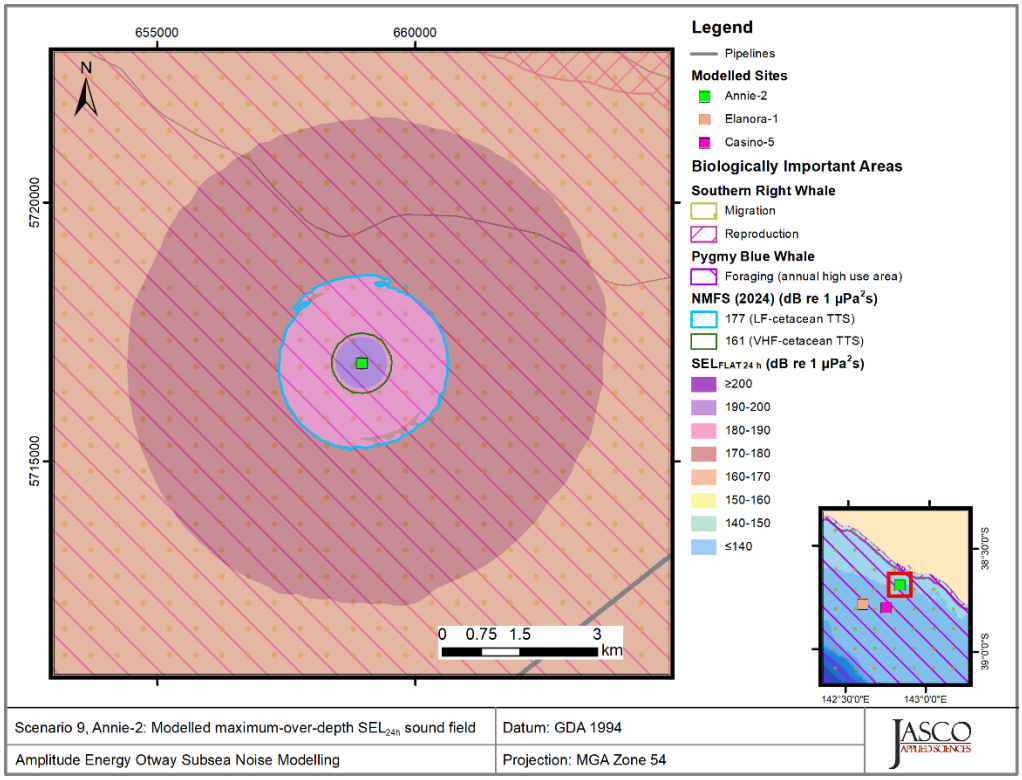



Figure 41. *Scenario 9, MODU on DP, Annie-2, accumulated SEL$_{24h}$*: Sound level contour map showing weighted maximum-over-depth SEL$_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

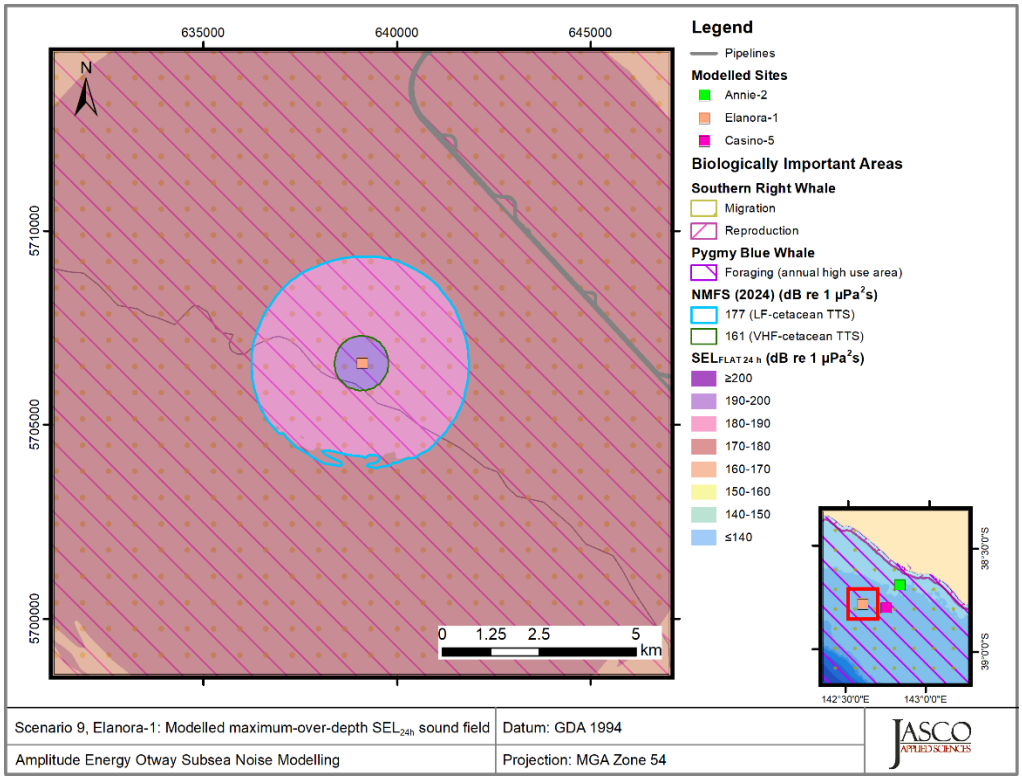



Figure 42. *Scenario 9, MODU on DP, Elanora-1, accumulated SEL$_{24h}$*: Sound level contour map showing weighted maximum-over-depth SEL$_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

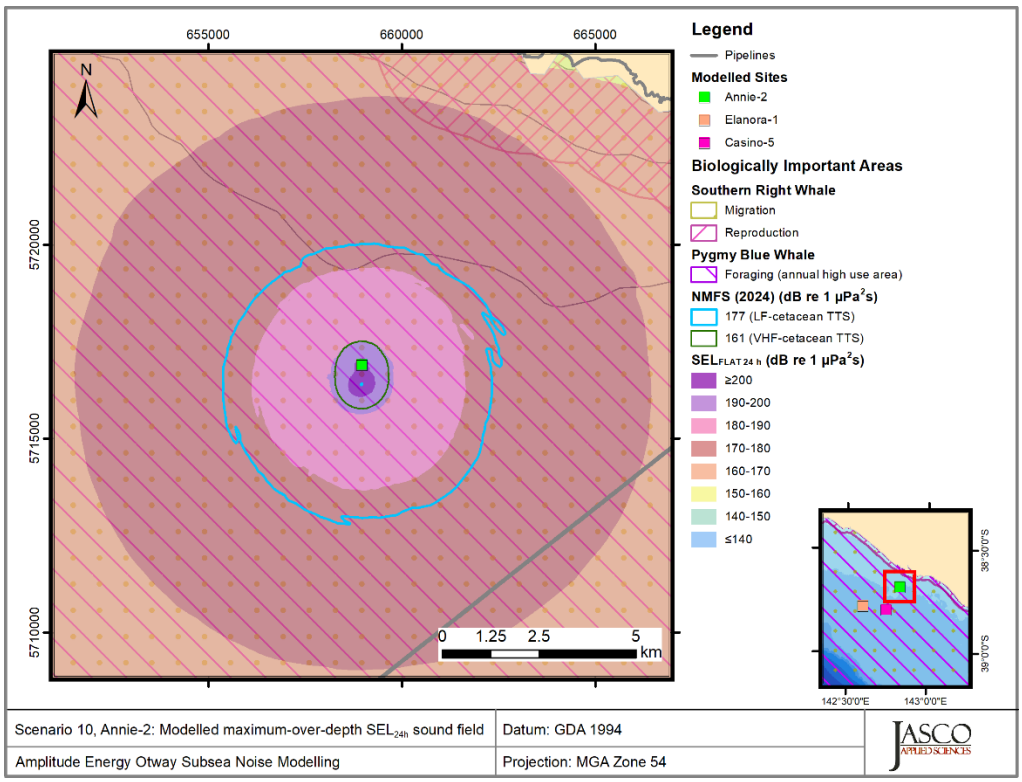



Figure 43. *Scenario 10, Mooring with MODU on DP, Annie-2, accumulated SEL$_{24h}$*: Sound level contour map showing weighted maximum-over-depth SEL$_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

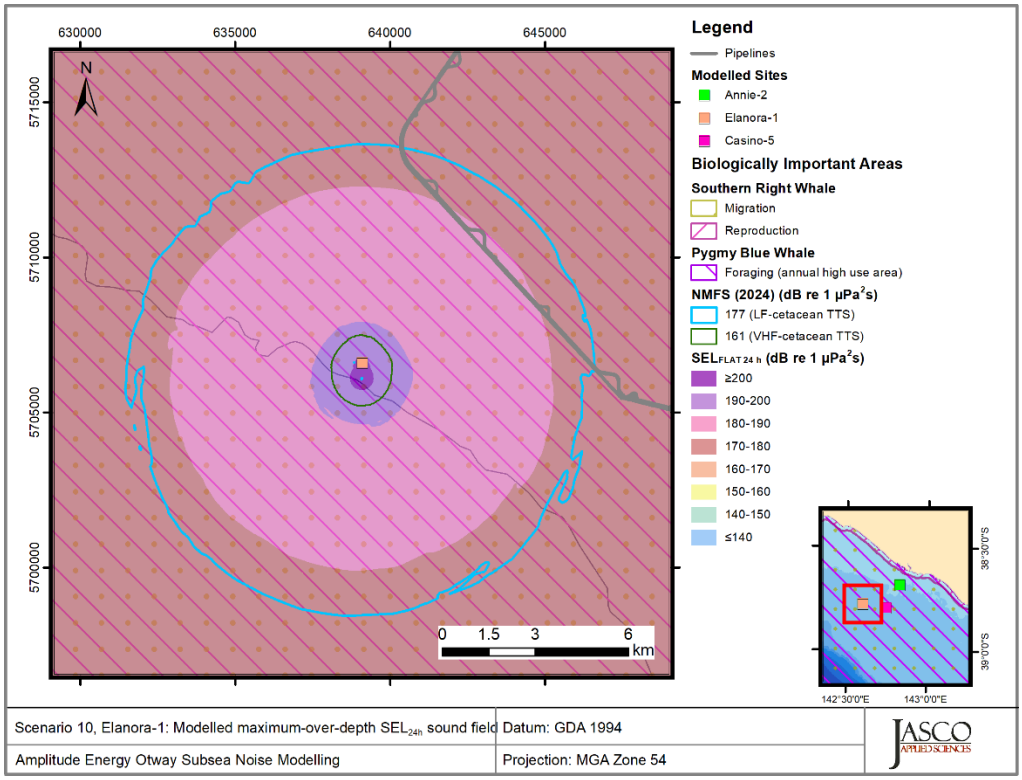



Figure 44. *Scenario 10, Mooring with MODU on DP, Elanora-1, accumulated $SEL_{24h}$*: Sound level contour map showing weighted maximum-over-depth $SEL_{24h}$ results, along with isopleths for TTS in low and very-high-frequency cetaceans. Thresholds omitted here were not reached or not long enough to display graphically.

# 5. Discussion and Conclusion

The sound speed profile (Appendix B.1.2) was derived from data from the U.S. Naval Oceanographic Office's Generalized Digital Environmental Model V 3.0 (GDEM; Teague et al. 1990, Carnes 2009). The month of August was chosen based on an analysis of the temperature, salinity, and sound speed profiles extracted from this database. The final profile consisted of a combination of three representative profiles from within the modelled area to capture the propagation effects associated with shallow and deep-water areas.

The August sound speed profile was primarily upward refracting between the sea surface and 160 m water depth. The upward refracting section of the profile may result in energy being refracted away from the seabed and back into the water column, which can lead to large distances to isopleths compared to other months. The upward refracting sound speed profile has the potential trap frequencies above 93 Hz based on the thickness of the refracting layer (Jensen et al. 2011). These frequencies also correspond to the majority of the highest spectral levels for the considered sources detailed in Section 3.1, which can further enhance large distances to isopleths and criteria compared to other months.

Considering activity locations are situated on the continental shelf, variations in bathymetry were generally gradual within the modelled areas. Any variations in the bathymetry had a small effect on the predicted sound field footprints as manifested in the generally symmetric sound field footprints. However, the composition of the seabed used for modelling had a more substantial influence when comparing the threshold radii and sound field footprints between the Annie-2 and Elanora-1 areas. The presence of a thin veneer of un-consolidated coarse sand overlying semi-cemented carbonate rock at Elanora-1 led to a more reflective seabed and likely led to larger isopleths for low level thresholds than Annie-2. This is most evident for the marine mammal behavioural threshold of 120 dB re 1 µPa (SPL) for non-impulsive sound sources, where the Elanora-1 radii and areas are larger than Annie-2 radii and areas. However, the distribution of sand over cemented carbonate appears to be variable in the Otway Basin; (McPherson et al. 2021). Towards the Elanora-1 area, for simplicity, modelling has assumed a sand layer throughout the area. In reality, the sand layer may be present or absent depending on exact location and hence radii may be smaller than predicted. In general, the sediment cover along the continental shelf of the Otway region is minimal and non-uniform (James and Bone 2010).

The modelled scenarios generally considered activities at either Elanora-1 or Annie-2. The exception are, pipelay between Annie-2 and Casino-5 and the concurrent operations with drilling activities at Elanora-1 occurring at the same time as pipelay between Annie-2 and Casino-5 (Scenario 8). The concurrent operations scenario (Scenario 8) was considered to capture what may be a worst-case occurrence, with multiple simultaneous operations occurring. Figures 21–23 show the potential difference in the SPL contours when the pipelay may occur simultaneously but at different locations along the route with drilling activities at Elanora-1. These contours can be compared to Figure 15 for the same drilling activities at occurring only at Elanora-1. Whilst the total ensonified area and isopleth contours do increase when activities at Elanora-1 are considered with pipelay between Annie-2 and Casino-5, the resultant contours to isopleths like the behavioural response criteria of 120 dB re 1 µPa (SPL) do not significantly change. This is likely due to the activities at Elanora-1 occurring over a more reflective seabed, as discussed above, and containing louder sources than the pipelay activity. Within this modelled scenario activities at Elanora-1 are predicted to be the dominant contributor to the sound field. For PTS and TTS thresholds, for all considered hearing groups, Figure 40 show the result of the concurrent operations scenario. The additional energy that is included by considering both sets of operations simultaneously is not substantial enough to increase the size of contours such that they join. As such, for the considered concurrent scenario, the distances to PTS and TTS thresholds are approximately the same whether activities occur independently or simultaneously.

For the tables presented in Section 4.1, where a dash is used in place of a horizontal distance, these thresholds may or may not be reached. Due to the discretely sampled 20 m calculation grids of the modelled sound fields, distances to these levels could not be estimated for practicable computational purposes. It is likely that SPL isopleths could be reached at distances between the source and the modelled horizontal resolution (20 m); however, distances to injurious accumulated SEL thresholds may not be reached at any range greater than the source due the species-specific frequency weighing functions. Additionally, if close-to-source radii are comparable to the dimensions of the modelled vessel (MODU, AHTS, ISV or DSV) then they may only be reached within close proximity to a vessel, if at all.

The key results of this modelling study are summarised in Tables 18 and 19 below. These tables present the maximum distances to relevant criteria and/or thresholds. Table 18 summarises scenarios 1–7 and associated operations which may occur at Annie-2, Elanora-1, and pipelay between Annie-2 and Casino-5. Table 19 summarises potential concurrent drilling operations at Elanora-1 and pipelay operations between Annie-2 and Casino-5.

Table 18. Summary of maximum ($R_{max}$) horizontal distances (in km) to the behavioural response threshold, temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine mammals. The maximum across scenarios 1–7 at Annie-2, Elanora-1, and pipelay between Annie-2 and Casino-5 are reported here.

| Hearing group | Modelled distance to effect threshold ($R_{max}$) | | | | | |
|---|---|---|---|---|---|---|
| | Behavioural response[a] | TTS[b] | PTS[b] | Behavioural response[a] | TTS[b] | PTS[b] |
| | Annie-2 | | | Elanora-1 | | |
| Low-frequency (LF) cetaceans | 7.87 | 3.60 | 0.40 | 21.7 | 7.54 | 0.50 |
| High-frequency (HF) cetaceans | | 0.47 | 0.03 | | 0.66 | 0.04 |
| Very High-frequency (VHF) cetaceans | | 0.69 | 0.11 | | 0.88 | 0.09 |
| Otariid Seals | | 0.44 | 0.03 | | 0.56 | 0.03 |

Noise exposure criteria: [a] NOAA (2024) and [b] NMFS (2024).

Table 19. Summary of maximum ($R_{max}$) horizontal distances (in km) to the behavioural response threshold, temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine mammals. For the concurrent scenario (Scenario 8) with drilling at Elanora-1 and pipelay between Annie-2 and Casino-5

| Hearing group | Modelled distance to effect threshold ($R_{max}$) | | |
|---|---|---|---|
| | Behavioural response[a] | TTS[b] | PTS[b] |
| | Concurrent | | |
| Low-frequency (LF) cetaceans | 30.7 | 7.50 | 0.48 |
| High-frequency (HF) cetaceans | | 0.90 | 0.03 |
| Very High-frequency (VHF) cetaceans | | 1.14 | 0.12 |
| Otariid Seals | | 0.57 | 0.03 |

Noise exposure criteria: [a] NOAA (2024) and [b] NMFS (2024).
This scenario is a combination of Scenario 5 at Elanora-1 and Scenario 6 to represent concurrent operations.

Table 20. Summary of maximum ($R_{max}$) horizontal distances (in km) to the behavioural response threshold, temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine mammals. The maximum across scenarios 9 and 10 at Annie-2 and Elanora-1 are shown.

| Hearing group | Modelled distance to effect threshold ($R_{max}$) | | | | | |
|---|---|---|---|---|---|---|
| | Behavioural response[a] | TTS[b] | PTS[b] | Behavioural response[a] | TTS[b] | PTS[b] |
| | Annie-2 | | | Elanora-1 | | |
| Low-frequency (LF) cetaceans | 8.02 | 3.88 | 0.61 | 24.8 | 7.92 | 0.67 |
| High-frequency (HF) cetaceans | | 0.71 | 0.03 | | 0.88 | 0.04 |
| Very High-frequency (VHF) cetaceans | | 0.87 | 0.07 | | 1.15 | 0.06 |
| Otariid Seals | | 0.68 | 0.03 | | 0.82 | 0.03 |

Noise exposure criteria: [a] NOAA (2024) and [b] NMFS (2024).

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# Appendix A. Acoustic Metrics

This section describes in detail the acoustic metrics, impact criteria, and frequency weighting relevant to the modelling study.

## A.1. Pressure Related Acoustic Metrics

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of $p_0$ = 1 µPa. Because the perceived loudness of sound, especially pulsed sound such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate sound and its effects on marine life. Here we provide specific definitions of relevant metrics used in the accompanying report. Where possible, we follow International Organization for Standardization definitions and symbols for sound metrics (e.g., ISO 2017, ANSI S1.1-2013).

The sound pressure level (SPL or $L_p$; dB re 1 µPa) is the root-mean-square (rms) pressure level in a stated frequency band over a specified time window ($T$; s). It is important to note that SPL always refers to an rms pressure level and therefore not instantaneous pressure:

$$L_p = 10 \log_{10} \left( \frac{1}{T} \int_T g(t)\, p^2(t)\, dt / p_0^2 \right) \text{ dB} \tag{A-1}$$

where $g(t)$ is an optional time weighting function. In many cases, the start time of the integration is marched forward in small time steps to produce a time-varying SPL function.

The sound exposure level (SEL or $L_E$; dB re 1 µPa$^2$·s) is the time-integral of the squared acoustic pressure over a duration ($T$):

$$L_E = 10 \log_{10} \left( \int_T p^2(t)\, dt / T_0 p_0^2 \right) \text{ dB} \tag{A-2}$$

where $T_0$ is a reference time interval of 1 s. SEL continues to increase with time when non-zero pressure signals are present. It is a dose-type measurement, so the integration time applied must be carefully considered for its relevance to impact to the exposed recipients.

SEL can be calculated over a fixed duration, such as the time of a single event or a period with multiple acoustic events. When applied to pulsed sounds, SEL can be calculated by summing the SEL of the $N$ individual pulses. For a fixed duration, the square pressure is integrated over the duration of interest. For multiple events, the SEL can be computed by summing (in linear units) the SEL of the $N$ individual events:

$$L_{E,N} = 10 \log_{10} \left( \sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}} \right) \text{ dB}\,. \tag{A-3}$$

If applied, the frequency weighting of an acoustic event should be specified, as in the case of weighted SEL (e.g., $L_{E,LFC,24h}$; Appendix 0). The use of fast, slow, or impulse exponential-time-averaging or other time-related characteristics should also be specified.

## A.2. Decidecade Band Analysis

The distribution of a sound's power with frequency is described by the sound's spectrum. The sound spectrum can be split into a series of adjacent frequency bands. Splitting a spectrum into 1 Hz wide bands, called passbands, yields the power spectral density of the sound. This splitting of the spectrum into passbands of a constant width of 1 Hz, however, does not represent how animals perceive sound.

Because animals perceive exponential increases in frequency rather than linear increases, analysing a sound spectrum with passbands that increase exponentially in size better approximates real-world scenarios. In underwater acoustics, a spectrum is commonly split into decidecade bands, which are one tenth of a decade wide. A decidecade is sometimes referred to as a "1/3 octave" because one tenth of a decade is approximately equal to one third of an octave. Each decade represents a factor 10 in sound frequency. Each octave represents a factor 2 in sound frequency. The centre frequency of the $i$th band, $f_c(i)$, is defined as:

$$f_c(i) = 10^{\frac{i}{10}} \text{ kHz} \tag{A-4}$$

and the low $(f_{lo})$ and high $(f_{hi})$ frequency limits of the $i$th decade band are defined as:

$$f_{lo,i} = 10^{\frac{-1}{20}} f_c(i) \quad \text{and} \quad f_{hi,i} = 10^{\frac{1}{20}} f_c(i) \tag{A-5}$$

The decidecade bands become wider with increasing frequency, and on a logarithmic scale the bands appear equally spaced (Figure A-1). The acoustic modelling spans from band 10 ($f_c$ (10) = 10 Hz) to band 44 ($f_c(44)$ = 25 kHz).

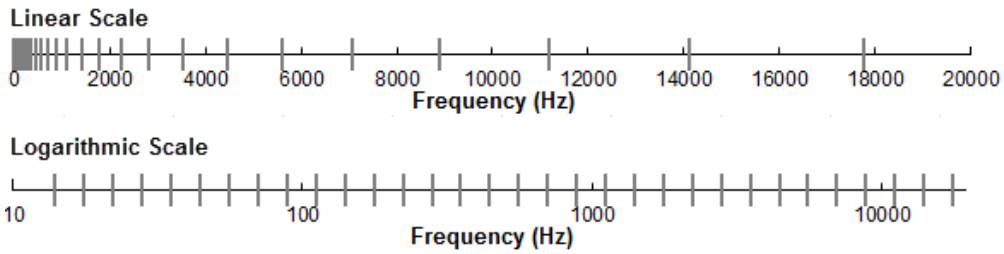



Figure A-1. Decidecade frequency bands (vertical lines) shown on a linear frequency scale and a logarithmic scale.

The sound pressure level in the $i$th band ($L_{p,i}$) is computed from the spectrum $S(f)$ between $f_{lo,i}$ and $f_{hi,i}$:

$$L_{p,i} = 10\, log_{10} \int_{f_{lo,i}}^{f_{hi,i}} S(f)\, \mathrm{d}f \text{ dB} \tag{A-6}$$

Summing the sound pressure level of all the bands yields the broadband sound pressure level:

$$\text{Broadband SPL} = 10 \log_{10} \sum_i 10^{\frac{L_{p,i}}{10}} \text{ dB} \tag{A-7}$$

Figure A-2 shows an example of how the decidecade band sound pressure levels compare to the sound pressure spectral density levels of an ambient sound signal. Because the decidecade bands are wider than 1 Hz, the decidecade band SPL is higher than the spectral levels at higher frequencies. Acoustic modelling of decidecade bands requires less computation time than 1 Hz bands and still resolves the frequency-dependence of the sound source and the propagation environment.

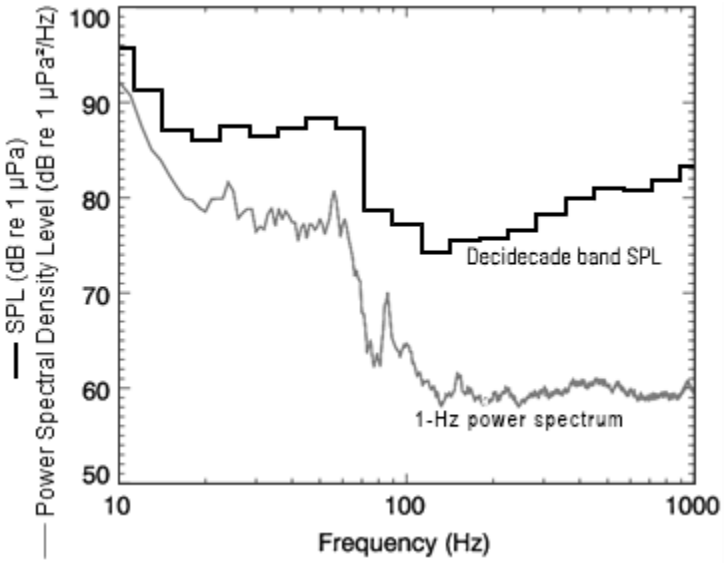



Figure A-2. Sound pressure spectral density levels and the corresponding decidecade band sound pressure levels of example ambient noise shown on a logarithmic frequency scale.Because the decidecade bands are wider with increasing frequency, the decidecade band SPL is higher than the power spectrum.

## A.3. Marine Mammal Noise Effect Criteria

It has been long recognised that marine mammals can be adversely affected by underwater anthropogenic noise. For example, Payne and Webb (1971) suggest that communication distances of fin whales are reduced by shipping sounds. Subsequently, similar concerns arose regarding effects of other underwater noise sources and the possibility that impulsive sources—primarily airguns used in seismic surveys—could cause auditory injury. This led to a series of workshops held in the late 1990s, conducted to address acoustic mitigation requirements for seismic surveys and other underwater noise sources (NMFS 1998, ONR 1998, Nedwell and Turnpenny 1998, HESS 1999, Ellison and Stein 1999). In the years since these early workshops, a variety of thresholds have been proposed for auditory injury, impairment, and disturbance. The following sections summarise the recent development of thresholds; however, this field remains an active research topic.

### A.3.1. Injury and Hearing Sensitivity Changes

In recognition of shortcomings of the SPL-only based auditory injury criteria, in 2005 NMFS sponsored the Noise Criteria Group to review literature on marine mammal hearing to propose new noise exposure criteria. Some members of this expert group published a landmark paper (Southall et al. 2007) that suggested assessment methods similar to those applied for humans. The resulting recommendations introduced dual auditory injury criteria for impulsive sounds that included peak pressure level thresholds and $SEL_{24h}$ thresholds, where the subscripted 24h refers to the accumulation period for calculating SEL. The peak pressure level criterion is not frequency weighted whereas $SEL_{24h}$ is frequency weighted according to one of four marine mammal species hearing groups: low-, mid- and high-frequency cetaceans (LF, MF, and HF cetaceans, respectively) and Pinnipeds in Water (PINN). These weighting functions are referred to as M-weighting filters (analogous to the A-weighting filter for humans; see Appendix A.4). The $SEL_{24h}$ thresholds were obtained by extrapolating measurements of onset levels of Temporary Threshold Shift (TTS) in belugas by the amount of TTS required to produce Permanent Threshold Shift (PTS) in chinchillas. The Southall et al. (2007) recommendations do not specify an exchange rate, which suggests that the thresholds are the same regardless of the duration of exposure (i.e., it implies a 3 dB exchange rate).

Wood et al. (2012) refined Southall et al.'s (2007) thresholds, suggesting lower PTS and TTS values for LF and HF cetaceans while retaining the filter shapes. Their revised thresholds were based on TTS-onset levels in harbour porpoises from Lucke et al. (2009), which led to a revised impulsive sound PTS threshold for HF cetaceans of 179 dB re 1 $\mu Pa^2 \cdot s$. Because there were no data available for baleen whales, Wood et al. (2012) based their recommendations for LF cetaceans on results obtained from MF cetacean studies. In particular they referenced the Finneran and Schlundt (2010) research, which found mid-frequency cetaceans are more sensitive to non-impulsive sound exposure than Southall et al. (2007) assumed. Wood et al. (2012) thus recommended a more conservative TTS-onset level for LF cetaceans of 192 dB re 1 $\mu Pa^2 \cdot s$.

As of present, a definitive approach is still not apparent. There is consensus in the research community that an SEL-based method is preferable, either separately or in addition to an SPL-based approach to assess the potential for injuries. In August 2016, after substantial public and expert input into three draft versions and based largely on the above-mentioned literature (NOAA 2013, 2015, 2016), NMFS finalised technical guidance for assessing the effect of anthropogenic sound on marine mammal hearing (NMFS 2016). The guidance describes auditory injury criteria with new thresholds and frequency weighting functions for the five hearing groups described by Finneran and Jenkins (2012b). The latest revision to this work was published in 2024 (NMFS 2024).

### A.3.2. Behavioural Response

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. However, it is recognised that the context in which the sound is received affects the nature and extent of responses to a stimulus (Southall et al. 2007, Ellison and Frankel 2012, Southall et al. 2016).

NMFS currently uses a step function (all-or-none) threshold of 120 dB re 1 µPa SPL (unweighted) for non-impulsive sounds to assess and regulate noise-induced behavioural impacts on marine mammals (NOAA 2024). The 120 dB re 1 µPa threshold is associated with continuous sources and 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 noise did not produce clear evidence of disturbance or avoidance for levels below 110 dB re 1 µPa (SPL), 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. It has been shown that both received level and proximity of the sound source is a contributing factor in eliciting behavioural reactions in humpback whales (Dunlop et al. 2017, Dunlop et al. 2018).

## A.4. Marine Mammal Frequency Weighting

The potential for noise to affect animals depends on how well the animals can hear it. Noises are less likely to disturb or injure an animal if they are at frequencies that the animal cannot hear well. An exception occurs when the sound pressure is so high that it can physically injure an animal by non-auditory means (i.e., barotrauma). For sound levels below such extremes, the importance of sound components at particular frequencies can be scaled by frequency weighting relevant to an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell et al. 2007).

## A.4.1. Marine Mammal Frequency Weighting Functions

In 2015, a US Navy technical report by Finneran (2015) recommended new auditory weighting functions. The overall shape of the auditory weighting functions is similar to human A-weighting functions, which follows the sensitivity of the human ear at low sound levels. The new frequency-weighting function is expressed as:

$$G(f) = K + 10\log_{10}\left[\left(\frac{(f/f_{lo})^{2a}}{\left[1+(f/f_{lo})^{2}\right]^{a}\left[1+(f/f_{hi})^{2}\right]^{b}}\right)\right] \quad \text{(A-8)}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low-, mid- and high-frequency cetaceans (LF, MF, and HF cetaceans, respectively), phocid pinnipeds, and otariid pinnipeds. The parameters for these frequency-weighting functions were further modified the following year (Finneran 2016) and were adopted in NOAA's technical guidance that assesses acoustic impacts on marine mammals (NMFS 2018), and in the latest guidance by NMFS (2024). The updates did not affect the content related to either the definitions of frequency-weighting functions or the threshold values, however, the terminology for mid- and high-frequency cetaceans was changed to high- and very high-frequency cetaceans (VHF cetaceans). Table A-1. lists the frequency-weighting parameters for each hearing group relevant to this assessment, and Figure A-3 shows the resulting frequency-weighting curves.

Table A-1. Parameters for the auditory weighting functions used in this project as recommended by NMFS (2024).

| | NMFS (2024) | | | | |
|---|---|---|---|---|---|
| **Functional Hearing group** | **a** | **b** | **flo (kHz)** | **fhi (kHz)** | **C (dB)** |
| Low-frequency cetaceans (baleen whales) | 0.99 | 5 | 0.168 | 26.6 | 0.12 |
| High-frequency cetaceans (most dolphins, plus sperm, beaked, and bottlenose whales) | 1.55 | 5 | 1.73 | 129 | 0.32 |
| Very high-frequency cetaceans (true porpoises, *Kogia*, river dolphins, *Cephalorhynchus* spp., *Lagenorhynchus cruciger* and *L. australis*) | 2.23 | 5 | 5.93 | 186 | 0.91 |
| Otariid Seals in water | 1.58 | 5 | 2.53 | 43.8 | 1.37 |

* The 'C' parameter in NMFS (2024) is equivalent to the 'K' parameter in Finneran (2015).

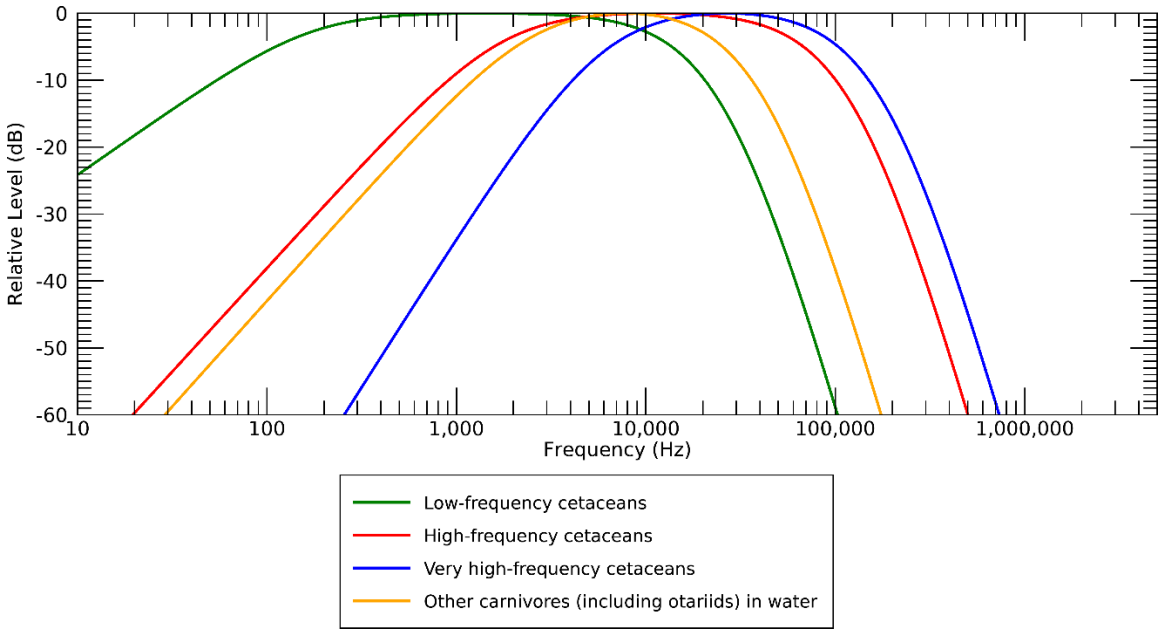



Figure A-3. Auditory weighting functions for functional marine mammal hearing groups used in this project as recommended by NMFS (2024).

# Appendix B. Methods and Parameters

## B.1. Environmental Parameters

### B.1.1. Bathymetry

Bathymetry throughout the modelled area was extracted from the Australian Bathymetry and Topography Grid, a 9 arc-second grid rendered for Australian waters (Whiteway 2009). Bathymetry data were re-gridded and combined onto a Map Grid of Australia (MGA) coordinate projection (Zone 54) with a regular grid spacing of 250 × 250 m (Figure B-1).

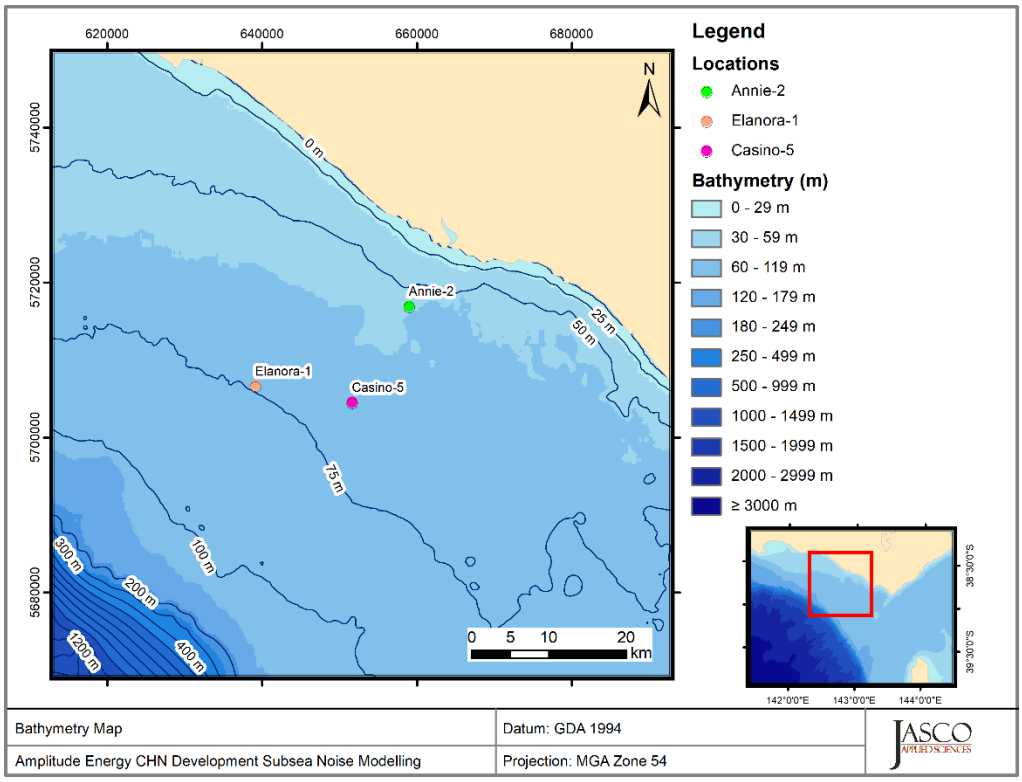



Figure B-1. Bathymetry in the modelled area.

### B.1.2. Sound Speed Profile

The sound speed profile in the area was derived from temperature and salinity profiles from the U.S. Naval Oceanographic Office's Generalized Digital Environmental Model V 3.0 (GDEM; Teague et al. 1990, Carnes 2009). GDEM provides an ocean climatology of temperature and salinity for the world's oceans on a latitude-longitude grid with 0.25° resolution, with a temporal resolution of one month, based on global historical observations from the U.S. Navy's Master Oceanographic Observational Data Set (MOODS). The climatology profiles include 78 fixed depth points to a maximum depth of 6800 m (where the ocean is that deep). The GDEM temperature-salinity profiles were converted to sound speed profiles according to Coppens (1981).

Mean monthly sound speed profiles were derived from the GDEM profiles at distances less than 40 km around the modelled site. The August sound speed profile is expected to be most favourable to longer-range sound propagation across the entire year which was determined by modelling a reduced number of transects for every month and comparing the ranges to thresholds. As such, August was

selected for sound propagation modelling to ensure precautionary estimates of distances to received sound level thresholds. Figure B-2 shows the resulting profile, which was used as input to the sound propagation modelling.

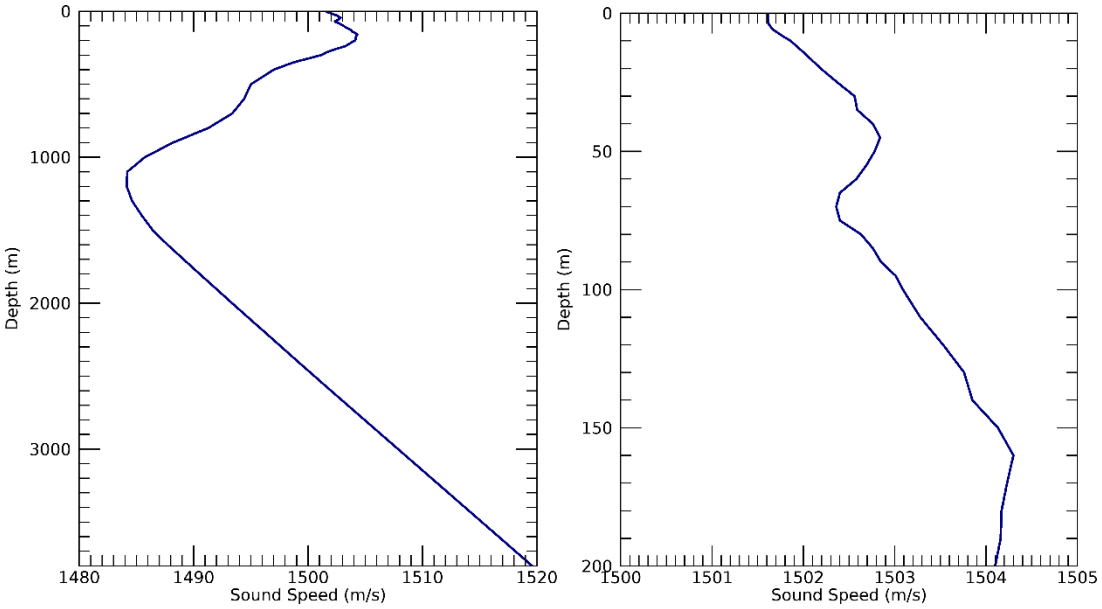



Figure B-2. The modelling sound speed profile corresponding to August: full profile (left) and top 200 m (right) Profiles are calculated from temperature and salinity profiles from Generalized Digital Environmental Model V 3.0 (GDEM; Teague et al. 1990, Carnes 2009).

## B.1.3. Geoacoustics

The propagation model used in this study consider a single geoacoustic profile for each well site area. Similar to previous modelling studies in the region (Wood and McPherson 2018, Koessler et al. 2020, Matthews et al. 2020, McPherson et al. 2021), two seabed types were considered for modelling. Both seabed profiles are indicative of seabed environments located on the continental shelf of the Otway region and are consistent with larger scale geological data and interpretations of the Australian continental shelf environment (James and Bone 2010).

The geoacoustic profiles Elanora-1, Casino-5 and Annie-2 well sites were generated using lithographic descriptions from the geotechnical and geophysical reports supplied by the client and considering previous underwater acoustic modelling and measurement studies (Koessler et al. 2020, Matthews et al. 2020, McPherson et al. 2021). Within the vicinity of Annie-2 the seabed is likely to consist of a well-cemented calcarenite caprock over a semi-cemented calcarenite. Near the Elanora-1 and Casino-5 locations, the seabed is likely to consist of a thin layer of coarse sand overlying a similar calcarenite structure. This sand layer may not be consistently present. In all cases, the calcarenite layering likely extended to many hundreds of metres below the seafloor.

Table B-1 and Table B-2 present the geoacoustic profiles used modelled sites in each respective development area.

Table B-1. Geoacoustic profile for Annie-2 associated modelled sites.

| Depth below seafloor (m) | Material | Density (g/cm$^3$) | P-wave speed (m/s) | P-wave attenuation (dB/λ) | S-wave speed (m/s) | S-wave attenuation (dB/λ) |
|---|---|---|---|---|---|---|
| 0-1 | Well-cemented carbonate caprock | 2.7 | 2600 | 0.5 | 1200 | 0.5 |
| 1-20 | Increasingly cemented calcarenite | 2.2 | 2000 | 0.30 | 900 | 0.27 |
| 20-40 | | 2.3 | 2120 | 0.34 | 960 | 0.31 |
| 40-60 | | 2.4 | 2240 | 0.38 | 1020 | 0.36 |
| 60-80 | | 2.5 | 2360 | 0.42 | 1080 | 0.41 |
| 80-10 | | 2.6 | 2480 | 0.46 | 1140 | 0.45 |
| >100 | Well-cemented calcarenite | 2.7 | 2600 | 0.50 | 1200 | 0.50 |

Table B-2. Geoacoustic profile for Elanora-1 and Casino-5 associated modelled sites.

| Depth below seafloor (m) | Material | Density (g/cm$^3$) | P-wave speed (m/s) | P-wave attenuation (dB/λ) | S-wave speed (m/s) | S-wave attenuation (dB/λ) |
|---|---|---|---|---|---|---|
| 0-1.5 | Coarse carbonate sand | 2.0 | 1800 | 0.85 | 300 | 3.68 |
| 1.5-2.5 | Well-cemented carbonate caprock | 2.7 | 2600 | 0.50 | 1200 | 0.50 |
| 2.5-22.5 | Increasingly cemented calcarenite | 2.2 | 2000 | 0.3 | 900 | 0.27 |
| 22.5-42.5 | | 2.3 | 2120 | 0.34 | 960 | 0.31 |
| 42.5-62.5 | | 2.4 | 2240 | 0.38 | 1020 | 0.36 |
| 62.5-82.5 | | 2.5 | 2360 | 0.42 | 1080 | 0.41 |
| 82.5-102.5 | | 2.6 | 2480 | 0.46 | 1140 | 0.45 |
| >102.5 | Well-cemented calcarenite | 2.7 | 2600 | 0.50 | 1200 | 0.50 |

## B.2. Estimated Vessel Source Levels

At the time of this study, the Platform Support Vessel (ISV) and Dive Support Vessel (DSV) to be used in the project were unconfirmed and a generic source level was proposed. Similar to the approach detailed Connell et al. (2021) in different vessels were identified as either potential ISV or RDSV vessels, therefore the source level and spectrum used to represent any of these four vessels was based on the nominal specifications for all indicated vessels, due to similarity in dimensions and total installed power ratings. This nominal vessel has an 89.2 m overall length, 20 m breadth, and 7.6 m maximum draft.

A main propulsion system is this generic vessel comprised of the following specifications.

Two stern propellers with

- 3.2 m propeller diameter,
- 165 rpm nominal propeller speed,

- 2,200 kW maximum continuous power input, and
- Typical DP operation at 26% MRC.

Additional thruster modules active during DP operations may include bow tunnel thrusters and a bow azimuth thruster. The two bow tunnel thrusters for the generic vessel were comprised of:

- 2.0 m propeller diameter,
- 318 rpm nominal propeller speed,
- 1,000 kW maximum continuous power input, and
- Typical DP operation at 17% MRC.

The bow azimuth thruster generic vessel was comprised of:

- 1.65 m propeller diameter,
- 373 rpm nominal propeller speed,
- 830 kW maximum continuous power input, and
- Typical DP operation at 21% MRC

Estimates of the acoustic source levels were based on the parameters of the propulsion system together with the method descripted in Appendix B.2.1, and the percent of Maximum Continuous Rating (MCR) for the vessel operating at during typical DP operations, as provided by the potential vessel operators.

## B.2.1. Thruster Source Level Estimation

A vessel equipped with propellers/thrusters has two primary sources of sound that propagate from the unit: the machinery and the propellers. For thrusters operating in the heavily loaded conditions, the acoustic energy generated by the cavitation processes on the propeller blades dominates (Leggat et al. 1981). The sound power from the propellers is proportional to the number of blades, the propeller diameter, and the propeller tip speed.

Based on an analysis of acoustic data, Ross (1976) provided the following formula for the sound levels from a vessel's propeller, operating in calm, open ocean conditions:

$$L_{100} = 155 + 60\log(u/25) + 10\log(B/4)\,, \qquad \text{(B-1)}$$

where $L_{100}$ is the spectrum level at 100 Hz, $u$ is the propeller tip speed (m/s), and $B$ is the number of propeller blades. Equation B-1 gives the total energy produced by the propeller cavitation at frequencies between 100 Hz and 10 kHz. This equation is valid for a propeller tip speed between 15 and 50 m/s. The spectrum is assumed to be flat below 100 Hz. Its level is assumed to fall off at a rate of −6 dB per octave above 100 Hz (Figure B-3).

Another method of predicting the source level of a propeller was suggested by Brown (1977). For propellers operating in heavily loaded conditions, the formula for the sound spectrum level is:

$$\mathrm{SL}_B = 163 + 40\log D + 30\log N + 10\log B + 20\log f + 10\log(A_c/A_D)\,, \qquad \text{(B-2)}$$

where $D$ is the propeller diameter (m), $N$ is the propeller revolution rate per second, $B$ is the number of blades, $A_C$ is the area of the blades covered by cavitation, and $A_D$ is the total propeller disc area. Similar to Ross's approach, the spectrum below 100 Hz is assumed to be flat. The tests with a naval propeller operating at off-design heavily loaded conditions showed that Equation B-2 should be used with a value of $(A_c/A_D) = 1$ (Leggat et al. 1981).

The combined source level for multiple thrusters operating together can be estimated using the formula:

$$\mathrm{SL}_{\mathrm{total}} = 10\log_{10}\sum_{i} 10^{\frac{SL_i}{10}}, \tag{B-3}$$

where $SL_{1,\ldots,N}$ are the source levels of individual thrusters. If the vessel is equipped with the same type of thrusters, the combined source level can be estimated using the formula:

$$\mathrm{SL}_N = \mathrm{SL} + 10\log N \tag{B-4}$$

where $N$ is the total number of thrusters of the same type.

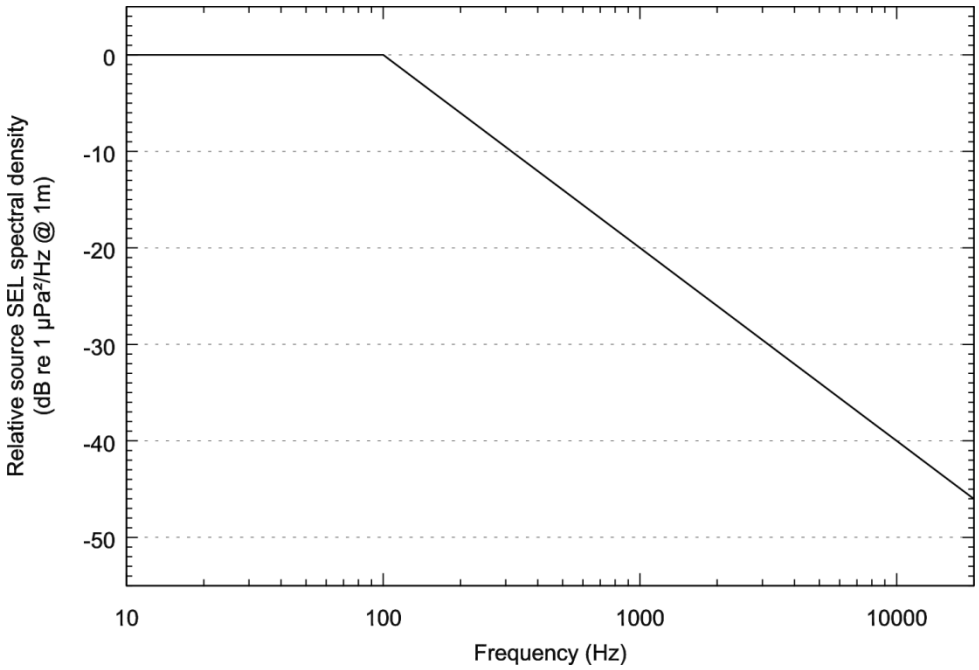



Figure B-3. Estimated sound spectrum from cavitating propeller (Leggat et al. 1981).

## B.2.2. Estimating Sound Field from Moving Vessels

During vessel transit, new sound energy is constantly being introduced to the environment. The noise footprint for the transiting vessels considered in this report were estimated by modelling the 1-s SEL for the vessel at one location, and by translating and summing these footprints along the vessel transit routes. The vessel locations along the tracks were spaced uniformly, with an approximate step of $\Delta s \approx 100$ m.

The SEL sound field at any given point along the path is dependent upon the duration of exposure, which with a fixed footprint spacing depends upon the speed of the vessel during each segment of the transit. The 1-s SEL footprint at each vessel location ($i$) were therefore scales based on the speed of the vessel following:

$$\mathrm{SEL}_i = \mathrm{SEL}_{1s} + 10\log_{10}\left(\frac{\Delta s}{v}\right). \tag{B-5}$$

where $v$ represents the vessel speed in m/s.

The present method acceptably reflects large-scale sound propagation features, primarily dependent on water depth, which dominate the cumulative field and is thus considered to provide a meaningful estimate of the $SEL_{24h}$ field.

# B.3. Sound Propagation Models

## B.3.1. Propagation Loss

The propagation of sound through the environment was modelled by predicting the acoustic propagation loss—a measure, in decibels, of the decrease in sound level between a source and a receiver some distance away. Geometric spreading of acoustic waves is the predominant way by which propagation loss occurs. Propagation loss also happens when the sound is absorbed and scattered by the seawater, and absorbed scattered, and reflected at the water surface and within the seabed. Propagation loss depends on the acoustic properties of the ocean and seabed; its value changes with frequency.

If the acoustic energy source level (ESL), expressed in dB re 1 $\mu Pa^2 \cdot s\ m^2$, and propagation loss (PL), in units of dB, at a given frequency are known, then the received level (RL) at a receiver location can be calculated in dB re 1 $\mu Pa^2 \cdot s$ by:

$$RL = SL - PL. \tag{B-6}$$

## B.3.2. MONM-BELLHOP

Long-range sound fields were computed using JASCO's Marine Operations Noise Model (MONM). While other models may be more accurate for steep-angle propagation in high-shear environment, MONM is well suited for effective longer-range estimation. This model computes sound propagation at frequencies of 10 Hz to 1.6 kHz via a wide-angle parabolic equation solution to the acoustic wave equation (Collins 1993) based on a version of the U.S. Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for a solid seabed (Zhang and Tindle 1995). MONM computes sound propagation at frequencies > 1.6 kHz via the BELLHOP Gaussian beam acoustic ray-trace model (Porter and Liu 1994).

The parabolic equation method has been extensively benchmarked and is widely employed in the underwater acoustics community (Collins et al. 1996). MONM accounts for the additional reflection loss at the seabed, which results from partial conversion of incident compressional waves to shear waves at the seabed and sub-bottom interfaces, and it includes wave attenuations in all layers. MONM incorporates the following site-specific environmental properties: a bathymetric grid of the modelled area, underwater sound speed as a function of depth, and a geoacoustic profile based on the overall stratified composition of the seafloor.

MONM computes acoustic fields in three dimensions by modelling propagation loss within two-dimensional (2-D) vertical planes aligned along radials covering a 360° swath from the source, an approach commonly referred to as N×2-D. These vertical radial planes are separated by an angular step size of $\Delta\theta$, yielding N = 360°/$\Delta\theta$ number of planes (Figure B-4).

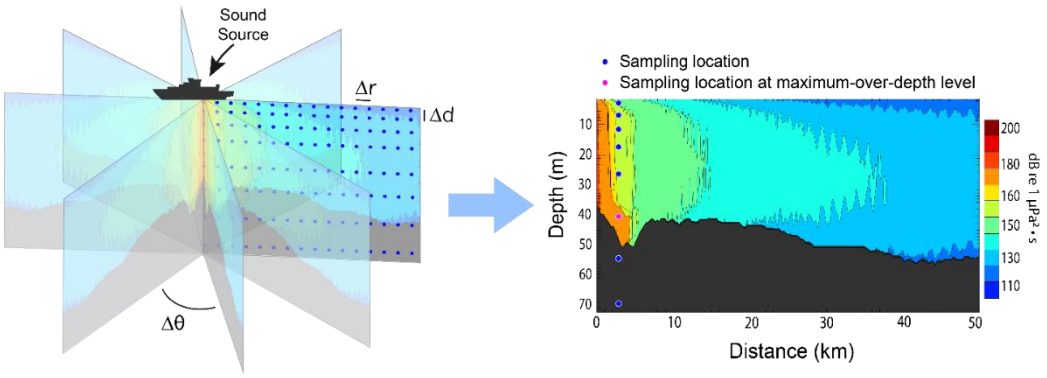



Figure B-4. The N×2-D and maximum-over-depth modelling approach used by MONM.

MONM treats frequency dependence by computing acoustic propagation loss at the centre frequencies of decidecade bands. Sufficiently many decidecade frequency-bands, starting at 10 Hz, are modelled to include most of the acoustic energy emitted by the source. At each centre frequency, the propagation loss is modelled within each of the N vertical planes as a function of depth and range from the source. The decidecade received per-second SEL are computed by subtracting the band propagation loss values from the directional source level in that frequency band. Composite broadband received per-second SEL are then computed by summing the received decidecade levels.

The received 1-s SEL sound field within each vertical radial plane is sampled at various ranges from the source, generally with a fixed radial step size. At each sampling range along the surface, the sound field is sampled at various depths, with the step size between samples increasing with depth below the surface. The step sizes are chosen to provide increased coverage near the depth of the source and at depths of interest in terms of the sound speed profile. For areas with deep water, sampling is not performed at depths beyond those reachable by marine mammals. The received per-second SEL at a surface sampling location is taken as the maximum value that occurs over all samples within the water column, i.e., the maximum-over-depth received per-second SEL. These maximum-over-depth per-second SEL are presented as colour contours around the source.

## B.3.3. Wavenumber Integration Model

VSTACK computes propagation loss versus depth and range for arbitrarily layered, range-independent acoustic environments using the wavenumber integration approach to solve the exact (range-independent) acoustic wave equation. This model is valid over the full angular range of the wave equation and can fully account for the elasto-acoustic properties of the sub-bottom. Wavenumber integration methods are extensively used in the field of underwater acoustics and seismology where they are often referred to as reflectivity methods or discrete wavenumber methods. VSTACK computes sound propagation in arbitrarily stratified water and seabed layers by decomposing the outgoing field into a continuum of outward-propagating plane cylindrical waves. Seabed reflectivity in the model is dependent on the seabed layer properties: compressional and shear wave speeds, attenuation coefficients, and layer densities. Additionally, VSTACK assumes range-invariant bathymetry with a horizontally stratified medium (i.e., a range-independent environment) which is azimuthally symmetric about the source. Typically, VSTACK is best suited to modelling the sound field near the source; however, it can also be used in conjunction with MONM to account for additional bottom loss in high shear speed seabeds as described in Section B.3.4.

## B.3.4. Limestone Seabed Propagation Loss

For sites where the seabed geoacoustic model consisted of bare calcarenite, an additional broadband correction was applied to the propagation loss results from MONM to better account for the additional

propagation loss associated with a limestone (calcarenite) seabed (Duncan et al. 2009). The accuracy of the broadband calculated propagation loss for the South-eastern continental shelf of Australia depends significantly upon the frequency content of the radiating sound source together with thickness of any overlying layers of unconsolidated sediment (e.g. sand) on top of calcarenite likely to occur within the region.

In general, the thinner the sand layer, the greater the overall propagation loss. When comparing SPL data McPherson et al. (2021), higher rates of propagation loss were observed and were attributed to, an absorptive carbonate (calcarenite) seabed. In this study, comparisons were conducted using JASCO's Marine Operations Noise Model (MONM), a wide-angle parabolic equation model which applies the BELLHOP Gaussian beam acoustic ray-trace model at higher frequencies, and JASCO's wavenumber integration model (VSTACK, Appendix B.3.3) which can fully account for the elasto-acoustic properties of the sub-bottom.

To account for the additional propagation loss associated with a cemented calcarenite seabed, an additional broadband correction was applied to the propagation loss results from MONM to account for the higher rates of loss when the full for the elasto-acoustic properties of the sub-bottom are consider. The differences between the broadband SPL from MONM and VSTACK were extracted at the same modelled ranges and depths that corresponded range independent predictions. The 90th percentile of the resultant dB differences in 250 m range bins were selected to generate a correction function for each individual site/source to be modelled. The conversion functions were applied after the propagation loss calculation from MONM but before summing decidecade band levels, gridding, and radii calculations for each modelled site in each modelled scenario considered.

## B.4. Estimating Range to Thresholds Levels

Sound level contours were calculated based on the underwater sound fields predicted by the propagation models, sampled by taking the maximum value over all modelled depths above the sea floor for each location in the modelled region. The predicted distances to specific levels were computed from these contours. Two distances relative to the source are reported for each sound level: 1) $R_{max}$, the maximum range to the given sound level over all azimuths, and 2) $R_{95\%}$, the range to the given sound level after the 5% farthest points were excluded (see examples in Figure B-5).

The $R_{95\%}$ is used because sound field footprints are often irregular in shape. In some cases, a sound level contour might have small protrusions or anomalous isolated fringes. This is demonstrated in the image in Figure B-5(a). In cases such as this, where relatively few points are excluded in any given direction, $R_{max}$ can misrepresent the area of the region exposed to such effects, and $R_{95\%}$ is considered more representative. In strongly asymmetric cases such as shown in Figure B-5(b), on the other hand, $R_{95\%}$ neglects to account for significant protrusions in the footprint. In such cases $R_{max}$ might better represent the region of effect in specific directions. Cases such as this are usually associated with bathymetric features affecting propagation. The difference between $R_{max}$ and $R_{95\%}$ depends on the source directivity and the non-uniformity of the acoustic environment.

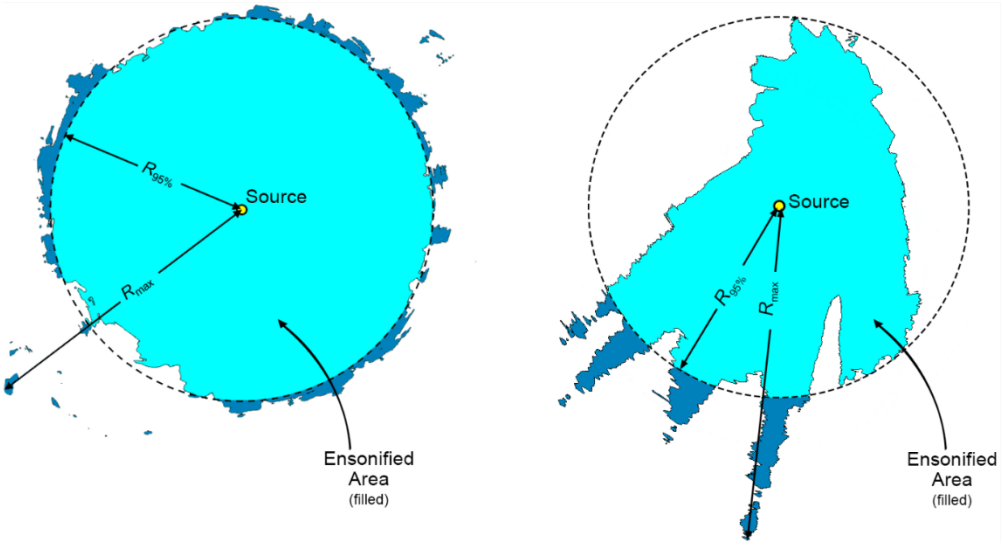



Figure B-5. Sample areas ensonified to an arbitrary sound level with $R_{max}$ and $R_{95\%}$ ranges shown for two different scenarios. (a) Largely symmetric sound level contour with small protrusions. (b) Strongly asymmetric sound level contour with long protrusions. Light blue indicates the ensonified areas bounded by $R_{95\%}$; darker blue indicates the areas outside this boundary which determine $R_{max}$.

## B.5. Model Validation Information

Predictions from JASCO's propagation models (MONM, FWRAM, and VSTACK) have been validated against experimental data from a number of underwater acoustic measurement programs conducted by JASCO globally, including the United States and Canadian Artic, Canadian and southern United States waters, Greenland, Russia and Australia (e.g. Hannay and Racca 2005, Aerts et al. 2008, Funk et al. 2008, Ireland et al. 2009, O'Neill et al. 2010, Warner et al. 2010, Racca et al. 2012a, Racca et al. 2012b, Matthews and MacGillivray 2013, Martin et al. 2015, Racca et al. 2015, Martin et al. 2017a, Martin et al. 2017b, Warner et al. 2017, MacGillivray 2018, McPherson et al. 2018, McPherson and Martin 2018, Quijano et al. 2018).

In addition, JASCO has conducted measurement programs associated with a significant number of anthropogenic activities that have included internal validation of the modelling (including McCrodan et al. 2011, Austin and Warner 2012, McPherson and Warner 2012, Austin and Bailey 2013, Austin et al. 2013, Zykov and MacDonnell 2013, Austin 2014, Austin et al. 2015, Austin and Li 2016, Martin and Popper 2016, Austin et al. 2018, Beach Energy Limited 2020).

# Appendix 5. GHG Modelling

Cooper Energy

# Otway Offshore Project Proposal

## GHG Inventory Technical Note

**ASSIGNMENT** P200203-S01
**DOCUMENT** P-200203-S01-A-REPT-001

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# REVISIONS & APPROVALS

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# 1 INTRODUCTION

## 1.1 Background

Cooper Energy's existing Otway Casino-Henry-Netherby (CHN) development (known as the 'existing CHN facilities') consist of the Casino, Henry and Netherby gas fields along with associated subsea infrastructure. Hydrocarbons from these fields are produced via four subsea wells and transported to shore via the CHN pipeline and processed at the shore-based Athena Gas Plant (AGP) situated ~6 km from Port Campbell.

Cooper Energy proposes extending the gas supply to the AGP by developing additional gas fields and tying them into the existing CHN facilities – the East Coast Gas Supply Project.

The East Coast Gas Supply Project will include up to 15 wells within eight potential gas development opportunities in Commonwealth waters which are either:

- a confirmed resource (Annie and Henry-3), or
- prospective resources (Pecten East, Elanora, Heera, Juliet, Nestor, and Isabella).

## 1.2 Aim and Objectives

This technical note presents the greenhouse gas (GHG) emissions inventory to identify and quantify GHG emissions for the East Coast Gas Supply Project for the purpose of environmental impact assessment in the Offshore Project Proposal (OPP) required under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 [OPGGS(E)R].

This includes direct and indirect GHG emissions associated with the East Coast Gas Supply Project.

Emissions have been estimated based on a scenario where all fields within the scope of the OPP are developed, and multiple fields are brought online simultaneously. It should be noted that this is considered conservative, and that production and emissions profiles will be refined as field development plans are matured.

# 2 DEFINITIONS AND BOUNDARY OF ASSESSMENT

As illustrated in Table 2-1, GHG emissions from the existing CHN facilities served as the baseline for the emissions estimation. The baseline has also included CHN and AGP decommissioning.

This technical report addresses and categorises GHG emissions into the following groups:

- Direct GHG emissions: Direct GHG emissions are created as a direct result of the East Coast Gas Supply Project activities within Commonwealth jurisdiction, including Surveys, Drilling, Installation and Commissioning, Operations (inclusive of Inspection, Maintenance and Repair [IMR]), and Decommissioning. These emissions originate from support activities - mobile offshore drilling unit (MODU), vessels, and remotely operated vehicle (ROV) / autonomous underwater vehicle (AUV)[1] within Commonwealth waters, including flaring.
- Indirect GHG emissions: Key sources of emissions in this category include:
  - Fuel gas
  - Flaring and Venting
  - Diesel for transport and stationary energy
  - Purchased goods and transportation, limited to the major items listed below:
    - Cement
    - Corrosion-resistant alloy (CRA)
    - Carbon steel
    - Flowlines
    - Umbilicals
    - Manifolds
    - Others (skids, hot-tap tie-in structure, protection pressure structure, pig launcher/receiver, and subsea trees)
  - Waste generated, including:
    - Solid steel waste
    - Flowline disposal
    - Umbilicals disposal
    - Mattresses disposal
    - Liquids (hazardous waste) disposal
  - Fugitive emissions
  - Other emissions including vessels within State jurisdiction and employee commuting (inclusive of helicopters)
  - Purchased electricity.
- Downstream indirect GHG emissions: Downstream indirect GHG emissions are associated with the product transmission and distribution to customers, and final combustion or use of gas and condensate products by customers.

[1] *No additional emissions from the ROV/AUV as they are powered by the vessels used.*

NB: The direct emissions do not equate to scope 1 emissions (i.e., emissions under operational control of the organisation) under the *National Greenhouse and Energy Reporting Act 2007*, as the:

- Direct emissions in this inventory includes relevant Support Operations both within and outside of Copper Energy's operational control.
- Scope 1 emissions associated with the transport and processing of hydrocarbons outside of Commonwealth Waters are considered indirect emissions in this inventory.

The indicative duration of each phase of the East Coast Gas Supply Project is as documented in the Description of Activity chapter of the OPP. The first stage of the East Coast Gas Supply Project is likely to be ready for development in 2025. There will likely be some small activities (e.g., mobilisation of drilling rig) in late 2024, but these activities will cause minimal impact on the annual GHG emissions profile and will not affect the final emissions figure. The Operations phase is forecast to end in approximately 2045 and Decommissioning phase by approximately 2049.

The following emissions sources/activities have been excluded from the GHG emissions assessment:

- Any expenses or activities related to Gippsland basin as these are not relevant to the East Coast Gas Supply Project.
- Processing of sold products and end-of-life treatment of sold products. These are not applicable due to the assumption that all products will be combusted (refer to Section 3.2).
- Emissions from the Cooper Energy offices have not been apportioned from the baseline as these emissions are not material.

Where the OPP is based on developing exploration targets, which do not have well test results to inform the reservoir characteristics used in the assessment of environmental impacts and risks, a conservative approach has been taken with regards to reservoir characteristics. This approach is informed by a detailed assessment of the Otway reservoirs. Given the reservoir targets are clustered around the CHN, they are likely to have similar properties, including low reservoir $CO_2$ (typically <1%).

*Table 2-1: Boundary of assessment and emissions sources (with Baseline being the emissions from the existing CHN facilities).*

| DIRECT GHG EMISSIONS SOURCES | | | | | INDIRECT GHG EMISSIONS SOURCES ‡ | DOWNSTREAM INDIRECT GHG EMISSIONS SOURCES ‡ |
|---|---|---|---|---|---|---|
| **The East Coast Gas Supply Project** | | | | | | |
| **Survey** | **Drilling** | **Installation and Commissioning** | **Operations** | **Decommissioning** | • Fuel gas usage<br>• Flaring and venting<br>• Diesel usage<br>• Fugitives<br>• Purchased goods and transportation<br>• Purchased electricity<br>Other (vessels including ROV/AUV‡*, liquid fuel, waste generated, and employee commuting) | • Combustion of products<br>• Fugitive emissions from natural gas transmission and distribution<br>• Condensate transportation |
| Vessels† | • MODU<br>• Flaring<br>• Vessels†<br>• ROV/AUV†* | • Vessels†<br>• ROV/AUV†* | • Vessels (IMR)†<br>• ROV/AUV (IMR)†*<br>• Flaring (well intervention) | • MODU<br>• Flaring<br>• Vessels†<br>• ROV/AUV† | | |
| **Baseline: The Existing CHN Facilities** | | | | | | |
| - | - | - | - | - | • Fuel gas usage<br>• Flaring and venting<br>• Diesel usage<br>• Fugitives<br>• Purchased goods and transportation<br>• Purchased electricity<br>• Other (vessels including ROV/AUV‡*, liquid fuel, waste generated, leased assets, employee commuting, business travel, CHN and AGP decommissioning) | • Combustion of products<br>• Fugitive emissions from natural gas transmission and distribution<br>• Condensate transportation |

*† Within Commonwealth jurisdiction*

*‡ Within State jurisdiction*

** No additional emissions from the ROV/AUV as they are powered by the vessels used.*

# 3 METHODOLOGY

## 3.1 Emissions Calculations

**Support activities (MODU and vessels), fuel gas, and stationary energy**

For these emissions sources, GHG emissions were calculated using Equation (1).

$$\text{GHG Emissions } [CH_4, CO_2, N_2O] \text{ (t } CO_2\text{-e)} = \text{Activity x Emissions Factor} \quad \text{... Equation (1)}$$

Activities were based on the information provided by Cooper Energy's data sets, including existing inventories and data from previous campaigns. The amounts of fuel use required for the support activities were estimated from Xodus' database. Emissions factors were sourced from the National Greenhouse and Energy Reporting (NGER) (Measurement) Determination 2008 (NGER Determination) (Clean Energy Regulator, 2023).

Unprocessed natural gas emissions factor from the NGER Determination was used for the fuel gas usage. Diesel oil emissions factor was used for the MODU, vessels, and stationary energy, whilst kerosene emissions factor was used for the helicopters. Marine gas oil (MGO) may be used, however, diesel was used as a conservative emissions estimate.

**Flaring and Venting**

GHG emissions for flaring during Drilling were calculated using Method 1 under Section 3.44 of the NGER Determination. Operational flaring and venting emissions due to gas processing were provided by Cooper Energy. Flaring may also occur due to well intervention activities and has been allowed for.

**Purchased goods and transportation**

Equation (1) was used to compute GHG emissions from purchased goods and transportation. For the types of purchased goods considered in Section 2, Xodus' rigid material estimation tool was used along with the emissions factors from the Inventory of Carbon and Energy (ICE Database v4) (Circular Ecology, 2024).

For goods transportation by sea, South Australia and Argentina were used as the departure ports for transporting cement and Oil Country Tubular Goods (OCTG), respectively. Emissions from sea transportation were estimated based on the vessel fuel consumption rate from Xodus database using diesel oil emissions factor from the NGER Determination. Emissions from land transportation were estimated based on the diesel fuel emissions factor for heavy-goods vehicle (HGV) sourced from the UK Government Conversion Factors (UK Government, 2023), with an assumed travel distance of 120 km and a carrying capacity of 40 t.

**Waste generated**

Equation (1) was used to compute GHG emissions from waste generated. For the types of waste considered in Section 2, the following emissions factors were used:

- Transportation and disposals of solid steel, flowline, umbilicals and mattresses: 0.0203 t $CO_2$-e/t ('Structural Steel' in Waste Reduction Model (WARM) tool v16) (US EPA, 2023)
- Transportation and treatment of hazardous waste: 0.0018 t $CO_2$-e/USD ('Hazardous Waste Treatment and Disposal' in Supply Chain GHG Emission Factor v1.2) (US EPA, 2023).

### Employee commuting

Helicopter was categorised as Employee Commuting. Equation (1) was used for emissions estimation. Kerosene emissions factor was used for the helicopters.

Equation (2) was used to estimate the GHG emissions from employee commuting by road. An emissions factor of 0.035 t $CO_2$-e/employee-day was used which was based on a case study on commuting for within 50 km and pro-rated to 100 km, one-way (Leao, 2013).

GHG Emissions (t $CO_2$-e) = No. of Employees x Working Days x Emissions Factor ... Equation (2)

### Electricity usage

Indirect GHG emissions due to the consumption of an energy commodity were provided by Cooper Energy based on the emissions factors in the NGER Determination.

### Downstream product transportation and use

Sales gas will be piped to end users from AGP to Cooper Energy's customers in Victoria and South Australia. Condensate product will be trucked to the Viva refinery in Geelong. The resulting fugitive emissions from pipeline transmission were calculated using Method 1 in Section 3.76 of the NGER Determination and the emissions from condensate transport were calculated using Method 1 in Section 2.41 of the NGER Determination.

To estimate the emissions from product use, the production forecast profiles for the sales gas and condensate provided by COE were used (Section 4.1.5 of the OPP). For conservatism, all products were assumed to be combusted, Equation (3) was used to calculate the emissions from the combustion of gas and condensate products with the emission factors sourced from the NGER Determination.

GHG Emissions [$CH_4$, $CO_2$, $N_2O$] (t $CO_2$-e) = Product Type x Emissions Factor ... Equation (3),

### Fugitives

Fugitive emissions resulted from gas processing at AGP were provided by Cooper Energy which were estimated using the methodologies in the NGER Determination.

## 3.2 Assumptions and Information

The following assumptions have been made when creating the GHG emissions inventory for the East Coast Gas Supply Project:

Direct GHG emissions:

- Duration of Drilling: 60 days/well, with five campaigns.
- Duration of Installation and Commissioning: 30 days/well.
- Duration of Decommissioning – P&A and retrieval and surveys, taken as 30 days/well, with two campaigns.
- Duration of Survey: 7 days/well.
- Flaring during the Drilling phase taken as 150 MMscf/well (gas) and 40 $m^3$/well (oil) with no venting.
- Flaring during IMR (well interventions) taken as 18 MMscf/well intervention activity.
- Flaring during the Decommissioning phase taken as 18 MMscf/well.
- Additional time for unexpected delays and extreme weather events taken as 30% of the expected durations when calculating vessel's wait-on-weather days.
- Support vessels return to port every 3 days during the Drilling phase, and 28 days for other phases.
- Bunkering vessels travel every 20 days for large vessels, and work for 24 hours/vessel.
- Sea transit time taken as 10 knots (except cargo ships at 12 knots).
- Immaterial fugitive emissions resulted from mud gas degassing (less than 100 t $CO_2$-e).

Indirect GHG emissions:

- The emissions from product use have been based on the forecast volume of sales gas and condensate.
- The average energy content factors of gas and condensate taken as 37.2 MJ/$m^3$ and 46.5 GJ/t respectively.
- The purchased goods included in the GHG inventory considered only the major items – cement, CRA, carbon steel, flowline, umbilicals, skids, manifolds, hot tap tie-in structure, protection pressure structure, pig launcher and subsea trees.
- For goods transportation, sea freight distances of approximately 400 nm (South Australia) and 6990 nm (Argentina) were assumed for transporting cement and OCTG, respectively. Land transportation was also included with an assumed travel distance of 120 km in rigid average-laden HGVs (>17 t), and a carrying capacity of 40 t per HGV.
- For the Operations phase, emissions from the purchased goods and transportation, solid waste and wastewaters generated, and diesel used were pro-rata to the percentage of products from the East Coast Gas Supply Project from the data given by Cooper Energy, based on the baseline.
- For venting emissions at AGP, the Otway Basin reservoir targets are clustered around the CHN fields and so are predicted to have similar low $CO_2$ outcomes (typically <1%). In the event that an unexpectedly high $CO_2$ composition is encountered, production operations will be managed to blend the higher $CO_2$ composition well stream with the other low $CO_2$ wells (e.g. via choking wells, switching wells on/off) in order to maintain the overall composition below the sales gas threshold. In event the $CO_2$ can't be managed via blending, $CO_2$ removal at the AGP may be required. Currently Amplitude Energy does not anticipate the requirement to install $CO_2$ removal technology at the plant based on our analysis of likely gas compositions. Therefore most likely incremental emissions from $CO_2$ removal and venting is therefore zero. However, to provide a

conservative estimate it has been assumes that $CO_2$ removal technology will need to be installed and in operation for approximately 50% of the production plateau period.

- For estimating the fugitive emissions from natural gas transmission and distribution, an assumption of 1000 km transmission pipeline length was used, which was based on an average distance from AGP to Cooper Energy's customers in Victoria and South Australia.
- Condensate product will be trucked to the Viva refinery in Geelong (~180 km from AGP) and the trucking frequencies were pro-rata to the basis year of 2022. Fuel consumption taken as 202.6026 L/100 km (CoA, n.d.).
- Emissions from structural steel waste and hazardous waste generated were pro-rata to the number of wells, based on the decommissioning estimate study (Cooper Energy, 2022).
- Emissions from employee commuting considered for fly-in-fly-out (FIFO) workers were based on 3:3 basis (except for once per year during the Operations phase), and included automobile travels up to 100 km.

Table 3-1 shows the input information used for creating a GHG inventory for the East Coast Gas Supply Project. Where options or a range of values exist, the options/values decided by Cooper Energy, or the most conservative values have been used.

*Table 3-1: Model inputs for the East Coast Gas Supply Project over the project life (2025~2049).*

| **GENERAL INFORMATION** | | | | | |
|---|---|---|---|---|---|
| **Number of wells:** | 15 | | | | |
| **Plant operation days/year:** | 342 | | | | |
| **IMR campaign:** | 1/year | | | | |
| **Inspections:** | 6 h/well/year (structural), 2 days/year (pipeline), 28 days/year (survey) | | | | |
| **DEVELOPMENT AND OPERATIONS INFORMATION** | | | | | |
| **For Direct Emissions Estimation:** | | | | | |
| **Phase:** | Survey | Drilling | Installation and Commissioning | Operations | Decommissioning |
| **Duration (cumulative days):** | 105 | 900 | 450 | 27,740 | 900 |
| **Flaring of gas:** | - | 150 MMscf/well | - | 18 MMscf/well intervention | 18 MMscf/well |
| **Flaring of oil:** | - | 40 $m^3$/well | - | - | - |
| **Helicopter frequency:** | - | 8/week | 8/week | - | 8/week |
| **Barges/supply frequency:** | - | - | - | 2/week | - |
| **Vessel requirement*:** | • Survey<br>• Diver support | • MODU<br>• AHTS<br>• Supply<br><br>Inspection:<br>• Supply<br>• ROV/AUV | • Survey<br>• ROV/AUV<br>• Installation and reel-lay<br>• Heavy lift/diver support<br>• Supply | • Supply<br>• IMR<br><br>Inspection:<br>• Supply<br>• ROV/AUV<br>• Installation | • MODU<br>• AHTS<br>• ROV/AUV<br>• Supply<br>• Survey<br>• Installation<br>• Diver support |

| GENERAL INFORMATION | | | | | |
|---|---|---|---|---|---|
| | | | | • Diver support | |
| **For Indirect Emissions Estimation:** | | | | | |
| **Fuel gas (PJ):** | - | - | - | 12 | - |
| **Diesel/Liquid fuel ($m^3$):** | - | 1920 | - | 154 | |
| **Operational flaring and venting (t $CO_2$-e):** | - | - | - | 377,632 | - |
| **Fugitives (t $CO_2$-e):** | | | | 147,730 | |
| **Maximum POB:** | 80 | 200 | 200 | 80 | 150 |
| **FIFO of POB:** | - | 3:3 | 3:3 | - | 3:3 |
| **Purchased goods:** | | | | | |
| **Cement (t):** | - | 2448 | 4,800 | - | 180 |
| **CRA (t):** | - | 936 | - | - | - |
| **Carbon steel (t):** | - | 3744 | 9,855 | - | - |
| **Flowline (km):** | - | - | 23 | - | - |
| **Umbilicals (km):** | - | - | 52.73 | - | - |
| **Manifolds:** | - | - | 5 | - | - |
| **Skids:** | - | - | 5 | - | - |
| **Others (hot-tap tie-in, pressure protection structures, subsea trees, pig launcher/receiver):** | - | - | 23 | - | - |
| **Waste generated:** | | | | | |
| **Structural steel waste (t):** | - | - | - | - | 60,510 |
| **Hazardous waste disposal (USD):** | - | - | - | - | 1,567,125 |

*Vessels transiting within Commonwealth and State jurisdictions considered as direct and indirect emissions respectively.

Table 3-2 shows the indicative project timings, as well as the selected year(s) for the GHG model. Note that these timings are only indicative and used for generating annual emissions profiles. Varying these timings will not significantly impact the GHG emissions estimates.

*Table 3-2: Selected year(s) for GHG model input for annual emissions estimate.*

| | INDICATIVE PROJECT TIMINGS | | | | SELECTED FOR GHG MODEL | | |
|---|---|---|---|---|---|---|---|
| | Development timing | First gas timing | End production timing | P&A and Decommissioning timing | Development year | Production year | P&A and Decommissioning year |
| **Baseline: CHN** | - | - | 2029~2032 | 2029~2037 | - | ~2030 | 2035~2036 |
| **Annie** | 2025~2027 | 2025~2027 | 2030~2033 | 2030~2038 | 2025 | 2025~2032 | 2035 |
| **Juliet** | 2025~2027 | 2025~2027 | 2030~2033 | 2030~2038 | 2025 | 2025~2032 | 2035 |
| **Nestor** | 2025~2027 | 2026~2028 | 2031~2034 | 2031~2039 | 2026 | 2026~2031 | 2034 |
| **Elanora** | 2029~2031 | 2030~2033 | 2038~2042 | 2038~2047 | 2029 | 2030~2039 | 2042~2043 |
| **Henry** | 2029~2031 | 2030~2033 | 2038~2042 | 2038~2047 | 2029 | 2030~2042 | 2045 |
| **Isabella** | 2029~2031 | 2030~2033 | 2038~2042 | 2038~2047 | 2029 | 2030~2042 | 2044 |
| **Pecten East** | 2031~2033 | 2032~2036 | 2040~2044 | 2040~2049 | 2031 | 2032~2044 | 2048 |
| **Heera** | 2031~2033 | 2032~2036 | 2040~2044 | 2040~2049 | 2031 | 2032~2044 | 2046~2047 |

# 4 RESULTS

## 4.1 Direct GHG Emissions

The direct GHG emissions for the East Coast Gas Supply Project are estimated to be 1,099 kt $CO_2$-e over the project life. Figure 4-1(a) shows the emissions generated during each project lifecycle stage and embeds the support operations associated with each stage. Figure 4-1(b) extracts the associated support operations from each life cycle stage and presents these emissions as its own stage alongside the non-vessel related activities. Surveying is not presented in Figure 4-1(b) as all emissions relate to vessel operation.

As presented in Figure 4-1(b), approximately 895 kt $CO_2$-e or around 81% of the direct GHG emissions are attributed to support operations (i.e., use of vessels and MODU), and approximately 204 kt $CO_2$-e or around 19% attributable to Well Construction, Operations and Decommissioning.

The emissions values are considered to be a conservatism estimate. In addition, maximum duration of the activities as well as a weather contingency of 30% have been used in the inventory.

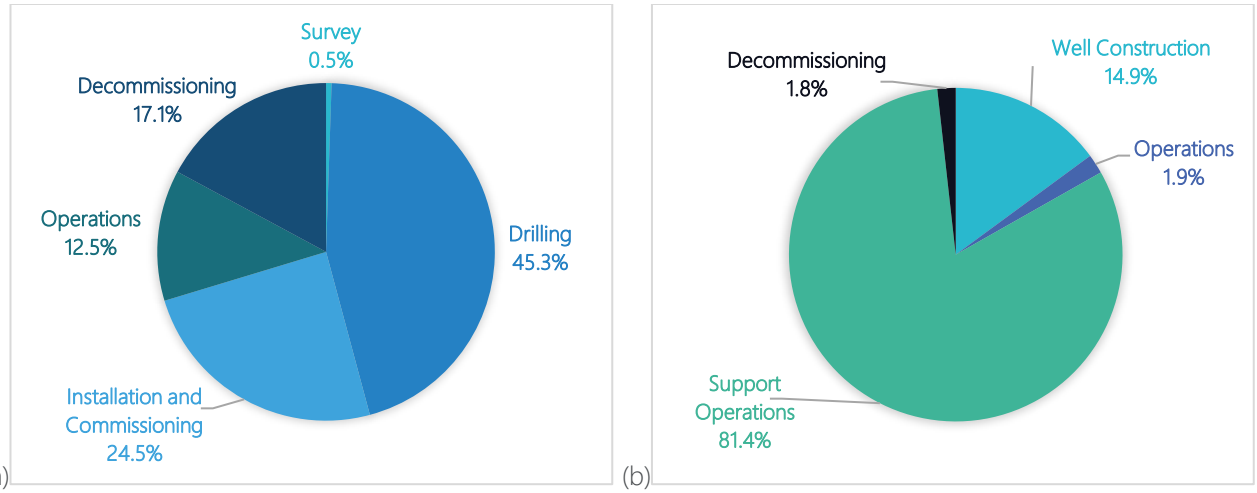



*Figure 4-1: (a) Direct GHG emissions generated during each project lifecycle stage (with support operations embedded in each stage), (b) Direct GHG emissions breakdown into Well Construction, Operations, Decommissioning and Support Operations.*

The indicative annual direct GHG emissions for the East Coast Gas Supply Project are presented in Figure 4-2. The maximum (peak) and average annual emissions are estimated to be approximately 236 kt $CO_2$-e/year and 44 kt $CO_2$-e/year, respectively.

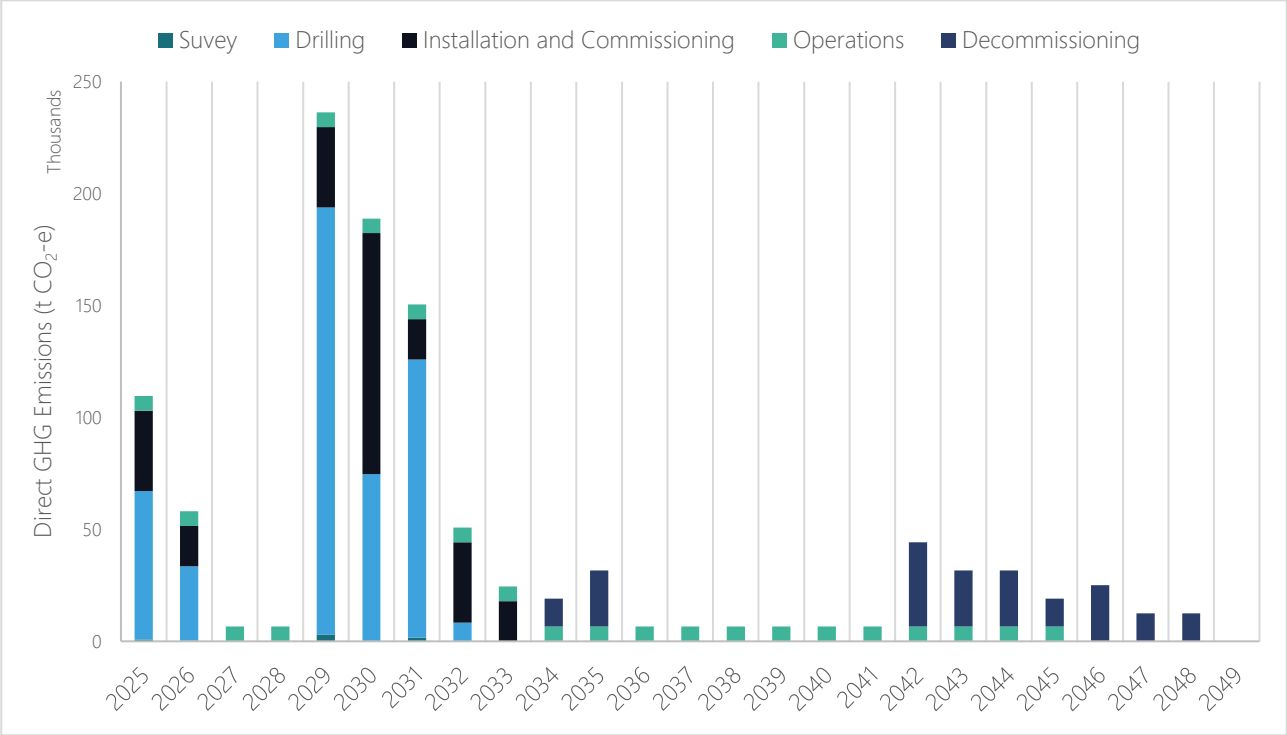



*Figure 4-2: Annual direct GHG emissions by project lifecycle stage (all stages are inclusive of support operations).*

## 4.2 Indirect GHG Emissions

The indirect GHG emissions, excluding downstream indirect GHG emissions, are estimated to be 1,571 kt $CO_2$-e over the project life. As summarised in Figure 4-3, the emissions sources are fuel gas (40.3%), flaring and venting (24.1%), purchased electricity (14.2%), purchase goods and transportation (10.7%), fugitive emissions (9.4%), and others (1.3%).

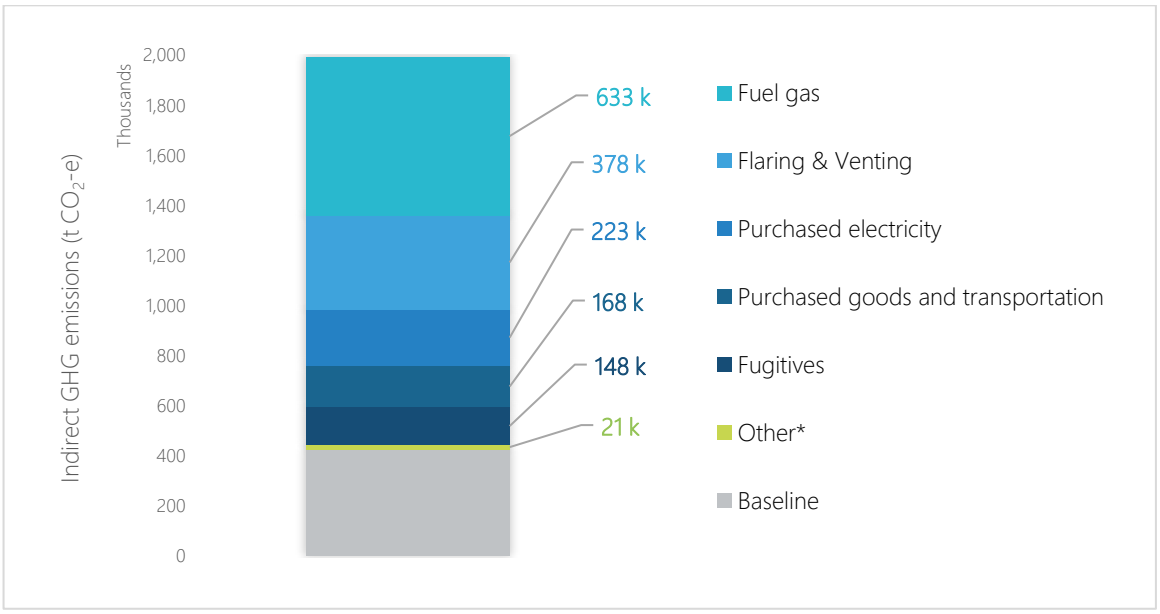



*Figure 4-3: Indirect GHG emissions breakdown by emissions source (*Other indicates vessels within State jurisdiction, liquid fuel, waste generated, and employee commuting).*

Figure 4-4 presents the indicative scope 1 annual emissions for onshore (AGP) gas processing throughout the project life.

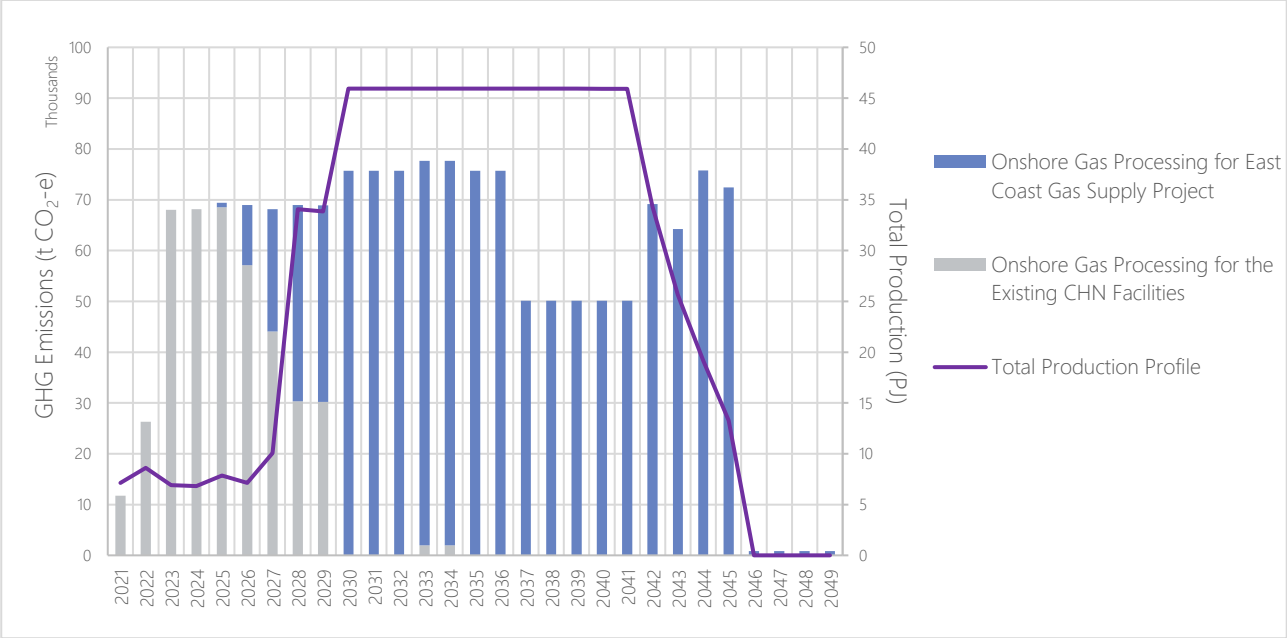



*Figure 4-4: Annual scope 1 emissions profile for onshore (AGP) gas processing.*

## 4.3 Downstream Indirect GHG Emissions

The downstream indirect GHG emissions are estimated to be 38,561 kt $CO_2$-e over the project life. As summarised in Table 4-1, the downstream indirect emissions include 6.5% of emissions from the downstream transportation and distribution and 93.5% of emissions from the combustion of products.

*Table 4-1: Downstream indirect GHG emissions breakdown.*

| | CATEGORY | EAST COAST GAS SUPPLY PROJECT | | BASELINE | TOTAL |
|---|---|---|---|---|---|
| | | t $CO_2$-e | % | t $CO_2$-e | t $CO_2$-e |
| 1 | Downstream transportation and distribution | 2,513,000 | 6.5 | 135,000 | 2,648,000 |
| | Fugitive emissions from natural gas transmission and distribution | 2,513,000 | 6.5 | 135,000 | 2,648,000 |
| | Condensate transportation | <400 | <0.5 | <100 | <500 |
| 2 | Combustion of products | 36,048,000 | 93.5 | 1,930,000 | 37,978,000 |
| | Combustion of gas product | 35,914,000 | 93.1 | 1,919,000 | 37,833,000 |
| | Combustion of condensate product | 134,000 | 0.4 | 11,000 | 145,000 |
| | Total Downstream Indirect GHG Emissions (t $CO_2$-e) | 38,561,000 | - | 2,065,000 | 40,626,000 |

## 4.4 Total GHG Emissions

Table 4-2 summarises the total direct and indirect GHG emissions for the East Coast Gas Supply Project. The direct emissions for the East Coast Gas Supply Project are estimated to be 1,099 kt $CO_2$-e over the project life, and the indirect emissions and downstream indirect emissions are estimated to be 1,571 and 38,561 kt $CO_2$-e, respectively.

*Table 4-2: Total GHG emissions for the East Coast Gas Supply Project.*

| | CATEGORY | EAST COAST GAS SUPPLY PROJECT | | BASELINE | TOTAL |
|---|---|---|---|---|---|
| | | t $CO_2$-e | % | t $CO_2$-e | t $CO_2$-e |
| 1 | Direct GHG emissions | 1,099,000 | 2.7 | 0 | 1,099,000 |
| 2 | Indirect GHG emissions | 1,571,000 | 3.8 | 422,000 | 1,993,000 |
| 3 | Downstream indirect GHG emissions | 38,561,000 | 93.5 | 2,065,000 | 40,626,000 |
| | Total GHG Emissions (t $CO_2$-e) | 41,231,000 | - | 2,487,000 | 43,718,000 |

Figure 4-5 shows the indicative annual total GHG emissions for the East Coast Gas Supply Project over the project life, broken down to the emissions category. The maximum and average annual emissions (inclusive of the baseline) are estimated to be approximately 2,872 kt $CO_2$-e/year and 1,749 kt $CO_2$-e/year, respectively. The associated emissions intensity based on a representative production year (2035) is estimated to be 58 t $CO_2$-e/TJ.

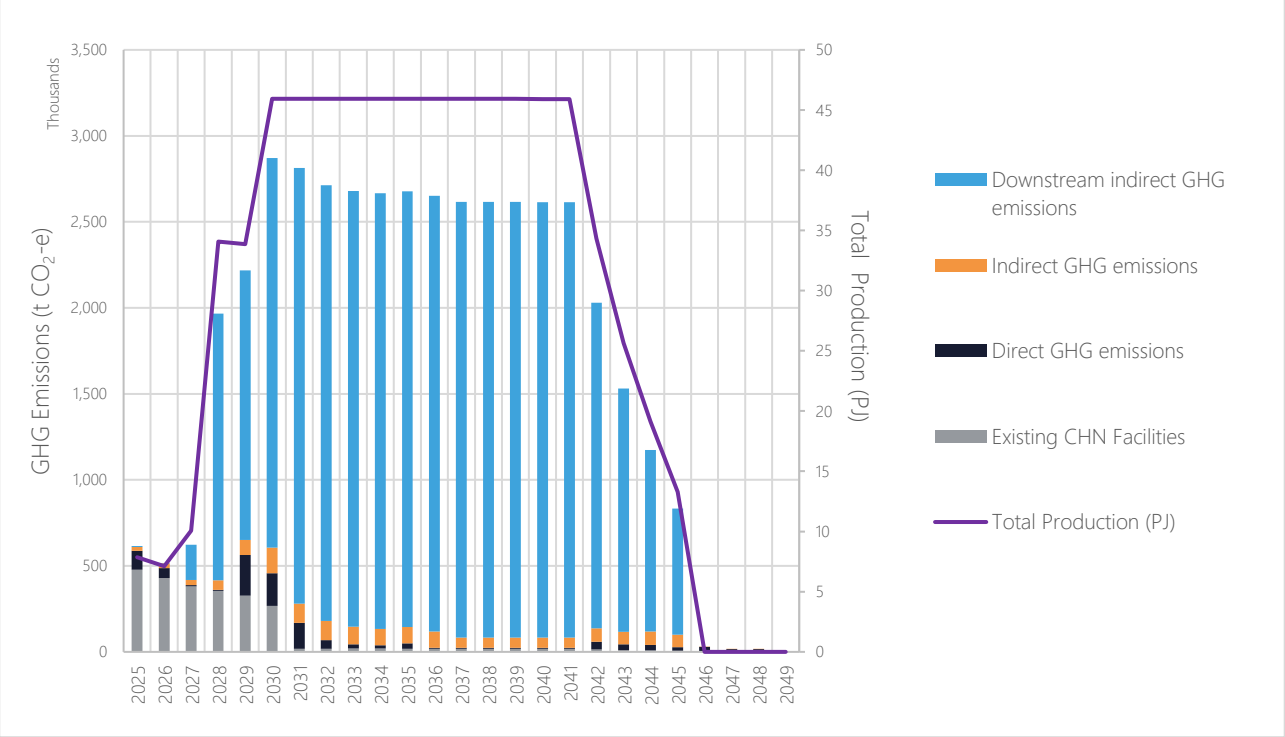



*Figure 4-5: Annual total GHG emissions breakdown by category and production profile forecast.*

# 5 CONCLUSIONS

This technical report presents the GHG emissions inventory for the East Coast Gas Supply Project. The GHG assessment has been conducted to derive the direct, indirect and downstream indirect emissions with the following key points:

- Direct GHG emissions are estimated to be approximately 1,099 kt $CO_2$-e over the project life (2025~2049). These consist of 81% emissions from the support operations (MODU, vessels), and 19% emissions from Well Construction, Operations, and Decommissioning.

- Indirect GHG emissions for the East Coast Gas Supply Project is estimated to be 1,571 kt $CO_2$-e over the project life. These consist of fuel gas (40.3%), flaring and venting (24.1%), purchased electricity (14.2%), purchase goods and transportation (10.7%), fugitive emissions (9.4%), and others (1.3%).

- Downstream indirect GHG emissions are estimated to be approximately 38,561 kt $CO_2$-e over the project life, consisting of 6.5% and 93.5% of the emissions from downstream transportation and distribution and combustion of products respectively.

- Based on a representative production year, the emissions intensity is estimated to be 58 t $CO_2$-e/TJ (inclusive of the baseline).

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