wheatstone project start-up and operations environment plan

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Document information

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Approvals

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1 environment plan summary

This *Wheatstone Project Start-up and Operations Environment Plan Summary* (Table 1-1) has been prepared from material provided in this Environment Plan (EP), and as required by Regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

An EP Summary as required by Regulation 11(7) of the Western Australian Petroleum Pipelines (Environment) Regulations 2012 and the Petroleum (Submerged Lands) (Environment) Regulations 2012 has been prepared as a separate document and submitted to the WA Department of Mines, Industry Regulation and Safety (DMIRS).

Table 1-1: Environment Plan summary

Regulation	EP summary material requirement	Relevant section of the EP
11(4)(a)(i)	the location of the activity	Section 2.2, Section 3.1.1
11(4)(a)(ii)	a description of the receiving environment	Section 4, Ref. 1^
11(4)(a)(iii)	a description of the activity	Section 3
11(4)(a)(iv)	details of environmental impacts and risks	Section 6, Section 7
11(4)(a)(v)	a summary of the control measures for the activity	Section 6, Section 7
11(4)(a)(vi)	a summary of the arrangements for ongoing monitoring of the titleholder's environmental performance	Section 8
11(4)(a)(vii)	a summary of the response arrangements in the oil pollution emergency plan	Section 7.3, Ref. 2*
11(4)(a)(viii)	details of consultation already undertaken, and plans for ongoing consultation	Section 2.6
11(4)(a)(ix)	details of the titleholder's nominated liaison person for the activity	Section 2.4

^ *Available publicly at appendix d*
* *Available publicly at: https://docs.nopsema.gov.au/A748691*

2 introduction

2.1 Overview

Chevron Australia Pty Ltd (CAPL) has prepared this EP to document the assessment and management of potential environmental impacts and risks associated with start-up and operations activities of the Wheatstone Liquefied Natural Gas (LNG) Project (the Project).

The Project produces hydrocarbon fluids from offshore fields, transports these fluids through flowlines to the Wheatstone platform (the platform) for initial processing, and then transports gas and condensate through the trunkline to the onshore gas plant for further processing. Resultant LNG and condensate are exported by vessels to the international market, and gas is available to the domestic market via a tie-in with the existing Dampier to Bunbury Natural Gas Pipeline.

The start-up and operations activities detailed in this EP will be conducted in Commonwealth waters, WA State waters, and on the WA mainland, thus spanning more than one regulatory jurisdiction. This EP has been developed and submitted to the following regulators for assessment under their relevant jurisdictions:

- the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance under the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R)
- the WA DMIRS for approval under the WA Petroleum (Submerged Lands) (Environment) Regulations 2012 (PSLER), and the WA Petroleum Pipelines (Environment) Regulations 2012 (PPER).

2.2 Location

The platform will receive fluids for processing and subsequent transportation to the WA mainland via the trunkline. Fluid production will be from wells located in the Wheatstone (WA-46-L, WA-47-L and WA-48-L) and Iago (WA-46-L and WA-48-L) fields located off the Pilbara coast of WA (Figure 2-1). Additionally, the platform (WA-3-IL) will receive fluids from the Julimar Development Project (JDP) in WA-49-L, located southwest of WA-48-L, as described in the Woodside Energy Julimar Pty Ltd (Woodside) EP (Ref. 4).

Approximate water depths in the offshore licence areas within the scope of this EP are ~150–280 m for the Wheatstone field, and ~70–120 m for the Iago field. The platform is in water ~71 m deep, with centre coordinates of 19° 55′ 45.78″ S and 115° 23′ 02.22″ E.

The trunkline has sections in both Commonwealth waters (WA-25-PL) and State waters (TPL/25): the section from the platform to the State waters boundary, and then from the State waters boundary to the shore crossing through a microtunnel, respectively. The trunkline exits the microtunnel and remains buried onshore for ~1 km before emerging above ground just before (~15 m) the onshore endpoint (defined in Section 2.3) located upstream of the gas plant. Figure 2-2 shows the onshore trunkline section and the surrounding licence area PL 99, which is included in the scope of this EP. The trunkline crosses the shore at Ashburton North, which is ~12 km southwest of Onslow, within the Shire of Ashburton, WA.

The trunkline generally extends along the outer continental shelf at ~110 m isobath, and crosses the shore through a microtunnel at Ashburton North, ~12 km south-west of Onslow on the Pilbara coast. The platform is ~50 km north of the Montebello Islands, while the trunkline is ~46 km west of Barrow Island and the Montebello Islands.

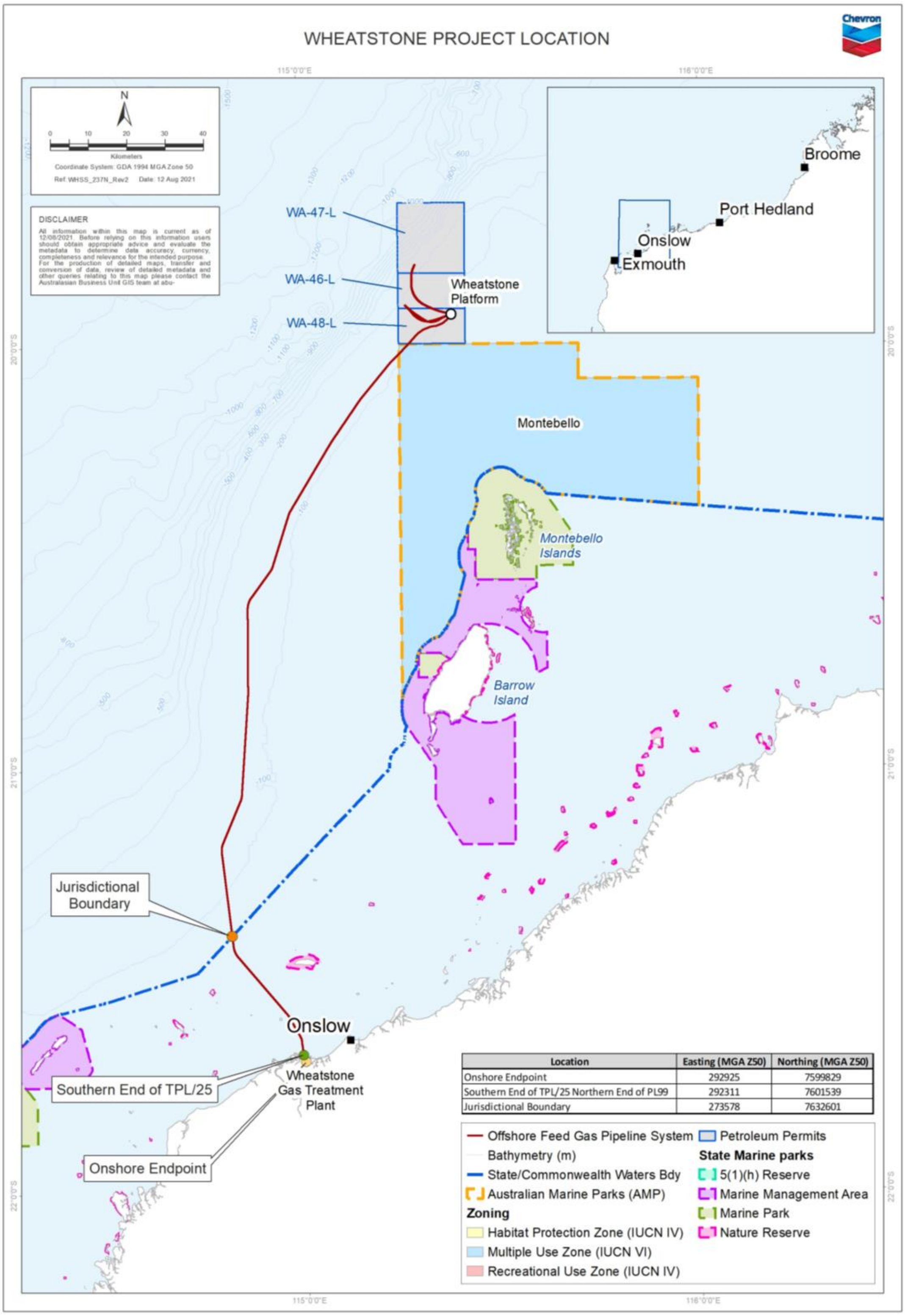


Figure 2-1: Project location

Figure 2-2: Onshore trunkline and licence area

2.3 Scope

2.3.1 In scope

This EP addresses start-up and operations activities associated with the Wheatstone and Iago hydrocarbon system and platform, which comprises:

- the Wheatstone and Iago field wells, trees, manifolds, flowlines, and umbilicals in WA-46-L, WA-47-L and WA-48-L, and all field subsea isolation valves (SSIVs) and flowline/umbilical risers at the platform
- the trunkline, from the platform to the onshore endpoint (WA-25-PL, TPL/25, PL 99)
  - the onshore endpoint is the south-eastern terminus of the petroleum pipeline licence PL99 shown in Figure 2-2, which includes the trunkline and associated infrastructure such as the pig receiver station, flanges, and valves, which are upstream of the gas plant area (as outlined in the licence PL 99)

The Wheatstone and Iago hydrocarbon system and platform are further described in Sections 3.2 and 3.3 respectively.

Specifically, this EP addresses the following activities associated with the Wheatstone and Iago hydrocarbon system and platform:

- start-up and operation of the Wheatstone and Iago hydrocarbon system (Section 3.2)
- start-up and operation of the platform infrastructure and facilities, including remote monitoring and operating from the central control room (CCR),

processing of all production fluids, platform maintenance, and well clean-ups to the platform (Section 3.3)

- inspection, maintenance, and repairs (IMR) of the Wheatstone and Iago hydrocarbon system (Section 3.4)
- long-term planning for decommissioning (Section 3.5)
- field support (Section 3.6)
  - this EP applies to vessels and vehicles directly involved in the petroleum activity once they enter the operational area (OA) until they exit from the OA
  - this EP also applies to helicopters performing petroleum activities at the platform, typically within 500 m.

In addition to fluids received from the Wheatstone and Iago hydrocarbon system, the platform will also receive third-party fluids from other fields, including the JDP field production system (WA-49-L and WA-26-PL). The JDP field production system includes the JDP wells, trees, manifolds, umbilicals and flowlines up to the platform riser inlet points (the flange that connects to the tie-in spool upstream of SSIV5 in Figure 3-1), located ~100 m from the platform and hereafter referred to as the JDP endpoint.

CAPL is not the registered titleholder for WA-49-L and WA-26-PL, and therefore, the JDP field production infrastructure upstream of the JDP endpoint is not included in the scope of this EP (refer to Section 2.3.2). However, the platform riser inlet infrastructure downstream of the JDP endpoint and the processing of JDP fluids on the platform have been considered in this EP. Further information on the operational interface with third-party assets is provided in Section 2.3.3.

2.3.2 Out of scope

The following summarises the facilities and activities that are not covered in the scope of this EP:

- facilities and activities associated with the JDP field production system in titles WA-49-L and WA-26-PL upstream of the JDP endpoint
  - in accordance with Regulation 9(1) of the OPGGS(E)R, Woodside, as titleholder for WA-49-L and WA-26-PL, will submit a separate JDP EP (Ref. 4) to NOPSEMA, addressing the impacts and risks associated with the start-up and operation of JDP field production system
- facilities and activities in WA-49-L and WA-26-PL associated with the gas plant downstream of the trunkline onshore endpoint
- activities associated with drilling and well completion, and well intervention activities for the Wheatstone and Iago wells completed in accordance with the NOPSEMA-accepted *Wheatstone Development Drilling and Completion Program Environment Plan*[1] (Ref. 5)
- activities associated with drilling, well completion, well intervention, and plug and abandonment activities for the Wheatstone and Iago wells which are covered under the NOPSEMA-accepted *Wheatstone Project: Wheatstone Well Intervention and Infill Drilling Environment Plan* (Ref. 6)

[1] Activities under this EP have been completed and the notification of completion has been accepted by NOPSEMA as per the requirements of Regulation 25A of the OPGGS(E)R.

- vessels (including emergency response vessels) transiting to or from the OA; these vessels are deemed to be operating under the Commonwealth *Navigation Act 2012* and not performing a petroleum activity
- end of facility life (EOFL) decommissioning and removal of infrastructure; these activities are not scheduled to occur within the 5-year in-force period of this EP (refer to Section 3.5.1).

2.3.3 Operational interface with third-party assets

A contract for services has been entered between CAPL as operator of the platform (WA-3-IL) and trunkline (WA-25-PL, TPL/25, PL99), and Woodside Energy Julimar Pty Ltd (Woodside) as operator of the Julimar-Brunello field (WA-49-L) and associated petroleum pipelines and flowlines (WA-26-PL) (collectively known as the JDP field production system). The contract regulates the operational interface between the JDP field production system and the platform by specifying field operating services, emergency response arrangements and communication and reporting requirements between CAPL and Woodside.

Under this contract for services, CAPL provides field operating services from the platform to Woodside which are necessary for the recovery of production fluids from the JDP field production system. The field operating services include, among other matters, operation and maintenance services for the JDP field production system from the platform. This includes operation and maintenance services for JDP subsea field infrastructure, wells, well jumpers, subsea wellheads, subsea manifolds, umbilicals and terminations, flowlines and subsea trees upstream of the JDP field production system endpoint. The contract also provides for Woodside to conduct vessel-based inspection, maintenance and repair of the JDP subsea field infrastructure. CAPL services provided under the contract include, for example:

- operation of all field production system controls, valves, chokes and safety devices and monitoring of all the field production system sensors, alarm and instrument data as required by manuals provided by Woodside and consistent with general direction given by Woodside
- operation of all safety shutdown devices
- performing inspections and tests related to the field production system in accordance with applicable laws and regulations
- integrity and production testing of the field production system, including the subsea trees and system valves, downhole safety valves and the opening of surface controlled subsurface safety valves (SCSSV) and SSIVs, as well as the testing of SCSSVs and SSIVs and monitoring and control of the SSIVs through the platform emergency shutdown system
- performing well tests (including pressure build-up tests and blowdown operations), monitoring well parameters and adjusting normal well parameters in accordance with Woodside’s operating manuals and applicable Wheatstone Platform manuals
- performing visual inspection of piping and equipment associated with the field production system and the route of the field production system at time intervals prescribed by applicable regulations.

CAPL will be given control of the JDP wells for the purpose of providing field operating services. Control of specific JDP wells will be transferred back to

Woodside during well workovers/interventions and internal well work. Handover of control of the field production system or individual wells is undertaken according to a handover process between CAPL and Woodside, which involves confirming the status of the wells and infrastructure, and the transfer of relevant records and test results (with a handover certificate) to ensure system integrity is appropriately maintained.

In the addition to the above field operating services, CAPL also provides emergency response and maintenance services to Woodside and has agreed associated communication and reporting requirements.

Under the contract, Woodside retains commercial responsibility for all field production system operations that are not performed by CAPL from or on the platform facility or which are not included in the field operating services provided by CAPL above.

These commercial arrangements do not alter the statutory obligations and responsibilities of the parties pursuant to the OPGGS Act and OPGGS(E)R.

2.3.3.1 Other third-parties

Over the life of the Project, other third-party drill centres may also deliver well production fluids to the platform. Should this occur, similar field operating agreements are expected to be implemented and associated activities and risks will be addressed in a separate EP or may trigger a review of this EP in accordance with Regulation 17 of the OPGGS(E)R.

2.4 Titleholder details

The titleholder details and nominated liaison person for this EP are listed in Table 2-1 and Table 2-2, respectively. Notification of change in details of a titleholder, liaison person, or contact information will be submitted to the relevant regulator via the appropriate means and timeframes specified in the regulations, in accordance with Section 8.3.2.2.

Table 2-1: Titleholder details

<table>
<tr><th>Titles</th><th>Details</th><th>Titleholders</th><th>Nominated Titleholder</th><th>Address</th></tr>
<tr><td colspan="5">Commonwealth</td></tr>
<tr><td>WA-3-IL</td><td>Infrastructure Licence (Platform)</td><td rowspan="2">Chevron Australia Pty Ltd
Woodside Energy Julimar Pty Ltd
PE Wheatstone Pty Ltd
Kufpec Australia (Julimar) Pty Ltd
Kufpec Australia (Wheatstone Iago) Pty Ltd
Kyushu Electric Wheatstone Pty Ltd</td><td rowspan="2">Chevron Australia Pty Ltd

(ACN: 081 647 047)</td><td rowspan="2">250 St Georges Terrace Perth, WA, 6000</td></tr>
<tr><td>WA-25-PL</td><td>Pipeline Licence (Trunkline–Commonwealth waters)</td></tr>
<tr><td>WA-46-L</td><td>Production Licence</td><td rowspan="2">Chevron Australia Pty Ltd
PE Wheatstone Pty Ltd</td><td rowspan="2">Chevron Australia Pty Ltd</td><td rowspan="2">250 St Georges Terrace Perth, WA, 6000</td></tr>
<tr><td>WA-47-L</td><td>Production Licence</td></tr>
</table>

Titles	Details	Titleholders	Nominated Titleholder	Address
		Kyushu Electric Wheatstone Pty Ltd	(ACN: 086 197 757)	
WA-48-L	Production Licence	Chevron Australia Pty Ltd Kufpec Australia (Wheatstone Iago) Pty Ltd PE Wheatstone Pty Ltd Kyushu Electric Wheatstone Pty Ltd	Chevron Australia Pty Ltd (ACN: 086 197 757)	250 St Georges Terrace Perth, WA, 6000
State				
TPL/25	Pipeline Licence (Trunkline–State waters)	Chevron Australia Pty Ltd Kufpec Australia (Julimar) Pty Ltd Kyushu Electric Wheatstone Pty Ltd PE Wheatstone Pty Ltd Kufpec Australia (Wheatstone Iago) Pty Ltd Woodside Energy Julimar Pty Ltd	Chevron Australia Pty Ltd (ACN: 081 647 047)	250 St Georges Terrace Perth, WA, 6000
PL 99	Pipeline Licence (Trunkline–State onshore)			

Table 2-2: Nominated liaison person

Name	Michael Stogner / Asten Roopra (public contact)
Company	Chevron Australia Pty Ltd
Position	Wheatstone Operations Manager / Corporate Affairs Partnerships Advisor
Business address	250 St Georges Terrace, Perth WA, 6000
Telephone number	+61 8 9216 4000
Email	ABUEnvPlanInfo@chevron.com

2.5 Environmental management framework

CAPL's operations are managed in accordance with Chevron Corporation's Operational Excellence Management System (OEMS), which is described in Section 8.

2.5.1 Environmental policy

CAPL's commitment to environmental management in all aspects of operations is documented in Chevron Corporation's Operational Excellence (OE) Policy 530 (appendix a).

2.5.2 Legislative framework

The Commonwealth and State legislative framework relevant to the petroleum activities covered in this EP are summarised in Table 2-3 and Table 2-4 respectively. Standards, guidelines, international conventions, and agreements relevant to the petroleum activities are described in Table 2-5 and Table 2-6.

Table 2-3: Commonwealth legislative requirements

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Australian Maritime Safety Authority Act 1990	Aims to promote maritime safety, protect the marine environment from pollution from ships or other environmental damage caused by shipping, and provide for a national search and rescue service	Requirements include the involvement of the Australian Maritime Safety Authority (AMSA) in response to relevant spill events	Roles and responsibilities are described in the Oil Pollution Emergency Plan (OPEP) (Ref. 2).
Biosecurity Act 2015 Biosecurity Regulations 2016	Provides biosecurity protection in Australian waters beyond territorial limits	Pre-arrival information must be reported through the Maritime Arrivals Reporting System (MARS) before arrival in Australian waters	Section 6.4.8
		Australian Ballast Water Management Requirements (Ref. 7)	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) EPBC Regulations 2000	Provides for the protection and management of nationally and internationally important flora, fauna, ecological communities, and heritage places	The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these protected matters	Section 4, Section 6, and Section 7
		EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans	Section 6.4.2, and Section 6.4.7
		Injury or fatality caused to EPBC-listed fauna shall be reported	Section 8.4.2
		The Wheatstone Project was approved under EPBC Act and is subject to approval conditions. The conditions are intended for the management of the Wheatstone Project as a whole, including activities which are beyond the scope of this EP.	Where relevant, control measures and reporting requirements are consistent with requirements of EPBC 2008/4469 Section 6, and Section 7
Navigation Act 2012	Provides for vessel and seafarer safety,	Notice to Mariners	Section 6.4.1, and Section 7.2

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
	and marine pollution prevention		
Navigation Act 2012 *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* Various marine orders	Gives effect to the requirements under the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) in Australia	Marine order 30—Prevention of collisions	Section 7.2
		Marine order 91—Marine pollution prevention—oil	Section 6.4.9, Section 6.4.11, and Section 7.2
		Marine order 95—Marine pollution prevention—garbage	Section 6.4.9, Section 6.4.10
		Marine order 96—Marine pollution prevention—sewage	Section 6.4.9
		Marine order 97—Marine pollution prevention—air pollution	Section 6.2.2
		Marine order 98—Marine pollution prevention—anti-fouling systems	Section 6.4.8
National Greenhouse and Energy Reporting Act 2007 (NGER Act)	The NGER Act establishes the national scheme for the reporting of greenhouse gas emissions, energy production and energy consumption.	Greenhouse gas emissions, energy consumption and energy production from the platform will be reported under the NGER Act.	Section 6.2.3, and Section 6.4.5
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) OPGGS Environment Regulations 2009 (OPGGS(E)R)	The OPGGS(E)R under the OPGGS Act requires a titleholder to have an accepted EP in place prior to commencement of a petroleum activity The regulations ensure petroleum activities are undertaken in an ecologically sustainable manner in accordance with an EP	An EP for a petroleum activity must be accepted by NOPSEMA before activities commence	This EP, including the OPEP (Ref. 2) and Operational and Scientific Monitoring Plan (OSMP) (Ref. 3)
OPGGS (Resource Management and Administration) Regulations 2011	These regulations require a titleholder to have an accepted Well Operations Management Plan (WOMP) in place The purpose of a WOMP is to ensure systems are in place	A WOMP for a petroleum well activity must be accepted by NOPSEMA before activities commence	WOMP (Ref. 8)

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
	to manage well integrity and well activities.		
Underwater Cultural Heritage Act 2018	Provides protection for shipwrecks, sunken aircraft and other cultural heritage sites in Australian waters	Identification of the presence of protected cultural heritage sites and assessment of any impacts and risks to these sites	Section 4, Section 6, and Section 7

Table 2-4: Summary of applicable State legislation

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Biodiversity Conservation Act 2016 Biodiversity Conservation Regulations 2018	Provides for the conservation and protection of biodiversity and biodiversity components in Western Australia	The EP must describe matters protected under the BC Act and assess any impacts and risks to these protected matters	Section 4, Section 6, and Section 7
Environmental Protection Act 1986 (EP Act)	Provides for the prevention, control, and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement, and management of the environment	The Project was assessed through the EIS/ERMP assessment process under the EP Act and was approved by the WA Minister for Environment on 30 August 2011 by way of Ministerial Statement 873 (MS 873) The conditions are intended for the management of the Wheatstone Project as a whole, including activities which are beyond the scope of this EP.	Where relevant, control measures and reporting requirements are consistent with requirements of MS 873 Section 6, and Section 7
Petroleum Pipelines Act 1969 PPER 2012	The PPER under this Act require an operator to have an accepted EP in place for any petroleum pipeline activity on State land	An EP for a petroleum activity must be accepted by DMIRS before activities commence	This EP, including the OPEP (Ref. 2), and OSMP (Ref. 3)
Petroleum (Submerged Lands) Act 1982 PSLER 2012	The PSLER under this Act require an operator to have an accepted EP in place for any petroleum	An EP for a petroleum activity must be accepted by DMIRS before activities commence	This EP, including the OPEP (Ref. 2), and OSMP (Ref. 3)

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
	activity in State waters The regulations ensure petroleum activities are undertaken in an ecologically sustainable manner in accordance with an EP		
Pollution of Waters by Noxious Substances Act 1987	Protects State waters and other waters under WA jurisdiction from pollution by oil and noxious substances	This Act gives effect to MARPOL 73/78 Annex I and II and sets measures to respond to spills	Section 6.4.9, Section 7.2, and OPEP (Ref. 2)

Table 2-5: Standards and guidelines

Standard / guideline	Description
Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Ref. 9)	International Maritime Organization (IMO) guidelines for global management of biofouling. This guideline requires a biofouling management plan and record book to be available and maintained.
National Light Pollution Guidelines for Wildlife, including Marine Turtles, Seabirds and Migratory Shorebirds (Ref. 10)	Outlines the process to be followed where there is the potential for artificial lighting to affect wildlife; applies to new projects, lighting upgrades and where there is evidence of wildlife being affected by existing artificial light.
Methane Guiding Principles (Ref. 309)	The Methane Guiding Principles are a voluntary, international multi-stakeholder partnership between industry and non-industry organisations. It has a focus on reducing methane emissions across the natural gas supply chain, from production to final customer. There are a number of best practice guides, including flaring, venting, equipment leaks, and continual improvement. Chevron Corporation is a signatory (i.e., a company with direct responsibility for the management of methane within its business activities) to the Methane Guiding Principles.
OGCI *Aiming for Zero Methane Emissions Initiative* (Ref. 310)	The approach of the Aiming for Zero Methane Emissions Initiative includes to "strive to reach near zero methane emissions from our operated oil and gas assets by 2030", and to "put in place all reasonable means to avoid methane venting and flaring, and to repair detected leaks, while preserving the safety of people and the integrity of operations" (Ref. 310). This initiative is meant as a supplement to the multi-stakeholder initiatives such as the Methane Guiding Principles. Chevron Corporation is a signatory to the Aiming for Zero Methane Emissions Initiative.
Accelerating action: an SDG Roadmap for the oil and gas sector (Ref. 312)	Chevron Corporation is a corporate member of IPIECA. Through membership in IPIECA, Chevron Corporation worked with the World Business Council for Sustainable Development on the creation of a Sustainable Development Goal (SDG) Roadmap for the oil and gas sector ("Roadmap"). The Roadmap identifies how IPIECA, as an

Standard / guideline	Description
	industry association, and individual oil and gas companies working within the sector, can work toward a lower-emissions future while contributing to a healthier and more prosperous world aligned with the 2030 Agenda for Sustainable Development. The Roadmap identifies 10 SDGs as priority areas where the sector has the most influence or ability to respond to societal needs.

Table 2-6: International agreements and conventions

Convention / agreement / code of practice	Applicability to the petroleum activity
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Ref. 11)	Provides a framework for water resource management, and states specific water quality guidelines for environmental values and the context within which they should be applied.
International Convention for the Prevention of Pollution from Ships (MARPOL)	Designed to reduce pollution of the marine environment from ships, including operational discharges (e.g., sewage, oil, garbage, air emissions) and accidental causes. MARPOL currently includes six technical Annexes. MARPOL is enacted in Australia through the Commonwealth *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and the *Navigation Act 2012*.
International Convention for the Control and Management of Ships' Ballast Water and Sediments	Aims to prevent the introduction of marine organisms to new regions and environments. Australia is party to the convention and has developed the *Australian Ballast Water Management Requirements* (Ref. 7) consistent with the requirements of the Convention. The Australian Ballast Water Management Requirements are enforceable under the Commonwealth *Biosecurity Act 2015*.
Convention of the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention)	This convention aims to improve the status of all threatened migratory species by national action and international agreements between range states. Species covered by these agreements are subject to protection under the EPBC Act.
Bilateral migratory bird agreements: • Japan–Australia Migratory Bird Agreement (JAMBA) • China–Australia Migratory Bird Agreement (CAMBA) • Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)	These agreements recognise international concern for the protection of migratory birds and birds in danger of extinction. Species covered by these agreements are subject to protection under the EPBC Act.

2.6 Stakeholder consultation

2.6.1 Methodology

CAPL followed the following process to undertake consultation for this petroleum activity:

- identify relevant stakeholders
- provide sufficient information to enable stakeholders to understand how this activity may affect their functions, interests, or activities
- assess the merit of any objections or claims raised by the stakeholders

- provide a response to the objection or claim, and ensure this is captured in the EP.

This methodology was developed with guidance sourced from:

- NOPSEMA's *Environment plan decision making* guideline (Ref. 12)
- NOPSEMA's *Consultation with Commonwealth agencies with responsibilities in the marine area* guideline (Ref. 13)
- NOPSEMA's *Considerations for five-year environment plan revisions* information paper (Ref. 14)
- DMP's *Guideline for the development of petroleum and geothermal environment plans in Western Australia* (Ref. 15)
- Australian Petroleum Production and Exploration Association's (APPEA's) draft *Stakeholder Consultation and Engagement Principles and Methodology for Environment Plans* (Ref. 16).

A process for ongoing consultation is described in Section 2.6.5.

2.6.2 Identification of relevant stakeholders

Establishing relevance under the OPGGS(E)R, PSLER, or the PPER depends on the nature and scale of the petroleum activity and its associated impacts and risks.

A 'relevant person' is defined as:

- each department or agency of the Commonwealth to which the activities to be carried out under the EP, or the revision of the EP, may be relevant
- each department or agency of a State or the Northern Territory to which the activities to be carried out under the EP, or the revision of the EP, may be relevant
- the department of the responsible State Minister, or the responsible Northern Territory Minister
- a person or organisation whose functions, interests, or activities may be affected by the activities to be carried out under the EP, or the revision of the EP
- any other person or organisation that the titleholder considers relevant.

With regards to Commonwealth agencies, advice provided in the NOPSEMA guideline (Ref. 13) has been taken into consideration in identifying relevance with respect to the activities provided for in this EP.

To facilitate successful stakeholder interaction appropriate to the nature and scale of the activities under the EP, CAPL have adopted the approach that there must be a direct connection between the activities that the EP provides for and the potential effect to the functions, interests, or activities of a department, person, or organisation. Based on the impact and risk assessments undertaken in this EP, CAPL understands that the impacts of the planned activities are limited to the vicinity of the OA, thus persons or organisations directly connected with functions, interests, or activities within the OA have been taken to be relevant.

CAPL acknowledges that the EP also includes a risk assessment for two emergency events (unplanned releases from a vessel collision or major defect) that have the potential to effect areas extending beyond the OA. In the event of an emergency event occurring, additional stakeholder consultation would be undertaken in accordance with Section 2.6.5.1.Since commencing the Project, CAPL has developed and maintained a list of stakeholders who are considered relevant. CAPL engaged with stakeholders in 2014/2015 before commencing start-up and operations activities associated with the Project and submission of the original version of this EP. This list has been reviewed to ensure that any new 'relevant person' is also included in the stakeholder consultation process as part of this current 5–year revision to the EP. For this 5–year EP revision, CAPL have also elected to use the Western Australian Fishing Industry Council's (WAFIC) oil and gas consultation service to help determine relevant commercial fisheries and fishers as well as review and distribute fishery-specific consultation material. The relevant stakeholders identified for consultation as part of this EP are listed in Table 2-7.

Table 2-7: Relevant stakeholders

Group	Stakeholder
Commonwealth departments or agencies	• Australian Fisheries Management Authority (AFMA) • Australian Hydrographic Office (AHO) • Australian Maritime Safety Authority (AMSA) • Department of Agriculture, Water and the Environment (DAWE) – Biosecurity – Fisheries • Department of Defence / Border Force
State departments or agencies	• Department of Biodiversity, Conservation and Attractions (DBCA) • Department of Primary Industries and Regional Development (DPIRD) • Department of Transport (DoT) • Department of Mines, Industry Regulation and Safety (DMIRS)
Commonwealth fisheries (peak bodies)	• Australian Southern Bluefin Tuna Industry Association • Commonwealth Fisheries Association • Tuna Australia • Western Australian Fishing Industry Council (WAFIC) • Pearl Producers Association • Bilyara Holdings Mackerel Area 2 License Holder
Commercial fisheries	• West Coast Deep Sea Crustacean • Mackerel Managed Fishery (Area 2) • Onslow Prawn Managed Fishery • Pilbara Crab Managed Fishery • Pilbara Line Fishery • Pilbara Trap Managed Fishery • North West Slope Trawl Fishery • Western Tuna and Billfish Fishery
Recreational fisheries	• RecFishWest • Marine Tourism WA • Ashburton Anglers • Apache Charters • Blue Juice Charters • Blue Lightning Fishing Charters

Group	Stakeholder
	• Mahi Charters • Exmouth Deep Sea Fishing • Western Boat Charters (formerly Heron Charters) • Montebello Island Safaris • Pelican Charters • Point Samson Charters • Top Gun Charters • Exmouth Game Fishing Club • Nickol Bay Sport Fishing Club • Onslow Visitor Centre • Port Hedland Game Fishing Club
Other petroleum operators	• Santos Ltd • Woodside Burrup Pty Ltd • Eni Australia Ltd
Emergency response	• AECOM • Australian Marine Oil Spill Response Centre • Gorgon HSE / Emergency Management Specialists • DoT Oil Spill Response Coordination Unit • Oil Spill Response Limited • BMT • GHD • Cleanaway • Port Authorities
Aboriginal	• Buurabalayji Thalanyji Aboriginal Corporation (BTAC) • Robe River Kuruma Aboriginal Corporation • Wirrawandi Aboriginal Corporation RNTBC Native Title body for Yaburara and Coastal Mardudhunera Aboriginal Corporation (YACMAC) • Yamatji Marlpa Aboriginal Corporation
Local	• Shire of Ashburton • Onslow Chamber of Commerce and Industry • Onslow Community Reference Group • Onslow Salt

2.6.3 Provision of material

Stakeholders must be provided with sufficient information to enable them to understand how a petroleum activity may affect their functions, interests, or activities.

CAPL sent a detailed fact sheet to stakeholders between May and August 2021—this fact sheet summarised the activity, aspects, and the proposed control measures to manage impacts and risks. Where further time was required to determine appropriate stakeholder contact details, an additional round of engagements was conducted on 28 July 2021 with two Aboriginal representative bodies and Onslow Salt.

WAFIC was also used to convey a factsheet, tailored for the commercial fishing sector during May 2021. Given WAFIC is the peak industry body representing commercial fisheries in WA, their review and advice on the factsheet is therefore considered by CAPL as assurance that the factsheet provided sufficient information to the fishery stakeholders.

A copy of the consultation materials is included in appendix b.

The content of the factsheet focussed on the continued presence of the Wheatstone and Iago infrastructure and the ongoing vessel operations to support IMR activities. Given that IMR schedules within this EP are determined using a risk-based approach, specific details on frequency and duration of vessel activity could not accurately be supplied as part of this initial material. However, Section 2.6.5 describes the process for ongoing consultation, including the triggers for when additional consultation in relation to specific IMR activities will occur. The same assessment and response process applies to any objections and claims received during ongoing consultation (Section 2.6.5) as it does for stakeholder consultation undertaken during the preparation of this EP.

All records and responses from relevant persons were included in a sensitive information report provided separately to NOPSEMA and DMIRS to preserve the privacy of those persons or organisations consulted. Specifically, these records and responses were considered to contain personal information (as defined by the Commonwealth *Privacy Act 1988*) or information that at the request of the relevant persons are not to be published as per Regulation 11(A) of the OPGGS(E)R.

2.6.4 Assessment and response

No objections or claims about adverse impacts relating directly to the petroleum activities covered in this EP were raised by relevant stakeholders during previous (2014/2015) or recent (2021) consultation.

A record of all consultation undertaken specifically for this activity is included in the stakeholder engagement log, which has been provided in the sensitive information report sent separately to NOPSEMA and DMIRS.

2.6.5 Ongoing consultation

The stakeholder notifications and ongoing consultation required for this petroleum activity is captured in Table 2-8.

Any objections or claims arising from ongoing consultation that have merit and have the potential to result in changes to the description of environment, impact or risk assessment, or control measures, will be subject to CAPL's Management of Change (MoC) process, in accordance with Section 8.3.2.2.

Table 2-8: Notifications and ongoing consultation

Stakeholder	Notification or ongoing consultation requirement	Timing	Frequency
Notifications			
AHO	Provide information to enable promulgation of Notice to Mariners Notify AHO via datacentre@hydro.gov.au	At least four working weeks before commencing activities or as otherwise agreed with AHO	As required
AMSA	Provide information to enable promulgation of radionavigation warnings Notify AMSA's JRCC via rccaus@amsa.gov.au	24 to 48 hours before commencing activities or as otherwise agreed with AMSA	As required

Stakeholder	Notification or ongoing consultation requirement	Timing	Frequency
	(phone: 1800 641 792 or +61 2 6230 6811)		
Ongoing consultation			
WAFIC	To inform of changes to activities or impacts/risks occurring that may affect fisheries Notify WAFIC via oilandgas@wafic.org.au	Prior to new or significant changes to activities or impacts/risks occurring	As required
		Regular project updates provided that includes any upcoming scheduled IMR activities	Biannual
		Prior to any major repairs from an unplanned event	As required
Interested parties, potentially affected parties, government agencies including: • DNP • DMIRS	CAPL to advise of any new or significant changes to activities or impacts/risks within the scope of the EP, following an evaluation as per Section 8.3.2.2, that may potentially impact marine users	Prior to new or significant changes to activities or impacts/risks occurring	As required

2.6.5.1 Stakeholder consultation in the event of an emergency

In the event of an emergency spill event, CAPL will immediately conduct oil spill trajectory modelling using the actual inputs associated with the spill event to predict trajectory, as described in the OPEP (Ref. 2).

Once oil spill trajectory modelling is completed, CAPL will start engaging with potentially affected stakeholders (those considered relevant from Table 2-7 and any others identified from the oil spill trajectory modelling). The process for reaching out to these stakeholders includes direct contact (phone or email) or indirect contact via the CAPL website.

3 description of the petroleum activity

3.1 Overview

Offshore infrastructure will produce and transport fluids (comprising gas, condensate, and produced water) from the subsea wells to the platform via subsea flowlines. The gas and condensate are dehydrated and dewatered at the platform, and then the dry gas and condensate are routed through the trunkline to the onshore endpoint.

The description of the petroleum activity is presented in the following sections:

- start-up and operation of the hydrocarbon system—includes the infrastructure (wells, flowlines, and trunkline) used for gathering and transporting hydrocarbon to the platform and the onshore end point; and other supporting infrastructure (umbilicals, pipelines, etc.) (Section 3.2)
- start-up and operation of the platform—includes various hydrocarbon processing and utility systems, as well as accommodation facilities, central control room (CCR), and helideck (Section 3.3)
- IMR—undertaken to ensure the integrity of the hydrocarbon system (Section 3.4)
- decommissioning— long-term planning for decommissioning of redundant infrastructure (Section 3.5)
- field support—includes the use of platform supply vessels, IMR vessels, and helicopters for personnel transfers (Section 3.6).

3.1.1 Operational area

The location of the petroleum activities are described in Section 2.2 and shown in Figure 2-1 and Figure 2-2.

The OA for the petroleum activity is defined as the petroleum titles (WA-46-L, WA-47-L, WA-48-L, WA-3-IL, WA-25-PL, TPL/25, PL 99) plus a 200 m wide corridor centred over the trunkline within Commonwealth and State waters. It is within this OA that the petroleum activity defined within Section 3 of this EP will be undertaken.

3.1.2 Timing

CAPL is currently operating the Wheatstone and Iago hydrocarbon system and platform, which is expected to be operational for ~30 years. IMR activities may occur at any time during operations. Activities covered by this EP can occur 24 hours a day and 7 days a week.

Any introduction of new reservoir fluids from third-party fields to the system will include a start-up phase expected to last between approximately six months and two years from the time fluids are produced from the wells. This timing and duration is indicative, dependent, in part, on success of well-start up and onshore facilities' demands, and thus is subject to change.

3.2 Hydrocarbon system

3.2.1 Infrastructure

The hydrocarbon system includes the infrastructure for gathering and transporting hydrocarbons from the offshore production wells to the platform for processing, and then transferring the hydrocarbons to the onshore endpoint via the trunkline (Figure 3-1).

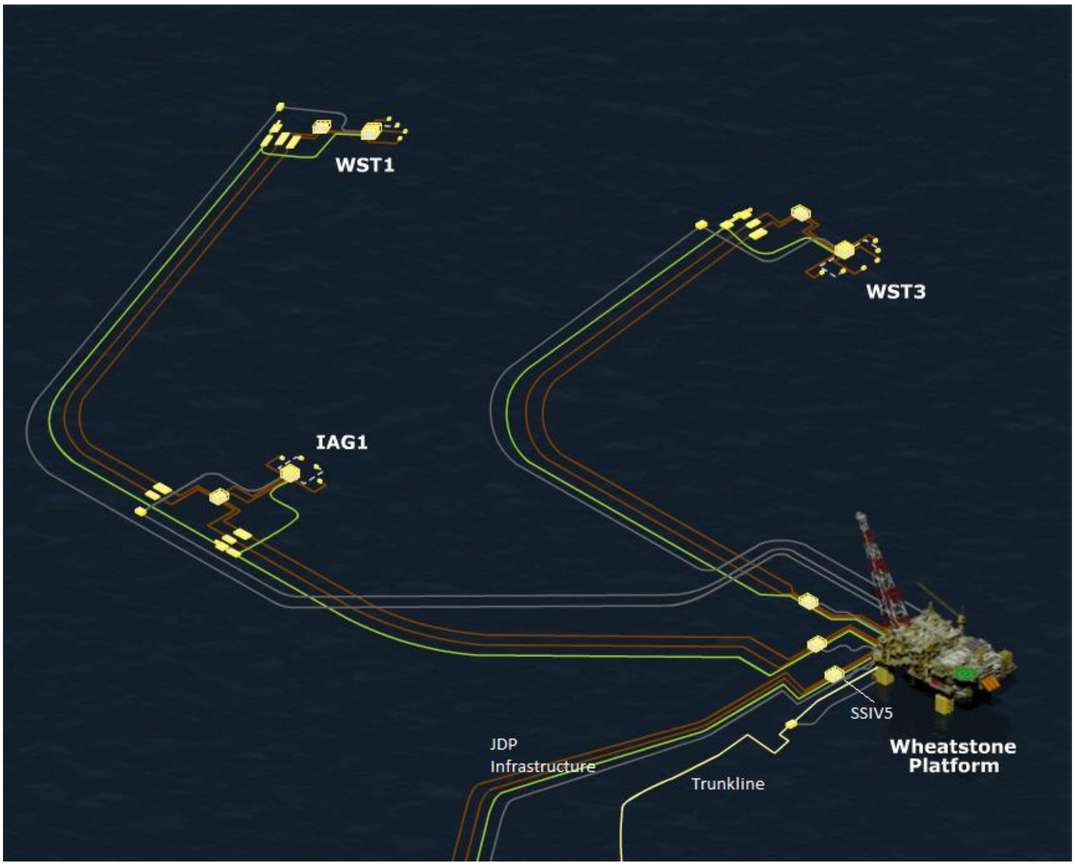


Figure 3-1: Schematic layout

3.2.1.1 Wells and trees

The Project involves a phased development of the drill centres. To deliver targeted production rates during the early years of operations, production occurs from nine Wheatstone and Iago wells (from the three drill centres WST-1, WST-3, IAG-1).

Each well includes a subsea tree structure connected to a central manifold structure in each drill centre. The operation and monitoring of the Wheatstone and Iago wells and trees are described further in Section 3.2.2.1.

The Wheatstone and Iago subsea well design includes a permanent downhole gauge to facilitate the downhole measurement of pressure and temperature, and a downhole safety valve. The subsea wells system comprise a tubing head spool, and a tree including the subsea control module.

Note: Although the production wells are described here, the construction of these wells and the installation of christmas trees and associated infrastructure are outside the scope of this EP (Section 2.3.2).

3.2.1.1.1 Environment Plan interface and well custody

When the Wheatstone and Iago wells are under the custodianship of the Wheatstone Operations work group, the wells will be operated and managed in accordance with this EP. However, if a well integrity event occurs, the custodianship will be handed over to the ABU Wells work group and activities completed in accordance with the NOPSEMA-accepted *Wheatstone Project: Wheatstone Well Intervention and Infill Drilling Environment Plan* (Ref. 6). Figure 3-2 shows the handover points when internal custodianship of the Wheatstone and Iago production wells are exchanged.

When the JDP wells are under the field operating services control of the Wheatstone Operations work group, the wells will be operated and managed in accordance with this EP. However, if a well integrity event occurs, the custodianship will be handed over to Woodside (as per contractual arrangements for third-party assets; Section 2.3.3).

The well custodian is the work group that most recently took control of the well by signing the well handover (or equivalent) certificate. The work group taking custody will be provided with a complete set of 'as-built' and 'as-left' well details as per the well handover document.

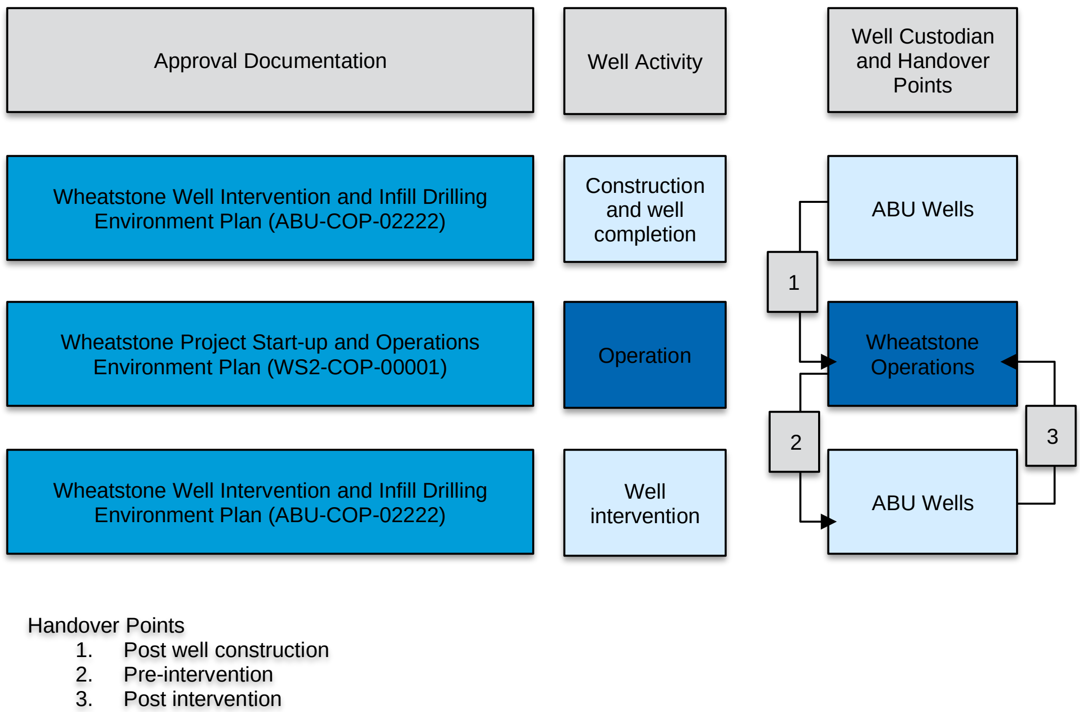


Figure 3-2: Well custody arrangements for Wheatstone and Iago production wells

3.2.1.2 Flowlines and pipelines

Each group of wells is connected to the platform by the flowlines and pipeline system[2]. The system transports production fluids from the wells to the platform through the production flowlines, and transports monoethylene glycol (MEG) or other chemicals (e.g., scale inhibitor) from the platform to the subsea system

[2] The production lines are classified as flowlines; the MEG and utility lines are classified as pipelines.

through pipelines. For the purposes of this EP, the jumpers, spools, and risers are collectively referred to as part of the flowlines and pipeline system.

3.2.1.3 Umbilicals

Umbilicals are parallel to the flowlines and pipeline system, and carry electrical power and hydraulic fluids to operate and control the manifolds and trees, and cabling to transmit signals. Steel and electrical flying leads are connected from the manifold to the wells, and for the purposes of this EP, are collectively referred to as umbilicals.

3.2.1.4 Subsea valves

3.2.1.4.1 Control valves

The subsea control system includes various production control valves on the trees, manifolds, and pipeline termination structures (PTSs), remotely operated from the platform CCR, which when actuated, release control fluids (further described in Section 3.2.2.3).

3.2.1.4.2 Isolation valves

SSIVs are installed on all incoming hydrocarbon flowlines and the export trunkline to isolate the subsea inventories in the unlikely event of an unplanned release. The SSIVs are located on the seabed, ~70 m away from the platform. SCSSVs are part of the well infrastructure, while riser emergency shutdown valves (RESDVs) are provided for each incoming flowline and the trunkline (included as part of the platform infrastructure description, Section 3.3). The valves can be closed via a dedicated pushbutton in the CCR, or can close automatically (failsafe) on emergency shutdown scenarios as described in the Wheatstone Facilities Safety Cases (Ref. 17; Ref. 18) and summarised in the platform central control description (Section 3.3.2.9).

3.2.1.5 Trunkline

The trunkline, which is ~221 km long and ~44 inches in diameter, transports the commingled dry gas and condensate from the platform to the onshore facility. The trunkline crosses other pipelines including Pluto, Jansz, and Gorgon in Commonwealth waters, and Roller Skate in State waters.

State waters and onshore

The State waters section of the trunkline is ~37 km long, begins at the State waters boundary, and includes trenched, stitch-rockdumped, and buried sections as it enters the shore approach into the microtunnel. The trunkline has been stabilised by a combination of pre-lay trenching with backfill and rock dump in State waters. The shore crossing microtunnel is ~1.2 km long, is supported by a concrete casing, and is routed up to the onshore beach valve. The subsea entry point (the offshore end) and the onshore end of the microtunnel are grouted with grout plugs.

The onshore trunkline section includes an ~1 km section between the microtunnel and the pig receiver station, upstream of the gas plant, and is shown in Figure 2-2. The onshore trunkline section is buried, either lying in between berms backfilled with soil, or trenched and backfilled. The embankment slopes are protected by rock and covered by a crushed rock surfacing. The onshore section includes the beach valve, pig receiver station and associated valves, and includes the adjacent area within the licence PL 99.

3.2.2 Start-up and operations

3.2.2.1 Wells and trees

The platform CCR (Section 3.3.2.9) provides remote operation and monitoring of the hydrocarbon system, including various parameters such as flow, temperature and pressure. Well integrity is managed by continuous surveillance, monitoring and periodic IMR of the wells to ensure infrastructure and operations are within pre-established safe limits.

3.2.2.2 Flowlines and trunkline

Typically, new flowlines are nitrogen filled and this will be purged to the platform flare system during initial start-up.

3.2.2.3 Subsea valves

Control of the hydrocarbon system includes the use of valves on the manifolds, trees, and PTSs via the umbilicals. Small quantities of control fluids are discharged from subsea valve actuations. The frequency of valve actuations may range from less than daily to up to several times a day for each valve, are non-continuous and of short duration (e.g., less than a minute). Discharge volumes are expected to range from 0.001–0.03 m^3 per discharge, with predicted total volumes from any tree or manifold expected to be ~1–5 m^3 per year, equating to a total of ~15–70 m^3 per year (for the three drill centres and nine wells covered in this EP).

3.3 Platform

3.3.1 Infrastructure and facilities

The platform dehydrates and dewaters the production fluids received from the Wheatstone and Iago hydrocarbon system and third-party field production systems, before transferring the dry gas and condensate into the trunkline. To achieve this, the platform includes various hydrocarbon processes, utility, and support systems to separate the gas from liquids, to dry the gas, and dewater the condensate. The hydrocarbon system operations are controlled from the platform.

The platform typically accommodates ~96 people on board (POB) during normal operations; and can accommodate up to 104 POB.

Safety and navigational lighting, as well as emergency lighting, illuminates the platform. Two pedestal cranes transfer and handle supplies and equipment, such as portable tanks for production chemicals, while bunkering hoses are used for MEG, tri-ethylene glycol (TEG), diesel, and potable water. Each crane pedestal stores ~135 m^3 of diesel. Laboratory facilities are provided for various analyses. A helideck is used for personnel transfer. The lower deck of the topsides is ~28 m above sea level.

3.3.2 Start-up and operations

3.3.2.1 Platform hydrocarbon processing

The following sections describe the hydrocarbon processing system on the platform and are indicative of normal operations. Where conditions differ from normal operations (potentially through well clean-up, well testing, start-up and commissioning processes), these differences are noted, where relevant. The normal production rate for the platform is ~1,700–2,100 million standard cubic feet per day (MMscfd).

3.3.2.2 Compression

As the reservoir depletes and the pressure within it is reduced, the compression system will ensure production targets are met. Two high efficiency open-cycle aero derivative gas turbines will supply the required compression duty for the platform. Reservoir predictions indicate that compression can be bypassed initially (free-flow), before switching to partial compression with one compressor operating at part load. In the longer term (estimated to commence ~10 years post start up) full compression, involving both compressors running, will be required. Compressors may also be used for periods during start-up processes.

3.3.2.3 Flare system

The platform has two safety-critical flare systems for the disposal of flammable gases—a high-pressure (HP) flare for high-pressure process upset, relief, and blowdown loads, and a low-pressure (LP) flare operating continuously to dispose of low-pressure waste gas from the process.

Waste gas streams routed to the LP flare on a continuous basis include:

- produced water system offgas
- TEG regeneration offgas
- stripping gas
- closed drains drum offgas
- compressor dry seals gas.

These waste streams (particularly the produced water system and TEG regeneration system offgas (when stripping is not required) will be mainly inert, having a high water and carbon dioxide content (Ref. 19).

The HP flare header disposes of hydrocarbons from the following streams:

- subsea flowline depressurisation
- field and individual flowline re-start
- system pressure relief and blowdown
- discharge from separators during overpressure scenarios.

The flare stack includes a constantly lit pilot, to prevent the need for cold venting, and purge gas will be sent to the flare to prevent oxygen ingress. Fuel gas will be the primary purge gas for the LP flare, whilst nitrogen will be the primary purge gas for the HP flare.

During well clean-up, initial start-up, and operational start-ups at the platform, additional HP flaring may be required until the systems are commissioned, have stabilised, and the required stream compositions and process conditions are met. Shutdowns (equipment, isolation, and depressurisation) during operations will also deliver gas through the flares.

3.3.2.4 Power generation

Power is generated by three high efficiency aero derivative gas turbines, with waste heat recovery provided by a hot oil system. The units are dual-fuelled, to allow diesel operation in case of loss of fuel gas. The turbine generator configuration is 3 × 50% rated (typically two operating, one spare). Additionally, an emergency diesel generator and a black-start generator are available for power generation, and temporary generators may also be used.

3.3.2.5 Chemical injection

A number of chemicals are used in the topsides processing system and subsea system. The chemicals typically required include: MEG (topsides and subsea); TEG (topsides); corrosion inhibitor (trunkline, J tubes and tempered water); scale inhibitor (subsea); demulsifier (topsides); reverse demulsifier (topsides); antifoam (topsides); biocide (topsides slops tank, fuel storage, J tubes and tempered water); sodium hypochlorite, water clarifier and calcite (topsides); pH buffer and alkalinity adjustment (topsides and MEG riser subsea); MEG oxygen scavenger (topsides); methanol, which may be used to prevent hydrates in future operations (subsea). These chemicals are generally used in reactions in the production process, or, in the case of TEG, used on the topsides for dehydration, and MEG, regenerated. Sodium hypochlorite is generated on the platform by the electrolytic decomposition of sea water, and minor quantities are injected into various piping, tanks, systems, and caissons to control and minimise marine growth.

3.3.2.6 Produced water treatment

Produced Water (PW) brought up from the hydrocarbon-bearing strata during the extraction of gas and condensate from the wells is physically separated from the well fluids at the platform, treated through a tiered treatment system, and discharged to the ocean through a caisson ~45 m below the lowest astronomical tide (LAT).

The treatment system includes primary treatment using hydrocyclones and a secondary treatment system comprising induced gas flotation (IGF) units with fuel gas injection. A slipstream can also be sent to a tertiary treatment system, comprising an organoclay filter for hydrocarbon adsorption, before recombining with the secondary treatment effluent and discharge through the PW caisson. The platform is designed to process up to ~265 m^3/h of PW.

Well clean-up

Upon the initial flow from each well to the platform, MEG is injected and the MEG/PW mix will contain traces of residual contaminants from previous drilling activities, requiring clean-up at the platform.

Typically, MEG received back to the platform as a result of unplanned shutdown and restart will be collected in the rich MEG tank and regenerated. However, during well clean-ups this is not possible due to the presence of drilling completion fluids. During these periods MEG/PW mix is treated through the PW treatment system or equivalent (such as a temporary treatment package containing infrastructure such as filtration, coalescers and carbon adsorption beds) and discharged via the produced water caisson.

3.3.2.7 Water and wastewater systems

Seawater system and cooling water

Seawater is drawn by seawater lift pumps located in the seawater lift caissons and used as: a cooling medium for heat exchange within the closed-loop tempered water circuit; source water for potable water generation; make-up firewater; and source water for generating the sodium hypochlorite solution. Seawater is continuously injected with hypochlorite to prevent biofouling of the facilities that are exposed to seawater. Cooling water (CW) from the seawater system is discharged through a caisson ~40 m below LAT. Reverse osmosis (RO) units produce potable water from sea water and the rejected brine is discharged through a caisson.

Sewage treatment

The platform sewage treatment unit is designed to treat sewage (with added greywater for system optimisation) generated by POB. The unit includes maceration, before discharging the wastewater ~40 m below LAT through a sewage discharge caisson.

Food waste

The kitchen waste system includes a macerator, with discharges to the ocean through a dedicated discharge pipe, ~40 m below LAT. Alternatively, food waste may be taken to shore for disposal.

Drains system

The open drains system collects deck drainage (firewater, stormwater, and washdown water), drip trays, and sample returns. Non-contaminated streams (such as rainwater from the roof of the living quarters) are sent directly to the open drains caisson. Potentially contaminated streams are routed to the slops tank, where they undergo coarse oil-in-water (OIW) separation, with the water being sent to a coalescer for further oil removal, then through the open drains caisson. Oil from the slops tank is reprocessed or taken as waste from the platform.

For high water flows beyond the capacity of the slops tank (e.g., storm or firewater deluge), the first flush is recovered to the slops tank but thereafter overflows directly to the open drains caisson (after the first flush, the drainage water is considered to be uncontaminated drainage water). The open drains system will also collect a degree of deluge.

The closed drains system collects hazardous wastes from the processing system and routes the hazardous waste to the closed drains drum. The closed drains system also drains and collects liquids from equipment and piping during maintenance. Condensate is recovered to the process system and collected water is directed to the PW treatment system.

3.3.2.8 Fire systems

The fire and gas system is used for detecting hydrocarbon gas and fire, and fires associated with non-process utilities, such as diesel, hot oil, lube/mineral oil, and transformer oil. Detectors include hydrogen gas detectors, flame detectors, smoke detectors, and heat detectors. The active fire protection system components include the firewater system, as well as deluge system, hose reels and extinguishers, and fire suppression systems. Fire-fighting foam is used to dose the firewater system. The open drains system has been sized to contain the first flush of firewater deluge, including the foam. During maintenance, the fire system will be tested several times per year resulting in some foam being discharged through the grated decks to the ocean. To ensure the firewater system is maintained in working order and chlorine levels are adequate to minimise fouling within the system, chlorine is injected and water within the system is flushed regularly resulting in discharge of chlorinated water.

3.3.2.9 Central control

Control and monitoring

The hydrocarbon system is controlled and monitored from the platform CCR. All subsea system process valves and instrumentation functions required to carry out production operations are operated by remote control from the platform CCR. Remote operation can also occur from the onshore plant if required.

In the CCR, various production data are monitored from probes and other equipment at the wells, trees, flowlines, and platform hydrocarbon processing systems. This monitoring can include process conditions, flow rates, pressure, temperature, sand production, erosion rates, and subsea and topsides systems equipment integrity and operational status. Well conditions and general integrity of the wells can be determined through the monitoring of downhole and tree-mounted instrumentation data at the CCR.

Shutdowns

Emergency shutdowns of the platform and hydrocarbon system (including individual wells and flowlines) can be activated automatically from trips and emergencies, or by CCR pushbutton, as per the Safety Case (Ref. 17; Ref. 18). Inventories are isolated through valve closures (at the well SCSSVs, flowlines SSIVs, and platform RESDVs) and equipment in process areas of the platform are also isolated through shutdown valves.

Individual equipment shutdowns can also occur at the platform if individual equipment items/packaged equipment are tripped when operating conditions outside design limits are detected. The equipment shutdown condition is activated automatically by the process or cascaded from a higher level shutdown.

If a trunkline release is confirmed, the platform could be shutdown, wells shut in, and the trunkline depressurised to the LNG Plant, through the production trains and/or blowdown via the onshore flare.

3.3.2.10 Platform maintenance

Platform maintenance preserves the safety, reliability, and integrity of the facility and maintains efficient conditions. Maintenance and inspection activities are extensive, and include risk-based inspection (RBI), predictive maintenance, condition monitoring, and generic maintenance. Maintenance on the platform is wide-ranging and can include breaking containment of vessels, opening lines, topping up and changing over fluids, draining water systems, testing valve function, changing filters, localised surface abrasive blasting and painting, general cleaning, and pressure cleaning.

3.4 Inspections, maintenance, and repairs

Any disturbance related to IMR activities will be contained within the Trunkline Direct Disturbance Footprint per MS 873 conditions or the OA defined in this EP. Upstream of the platform, a marine disturbance footprint of 100 m (50 m either side of pipeline centre line) is not expected to be exceeded during IMR activities.

3.4.1 Subsea

Section 572(2) of the OPGGS Act requires a titleholder to maintain in good condition and repair all structures, equipment, and other property (hereafter collectively referred to as ‘property’) that is within the title area and is used in connection with the operations authorised by the title.

IMR is undertaken to ensure that the integrity of the hydrocarbon system is maintained at or above acceptable standards. IMR activities may occur at any time during operations, including during start-up and operations.

The intent of Section 572(2) relates to ensuring that property is fit for purpose and is able to be removed when neither used, nor to be used, in connection with the operations (Ref. 20).

Subsea IMR typically requires the support of a vessel; these vessel operations are covered within Section 3.6.1.

3.4.1.1 Inspections

Subsea inspections provide assurance that infrastructure is being maintained and operated according to design and proactively identify maintenance or repair activities that may be required. Inspection generally involves the use of a vessel travelling along the route of the subsea system with an autonomous underwater vehicle (AUV) or remotely operated vehicle (ROV) (and in some cases, divers).

Inspections will be undertaken in accordance with the *Wheatstone Upstream Subsea System Inspection and Monitoring Plan* (Ref. 21) and *Wheatstone Upstream Trunkline System Inspection and Monitoring Plan* (Ref. 22). Inspections are typically conducted more frequently (e.g., one to three years) during early operations, with the frequency likely to decrease over time during steady-state operations, depending on previous inspection results. Inspection techniques may include:

- visual inspections—may involve ROVs or AUVs deployed from a vessel; may also involve divers and a dive support vessel
- marine acoustic surveys—may include the use of side-scan sonar (SSS) and multibeam echo sounders (MBES), and are typically done from a vessel using towed acoustic instruments, ROVs, or AUVs
- non-destructive testing—may include ultrasonic testing and electrical resistance testing, which are typically undertaken using an ROV or AUV deployed from a vessel
- cathodic protection measurements—are completed using ROVs or AUVs and conductivity probes or by making visual assessments of anode wastage
- fatigue monitoring/inspection—where required, fatigue monitoring equipment will be installed, inspected, and/or retrieved by a ROV deployed from a vessel.

Intelligent pigging (IP) may be used to inspect the trunkline condition. Conditioning (cleaning or batch) pigging is typically required before an IP inspection run and requires a pig to sweep any debris and gauge the pipeline to ensure that the pipeline is in suitable condition for a subsequent IP inspection. Batch pigging may also be required to distribute chemicals (e.g., corrosion inhibitor). Pigs are launched from the platform through the trunkline to the onshore pig receiver. Tethered IP may be used to inspect the MEG risers for integrity management due to the inability to externally inspect areas of concern. In exceptional circumstances, pigging may also be conducted on the flowlines, with temporary pig launchers used on the flowlines and pigs received at the platform.

3.4.1.2 Maintenance and repair

Maintenance and repair activities, including equipment change-out, will be conducted during the operational life of the Project to:

- prevent deterioration and/or failure of infrastructure
- maintain reliability and performance of infrastructure
- ensure infrastructure is adequately maintained to enable the potential for future removal.

Maintenance and repair activities are typically conducted in response to inspection findings, engineering analyses, and/or external events. The activities are likely to be performed by ROV from the IMR vessel (or similar) used for inspections, or in exceptional circumstances may require the use of a larger vessel. IMR activities may involve the occasional subsea discharge of small quantities of fluids (typically MEG, hydraulic fluids, or well fluids) and/or minor seabed disturbances.

There are no planned interventions downstream of the platform (i.e., along the trunkline between the platform and onshore LNG plant) during operations. The trunkline is designed and was installed for maintenance-free operation for at least a 30-year period.

Maintenance and minor repairs (and any associated testing) may include, but are not limited to:

- Equipment change-outs—The subsea system (upstream of the platform) includes some modular and retrievable items. Upon confirmation of degradation or failure, retrievable units may be recovered and replaced with a new module, typically performed with the aid of an ROV or remotely operated tool. Change-out is planned for very few retrievable items, however for the purposes of risk assessment under this EP, the frequency has been conservatively estimated as ~2 times per year with declining frequency through steady state operations. Before performing equipment change-outs, the bleeding of equipment such as valves may be required. No equipment change-outs are planned along the trunkline.
- CP system maintenance—Anodes are expected to last for the design life of the pipeline they are protecting. Anode replacement, although not planned, would be undertaken by ROV. If continuity straps are missing or broken, electrical continuity may be restored using an ROV to replace the straps.
- Valve function testing—Function testing is planned for remotely operated valves with critical functions (e.g., emergency shutdown valves). Valve function testing can be performed from the platform with observations by the ROV, or manually performed by ROV. Routine testing results in small quantities of fluids being discharged.
- Marine growth and calcareous deposit removal—Marine growth and calcareous deposits may be removed by water jetting from an ROV or by divers, generally with potable water or sea water, although items exhibiting calcareous deposit accumulation may require acid washing or soaking (typically using water-soluble sulfamic acid or similar). This task generally precedes pigging or equipment change-out activities, where operation of or access to the equipment is hindered by marine growth or calcareous deposits.

- Stabilisation—Stabilisation may be required to manage spanning and scouring around the subsea system and may involve installing mattresses, grout bags, rocks, frond mats or similar stabilisers, or trenching. Stabilisation of the trunkline is an unplanned and highly improbable activity.
- Excavation for intervention—To undertake subsea IMR, localised excavation may be conducted directly adjacent to the subsea system, allowing access to buried or partly buried infrastructure. Typically, this is conducted by jetting and/or digging equipment from an ROV, vessel, or by using divers, depending on the location, depth, and seabed characteristics. This task generally precedes valve function testing and equipment change-out, however excavation is not expected to be required for every intervention.

Approximate seabed disturbances associated with targeted IMR activities may include:

- placement of grout bags (~1 m^2) concrete mattresses (~18 m^2) or rock for pipeline span correction, protection and stabilisation
- CP anode placement or remediation (~50 m^2)
- placement of ROV tool baskets (~15 m^2) and DP transponders (~2 m^2)
- disturbance from replacement of subsea equipment such as a section of spool, flying lead or jumper – sections up to ~100 m long (i.e. max distance between subsea manifold and tree) within a ~5 m 'touch down' corridor to allow positioning of the spool or jumper.

Estimated discharge compositions and volumes for typical IMR activities include:

- chemical dye releases (~10–20 L) during pressure and leak testing
- control fluid releases (~5–10 L) during hotstab/coldstab interventions and valve function testing
- hydrocarbon (~1–10 m^3), MEG (~100 L) and scale inhibitor (~50 L) during intervention isolations and subsea equipment replacements
- acid-water mix (~20–200 L) during calcium deposit removal
- hydraulic fluid (~20–100 L) from operation of ROVs
- dilute preservation fluids: Corrosion inhibitor, oxygen scavenger, biocide (~5–10 L)
- grout bag filling/hose flush (~20–200 L).

3.4.1.3 Major repairs

This EP has allowed for scenarios where major repairs of the pipeline system (including flowlines, pipelines and umbilicals) may be required.

CAPL has prepared for a potential major repair event by implementing the Emergency Pipeline Repair System (EPRS). The EPRS delivers a set of repair procedures, common repair equipment, and specific equipment for the flowlines and trunkline. The EPRS also includes methodologies for the repair of support infrastructure such as umbilicals and pipelines.

The target repair duration is ~180 days, from mobilisation of equipment and vessels, in situ repair, to recommissioning. Several vessels are likely to be involved to conduct and support the repair works or provide temporary power and controls to maintain system operability and reliability.

As major repair of a pipeline is the most complex major repair activity, this has been described in greater detail below. The EPRS includes a combination of equipment which, when used together, enables a section of production pipeline to be cut out and replaced. It is deployed off the back deck of a support vessel and supported with ROVs. The EPRS is stored in a warehouse in Perth until required. The EPRS equipment includes:

- hydraulic-actuated pipeline lifting and repair equipment deployment frames
- pipe preparation tools, including but not limited to, coating removal, weld seam removal, end preparation, and water blasting equipment
- pipeline specific repair clamps and flange adaptors.

Depending on the seabed conditions at the repair location, additional seabed area immediately surrounding the pipeline system infrastructure may be disturbed if it is determined that pipeline requires de-burial or rock removal prior to repair, or concrete mattresses or rock stabilisation measures post-repair.

The EPRS equipment may be deployed for the flowlines or trunkline where the pipeline (or section of pipeline) does not exceed the limitations of its design (i.e., not within water depths of <20 m).

Pipeline temporary decommissioning

Following a major defect or full bore rupture, the field would be shut-in, and the pipeline allowed to naturally depressurise to subsea ambient pressure, resulting in free-flooding of the pipeline with sea water.

The pipelines would then be flooded with sea water inhibited with chemical additives (including biocide and oxygen scavenger) that will propel a flooding pig towards the defect location. Flooding may be undertaken from both ends of the pipeline, resulting in a release of sea water, gas, condensate, and rich MEG to the marine environment at the location of the defect.

Pipeline repair

The EPRS equipment is operated using ROVs, controlled from the support vessel. Two ROVs are expected to be required. The ROVs are electrically powered from the vessel and deliver hydraulic pressure to the operating parts of the repair system.

Pipeline repair includes the following stages:

- pre-deployment survey
- remove damaged section
- EPRS deployment
- installation of new replacement section
- pipeline stabilisation (if required).

Pre-deployment survey

Prior to deployment of the EPRS, a number of different surveys may be undertaken. These surveys may be undertaken up to 500 m away from the pipeline. The types of survey will depend on the location and event causing the pipeline defect, but may include:

- side scan sonar (SSS) or multibeam echo sounder (MBES) or similar

- ROV
- piezo cone penetration test (PCPT) or similar.

PCPT involves pushing a probe into the seabed to test soil characteristics and strengths. Up to three PCPTs may be required at each of the eight mudmat locations. The tests are expected to comprise a 100 mm diameter cone penetration test to a depth of 5 m.

Removal of damaged sections

If required, the damaged section will undergo pipeline deburial or have rock stabilisation material physically removed. The damaged section of the pipeline will then be cut using appropriate cutting tools.

Once cut, the damaged section of pipeline will be wet stored on the seabed whilst it is cut into smaller sections (~3 m lengths), then loaded into debris removal baskets and transferred back to the vessel.

EPRS deployment

Subsea transponders may be deployed to ensure accurate seabed positioning of the EPRS. The deployment of transponders may result in localised seabed disturbance of approximately 1–2 m^2 (per transponder). Once no longer needed these are recovered back to the vessel using an ROV. The EPRS lifting frames and cradles for repositioning of the pipeline are then deployed and installed.

The length of pipeline over which a typical repair will take place is ~300 m. Over this length, the areas and depths of seabed expected to be disturbed during a repair include:

- at the four pipe lift frame locations, ~450 m^2 of surficial seabed will be disturbed by the pipe lift frame mudmats to an approximate maximum depth of ~4.5 m by the skirt foundations of these mudmats
- at the pipe end repair location, ~250 m^2 of surficial seabed will be disturbed by the repair pipeline flange adaptor (PFA) deployment frame mudmat skirts (up to ~0.3 m depth)
- in the vicinity of the repair location, ~100 m^2 of seabed will be required for temporary wet storage of materials and equipment during the repair operation.

Installation of new replacement section

Once the damaged section of pipeline is removed, the pipeline ends are prepared (coating and weld seams removed) to allow PFA installation. The PFA stud bolts are then tensioned with the flange bolting systems and subsequently back seal tested. The PFAs are then activated to complete the repair.

The entire pipeline is then typically subjected to a hydrostatic leak testing. If the leak testing fails, the repair will need to be rectified, and re-installed. The leak test may comprise flooding, gauging, and/or cleaning pigs, but is typically performed using a small water-winning/filtration and chemical injection spread, and high-pressure pumping equipment, and will use an onshore spread that will differ depending on the pipeline.

Pipeline stabilisation

Depending on the seabed conditions at the repair location, additional seabed area may be disturbed by permanent concrete mattresses and post-repair rock stabilisation measures. However, this is location specific and thus will need to be determined at the time of event.

Pipeline recommissioning

Following a successful hydrostatic leak test, the pipeline must be recommissioned via a dewatering and conditioning pig train. The conditioning pig train is expected to comprise slugs of compressed air, treated potable water, and MEG.

The pipeline contents will be discharged subsea via the platform.

3.4.2 Onshore

3.4.2.1 Inspections

Most of the onshore section of the trunkline is buried until it emerges above ground, upstream of the onshore endpoint. Internal inspection of the trunkline in the microtunnel and onshore section is typically via IP.

Visual inspection of the onshore section is limited as the pipeline is mostly buried. General visual inspection of the exposed section of trunkline and the surrounding PL 99 pipeline licence area is conducted in accordance with the *Wheatstone Upstream Trunkline System Inspection and Monitoring Plan* (Ref. 22).

With the exception of a 'soil to air interface' inspection (typically only completed once every five years), onshore inspections do not require the removal of pipeline top-cover. For the 'soil to air interface' inspection, a small bell-hole of ~2 m length by ~1 m width by ~0.5 height, may be excavated. Where excavation of soil is required, soil will be stockpiled, and then reinstated. This type of inspection may take up to two days to complete.

3.4.2.2 Maintenance and repair

Maintenance of the onshore trunkline section can include CP system maintenance, coating repair, maintenance pigging (from the platform), as well as maintenance of access ways, pig receiver station, valves and associated auxiliaries, and instrumentation. The maintenance activities for the pig traps typically include the greasing of hinges, UT for detection of internal corrosion, and maintenance of the pig signaller.

Trunkline repairs are not planned activities; they are triggered by inspection or maintenance activity findings and are then scheduled according to severity and risk. For repair of the buried onshore sections, the trunkline will typically be accessed from the side, requiring localised excavation work to remove backfilled soil in which the pipeline is housed. Surface treatment and work on the outer surface of the onshore section may be required in exceptional circumstances. If the pipeline is damaged and requires repair, temporary clamps may be installed on damaged sections, and onshore pipe section removal and replacement may be conducted in the event of failure, which will require heavy machinery to access the site. Potential onshore repair activities that may be undertaken during trunkline operations are described in Table 3-1.

Any onshore trunkline repair activities described above are only relevant to the ~1 km section of trunkline between the end of the microtunnel and the onshore end point (Figure 2-2). Any defects or leaks within the buried microtunnel section cannot be repaired; therefore, a repair would involve a new microtunnel section. If required, this scope would be covered under a separate EP.

Table 3-1: Onshore trunkline repairs

Repair	Description
Repair of pipeline top-cover	If the removal of pipeline top-cover is required (e.g., for repairs), the pipeline will be located by 'potholing', which is an exploratory excavation using methods that may include hand tools, water-jet and vacuum excavation, or pure suction excavation. Once potholing has revealed the buried pipe, mechanical and/or manual excavation methods may be used to expose the section of pipeline. A bell-hole for a pipeline repair may be up to ~24 m length by ~5 m wide, by ~0.5m depth (these dimensions are estimated based on exposing two pipe joints). Where excavation of soil is required, soil will be stockpiled on site for future use (e.g., reinstatement). Accidental pipe exposure (e.g., from washout or flooding) may require backfill, using a soft or hard substrate depending on need.
Replacement of equipment	Equipment at the pig receiver station may need to be replaced or upgraded during its operational life.
Design modifications	During the operational life of the pipelines, design modifications and upgrades to the pig receiver station or its equipment may be undertaken to improve efficiency.
Repair of damaged pipeline	If repair and replacement of a section of pipeline is required, the damaged section will undergo pipeline deburial (via localised top-cover removal). The pipeline will be depressurised, and the damaged section clamped, or cut using appropriate cutting tools, and then removed. The new section of pipeline is then installed, welded, and typically leak tested. Pipeline top-cover is then reinstated.

Onshore IMR activities may require the use of vehicles for transporting personnel, tools, equipment, and waste. Excavators, cranes, vehicles, and other equipment may be used if clamping is required. Maintenance and repair activities are expected to be conducted during daylight hours. However, depending on the severity and risk, repair works may be undertaken 24 hours a day. Portable lighting and diesel generators may be needed for short durations if night activities are required.

3.5 Decommissioning

Under Section 270(3)(c) of the OPGGS Act, before a title can be surrendered, all property brought into a title area must be removed or arrangements that are satisfactory to NOPSEMA must be made in relation to the property.
Section 572(3) of the OPGGS Act also requires a titleholder to remove all property that is within the title area and is neither used nor to be used in connection with the operations authorised by the title.

Similarly, Section 98(3) of the *Petroleum (Submerged Lands) Act 1982* (PSL Act) and Section 38(c) of the *Petroleum Pipelines Act 1969* (PP Act) require the operator to decommission and remove all structures, equipment, and other property from petroleum activity sites. The base case is for full decommissioning and removal of all infrastructure brought into the title area, however exceptions to this requirement may be considered by the Minister on a case-by-case basis (Ref. 296).

3.5.1 End of facility life

As described in Section 3.1.1 the operational design life for the Wheatstone and Iago field development is expected to be ~30 years. Therefore, no end of facility life (EOFL) decommissioning activities for the subsea or onshore infrastructure is scheduled to occur within the 5-year in-force period of this EP.

Prior to any EOFL decommissioning CAPL will submit a Decommissioning EP to NOPSEMA and DMIRS that will demonstrate that the impacts and risks associated with field decommissioning activities are reduced to ALARP and acceptable levels. While the requirement for complete removal of property will be considered the base case within any Decommissioning EP (as per the requirements of Section 572(3) of the OPGGS Act, Section 98(3) of the PSL Act and Section 38(c) of the PP Act), alternative arrangements that may be satisfactory are ones that deliver equal or better environmental, safety and well integrity outcomes compared to complete removal (Ref. 23). The Decommissioning EP will be developed to meet the requirements of the OPGGS Act and OPGGS(E)R, PSL Act and PSLER, PP Act and PPER, as well as any additional relevant legislation (e.g., *Environment Protection (Sea Dumping) Act 198*1) or guidelines (e.g., Ref. 20; Ref. 23; Ref. 296) in force at the time.

3.5.2 Subsea inventory

To assist with the long-term planning for decommissioning an internal inventory of subsea property is maintained by CAPL. The subsea inventory will include property that is “operational” by the Wheatstone Project, as well as “non-operated assets” that are not associated with any of its current operations[3]. A static summary of the inventory has been included in appendix c.

Subsea assets classified as abandoned (with relevant supporting regulator documentation) are not included within the subsea inventory.

3.5.3 Removal of property

In accordance with Section 572(3) of the OPGGS Act, removal of property will be undertaken throughout operations when property is neither used, nor to be used, in connection with the operations. However, NOPSEMA recognises that removal may not always be practical at the time when property is neither used, nor to be used (Ref. 20).

The process that CAPL will follow to determine where a deviation from the requirement to remove property at the point in time that it is neither used nor to be used is appropriate, includes consideration of several criteria. Deferral of removal may be considered by CAPL if:

- redundant equipment is incorporated within or located close to live infrastructure which introduces additional complexities and risks that can be avoided during EOFL decommissioning
- while subsea property is in situ, the risks to other marine users associated with its physical presence are low
- the environmental risks when leaving redundant infrastructure in-situ under current operations is considered to be low
- the cost of standalone retrieval work scopes are considered disproportionate when considering the risks of retrieval during current operations versus risk of extending duration in-situ.

If after applying the above criteria, any redundant property is to remain in-situ within the title area for decommissioning as part of EOFL, it will be recorded in the subsea inventory as a “non-operated asset” (refer to Section 3.5.4), and will be

[3] Note: at the time of submission of this EP, no non-operated assets are included within the subsea inventory provided in appendix c.

subject to inspections to ensure that the property does not degrade to a state that would prevent future removal (refer to Section 3.4). This ongoing inspection, monitoring, and maintenance of non-operated assets is also a requirement of DMIRS (Ref. 296).

3.5.4 Non-operated assets

CAPL are currently undertaking an investigation to determine the presence of non-operated subsea assets within all their petroleum permits in Australia. This investigation also includes determining the status (e.g., abandoned) of the identified subsea asset. It is anticipated that this investigation will be completed by Q2 2022. Once this investigation is complete, if any subsea property that have not yet been abandoned are identified, CAPL will engage with NOPSEMA regarding the removal of property or deviation from this requirement via an EP. If it is determined that an EP (either new, or revision to an existing EP) is required, CAPL will consult with NOPSEMA within two months of completion of the investigation and submit the relevant EP/EPs relating to non-operated assets on Wheatstone petroleum permits by no later than Q1 2023 to address these requirements.

3.5.5 Onshore closure planning

PL 99 extends over the onshore trunkline (Figure 2-2). The trunkline exits the microtunnel and remains buried onshore for ~1 km before emerging above ground just before (~15 m) the onshore endpoint. Approximately 0.5 km of the onshore trunkline occurs within the fenced Major Hazard Facility (MHF) boundary for the Wheatstone LNG Project.

The land within PL 99 occurs within the Ashburton North Strategic Industrial Area (ANSIA), and as such the post-activity land use has been identified as industrial.

As described in Section 3.5.1, no EOFL decommissioning is planned within the 5-year in-force period of this EP. However, to assist with the long-term planning for decommissioning, CAPL have identified preliminary closure objectives and completion criteria as described in Table 3-2. Given the operational design life for the Wheatstone and Iago field development is expected to be ~30 years, these closure objectives and completion criteria are subject to change prior to decommissioning.

Table 3-2: Preliminary closure objectives and completion criteria for PL 99

Closure objective	Completion criteria	Measurement tools
Land within PL 99 shall be reinstated to facilitate future industrial land use within the Ashburton North Strategic Industrial Area (ANSIA)	Any disturbed surfaces between the end of the microtunnel and the onshore end point within PL 99 to be made stable	Visual inspection (supported by photographs) of reinstated surface
	Land within PL 99 is acceptable for future industrial land use	Endorsement from relevant government agencies

3.6 Field support

3.6.1 Vessel operations

Platform supply vessels will transfer miscellaneous items including chemicals and diesel to the platform via the platform cranes, and will also bunker (via a platform hose to the respective platform storage tanks) water, MEG, TEG, and diesel. A safety standby vessel, capable of launching a fast rescue craft to recover personnel from the sea, may be present to support the platform. For occasional major maintenance campaigns or platform TAR, an accommodation support vessel (ASV) may be required for short periods.

Typically, a survey-type vessel (or similar) will be used for IMR. In exceptional circumstances, depending on the type of IMR activity, additional similar vessels may be used, and/or a larger vessel. IMR vessels may be supported by helicopter operations for crew changes if required (Section 3.6.2).

Vessels will typically use dynamic positioning (DP), however in certain circumstances, anchoring or use of pre-laid moorings may be required. Vessels will not use Heavy Fuel Oil (HFO) but will utilise a lighter marine fuel such as marine diesel oil (MDO) or Marine Gas Oil (MGO). Vessels are expected to return to port to bunker, although may occasionally bunker at sea. Vessels routinely discharge a variety of wastewater streams to the marine environment including sewage, greywater, food waste, CW, brine, and oily bilge water; vessels may also incinerate solid wastes.

3.6.2 Helicopter operations

The platform is serviced by helicopters, generally from Barrow Island, which are used for passenger transfers/crew changes and delivering minor supplies. Where required, helicopters may also be used for crew transfers to/from the IMR vessels. When an ASV is on site, the vessel helideck may also be utilised.

4 description of the environment

4.1 Overview

For the purposes of this EP, CAPL have defined and described the following three areas:

- OA—as described in Section 3.1.1, this is the area in which the petroleum activities will be undertaken; for the purposes of describing the environment this has further been split into the offshore fields (including platform) and the trunkline
- Environment that May Be Affected (EMBA)—defined as the area in which CAPL's activities may result in environmental impacts (thus for the purpose of this EP, defined as the area potentially impacted by hydrocarbons from a spill event above impact concentration thresholds [Table 7-5])
- Environmental Exposure Area (EEA)—defined as the outer area in which hydrocarbons from a spill event may be present in the environment (thus for the purpose of this EP, defined as the area potentially exposed to hydrocarbons from a spill event above exposure concentration thresholds [Table 7-4]).

These areas are shown in Figure 4-1.

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1; appendix d) describes the environment within the total area in which all CAPL's activities may interact with the environment (i.e., includes activities and projects beyond the scope of this EP). The above three areas, the OA, EMBA and EEA, that are specifically relevant to activities within this EP, all occur within the spatial extent of Planning Area. Therefore, the descriptions provided in the *Description of the Environment: CAPL Planning Area* (Ref. 1;) are appropriate for providing supporting information for use in this EP. The identification of the specific values and sensitivities relevant to the areas for this EP are detailed in the following sections.

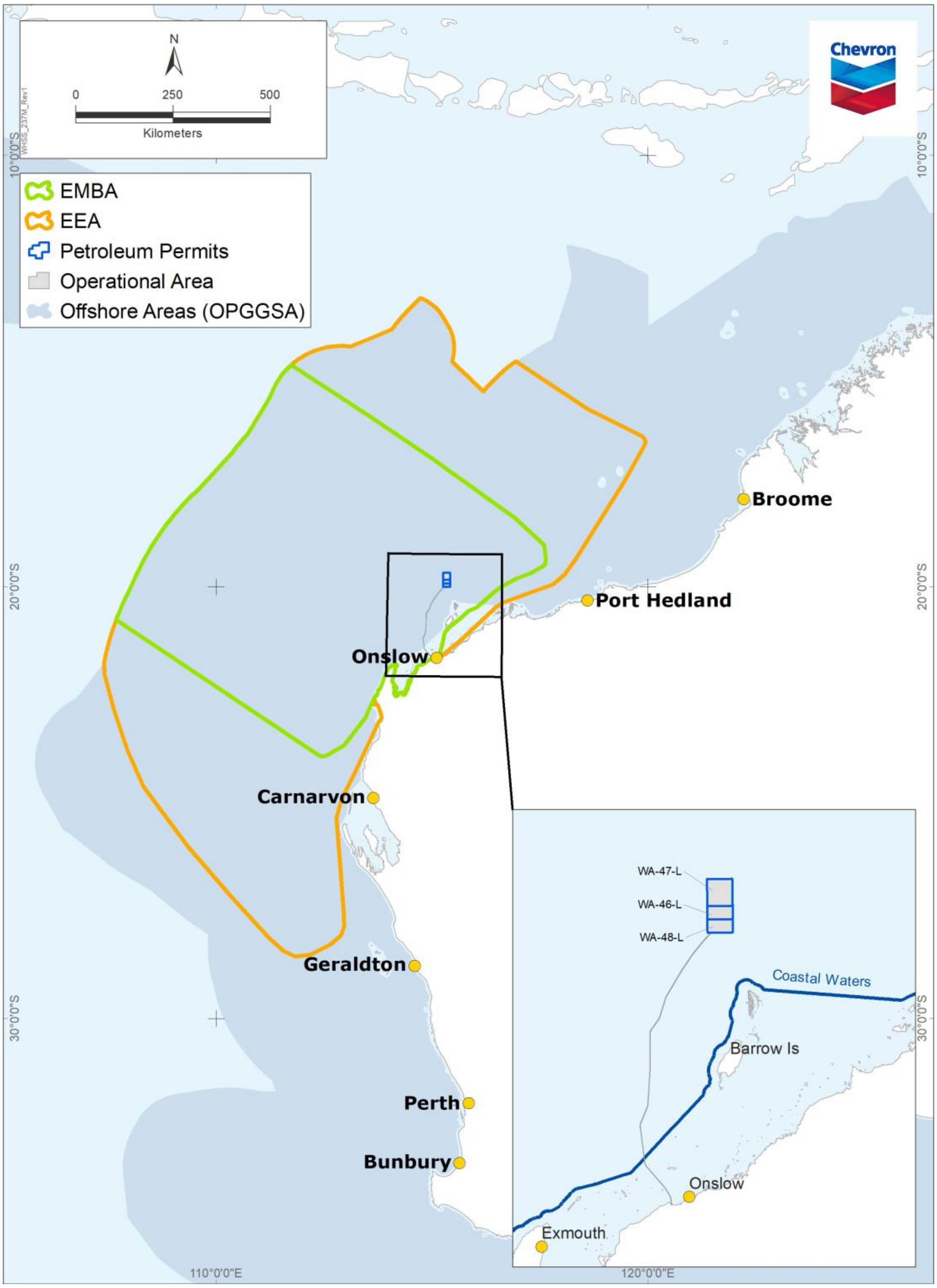


Figure 4-1: OA, EMBA, and EEA for Wheatstone start-up and operations

4.2 Physical environment

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and summarises the physical environment within the Planning Area.

4.3 Biological environment

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and summarises the biological environment within the Planning Area. Key threats and relevant management actions from any Conservation Advice or Recovery Plan for threatened or migratory species have also been described (Ref. 1).

The specific presence of biological values and sensitivities within the OA, EMBA and EEA is detailed in the following subsections.

4.3.1 Marine mammals

Based on searches of the protected matters database (Ref. 24;appendix e), the threatened and/or migratory mammal species shown in Table 4-1 may be present within the OA, EMBA and EEA. Biologically important areas (BIAs) associated with marine mammal species are listed in Table 4-2.

Table 4-1: Presence of threatened and/or migratory marine mammals

Common name	OA (field)	OA (trunkline)	EMBA	EEA
Cetaceans (whales)				
Antarctic Minke Whale, Dark-shoulder Minke Whale		✓	✓	✓
Blue Whale	✓	✓	✓	✓
Bryde’s Whale	✓	✓	✓	✓
Fin Whale	✓	✓	✓	✓
Humpback Whale	✓	✓	✓	✓
Sei Whale	✓	✓	✓	✓
Southern Right Whale		✓	✓	✓
Sperm Whale	✓	✓	✓	✓
Cetaceans (dolphins)				
Australian Humpback Dolphin	✓	✓	✓	✓
Killer Whale, Orca	✓	✓	✓	✓
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	✓	✓	✓	✓
Sirenians				
Dugong		✓	✓	✓

Table 4-2: Presence of BIAs for marine mammals

Common name	BIA behaviour	Seasonal presence	OA (field)	OA (trunkline)	EMBA	EEA
Dugong	Breeding	Year-round			✓	✓
	Calving	Year-round			✓	✓
	Foraging (high density seagrass beds)	Year-round			✓	✓
	Nursing	Year-round			✓	✓
Humpback Whale	Migration (north and south)	Northern migration, late July to September		✓	✓	✓
	Resting	Winter			✓	✓
Pygmy Blue Whale	Distribution	(Not defined in database)	✓	✓	✓	✓

Common name	BIA behaviour	Seasonal presence	OA (field)	OA (trunkline)	EMBA	EEA
	Foraging	(Not defined in database)			✓	✓
	Migration	Northern migration (enter Perth canyon January to May; pass Exmouth April to August; continue north to Indonesia). Southern migration (follow WA coastline from October to late December)	✓		✓	✓

4.3.2 Reptiles

Based on searches of the protected matters database (Ref. 24;appendix e), the threatened and/or migratory reptile species shown in Table 4-3 may be present within the OA, EMBA and EEA. Habitat critical to survival and BIAs associated with marine reptile species are listed in Table 4-4 and Table 4-5 respectively.

Only Flatback Turtles are known to nest on beaches in the vicinity of the nearshore Project infrastructure; this includes Ashburton Delta and some of the inshore Pilbara islands (Ref. 289). Typically, Flatback Turtle nesting in the Ashburton area occurs between October and February, with peak nesting activity in December (Ref. 289).

Table 4-3: Presence of threatened and/or migratory reptiles

Common name	OA (field)	OA (trunkline)	EMBA	EEA
Seasnakes				
Leaf-scaled Seasnake		✓	✓	✓
Short-nosed Seasnake		✓	✓	✓
Turtles				
Flatback Turtle	✓	✓	✓	✓
Green Turtle	✓	✓	✓	✓
Hawksbill Turtle	✓	✓	✓	✓
Leatherback Turtle, Leathery Turtle, Luth	✓	✓	✓	✓
Loggerhead Turtle	✓	✓	✓	✓

Table 4-4: Critical habitat for the survival of marine turtles

Common name	Location	Seasonal presence	Occurrence descriptor	OA (field)	OA (trunkline)	EMBA	EEA
Loggerhead Turtle	Exmouth Gulf and Ningaloo Coast. 20 km internesting buffer	Nov–May	Known to occur			✓	✓

Common name	Location	Seasonal presence	Occurrence descriptor	OA (field)	OA (trunkline)	EMBA	EEA
	Gnaraloo Bay and beaches. 20 km internesting buffer	Nov–May	Known to occur				✓
	Shark Bay, all coastal and island beaches out to the northern tip of Dirk Hartog Island. 20 km internesting buffer	Nov–May	Known to occur				✓
Green Turtle	Dampier Archipelago. 20 km internesting buffer	Nov–Mar	Known to occur				✓
	Barrow Island, Montebello Islands, Serrurier Island, and Thevenard Island. 20 km internesting buffer	Nov–Mar	Known to occur		✓	✓	✓
	Exmouth Gulf and Ningaloo Coast. 20 km internesting buffer	Nov–Mar	Known to occur			✓	✓
Hawksbill Turtle	Dampier Archipelago, including Delambre Island and Rosemary Island. 20 km internesting buffer	Oct–Feb	Known to occur				✓
	Cape Preston to mouth of Exmouth Gulf including Montebello Islands and Lowendal Islands. 20 km internesting buffer	Oct–Feb	Known to occur		✓	✓	✓
Flatback Turtle	Mundabullangana Beach. 60 km internesting buffer	Oct–Mar	Known to occur				✓
	Dampier Archipelago, including Delambre Island and Hauy Island. 60 km internesting buffer	Oct–Mar	Known to occur			✓	✓
	Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island. 60 km internesting buffer	Oct–Mar	Known to occur		✓	✓	✓

Table 4-5: Presence of BIAs for reptiles

Common name	BIA behaviour	Seasonal presence	OA (field)	OA (trunkline)	EMBA	EEA
Flatback Turtle	Aggregation				✓	✓
	Foraging	Summer			✓	✓
	Internesting				✓	✓
	Internesting buffer	Summer	✓	✓	✓	✓
	Mating	Summer			✓	✓

Common name	BIA behaviour	Seasonal presence	OA (field)	OA (trunkline)	EMBA	EEA
	Nesting	Summer		✓	✓	✓
Green Turtle	Aggregation				✓	✓
	Basking	Summer			✓	✓
	Foraging	Summer			✓	✓
	Internesting	Summer			✓	✓
	Internesting buffer	Summer			✓	✓
	Mating	Summer			✓	✓
	Nesting	Summer			✓	✓
Hawksbill Turtle	Foraging	Year-round, spring, early-summer			✓	✓
	Internesting	Spring, early-summer			✓	✓
	Internesting buffer	Year-round, spring, early-summer		✓	✓	✓
	Mating	Year-round, spring, early-summer			✓	✓
	Nesting	Year-round, spring, early-summer			✓	✓
Loggerhead Turtle	Internesting buffer				✓	✓
	Nesting				✓	✓

4.3.3 Fishes, including sharks and rays

Based on searches of the protected matters database (Ref. 24; appendix e), the threatened and/or migratory fish species shown in Table 4-6 may be present within the OA, EMBA and EEA. BIAs associated with fish species are listed in Table 4-7.

Table 4-6: Presence of threatened and/or migratory fishes, including sharks and rays

Common name	OA (field)	OA (trunkline)	EMBA	EEA
Dwarf Sawfish, Queensland Sawfish	✓	✓	✓	✓
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	✓	✓	✓	✓
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	✓	✓	✓	✓
Green Sawfish, Dindagubba, Narrowsnout Sawfish	✓	✓	✓	✓
Grey Nurse Shark (west coast population)	✓	✓	✓	✓
Longfin Mako	✓	✓	✓	✓
Narrow Sawfish, Knifetooth Sawfish	✓	✓	✓	✓
Oceanic Whitetip Shark	✓	✓	✓	✓
Porbeagle, Mackerel Shark			✓	✓

Common name	OA (field)	OA (trunkline)	EMBA	EEA
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray	✓	✓	✓	✓
Shortfin Mako, Mako Shark	✓	✓	✓	✓
Whale Shark	✓	✓	✓	✓
White Shark, Great White Shark	✓	✓	✓	✓

Table 4-7: Presence of BIAs for fishes, including sharks and rays

Common name	BIA behaviour	Seasonal presence	OA (field)	OA (trunkline)	EMBA	EEA
Whale Shark	Foraging	Spring	✓	✓	✓	✓
	Foraging (high density prey)	Apr-Jun. Autumn			✓	✓

4.3.4 Seabirds and shorebirds

Based on searches of the protected matters database (Ref. 24;appendix e), the threatened and/or migratory seabird and shorebird species shown in Table 4-8 may be present within the OA, EMBA and EEA. BIAs associated with fish species are listed in Table 4-9.

Table 4-8: Presence of threatened and/or migratory seabirds and shorebirds

Common name	OA (field)	OA (trunkline)	EMBA	EEA
Abbott's Booby			✓	✓
Amsterdam Albatross				✓
Asian Dowitcher		✓	✓	✓
Australian Fairy Tern	✓	✓	✓	✓
Australian Lesser Noddy				✓
Australian Painted Snipe		✓	✓	✓
Bar-tailed Godwit		✓	✓	✓
Black-browed Albatross				✓
Bridled Tern			✓	✓
Brown Booby				✓
Campbell Albatross, Campbell Black-browed Albatross			✓	✓
Caspian Tern			✓	✓
Christmas Island White-tailed Tropicbird, Golden Bosunbird	✓	✓	✓	✓
Common Greenshank, Greenshank		✓	✓	✓
Common Noddy	✓	✓	✓	✓
Common Sandpiper	✓	✓	✓	✓
Curlew Sandpiper	✓	✓	✓	✓
Eastern Curlew, Far Eastern Curlew	✓	✓	✓	✓
Flesh-footed Shearwater, Fleshy-footed Shearwater			✓	✓

Common name	OA (field)	OA (trunkline)	EMBA	EEA
Fork-tailed Swift		✓	✓	✓
Great Frigatebird, Greater Frigatebird	✓		✓	✓
Greater Crested Tern			✓	✓
Greater Sand Plover, Large Sand Plover			✓	✓
Grey Falcon		✓	✓	
Indian Yellow-nosed Albatross		✓	✓	✓
Lesser Frigatebird, Least Frigatebird	✓	✓	✓	✓
Little Tern		✓	✓	✓
Night Parrot		✓	✓	✓
Northern Giant Petrel				✓
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri)		✓	✓	✓
Oriental Plover, Oriental Dotterel		✓	✓	✓
Oriental Pratincole		✓	✓	✓
Osprey	✓	✓	✓	✓
Pectoral Sandpiper	✓	✓	✓	✓
Red Knot, Knot	✓	✓	✓	✓
Red-tailed Tropicbird				✓
Roseate Tern			✓	✓
Sharp-tailed Sandpiper	✓	✓	✓	✓
Shy Albatross, Tasmanian Shy Albatross			✓	✓
Soft-plumaged Petrel			✓	✓
Southern Giant-Petrel, Southern Giant Petrel		✓	✓	✓
Southern Royal Albatross				✓
Streaked Shearwater	✓	✓	✓	✓
Wandering Albatross				✓
Wedge-tailed Shearwater			✓	✓
White-capped Albatross			✓	✓
White-tailed Tropicbird	✓	✓	✓	✓
White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren			✓	✓

Table 4-9: Presence of BIAs for seabirds and shorebirds

Common name	BIA behaviour	Seasonal presence	OA (field)	OA (trunkline)	EMBA	EEA
Bridled Tern	Foraging (in high numbers)	Late-September to early-May				✓
Fairy Tern	Breeding	July to late-September			✓	✓
Lesser Crested Tern	Breeding	March to June		✓	✓	✓

Common name	BIA behaviour	Seasonal presence	OA (field)	OA (trunkline)	EMBA	EEA
Lesser Frigatebird	Breeding	March to September				✓
Little Shearwater	Foraging (in high numbers)	Early-January to early-December; mainly April to November				✓
Little Tern	Resting	June, July and October				✓
Roseate Tern	Breeding	Mid-March to July			✓	✓
Sooty Tern	Foraging	Late-August to early-May				✓
Wedge-tailed Shearwater	Breeding	Mid-August to April (Pilbara) or mid-May (Shark Bay)	✓	✓	✓	✓
	Foraging (in high numbers)	Mid-August to May				✓
White-faced Storm Petrel	Foraging (in high numbers)					✓
White-tailed Tropicbird	Breeding	May and October				✓

4.3.5 Marine habitats

Subtidal habitat includes coral reef, seagrass, filter feeder (e.g., sessile invertebrates), and macroalgae communities. Figure 4-2 to Figure 4-10 are a series of marine habitat maps covering both the OA and broader EMBA and EEA; spanning an area east of Dampier, seaward to the Wheatstone Platform and south to the Ningaloo Marine Park.

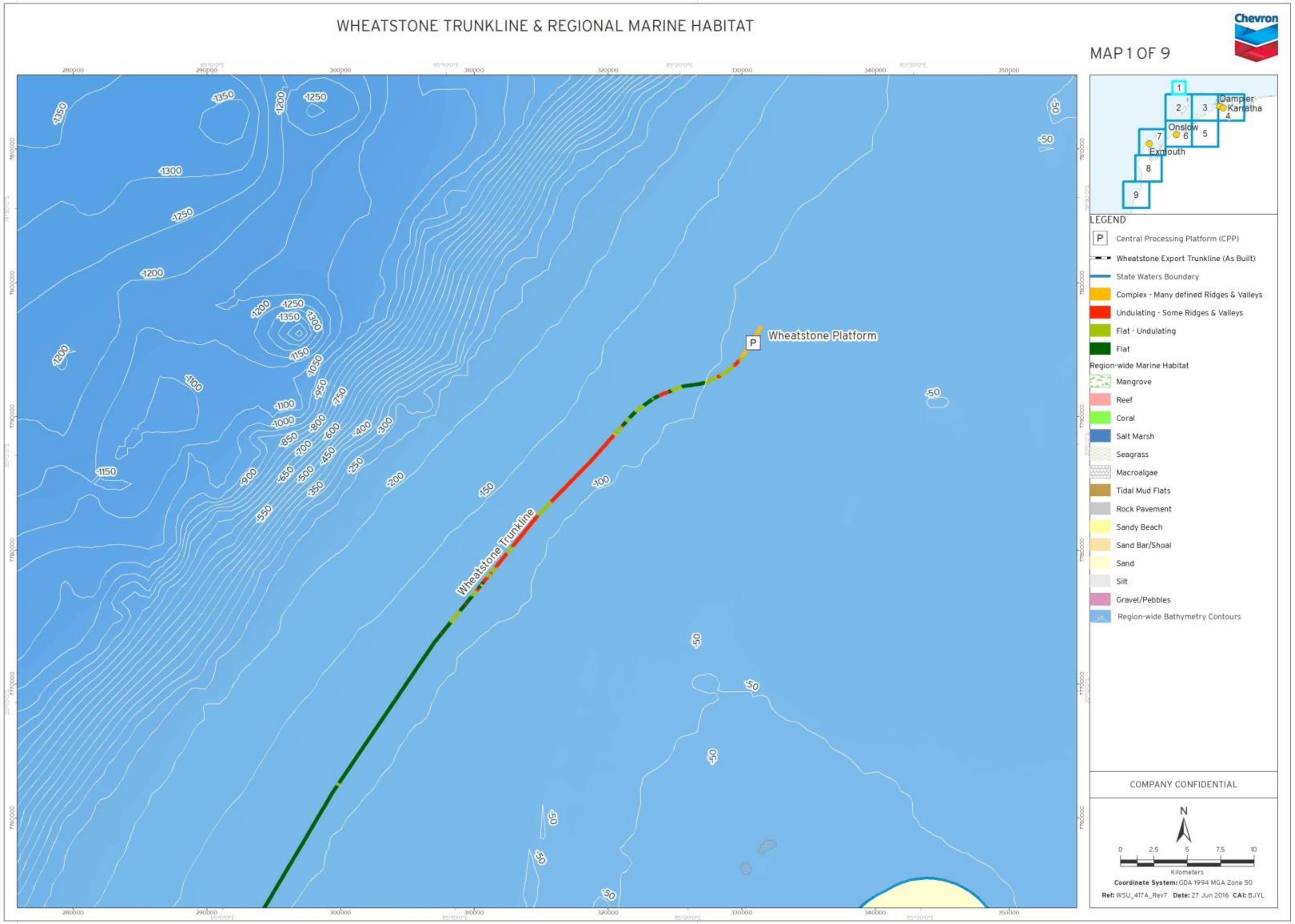


Figure 4-2: Wheatstone trunkline and regional marine habitat (map 1 of 9)

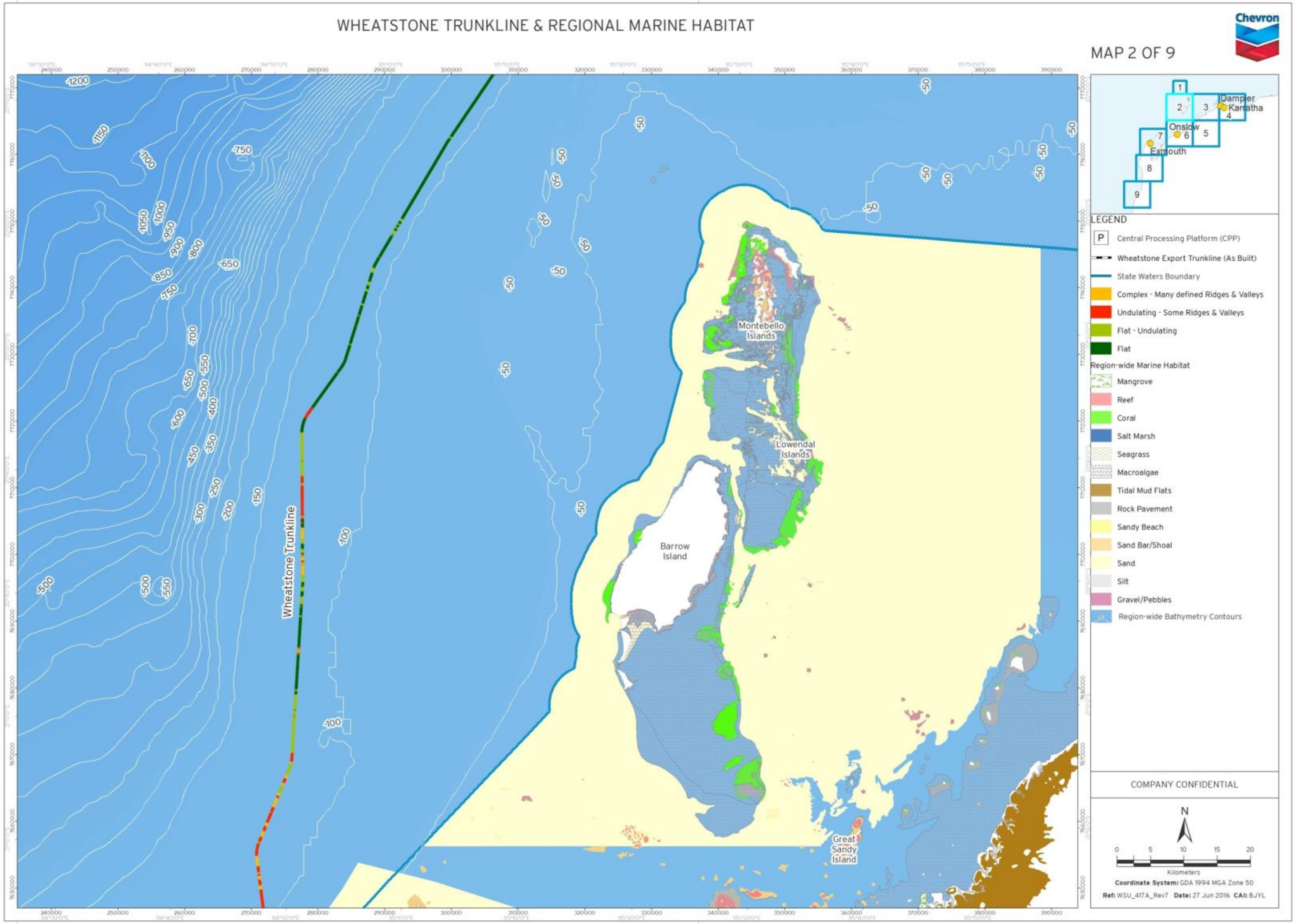


Figure 4-3: Wheatstone trunkline and regional marine habitat (map 2 of 9)

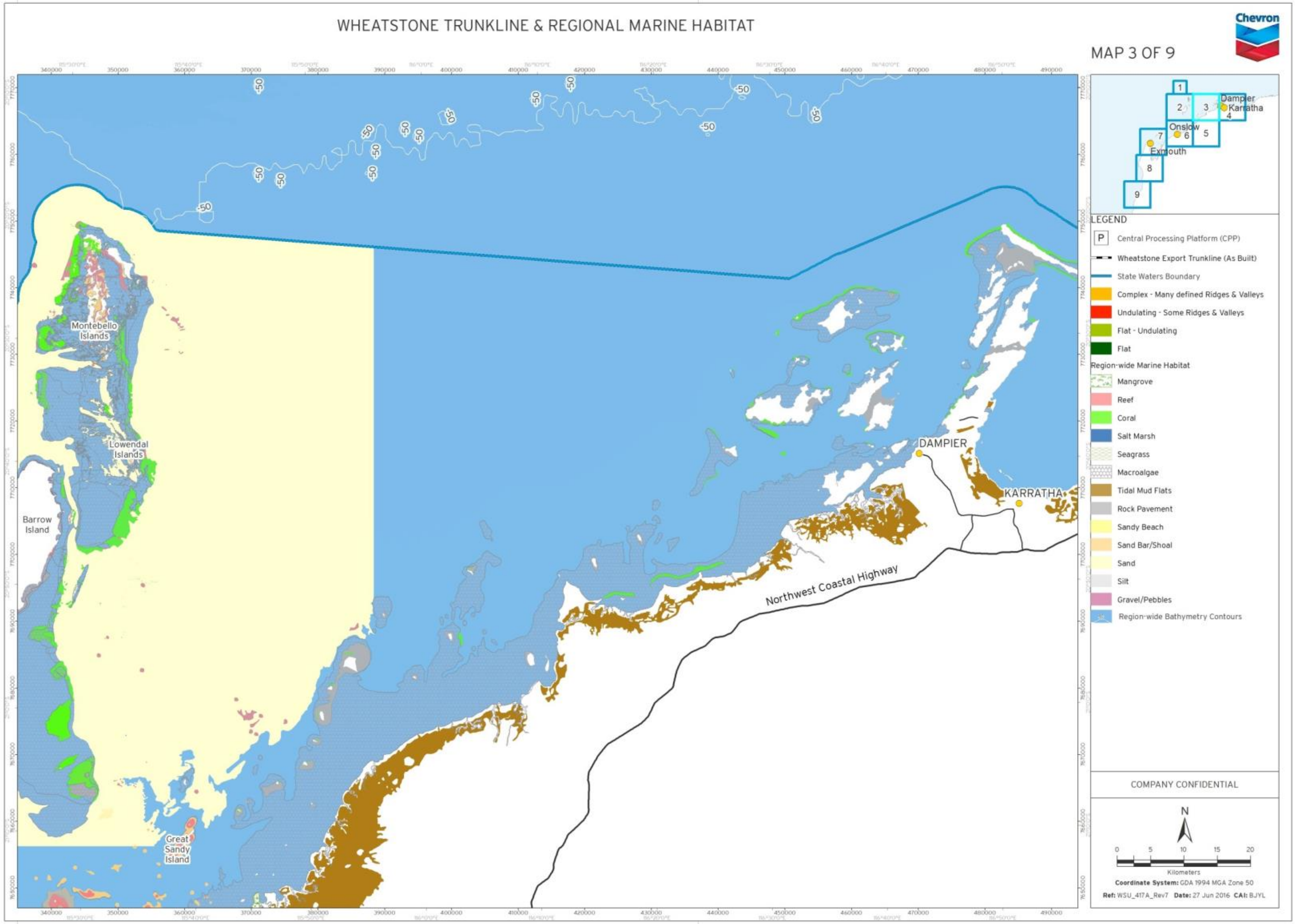


Figure 4-4: Wheatstone trunkline and regional marine habitat (map 3 of 9)

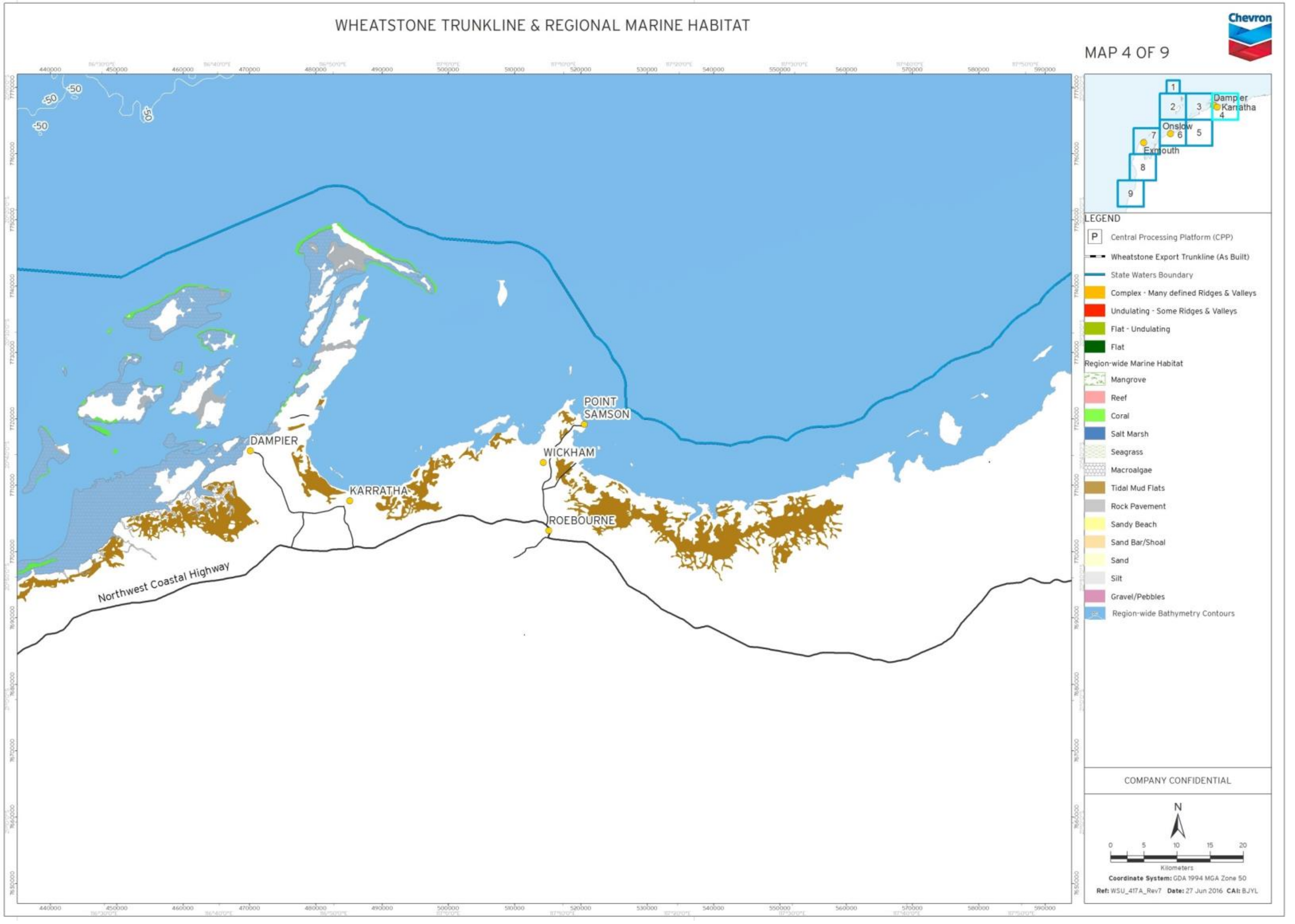


Figure 4-5: Wheatstone trunkline and regional marine habitat (map 4 of 9)

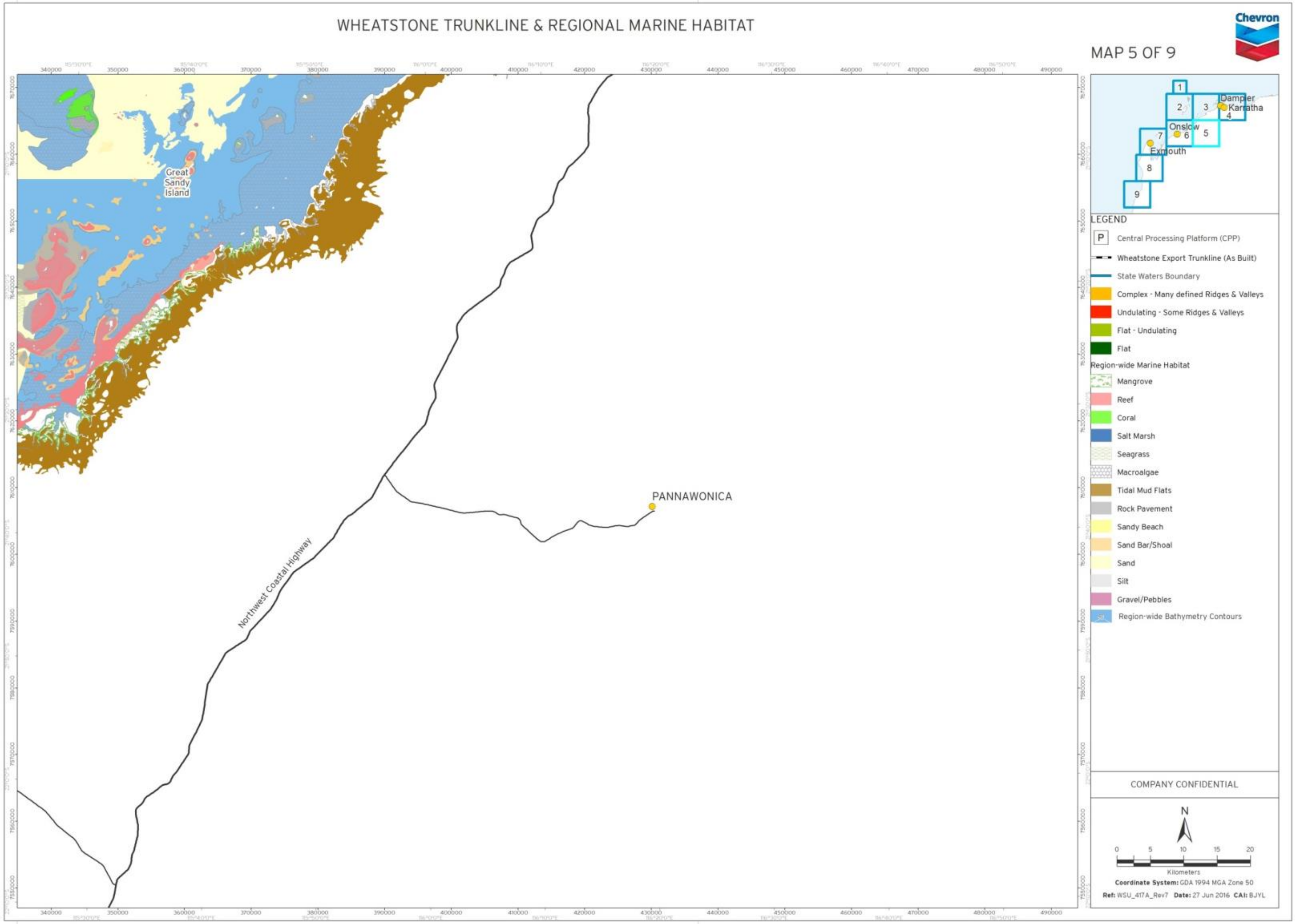


Figure 4-6: Wheatstone trunkline and regional marine habitat (map 5 of 9)

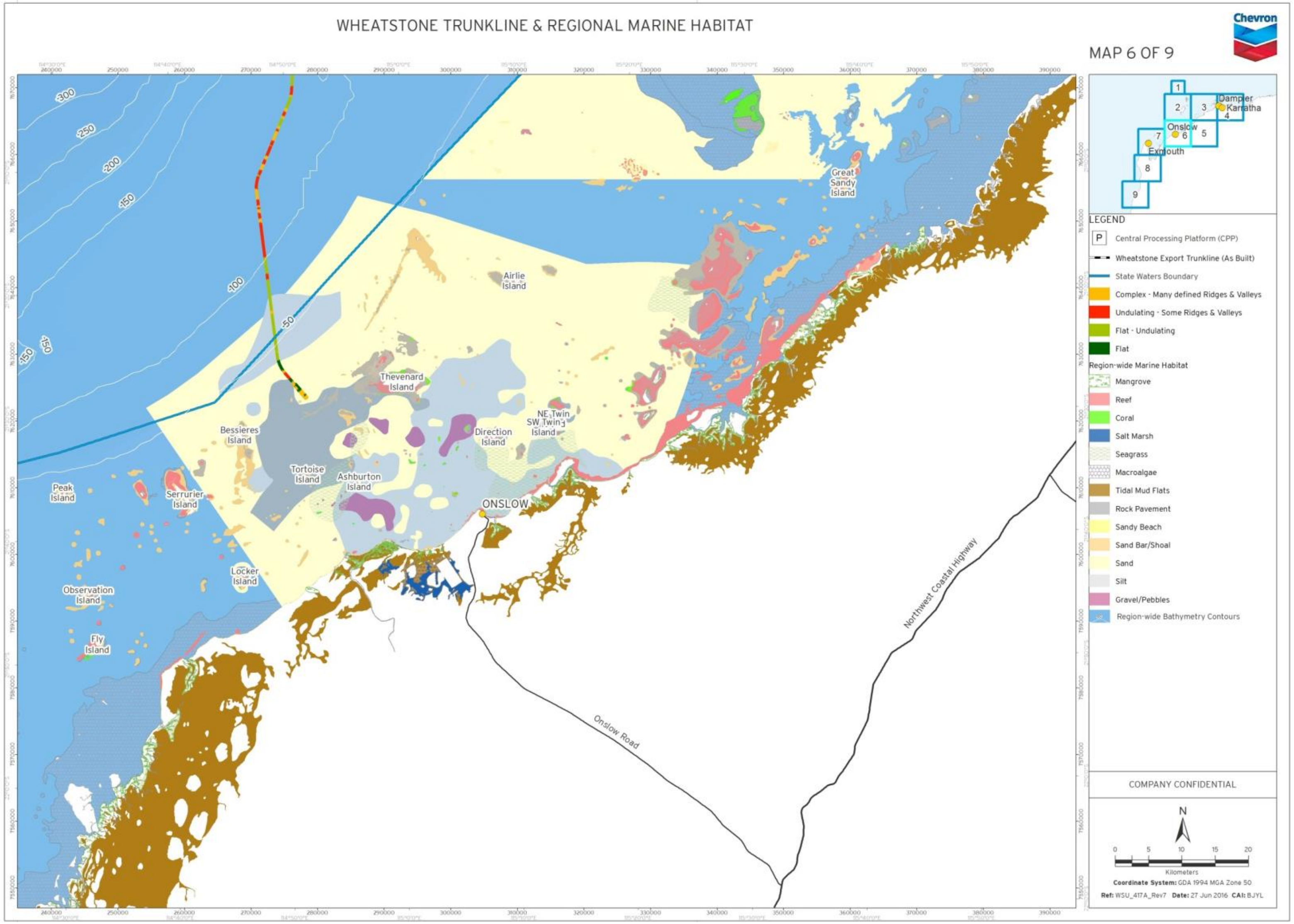


Figure 4-7: Wheatstone trunkline and regional marine habitat (map 6 of 9)

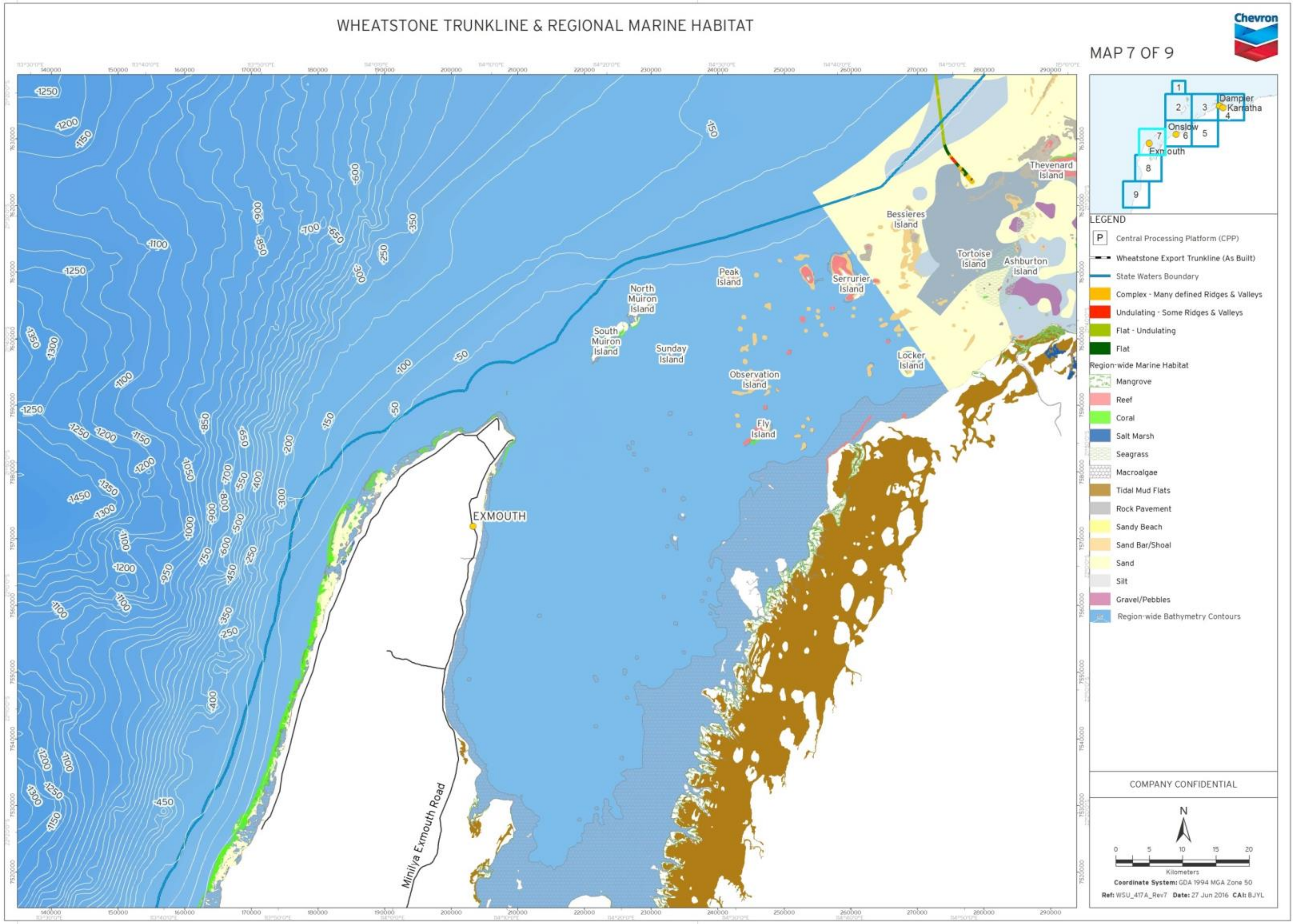


Figure 4-8: Wheatstone trunkline and regional marine habitat (map 7 of 9)

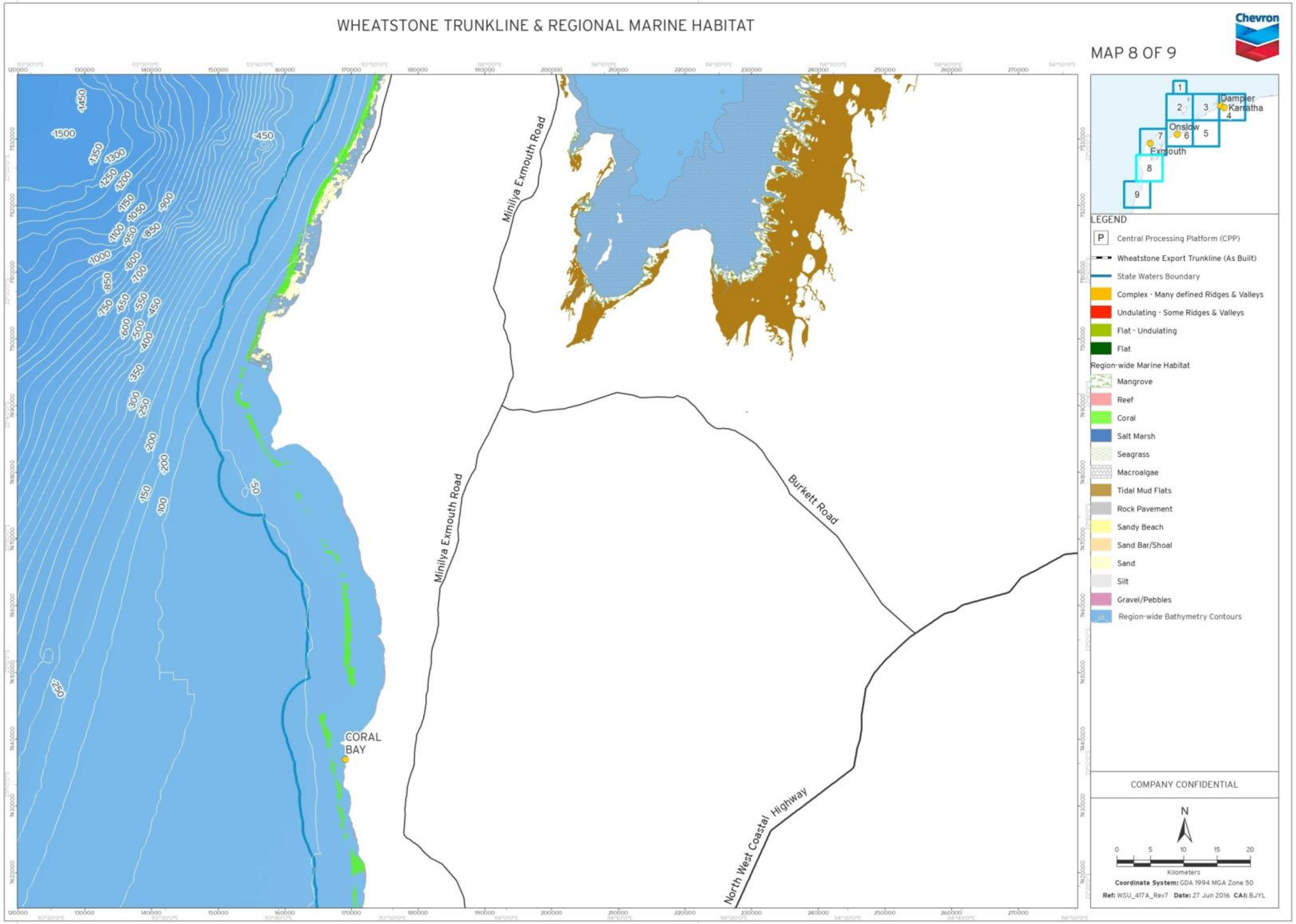


Figure 4-9: Wheatstone trunkline and regional marine habitat (map 8 of 9)

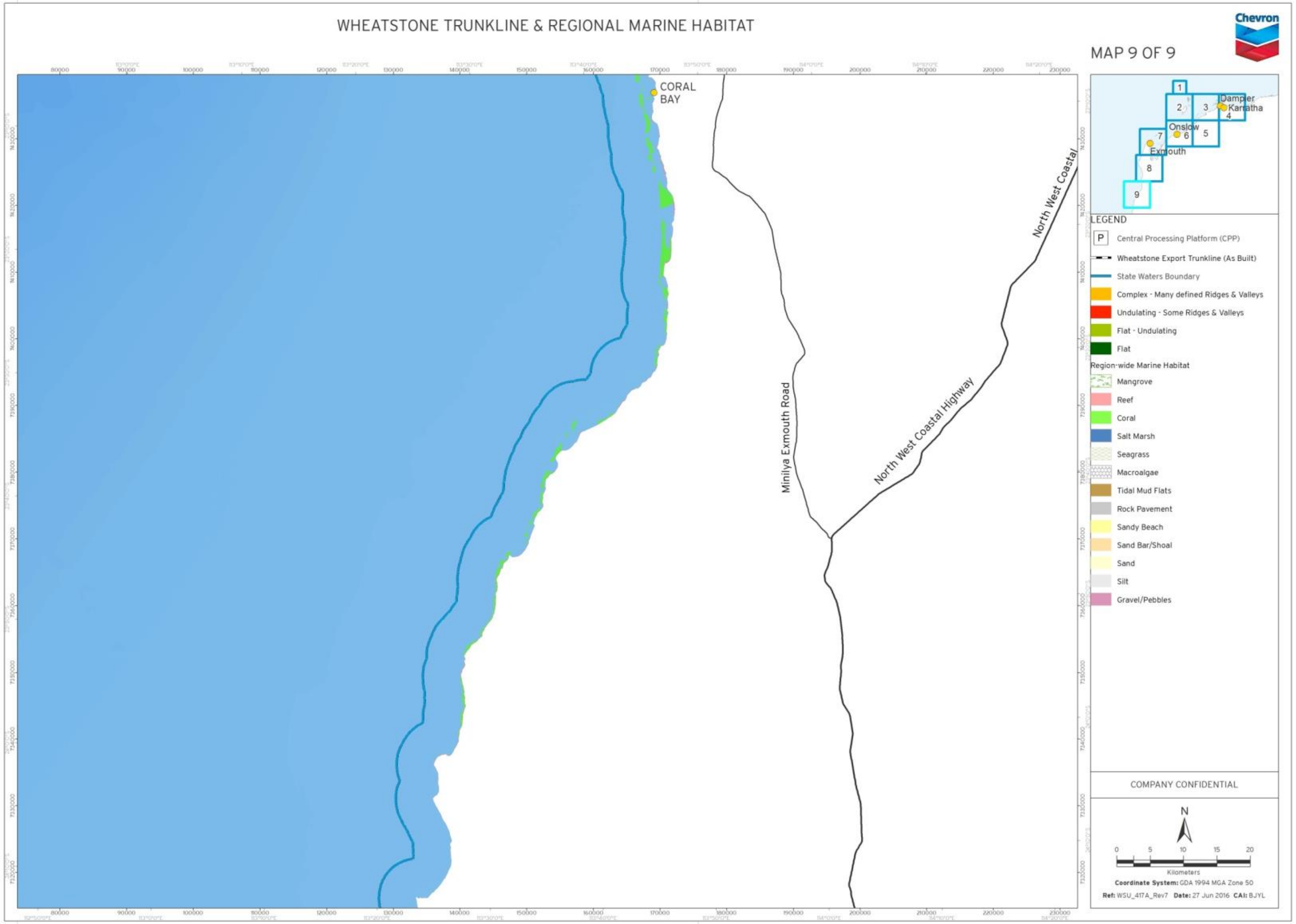


Figure 4-10: Wheatstone trunkline and regional marine habitat (map 9 of 9)

4.3.5.1 Operational area (trunkline)

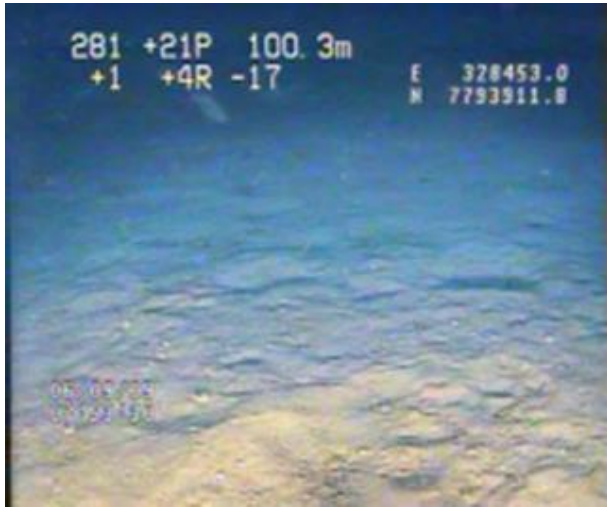
Several data sources were used to define benthic habitat types along the trunkline, including targeted ROV benthic surveys, and geotechnical surveys associated with infrastructure installation for the Wheatstone Project. From the data collected, four benthic habitats were defined in terms of the sea floor substrate (soft versus hard substrate) and topographical complexity, and were used to classify habitat type adjacent to the trunkline. These habitat types were: complex (ridges and valleys), undulating (some ridges), flat (undulating) and flat. The former two are dominated by hard substrate and the latter two by unconsolidated sediment. The description of the trunkline habitat (below) starts at the Wheatstone Platform and continues landward. Table 4-10 describes these habitats and their ecological values; their placement along the Trunkline is shown in Figure 4-11.

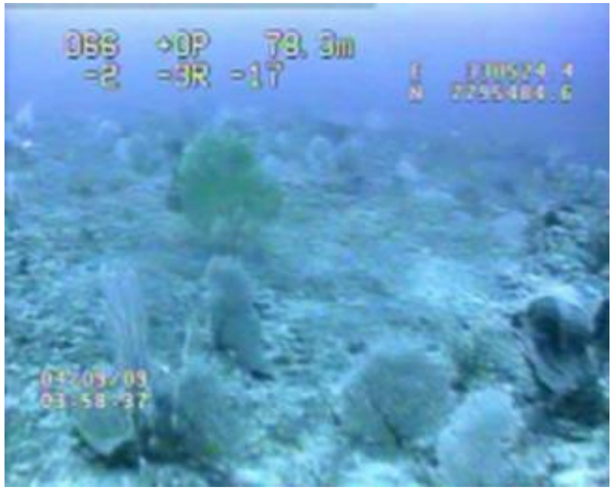
Habitats along the trunkline at depths >100 m were characterised primarily by undulating, flat (undulating), or flat substrates (Figure 4-2, Figure 4-3), with only small localised areas of complex habitat (Ref. 25).

In waters depths between 15 m and 100 m (Figure 4-7), the dominant habitat (>75% of the substratum) observed along the trunkline was sand (Ref. 25). Other habitats included low-profile reef and sand-inundated reefs. Biotic communities associated with the sand habitat in depths between 15 m and 100 m were dominated by mats of red algae, while invertebrates (e.g., sponges, macroalgae) were evident on more complex habitat types (Ref. 25).

The sub-tidal habitats <15 m (adjacent to the mainland, largely in State waters) were described extensively in the Wheatstone Draft EIS/ERMP (Ref. 25). The trunkline in these shallow water environments intercepted inter-reefal habitats characterised by sponges, macroalgae, seagrasses, and sand largely devoid of invertebrates and flora. These form mosaics of habitat patches of varying spatial scales. The broad-scale distribution of seagrasses is shown in Figure 4-7 and the other habitats are shown on maps in Chapter 6 of the Draft EIS/ERMP (Ref. 25). Abundance estimates of these organisms not only vary spatially, but for macroalgae and seagrasses cover estimates vary seasonally. The closest coral reef structure to the trunkline is Ashburton Island, about 1 km west of the trunkline (Figure 4-7). Cover of scleractinian corals on this and other reefs adjacent to the trunkline was typically <10% at the time of the surveys. Turf algae was the dominant sessile benthic organism on these reefs.

Table 4-10: Trunkline habitat characterisation

Habitat	Description	% of Trunkline and position	Representative Imagery
Flat	Habitats characterised by unconsolidated soft sediment, and little to no hard substrate. Flat habitats support no pronounced benthic assemblages, but may support some burrowing organisms.	43%. Largely in deeper habitats >100 m depth, and away from topographic features of ridgelines.	
Flat – Undulating	Habitats largely characterised by unconsolidated soft sediment, with small patches of topographic complexity representing rock or hard structure in undulating areas, which has a low potential to support invertebrate assemblages. Flat-undulating habitats may support 1 to 2% of benthic invertebrates, such as sponges, but has no pronounced benthic assemblages; may support some burrowing organisms.	28%. Largely in deeper habitats >100 m depth, and away from topographic features of ridgelines.	

Habitat	Description	% of Trunkline and position	Representative Imagery
Undulating – Some Ridges and Valleys	Habitats largely characterised by hard substrate patches broken by areas of soft unconsolidated sediment that appear to have accumulated between undulations. Undulating habitat may support 2 to 10% of benthic invertebrates, such as sponges and the presence of gorgonians; may support some burrowing organisms in areas of soft substrate.	22%. Largely adjacent to state water (>70 m depth), and adjacent to the Wheatstone Platform, on the ridgeline.	
Complex – Many Defined Ridges and Valleys	Habitats largely characterised by hard substrate forming calcariate reef. Undulating habitat may support 2 to 10% or more of benthic invertebrates, such as sponges and gorgonians in more pronounced benthic communities; unlikely to support some burrowing organisms due to the absence of soft substrate.	7%. Largely adjacent to state water (>70 m depth), and adjacent to the Wheatstone Platform, on the ridgeline.	

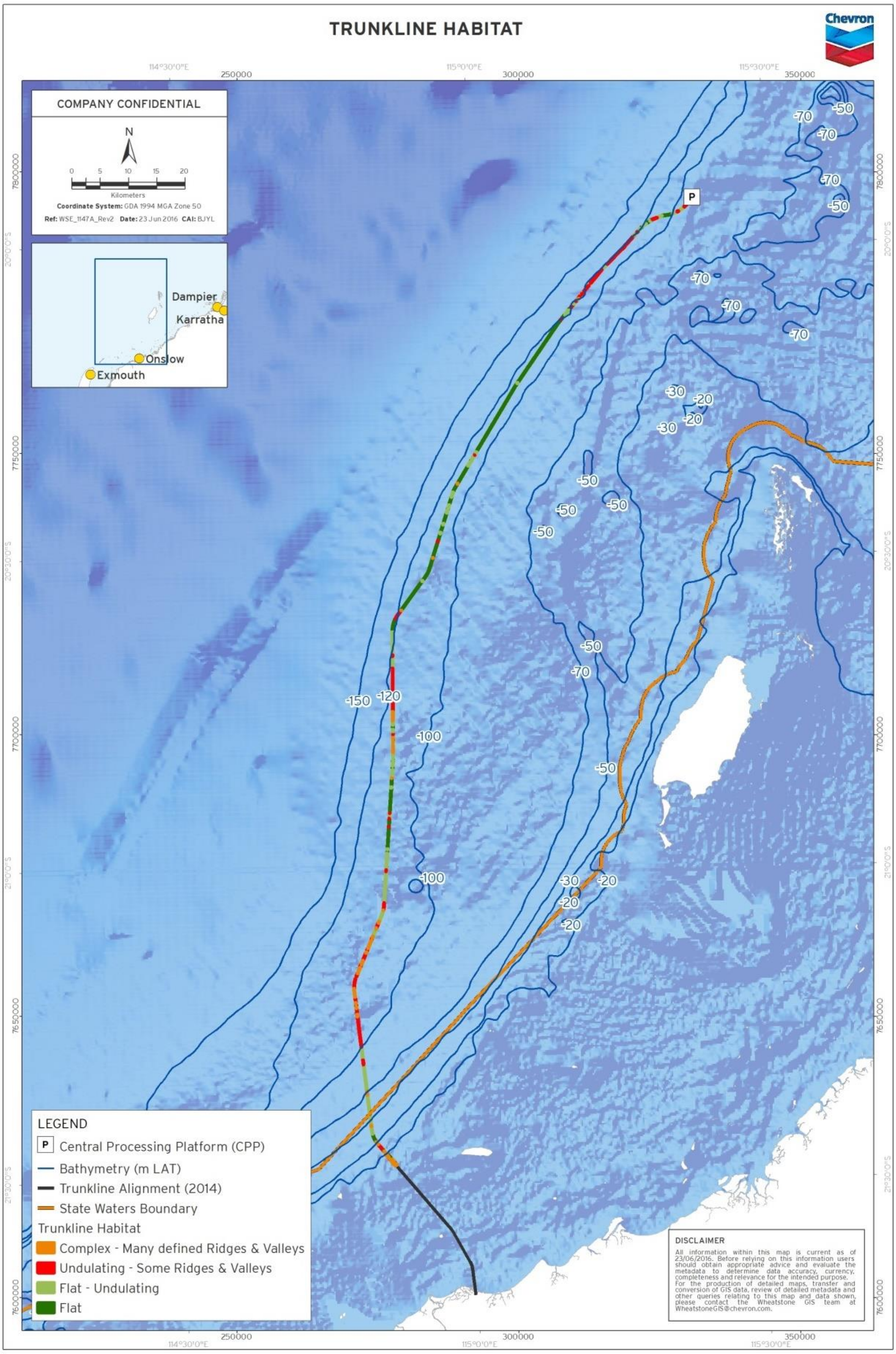


Figure 4-11: Wheatstone trunkline habitat

4.3.5.2 Operational area (platform)

The platform is on a ridgeline (~11 km long), in an area of hard substratum (Figure 4-12, Figure 4-13). The closest drill centre is ~4 km from the ridgeline. Much of the seafloor at the platform and its immediate vicinity comprises hard rock with a thin veneer of sand. This has been identified using a combination of cone penetration tests, multibeam echo sounder and video images taken before the installation of the rock blanket (Ref. 26).

The platform ridgeline is not an isolated area of hard substratum, as there are additional areas of hard substratum to the northeast and southeast, outside the OA. The platform hard substratum may support higher amounts of benthic fauna (such as sponges and soft corals), relative to soft substratum (Ref. 27) (Figure 4-14). Based on studies undertaken for the Project, the categories of marine habitats and associated benthic fauna identified around the platform are described in more detail below.

Benthic or seafloor habitats were characterised by 2–10% cover of sessile benthic invertebrates (Ref. 28). The dominant sessile benthic invertebrates on the ridgeline were soft corals, sea fans, and sponges (Ref. 28) (Figure 4-14). Soft corals and sea fans belong to the order Alcyonacea, but are hereafter collectively referred to as ‘gorgonians’. The term ‘sea fan’ is reserved exclusively for gorgonians with a fan-shaped morphology, which appear to be the dominant growth-form on the ridgeline (Ref. 28) (Figure 4-14). The apparent absence or rarity of zooxanthellae hard corals and gorgonians at the ridgeline probably relate to low benthic light levels at depths >70 m.

A baseline benthic habitat survey was undertaken in December 2016 (Ref. 221). The survey found the dominant benthic organisms on the ridgeline belonged to the phylum Cnidaria, and included gorgonians, antipatharians (or black coral) and hydrozoans. Overall, the cover (percentage cover) and density (counts/unit area) of benthic organisms were low and spatially variable in the study area. Densities were positively correlated with increasing levels of hard substrate and negatively correlated with increasing water depth.

Findings reported in 2010 (Ref. 28) and 2016 (Ref. 221) are similar to those of other surveys conducted on the North West Shelf (NWS), which found hard substratum to be characterised by epifauna assemblages dominated by gorgonians and sponges (Ref. 29).

Gorgonians belong to the taxonomic class Anthozoa. Unlike hard corals, most gorgonians lack a ridged skeleton and the fan-shaped gorgonians from the Indo-Pacific do not possess the symbiotic dinoflagellates called zooxanthellae (Ref. 29). The taxonomy of gorgonians and sponges on the north-west shelf is incomplete (Ref. 29). Azooxanthallate gorgonians are suspension feeders that rely on currents to transport food, such as small plankton, to their polyps (Ref. 29).

Sponges also rely on currents to transport food, such as plankton and bacteria (Ref. 30). This may explain the dominance of gorgonians and sponges on the ridgeline. Most gorgonians and sponges need to attach to hard substratum, but some species of sponges can burrow into sediment (Ref. 30). This may also explain why cover and densities of these animals are less on the soft substratum compared with the ridgeline.

The ridgeline will support fish communities that may differ to that found on the adjacent soft substratum, but are likely to be similar to other hard substratum on the NWS. According to Last et al (Ref. 31) there are 1,090 species of fishes in Australia’s shelf demersal habitat defined as depths between 40 and 200 m. The exact number found in these depths on the NWS is unclear. Sainsbury et al. (Ref. 32) listed 732 species from shelf waters (30–150 m) between Exmouth and the Gulf of Carpentaria. Allen and Swainston (Ref. 33) listed 1062 species for shelf waters (mainland to outer NWS) of northern WA. Only a small sub-set of these species would be demersal that would largely be restricted to hard substratum. Such species would include groupers (*Epinephelus*) and some species of snapper belonging to the genus *Lutjanus* (Ref. 34).

Seagrasses and macroalgae, which are characteristic of sand habitats and reefs, are unlikely to occur within the Commonwealth waters of the operational area (Ref. 36). This is most likely due to low benthic light levels characteristic of deep waters.

Based on available information, the level of diversity does not appear to be greater in the platform area than the remaining area of the ridgeline (Ref. 28). There are no identified ecologically isolated or regionally significant marine habitats found around the platform or in the operational area (Ref. 28; Ref. 37). Fromont *et al*. (Ref. 35) suggest that similar hard substratum habitats of the region, and adjacent regions, occur along the outer shelf and may include some unique species; however, Project surveys indicate these habitats are well represented regionally (Ref. 28; Ref. 37; Ref. 38; Ref. 39).

This finding was consistent with studies of the shallow Australian sponge fauna, indicating that the environmental factors that influence their distribution are generally related to factors of depth, substratum, and currents (Ref. 35). Regionally, hard substratum occur episodically as an escarpment through the Northwest Shelf Province and Northwest Shelf Transition formations (Ref. 35; Ref. 27) at the 125 m depth mark.

4.3.5.3 Operational Area (fields)

CAPL has conducted extensive surveys within the production licences to understand the nature and composition of habitat and seabed sediments, and thus provide accurate bathymetry for geohazard assessment and engineering design. These surveys comprise high-resolution geophysical surveys, predominantly supported by seabed sampling campaigns. Data from these surveys were interpreted to characterise benthic substrate; the benthic habitat within the OA comprises soft substrate (Figure 4-15). These surveys indicate that the seabed in the OA around the subsea infrastructure such as flowlines and drill centres, mostly comprises unvegetated, soft, and unconsolidated sediments with a low but varying degree of benthic invertebrate habitation (Figure 4-16, Figure 4-17) (Ref. 28).

The shelf of the North-west Marine Region contains several terraces and steps. The most prominent of these features occurs as an escarpment along the NWS and Sahul Shelf at a depth of 125 m, known as the ancient coastline. Parts of the ancient coastline, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats such as fish communities in areas otherwise dominated by soft sediments (Ref. 40).

Figure 4-4 to Figure 4-6, and Figure 4-8 to Figure 4-10 illustrate habitats over a wide area and distant from the trunkline in order to provide region-wide perspective. These maps are based on the North West Shelf Marine Habitat data (DBCA) and data collected for the Wheatstone baseline study (Ref. 25). The habitats are described in terms of abiotic and biotic types, and are based on the DBCA-defined classification. Abiotic habitats include ‘sandy beach’ while biotic habitats include ‘seagrass’. The complete habitat classification is shown in the legend of each map. Habitat diversity is greatest closer to shorelines, especially around islands. The dominant subtidal habitat is referred to as ‘sand’ and covers large areas between the mainland and islands.

Note that the seaward boundaries of the DBCA-defined habitats (Figure 4-4 to Figure 4-6, and Figure 4-8 to Figure 4-10) are based on State water limits or boundaries of marine protected areas, and thus do not extend to some sections of the trunkline. To predict habitat types between the DBCA-defined habitats and the trunkline, bathymetric contour lines have been overlayed on the figures. The bathymetric contour lines Figure 4-2 to Figure 4-3 suggest an absence of complex seafloor topography (e.g., reefs, shoals etc.) between the seaward boundaries of the DBCA-defined habitats and the trunkline. Instead, the bathymetric lines suggest that seafloor in this area is characterised by a gentle slope consistent with the subtidal ‘sand’ habitat defined by DBCA.

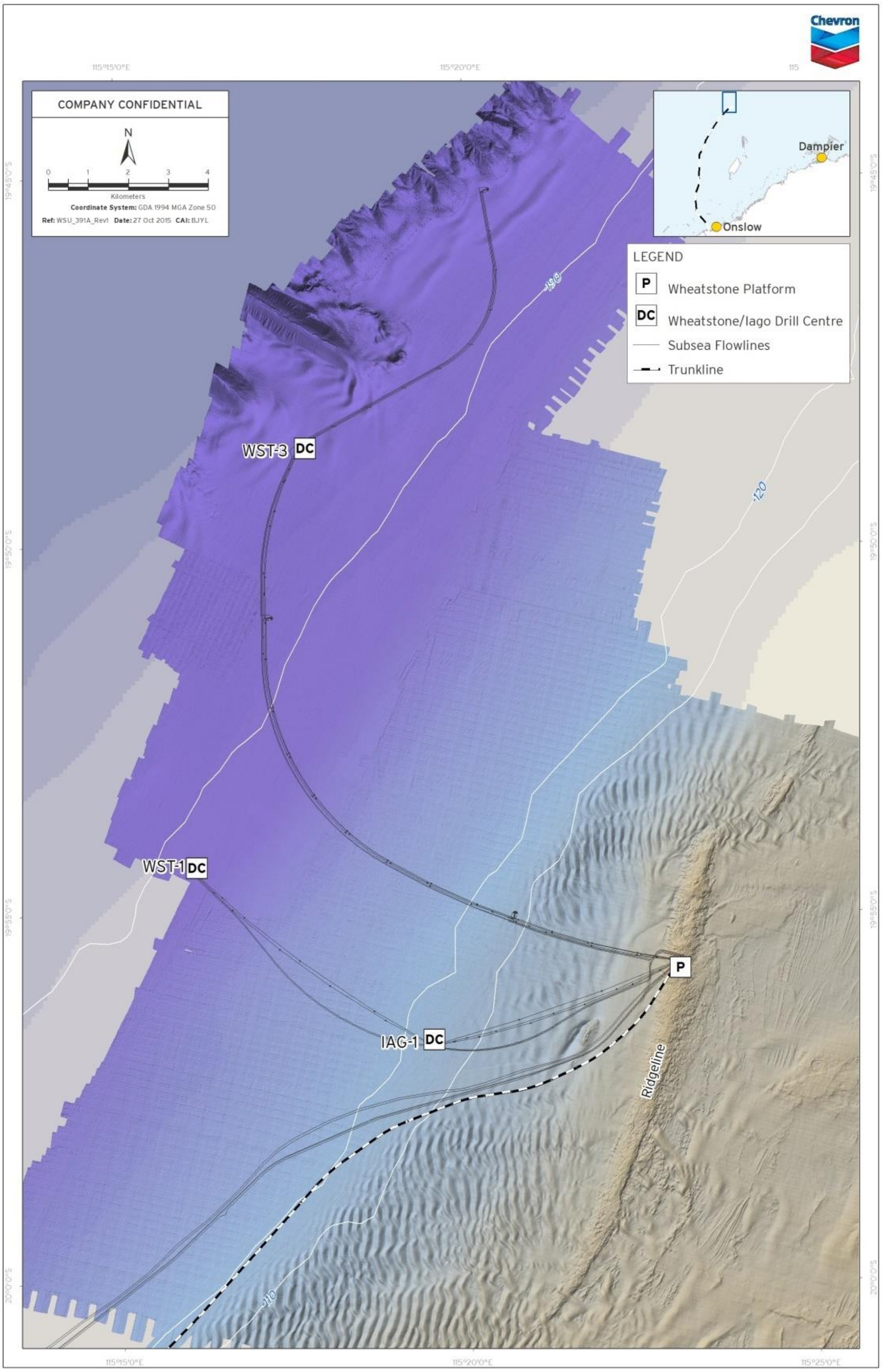


Figure 4-12: Subsea infrastructure relative to the ridgeline

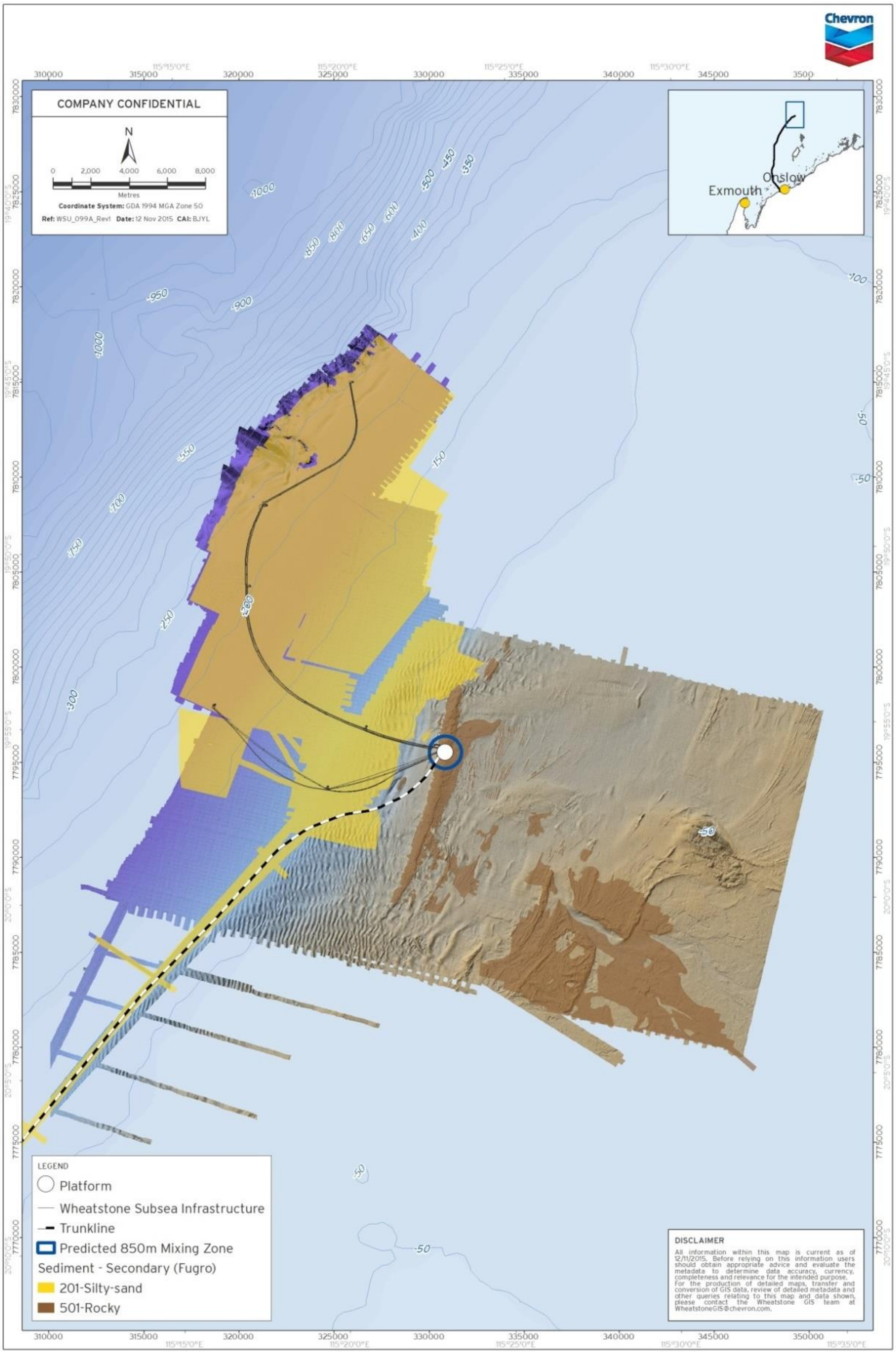
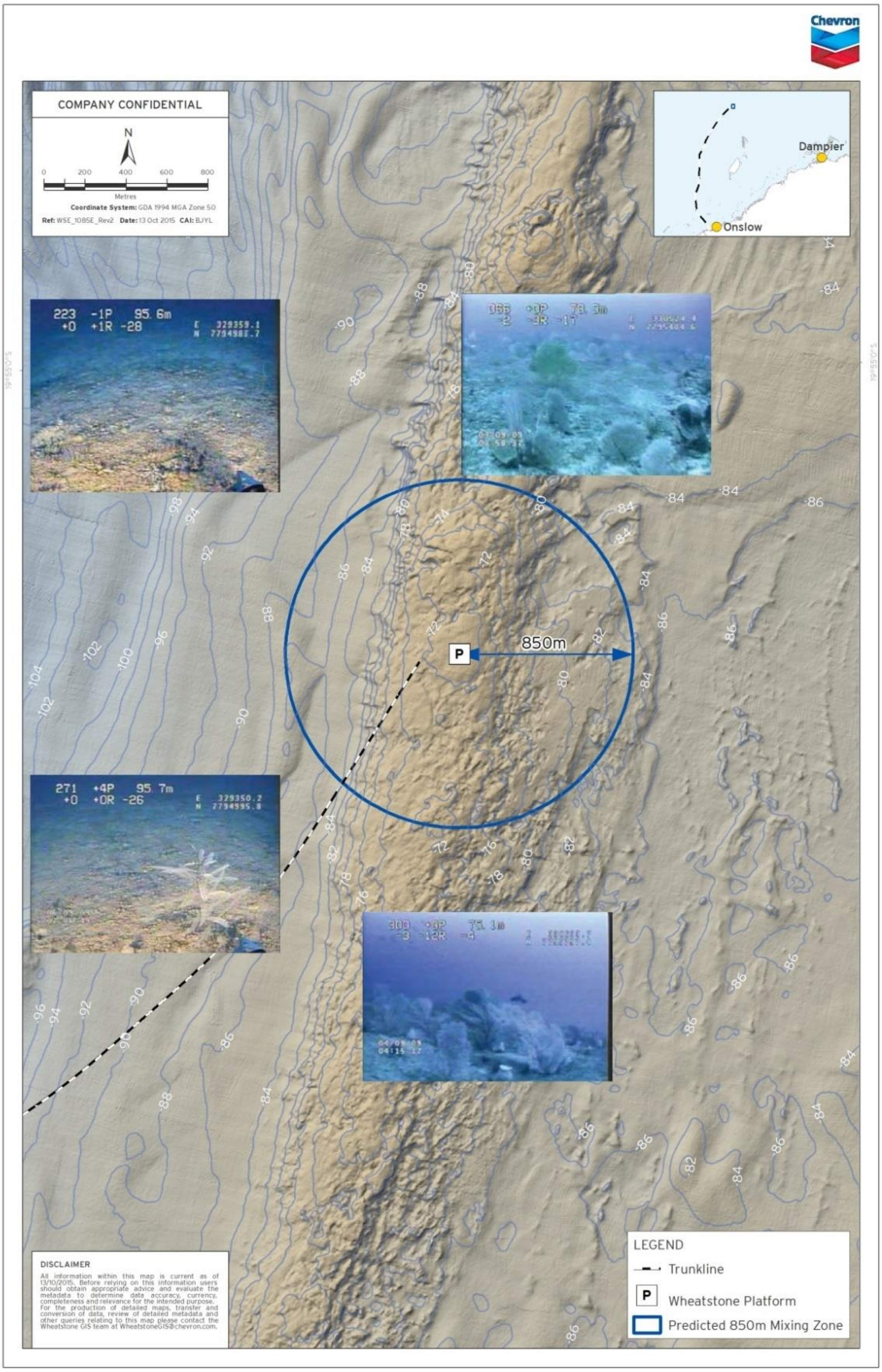


Figure 4-13: Subsea infrastructure, bathymetry, and substratum



Note: representative photographs are shown

Figure 4-14: Common sessile benthic fauna associated with hard substratum of the ridgeline and the adjacent soft substratum

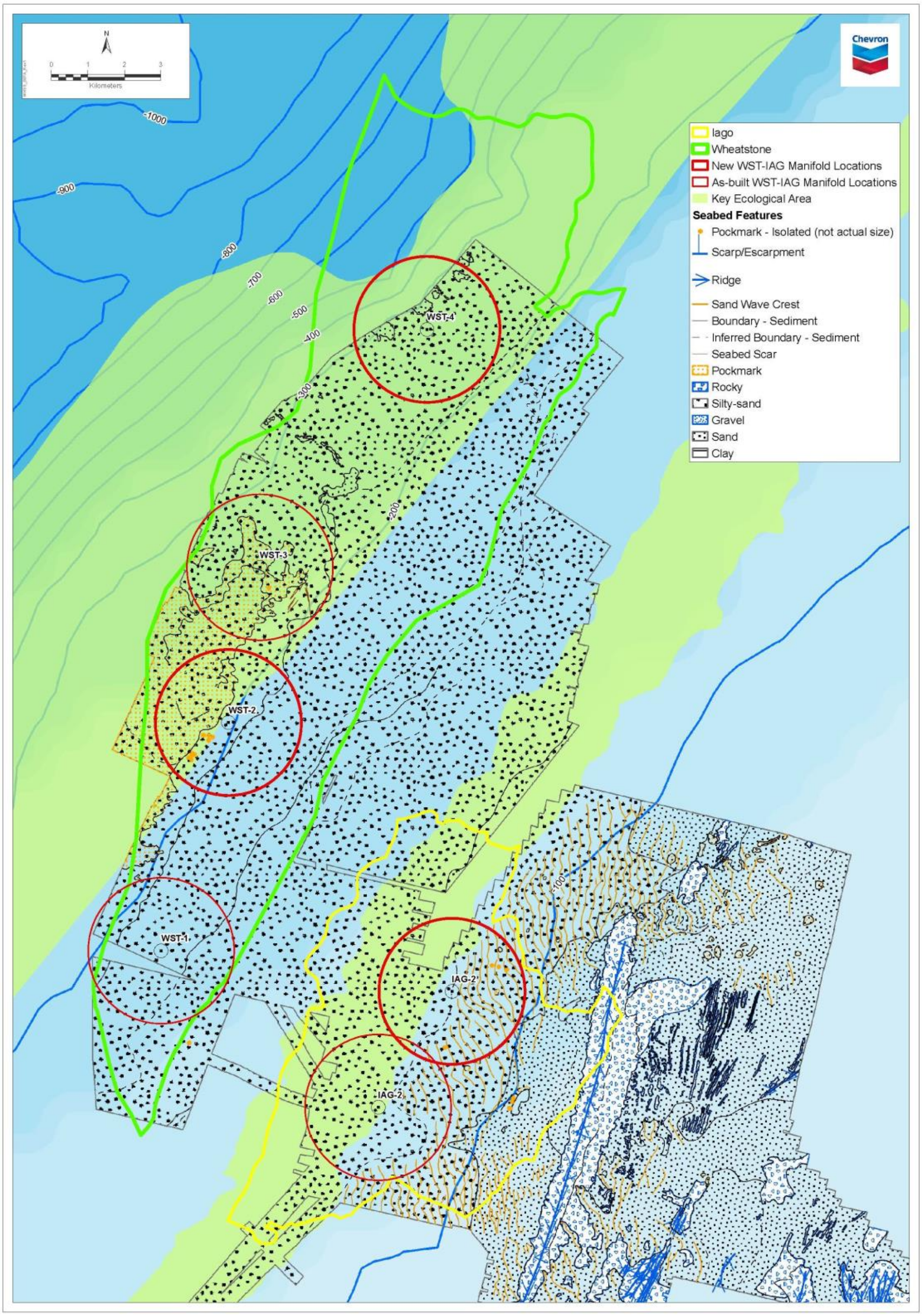


Figure 4-15: Wheatstone and Iago well locations and benthic habitat

Figure 4-16: Seabed survey image showing typical seabed habitat at IAG-1 drill centre

Figure 4-17: Seabed survey image showing typical seabed habitat at WST-3 drill centre

4.3.5.4 Other marine habitat

Marine habitats considered to provide a specific value for matters of national environmental significance (MNES) as described in CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) that were identified within the OA, EMBA, and EEA are shown in Table 4-11.

Table 4-11: Marine habitat and key sensitivities

Matter of national environmental significance	Habitat type					Presence of key value or sensitivity			
	Seagrass	Mangroves	Coral	Saltmarsh	Macroalgae	OA (field)	OA (trunkline)	EMBA	EEA
Mermaid Reef – Rowley Shoals[1]			✓						✓
Ningaloo Coast[2,3]		✓	✓					✓	✓
Ningaloo Marine Area – Commonwealth Waters[1]			✓					✓	✓

1 *Commonwealth Heritage*
2 *National Heritage Place*
3 *World Heritage Property*

4.3.6 Onshore habitats

The small section of the onshore operational area is pre-disturbed (Figure 2-2) as part of an industrial site. The industrial site is the already disturbed area (from previous phases of the Project) and provides little local ecological value. No threatened ecological communities coincide with the onshore area (Ref. 25).

The Interim Biogeographic Regionalisation for Australia (IBRA) categorises the Australian continent into regions of similar geology, landform, vegetation, fauna and climate, referred to as bioregions. Ashburton North is located at the junction between two Interim bioregions: the Carnarvon and Pilbara bioregions, with the majority of Project infrastructure located within the north-eastern corner of the Carnarvon bioregion. The sub-Carnarvon region is distinguished by quaternary coastal beach dunes and mud flats. These tidal mudflats support extensive mangroves, beach dunes with spinifex communities and an extensive mosaic of alluvial plains with samphire and saltbush low shrub-lands. Most of the area is comprised of a sandy surface covered with grasses and low bushes (Coastal Ridge and Longitudinal Dune System).

An assessment of potential acid sulphate soils (PASS) undertaken as part the *Draft Environmental Impact Statement / Environmental Review and Management Proposed Wheatstone Project* (Ref. 25) indicated that a moderate to high risk of the presence of PASS typically occurred at or below the water table. In an undisturbed state, any PASS are benign and do not pose a risk to the environment; it is the disturbance and subsequent exposure to water and oxygen that can lead to acidic conditions.

Environmental groundwater heads indicate water table mounding beneath the dunes and discharge towards the ocean with widely variable salinity, ranging from brackish, saline, to hypersaline.

4.3.6.1 Vegetation

Vegetation units that are in proximity to the onshore operational area of PL99 include CD1 and CD2, both of which are within the Coastal Sand Dunes habitat type (Ref. 41) and CS1/CS2 from the Coastal Sand Plains habitat. These vegetation units are described as being of low local significance as they do not support threatened flora, priority flora or other flora species of interest (Ref. 41).

These vegetation units are representative of the vegetation in the locality and are substantially degraded by the invasion of buffel grass (*Cenchrus ciliaris*).

One vegetation unit, CP1, within the Clayey Plains habitat type is described as being of Moderate conservation value, being generally in very good condition and supporting a suite of species specific to this substratum. An additional vegetation unit, ID1 is considered to be of High local conservation significance as it potentially supports Priority Flora (*Eremophila forrestii* subsp. *viridis* and *Triumfetta echinata*), species of interest (*Aenictophyton aff. reconditum*), and the dune features would also be particularly susceptible to erosion and weed invasion following disturbance to the soil profile. However, only one flora taxa of conservation interest has been recorded in proximity to the PL99 licence area. Abutilon sp. is an undescribed taxa, which has been recorded from multiple locations within the wider Wheatstone EIS/ERMP vegetation and flora survey area.

Mangroves are of conservation significance. This vegetation unit is discussed further in CAPL's *Description of the Environment* (Ref. 1; appendix d) as part of the shoreline habitats description.

An ecological community is a naturally occurring group of plants, animals and other organisms interacting in a unique habitat. The Minister for Environment may list an ecological community as being threatened (threatened ecological communities [TECs]) if the community is presumed to be totally destroyed or at risk of becoming totally destroyed. Ecological communities with insufficient information available to be considered a TEC, or which are rare but not currently threatened, are placed on the priority list and referred to as priority ecological communities (PECs). No TECs or PECs are located within the OA at Ashburton North. Additionally, no ecological communities listed under the EPBC Act are known to occur within this area.

4.3.6.2 Fauna

Vertebrate Fauna Species

Extensive surveys of terrestrial fauna have been conducted in the vicinity of the Project area, and ten broad fauna habitats were identified (Ref. 41). These habitats were distinguished on the basis of differences in substrate, vegetation, soils and landform. The Wheatstone LNG Fauna Study identified 128 vertebrate species, comprising 51 herpetofauna, 60 avifauna and 17 mammals (Ref. 41). The following six threatened (Schedule 1) vertebrate fauna species (or signs of these species) were recorded:

- Little Northern Freetail Bat (*Mormopterus loriae cobourgensis* [Priority 1])
- Australian Bustard (*Ardeotis australis* [Priority 4])
- Western Pebble-mound Mouse (*Pseudomys chapmani* [Priority 4])
- Rainbow Bee-eater (*Merops ornatus* [Migratory])
- Fork-tailed Swift (*Apus pacificus* [Migratory])
- White-bellied Sea Eagle (*Haliaeetus leucogaster* [Migratory]).

These species are well represented in the wider area. It was concluded that the OA and surrounds does not support significant numbers of migratory waterbirds and studies have also demonstrated that the locality is not an important habitat for migratory bird species (Ref. 25).

Short Range Endemics

Despite thorough searching surveys of suitable habitat for invertebrate groups considered to support short-range endemic taxa, none were identified within the Ashburton North locality (Ref. 25).

Subterranean Fauna

A subterranean fauna study was conducted for the Wheatstone Project with sampling conducted in June, July, September, and October 2009 (Ref. 25). A desktop assessment of the likelihood of subterranean fauna being found within the plant site and within the shared infrastructure corridor was conducted.

No troglobitic fauna were recovered from any of the 96 traps within the 18 bore holes that were sampled. The desktop assessment concluded that there is a low likelihood that the survey area would support a significant troglobitic community as the landforms, stratigraphy and the small amount of habitat space available between the ground surface and the water table are not conducive to troglobitic fauna (Ref. 25). The survey results suggest that a diverse or significant stygal community does not occur in the aquifers beneath the survey area (Ref. 25).

4.4 Commercial interests

4.4.1 Commercial fisheries

Natural and physical resources are described as substances occurring in nature that can be exploited for economic gain. The specific resources considered in this EP include commercial fisheries. CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and summarises the commercial fisheries that have management areas present within the Planning Area, and seasonal catch data for the entire fishery. The occurrence of recent fishing effort within the areas (OA, EMBA, and EEA) specific to this EP are identified below.

The State-managed commercial fisheries with fishing effort recorded over a 20-year period (1999–2019) (Ref. 42) within areas that overlap the OA, EMBA, and EEA are listed in Table 4-12. Seven fisheries were identified with activity within the vicinity of the OA; these are shown in Figure 4-18 to Figure 4-24.

The Commonwealth-managed commercial fisheries with fishing effort recorded over a five-year period (2015–2020) (Ref. 43) within areas that overlap the OA, EMBA, and EEA are listed in Table 4-13. The only fishery with fishing effort recorded within the OA was the North West Slope Trawl Fishery (Table 4-13, Figure 4-25). Relative fishing intensity data is not available for this fishery due to low vessel numbers and confidentiality. The Southern Bluefin Tuna Fishery is active within waters in the Great Australian Bight and south-eastern Australia (i.e., not within the OA, EMBA, or EEA); however, the spawning grounds for Southern Bluefin Tuna are located in the north-east Indian Ocean (Ref. 43). This indicative spawning area extends into the OA, EMBA, and EEA.

Table 4-12: Presence of recent fishing effort recorded during 1999–2019 within State-managed commercial fisheries

Fishery	OA (field)	OA (trunkline)	EMBA	EEA
North Coast Bioregion				
Mackerel Managed Fishery		✓	✓	✓
Nickol Bay Prawn Managed Fishery			✓	✓

Fishery	OA (field)	OA (trunkline)	EMBA	EEA
Onslow Prawn Managed Fishery		✓	✓	✓
Pilbara Crab Managed Fishery		✓	✓	✓
Pilbara Fish Trawl (Interim) Managed Fishery			✓	
Pilbara Line Fishery	✓	✓	✓	✓
Pilbara Trap Managed Fishery	✓	✓	✓	✓
West Australian Sea Cucumber (Beche-De-Mer) Fishery			✓	✓
Gascoyne Bioregion				
Exmouth Gulf Prawn Managed Fishery			✓	✓
Gascoyne Demersal Scalefish Fishery			✓	✓
Shark Bay Crab Fishery				✓
Shark Bay Prawn Managed Fishery				✓
Shark Bay Scallop Managed Fishery				✓
West Coast Deep Sea Crustacean Fishery			✓	✓
West Coast Bioregion				
West Coast Rock Lobster Fishery				✓
West Coast Demersal Scalefish (Interim) Managed Fishery				✓
Statewide				
Marine Aquarium Fish Managed Fishery		✓	✓	✓
Specimen Shell Managed Fishery		✓	✓	✓

Table 4-13: Presence of recent (2015-2020) fishing effort recorded within Commonwealth-managed commercial fisheries

Fishery	OA (field)	OA (trunkline)	EMBA	EEA
North-West Slope Trawl Fishery	✓		✓	✓
Western Deepwater Trawl Fishery			✓	✓
Western Tuna and Billfish Fishery				✓

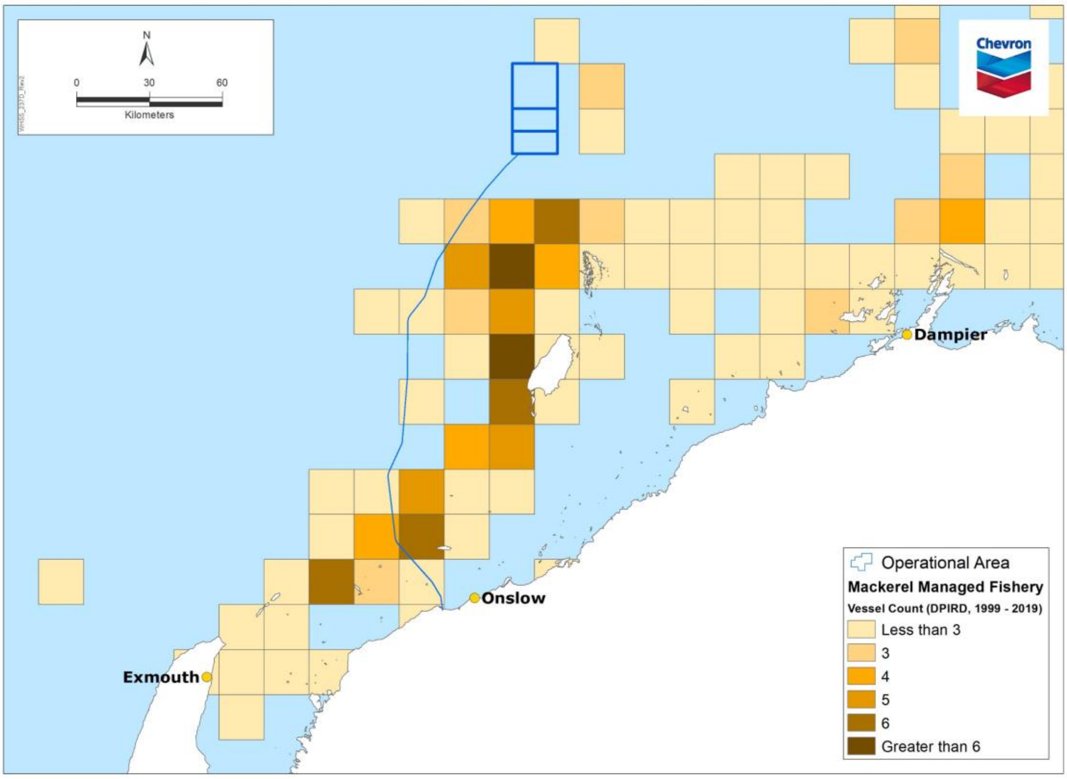


Figure 4-18 Recorded fishing effort for the Mackerel Managed Fishery within the vicinity of the OA

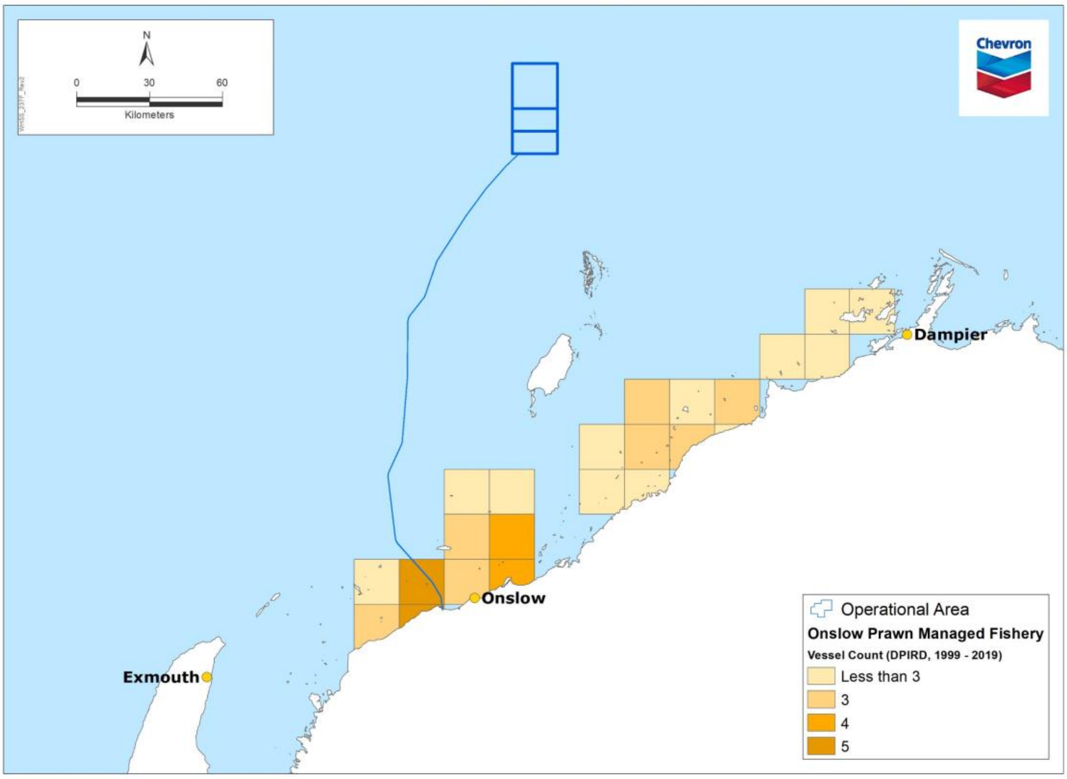


Figure 4-19: Recorded fishing effort for the Onslow Prawn Managed Fishery within the vicinity of the OA

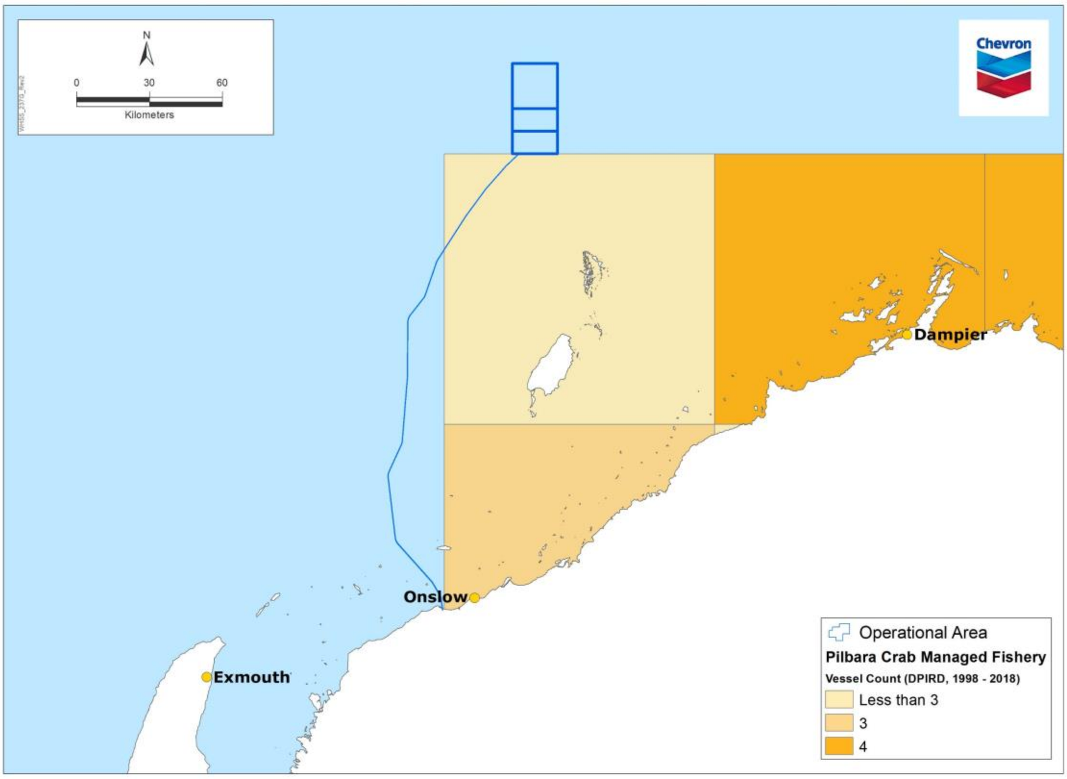


Figure 4-20: Recorded fishing effort for the Pilbara Crab Managed Fishery within the vicinity of the OA

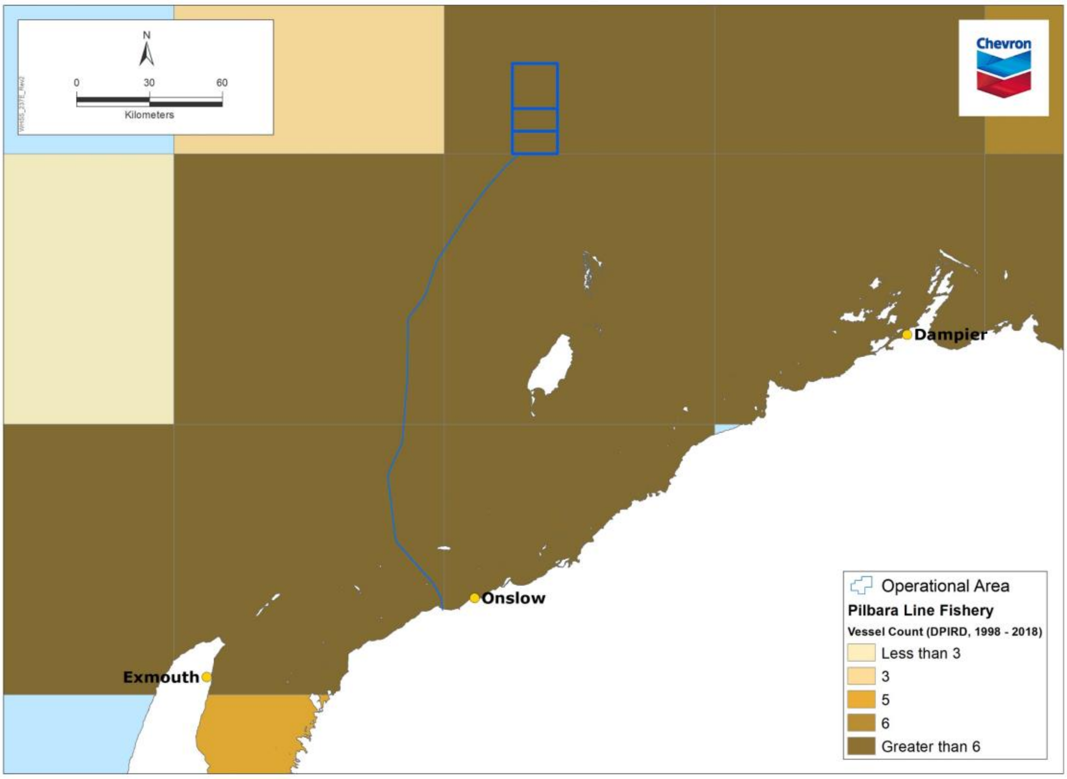


Figure 4-21: Recorded fishing effort for the Pilbara Line Fishery within the vicinity of the OA

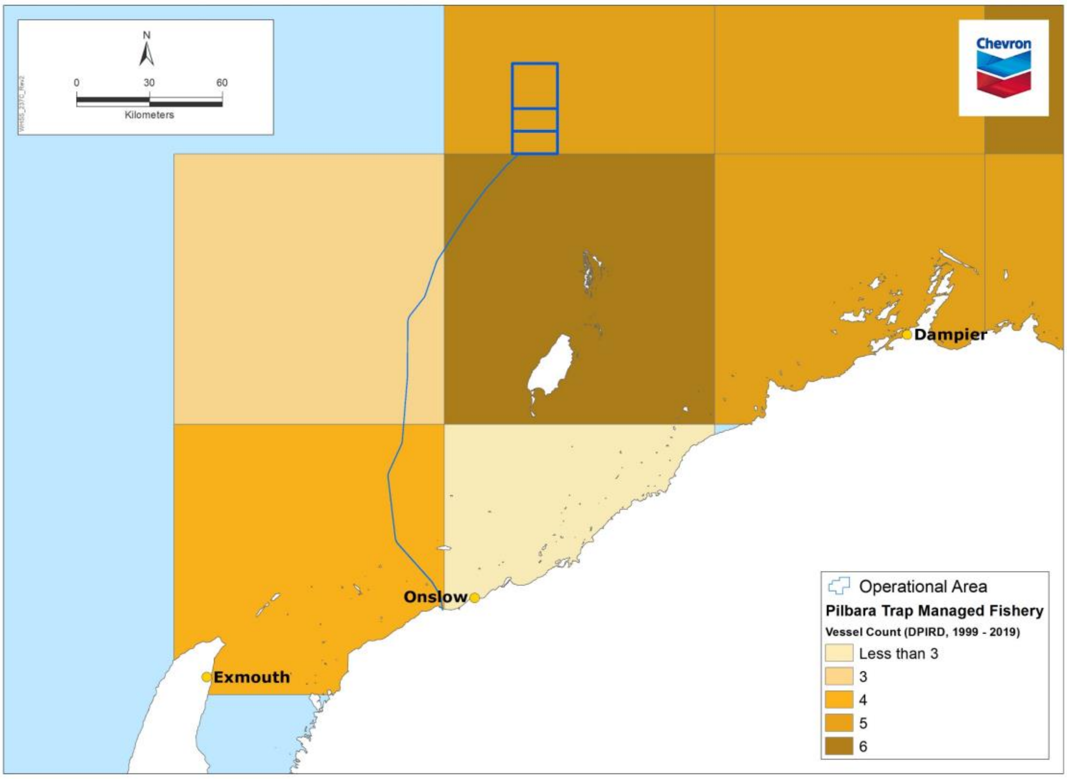
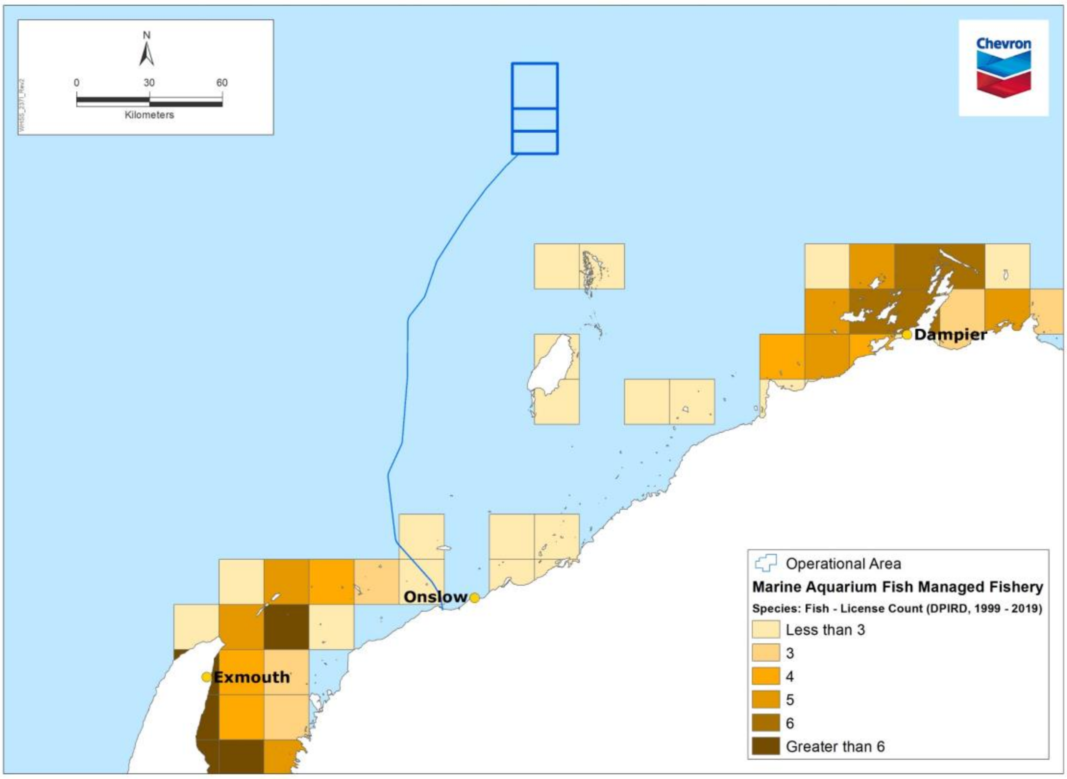


Figure 4-22: Recorded fishing effort for the Pilbara Trap Managed Fishery within the vicinity of the OA



Note: Collection effort shown for fish, and no other components (e.g., corals, invertebrates) of the fishery

Figure 4-23: Recorded fishing effort for the Marine Aquarium Fish Managed Fishery within the vicinity of the OA

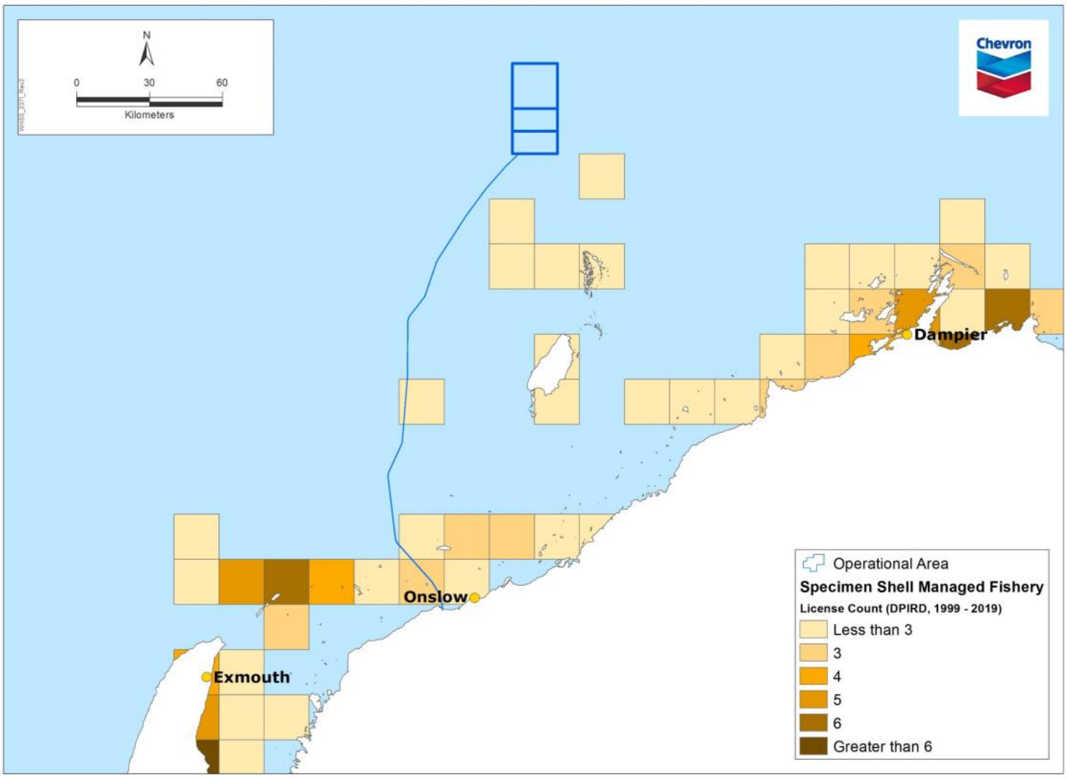
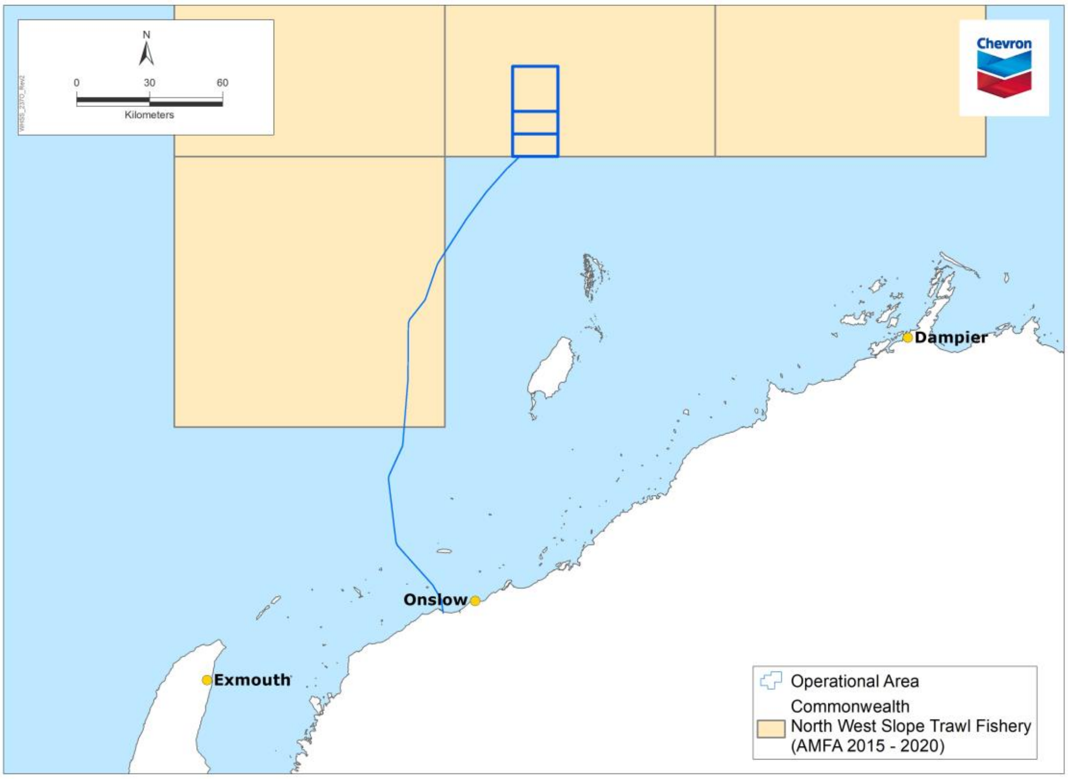


Figure 4-24: Recorded fishing effort for the Specimen Shell Managed Fishery within the vicinity of the OA



Source: Fisheries data were supplied by the Australian Bureau of Agricultural and Resource Economics and Sciences from data collected by the Australian Fisheries Management Authority. Where <5 vessels were operating data is available only in the form of a 'footprint' (i.e., total area of waters fished), and not as a relative fishing intensity.

Figure 4-25: Presence of fishing activity (2015-2020) for the North West Slope Trawl Fishery within the vicinity of the OA

4.4.2 Shipping

AMSA collects vessel traffic data from a variety of sources, including satellite shipborne automated identification system (AIS) data, across Australia's Search and Rescue region. This data has been used to develop Figure 4-26, which shows recent vessel traffic within the vicinity of the OA. The figure shows some increased density around CAPL's existing infrastructure, but also shows that the OA is not located within any of the main shipping fairways on the NWS.

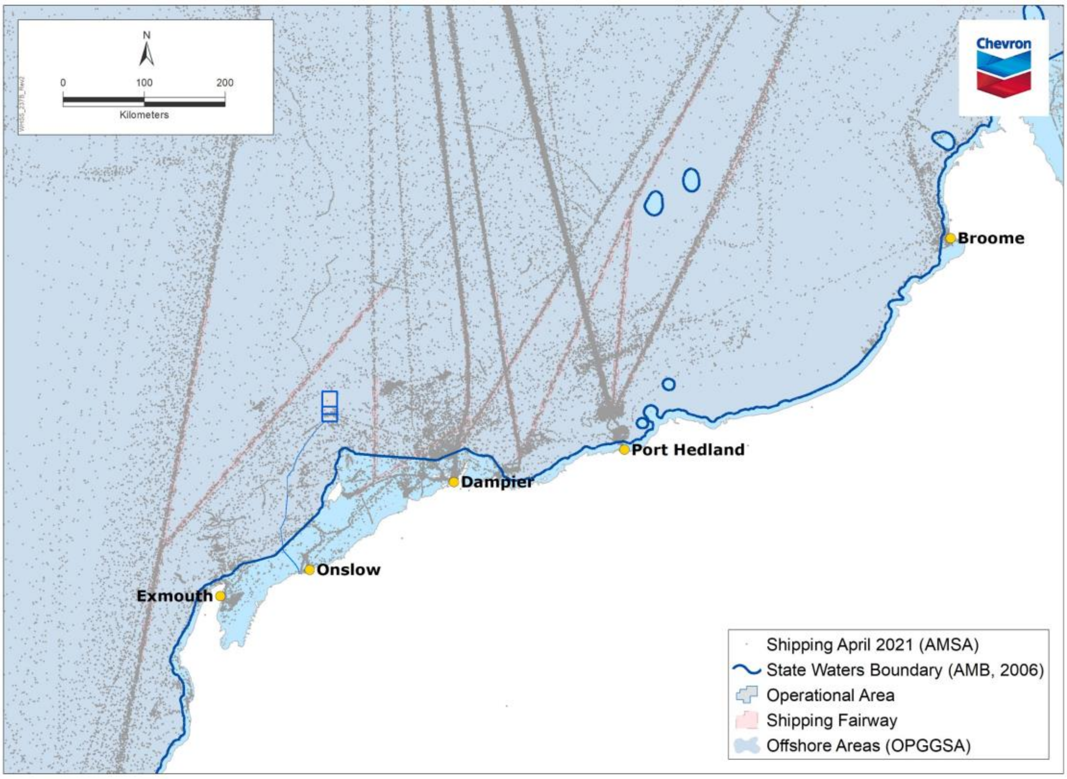


Figure 4-26: Vessel traffic within the vicinity of the OA

4.5 Qualities and characteristics of locations, places, and areas

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and describes the qualities and characteristics of the locations, places, and areas, present within the Planning Area, that CAPL considers to comprise these receptor groups:

- Ramsar wetlands
- threatened ecological communities (TECs)
- Australian Marine Parks (AMPs)
- key ecological features (KEFs).

Specific to activities within this EP, there were no Ramsar wetlands or TECs identified within the OA, EMBA, or EEA. The specific presence of AMPs and KEFs within the OA, EMBA, and EEA is detailed in Table 4-14 and Table 4-15 respectively.

The platform is located ~4.3 km from the ancient coastline KEF, and ~15 km from the continental slope demersal fish communities KEF. The trunkline, flowlines, and IAG-1 drill centre cross the ancient coastline at 115–135 m water depth. The WST-3 drill centre is within the continental slope demersal fish communities KEF. ROV surveys showed no benthic habitat in the vicinity of the drill centres, with only unvegetated, unconsolidated sediment without obvious epifauna (Figure 4-16 and Figure 4-17).

Table 4-14: Presence of AMPs

Australian Marine Park	OA (field)	OA (trunkline)	EMBA	EEA
Abrolhos				✓
Argo-Rowley Terrace				✓
Carnarvon Canyon				✓
Gascoyne			✓	✓
Mermaid Reef				✓
Montebello		✓	✓	✓
Ningaloo			✓	✓
Shark Bay				✓

Table 4-15: Presence of KEFs

Key ecological feature	OA (field)	OA (trunkline)	EMBA	EEA
Ancient coastline at 125 m depth contour	✓	✓	✓	✓
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula			✓	✓
Commonwealth waters adjacent to Ningaloo Reef			✓	✓
Continental slope demersal fish communities	✓		✓	✓
Exmouth Plateau			✓	✓
Glomar Shoals			✓	✓
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals				✓
Meso-scale eddies				✓
Perth Canyon and adjacent shelf break, and other west coast canyons				✓
Wallaby Saddle				✓
Western demersal slope and associated fish communities				✓

4.6 Heritage value of places

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and describes the heritage values present within the Planning Area.

The World Heritage properties, National Heritage places, and Commonwealth Heritage places within the OA, EMBA, and EEA are listed in Table 4-16, Table 4-17, and Table 4-18 respectively.

Historic shipwrecks and sunken aircrafts (>75 years old) and other underwater heritage artefacts and sites are protected under the Commonwealth *Underwater Cultural Heritage Act 2018*. The Australasian Underwater Cultural Heritage Database (Ref. 44) identified that no historic shipwrecks are present within the OA, but some do occur within the spatial extent of the EMBA and EEA; and no historic sunken aircrafts were identified within the OA, EMBA, or EEA.

Table 4-16: World Heritage properties

World Heritage properties	OA (field)	OA (trunkline)	EMBA	EEA
The Ningaloo Coast			✓	✓

Table 4-17: National Heritage places

National Heritage properties	OA (field)	OA (trunkline)	EMBA	EEA
HMAS Sydney II and *HSK Kormoran* Shipwreck Sites				✓
The Ningaloo Coast			✓	✓

Table 4-18: Commonwealth Heritage places

Commonwealth Heritage places	OA (field)	OA (trunkline)	EMBA	EEA
HMAS Sydney II and *HSK Kormoran* Shipwreck Sites (External territories list)				✓
Learmonth Air Weapons Range Facility (WA list)			✓	✓
Mermaid Reef – Rowley Shoals (WA list)				✓
Ningaloo Marine Area – Commonwealth Waters (WA list)			✓	✓

5 environmental impact and risk assessment methodology

This section provides a description of the methods used to identify and evaluate the environmental impacts and risks associated with the petroleum activities (as described in Section 3) and any potential emergency conditions associated with these activities.

The impact and risk assessment for this EP was undertaken in accordance with the CAPL's *ABU OE Risk Management Process* (Ref. 45) and using Chevron Corporation's Integrated Risk Prioritization Matrix (Table 5-1). This approach generally aligns with the processes outlined in ISO 31000:2018 *Risk management – Principles and guidelines* (Ref. 46) and the HB 203:2012 *Managing environment-related risk* (Ref. 47).

The impact and risk assessment process and evaluation involved consulting with environmental, health, safety, commissioning, start-up, operations, maintenance, engineering, and emergency response personnel. The impacts and risks considered and covered in this EP were identified and informed by:

- experience gained during the GFP
- expertise and experience of CAPL personnel involved in operations
- stakeholder engagement (Section 2.6).

5.1 Identification and description of the petroleum activity

All components of the petroleum activity and potential emergency conditions relevant to the scope of this EP were described and evaluated during the risk assessment. The activity is described in detail in Section 3.

5.2 Identification of particular environmental values and sensitivities

The presence of environmental values and sensitivities within the OA, EMBA, and wider EEA is documented in Section 4, with the values and sensitivities further described in CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1; appendix d). CAPL considers the particular values and sensitivities to be:

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

Because many protected, rare, or endangered fauna have the potential to transit through the OA, EMBA, and wider EEA, the habitat and/or temporal area that supports protected and endangered fauna (including areas defined as BIAs for these species) is considered the particular value or sensitivity.

5.3 Identification of relevant aspects

CAPL defines an aspect as an element of CAPL's activities, products, or services related to an operation that has the potential to interact with the environment at present or later (e.g., wastewater discharge, greenhouse gas emission, legacy environmental obligations).

After describing the petroleum activity, an assessment was carried out to identify potential interactions between the petroleum activity and the receiving environment. The outcomes of stakeholder consultation also contributed to this scoping process.

Note: Potential interactions with safety, health, and assets is outside the scope of this EP.

Environmental aspects categorised for use in the impact and risk assessment of this petroleum activity include:

- physical presence
- seabed or ground disturbance
- air emissions
- greenhouse gas emissions
- dust emissions
- light emissions
- underwater sound
- invasive marine pests or non-indigenous species
- planned discharges
- unplanned releases.

5.4 Identification of relevant environmental impacts and risks

Potential impacts and risks arising from the aspects were then identified during a scoping exercise and then evaluated in detail.

5.5 Evaluation of impacts and risks

5.5.1 Consequence

After identifying the aspects, and associated potential impacts and risks, the potential consequences were evaluated using the Integrated Risk Prioritization Matrix (Table 5-1). The consequence level is determined by considering:

- the spatial scale or extent of potential interactions within the receiving environment
- the nature of the receiving environment (within the spatial extent), including proximity to sensitive receptors, relative importance, and sensitivity or resilience to change
- the impact mechanisms (cause and effect) of the aspect within the receiving environment (e.g., persistence, toxicity, mobility, bioaccumulation potential)
- the duration and frequency of potential effects and time for recovery

- the potential degree of change relative to the existing environment or to acceptability criteria.

For aspects that have the potential to cause both impacts and risks, the highest level consequence was carried through the remainder of the assessment to ensure the most conservative analysis is presented.

Table 5-1: Chevron Corporation's Integrated Risk Prioritization Matrix

Likelihood Descriptions									
	Expected to occur	Likely	1	6	5	4	3	2	1
	Conditions may allow to occur	Occasional	2	7	6	5	4	3	2
	Exceptional conditions may allow to occur	Seldom	3	8	7	6	5	4	3
	Reasonable to expect will not occur	Unlikely	4	9	8	7	6	5	4
	Has occurred once or twice in the industry	Remote	5	10	9	8	7	6	5
	Rare or unheard of	Rare	6	10	10	9	8	7	6
Consequence Descriptions				6	5	4	3	2	1
				Incidental	Minor	Moderate	Major	Severe	Catastrophic
				Limited environmental impact	Localised, short-term environmental impact	Localised, long-term environmental impact	Short-term, widespread environmental impact	Long-term widespread environmental impact	Persistent landscape-scale environmental impact

5.5.2 Control Measures and ALARP

The process for identifying control measures depends on the 'as low as reasonably practicable' (ALARP) decision context set for that particular aspect. Regardless of the process, control measures are assigned in accordance with the defined environmental performance outcomes, with the objective to eliminate, prevent, reduce, or mitigate consequences associated with each identified environmental impact and risk.

5.5.2.1 ALARP Decision Context

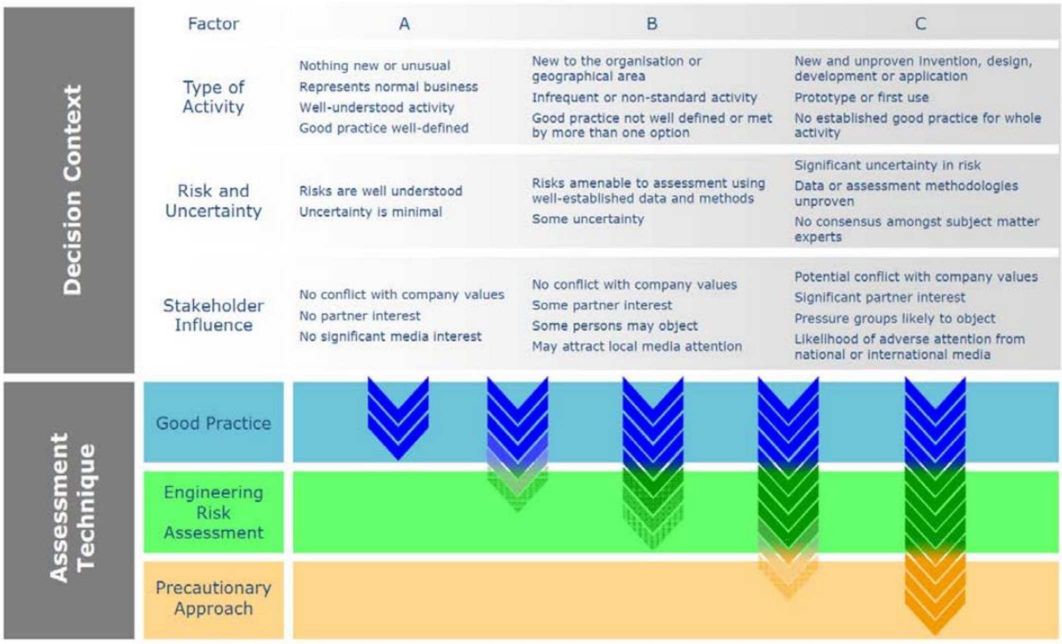
In alignment with NOPSEMA's ALARP guidance note (Ref. 48), CAPL has adapted the approach developed by Oil and Gas UK (OGUK) (Ref. 49) for use in an environmental context to determine the assessment technique required to demonstrate that impacts and risks are ALARP. Specifically, the framework considers the magnitude of impacts and risks along with these guiding factors:

- activity type
- risk and uncertainty
- stakeholder influence.

A Type A decision (Figure 5-1) is made for lower-order impacts and risks (Table 5-3) where they are relatively well understood, activities are well-practised, and there is no significant stakeholder interest. However, if good practice is not sufficiently well defined, additional assessment may be required. In addition, where an aspect associated with the activity is listed as either a key threat to a protected matter under a document made or implemented under the EPBC Act (such as recovery plans, conservation management plans, or a conservation advice), or identified as an aspect of concern to a listed conservation value under an EPBC Act marine bioregional plan, and can result in a credible impact or risk to these sensitivities, additional control consideration will be undertaken.

A Type B decision (Figure 5-1) is made for higher-order impacts and risks (Table 5-3) if there is greater uncertainty or complexity around the activity, and there are relevant concerns from stakeholders. In this instance, established good practice is not considered sufficient and further assessment is required to support the decision and ensure the risk is ALARP.

A Type C decision (Figure 5-1) typically involves sufficient complexity, higher-order impact and risks (Table 5-3), uncertainty, or stakeholder interest to require a precautionary approach. In this case, relevant good practice still has to be met, additional assessment is required, and the precautionary approach must be considered for those controls that only have a marginal cost benefit.



(Source: Ref. 48)

Figure 5-1: ALARP decision support framework

In accordance with the regulatory requirement to demonstrate that environmental impacts and risks are ALARP, CAPL has considered the above decision context in determining the level of assessment required. This is applied to each aspect described in Sections 6 and 7. The assessment techniques considered include:

- good practice
- engineering risk assessment
- precautionary approach.

5.5.2.2 Good practice

OGUK (Ref. 49) defines ‘good practice’ as:

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

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

- requirements from Australian legislation and regulations
- relevant Commonwealth government policies
- relevant Commonwealth government guidance
- relevant industry standards
- relevant international conventions.

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

5.5.2.3 Engineering risk assessment

All impacts and risks that require further assessment are subject to an engineering risk assessment. Based on the various approaches recommended by OGUK (Ref. 49), CAPL believes the methodology most suited to this activity is a comparative assessment of risks, costs, and environmental benefit. A cost–benefit analysis should show the balance between the risk benefit (or environmental benefit) and the cost of implementing the identified measure, with differentiation required such that the benefit of the risk-reduction measure can be seen and the reason for the benefit understood.

5.5.2.4 Precautionary Approach

After considering all available engineering and scientific evidence, OGUK (Ref. 49) state that if the assessment is insufficient, inconclusive, or uncertain, then a precautionary approach to hazard management is needed. A precautionary approach will mean that uncertain analysis is replaced by conservative assumptions that will result in control measures being more likely to be implemented.

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

5.5.3 Likelihood

For environmental impacts (where there is a planned emission or discharge resulting in a known change to the environment) likelihood is not considered.

For risks where the aspect or event may lead to environmental impacts under certain circumstances, the likelihood (probability) of the defined consequence occurring is determined. The likelihood is considered on the assumption that all control measures are in place. The likelihood of a consequence occurring was identified using one of the six likelihood categories shown in Table 5-1.

5.5.4 Quantification of the level of risk

The Integrated Risk Prioritization Matrix (Table 5-1) was applied during an environmental risk assessment workshop. This matrix uses consequence and likelihood rankings of 1 to 6, which when combined, result in a risk level between 1 (highest risk) and 10 (lowest risk). Risk assessment outcomes are based solely on assessment of risk to the environment.

5.6 Impact and risk acceptance criteria

NOPSEMA provides guidance on demonstrating that impacts and risks will be of an ‘acceptable level’ (Ref. 12). This guidance indicates that an acceptable level is the level of impact or risk to the environment that may be considered broadly acceptable with regard to all relevant considerations, including:

- principles of ecologically sustainable development (ESD)
- legislative and other requirements (including laws, policies, standards, conventions)
- matters protected under Part 3 of the EPBC Act, consistent with relevant policies, guidelines, threatened species recovery plans, management plans, management principles etc.

- internal context (titleholder policy, culture, processes, standards and systems)
- external context (existing environment, stakeholder expectations).

5.6.1 Principles of ESD and precautionary principle

The principles of ESD are considered in Table 5-2 in relation to acceptability evaluations.

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

Table 5-2: Principles of ESD in relation to petroleum activity acceptability evaluations

Principles of ESD	How they have been applied
(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social, and equitable considerations	CAPL's impact and risk assessment process integrates long-term and short-term economic, environmental, social, and equitable considerations. This is demonstrated through the Integrated Risk Prioritization Matrix (Table 5-1), which includes provision for understanding the long-term and short-term impacts associated with its activities, and the ALARP process, which balances the economic cost against environmental benefit. As this principle is inherently met by applying the EP assessment process, it is not considered separately for each evaluation.
(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation	Consider if there is serious or irreversible environmental damage (i.e., consequence level between Major [3] and Catastrophic [1]). If so, assess whether there is significant uncertainty associated with the aspect.
(c) the principle of inter-generational equity – that the present generation should ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations	The risk assessment methodology ensures that impacts and risks are reduced to levels that are considered ALARP. If the impacts and risk are determined to be serious or irreversible, the precautionary principle is implemented to ensure that risks are managed to ensure that the environment is maintained for the benefit of future generations.
(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	Evaluate if there is the potential to affect biological diversity and ecological integrity.
(e) improved valuation, pricing, and incentive mechanisms should be promoted	Not considered relevant for petroleum activity acceptability demonstrations.

5.6.2 Defining an acceptable level of impact and risk

Following NOPSEMA's ALARP Guidance Note (Ref. 48), CAPL has applied the approach that lower-order environmental impacts or risks (Table 5-3) assessed as Decision Context A are 'broadly acceptable', while higher-order environmental impacts or risks determined to be Decision Context B or C require further evaluation against a defined acceptable level because they are not inherently 'broadly acceptable'. However, in alignment with NOPSEMA's decision making guidance (Ref. 12) even where the impact or risk is evaluated as being a lower-order impact or risk, but the aspect associated with the activity is listed as a threat to a protected matter under a document made or implemented under the EPBC Act, or identified as an aspect of concern to a listed conservation value under an EPBC Act Marine Bioregional Plans, and can result in a credible impact or risk, CAPL will define an acceptable level of impact and risk in accordance with a document made or implemented under the EPBC Act.

Table 5-3: CAPL definition of lower- and higher-order impacts and risks

Magnitude	Impacts	Risk	Decision context
Lower-order	Consequence Level: 4–6	Risk Level: 7–10	A
Higher-order	Consequence Level: 1–3	Risk Level: 1–6	B or C

CAPL will considers these types of documents when defining the acceptable level of impact or risk:

- bioregional plans
- AMP plans
- conservation advice
- recovery plans
- government guidelines.

The objectives of the documents are identified and, having regard for the described activity, CAPL will set an acceptable level of impact that aligns with these objectives. Where the impact arising from the activity is inconsistent with the defined level (or objectives of the relevant documents), it is unacceptable.

5.6.3 Summary of acceptance criteria

Table 5-4 outlines the criteria that CAPL used to demonstrate that impacts and risks from each identified aspect are acceptable.

Table 5-4: Acceptability criteria

Acceptability Test	
Principles of ESD	Is there the potential to affect biological diversity and ecological integrity? Do activities have the potential to result in permanent/irreversible, medium-large scale, and/or moderate-high intensity environmental damage?
	If yes: Is there significant scientific uncertainty associated with the aspect?
	If yes: Are there additional measures to prevent degradation of the environment from this aspect?
Relevant environmental legislation and other requirements	Confirm that impact and risk management is consistent with relevant Australian environmental management laws and other regulatory / statutory requirements.

Acceptability Test	
Internal context	Confirm that all good practice control measures were identified for this aspect through CAPL's management systems and that impact and risk management is consistent with company policy, culture, and standards.
External context	What objections and claims regarding this aspect were made, and how were they considered / addressed?
Defined acceptable level	Is the impact and risk broadly acceptable (i.e., Decision Context A)?
	If no: For higher-order environmental impacts and risks (Decision Context B or C), what is the defined level of impact, and does the activity meet this level?

5.7 Environmental performance outcomes, standards, and measurement criteria

Environmental performance outcomes, performance standards, and measurement criteria were defined to address the environmental impacts and risks identified during the risk assessment.

CAPL is committed to conducting activities associated with the petroleum activity in an environmentally responsible manner and aims to implement best practice environmental management as part of a program of continual improvement to reduce impacts and risks to ALARP. CAPL defines environmental performance outcomes, standards, and measurement criteria that relate to managing the identified environmental risks as:

- **Environmental performance outcomes**—a measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level
- **Environmental performance standards**—a statement of the performance required of a control measure
  - These statements will consider the effectiveness of the control measures, and, in accordance with NOPSEMA's decision making guidance (Ref. 12), effectiveness will be considered with regards to the controls' functionality, availability, reliability, survivability, independence, and compatibility with other control measures
- **Measurement criteria**—compliance and assurance statement or records that detail how CAPL enacts the outlined performance standard; these are used to determine whether the environmental performance outcomes and standards were met and whether the implementation strategy was complied with. If no practicable quantitative target exists, a qualitative criterion is set.

For the purposes of this EP, "environmental performance outcome" is to be interpretated as being equivalent to an "environmental performance objective" as defined under the PSLER and PPER.

6 environmental impact and risk assessment and management—petroleum activity

This section provides an evaluation of the impacts and risks associated with the petroleum activity appropriate to the nature and scale of each impact and risk, details the control measures that are used to reduce the risks to ALARP and to an acceptable level, and identifies the associated environmental performance outcomes, performance standards, and measurement criteria.

Table 6-1 summarises the impacts and risks that were identified and evaluated for this activity.

Table 6-1: Summary of impact and risk evaluation—petroleum activity

Section	Aspect	Impact	Risk			Decision context	ALARP	Acceptable
		C^	C^	L	R			
Hydrocarbon system								
6.1.1	Physical presence—Other marine	–	6	4	9	A	Yes	Yes
6.1.2	Greenhouse gas emissions	–	–	–	–	–	–	–
6.1.3	Planned discharges—Subsea operations	6	6	5	10	A	Yes	Yes
6.1.4	Unplanned release—Loss of containment	–	6	4	9	A	Yes	Yes
Platform								
6.2.1	Physical presence—Other marine users	–	6	4	9	A	Yes	Yes
6.2.2	Air emissions	6	–	–	–	A	Yes	Yes
6.2.3	Greenhouse gas emissions	6	–	–	–	A	Yes	Yes
6.2.4	Light emissions	6	6	5	10	A	Yes	Yes
6.2.5	Underwater sound	6	–	–	–	A	Yes	Yes
6.2.6	Planned discharges—Produced water	4	4	5	8	A	Yes	Yes
6.2.7	Planned discharges—Wastewater	5	6	5	10	A	Yes	Yes
6.2.8	Unplanned release—Waste	–	6	5	10	A	Yes	Yes
6.2.9	Unplanned release—Loss of containment	–	6	4	9	A	Yes	Yes
IMR								
Subsea								
6.3.1.1	Seabed disturbance	5	–	–	–	A	Yes	Yes
6.3.1.2	Greenhouse gas emissions	–	–	–	–	–	–	–
6.3.1.3	Underwater sound	5	5	6	10	A	Yes	Yes
6.3.1.4	Planned discharges—Subsea operations	6	6	6	10	A	Yes	Yes

Section	Aspect	Impact	Risk			Decision context	ALARP	Acceptable
		C^	C^	L	R			
6.3.1.5	Unplanned release—Loss of containment	–	6	5	10	A	Yes	Yes
Onshore								
6.3.2.1	Physical presence—Terrestrial fauna	–	6	5	10	A	Yes	Yes
6.3.2.2	Ground disturbance	–	–	–	–	–	–	–
6.3.2.3	Greenhouse gas emissions	–	–	–	–	–	–	–
6.3.2.4	Dust emissions	–	–	–	–	–	–	–
6.3.2.5	Light emissions	–	–	–	–	–	–	–
6.3.2.6	Fire	–	–	–	–	–	–	–
6.3.2.7	Non-indigenous species	–	5	6	10	A	Yes	Yes
6.3.2.8	Unplanned release—Loss of containment	–	6	4	9	A	Yes	Yes
Field support								
6.4.1	Physical presence—Other marine users	–	6	5	10	A	Yes	Yes
6.4.2	Physical presence—Marine fauna	–	6	5	10	A	Yes	Yes
6.4.3	Seabed disturbance	6	–	–	–	A	Yes	Yes
6.4.4	Air emissions	6	–	–	–	A	Yes	Yes
6.4.5	Greenhouse gas emissions	6	–	–	–	A	Yes	Yes
6.4.6	Light emissions	6	6	5	10	A	Yes	Yes
6.4.7	Underwater sound	5	5	6	10	A	Yes	Yes
6.4.8	Invasive marine pests	–	2	6	7	A	Yes	Yes
6.4.9	Planned discharges—Vessel operations	6	6	6	10	A	Yes	Yes
6.4.10	Unplanned release—Waste	–	6	5	10	A	Yes	Yes
6.4.11	Unplanned release—Loss of containment	–	5	5	9	A	Yes	Yes

C = Consequence; L = Likelihood; R = Risk level

^ For aspects identified as causing both impacts and risks, the highest-level consequence was evaluated in detail to ensure that justification is provided to support the highest consequence level for the aspect

6.1 Hydrocarbon system

6.1.1 Physical presence—Other marine users

Source

Activities identified as having the potential to result in an interaction with other marine users are:

- permanent presence of the subsea hydrocarbon system within the OA.

Potential impacts and risks

Impacts	C	Risks	C
N/A	-	Unplanned interactions with other marine users may result in: • entanglement of trawl fishing gear on subsea infrastructure.	6

Consequence evaluation

The subsea hydrocarbon infrastructure associated with this activity is contained wholly within the OA. The field OA consists of an area of ~650 km^2, and the trunkline is ~221 km long.

The potential for unplanned interactions between other marine users with the subsea hydrocarbon system is limited to where these users interact with the seafloor. Marine users that have the potential to interact with the subsea infrastructure are limited to commercial fisheries that utilise trawling fishing methods. The potential risks to trawling vessels from subsea infrastructure includes disruption to fishing efforts caused by the need for vessels to avoid the infrastructure and physical damage to trawling gear that contacts the hydrocarbon system.

As identified in Section 4.4.1, one Commonwealth managed commercial trawl fishery (North West Slope Trawl Fishery) has a management area that overlaps with the OA. The extent to which the hydrocarbon system infrastructure overlaps this trawl fishery management area is <1%. Fishing activity within the Commonwealth trawl fisheries is restricted to waters >200 m water depth. The entire fishery has a small number of active permits and vessels (e.g., seven permits with four vessels were active during the 2018-2019 season [Ref. 1]).

As identified in Section 4.4.1, one State managed commercial trawl fishery (Onslow Prawn Fishery) has a management area that overlaps with the OA. The extent to which the hydrocarbon system infrastructure overlaps this trawl fishery management area is <1%. The fishery also has only a small number of active vessels and fishing effort is only recorded within the trunkline OA (Figure 4-19).

Subsea infrastructure has been in place within the OA for several years (installation completed in 2015), and to date, no incidences of commercial fishing activities interacting with the infrastructure has been communicated to CAPL. Consequently, the continued presence of the hydrocarbon system infrastructure is not expected to result in a significant impact to commercial trawl fishing operations (via loss of catches or damage to fishing equipment). Any deviation required by trawling vessels around the subsea infrastructure is not expected to impact on the functions, interests, or activities of other marine users (as confirmed by stakeholder consultation records).

In summary, the physical presence of the hydrocarbon system is not expected to cause significant impacts to other marine users, and the risks are considered limited with potential consequences. Therefore, CAPL has ranked the potential consequence to other marine users from physical presence as Incidental (6).

ALARP decision context justification

The operation of subsea infrastructure is commonplace and well-practised nationally and internationally. The control measures to manage the risks associated with unplanned interactions with other marine users are well defined and understood by the industry.

During stakeholder consultation, no objections or claims were raised regarding disturbance/disruption to other marine users arising from the petroleum activity.

The risks arising from the physical presence of subsea infrastructure and support vessels to other marine users are considered lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

<table>
<tr><th colspan="3">Good practice control measures and source</th></tr>
<tr><th>Control measure</th><th colspan="2">Source</th></tr>
<tr><td>Stakeholder engagement</td><td colspan="2">Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information.
Communicating the activity details, location, and presence of vessels to other marine users ensures they are informed and aware, thereby reducing the risk of unplanned interactions.
For planned IMR activities this notification will occur via the regular project updates provided by CAPL to WAFIC for dissemination to commercial fisheries (Table 2-8). For a major repair resulting from an unplanned event, a specific notification will be released detailing the location and duration of any works required (Table 2-8).</td></tr>
<tr><th colspan="3">Additional control measures and cost benefit analysis</th></tr>
<tr><th>Control measure</th><th>Benefit</th><th>Cost</th></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><th colspan="3">Likelihood and risk level summary</th></tr>
<tr><td>Likelihood</td><td colspan="2">The subsea infrastructure is located in areas of low commercial trawl fishing activity and covers only a small percentage of fishery management areas. Interaction with subsea infrastructure is expected to be limited based upon operating experience over the past five years. As such, CAPL consider that the likelihood of the consequence occurring is Unlikely (4).</td></tr>
<tr><td>Risk level</td><td colspan="2">Very low (9)</td></tr>
<tr><th colspan="3">Determination of acceptability</th></tr>
<tr><td>Principles of ESD</td><td colspan="2">The risks associated with this aspect are associated with unplanned interactions causing incidental disruption to other marine users, which is not considered as having the potential to affect biological diversity and ecological integrity.
The consequence associated with this aspect is Incidental (6).
Therefore, no further evaluation against the Principles of ESD is required.</td></tr>
<tr><td>Relevant environmental legislation and other requirements</td><td colspan="2">No legislation or other requirements were considered relevant to this aspect.</td></tr>
<tr><td>Internal context</td><td colspan="2">No CAPL environmental performance standards / procedures were deemed relevant for this aspect.</td></tr>
<tr><td>External context</td><td colspan="2">During stakeholder consultation, no objections or claims were raised regarding interaction with other marine users arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td colspan="2">These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.</td></tr>
<tr><th>Environmental performance outcome</th><th>Performance standard / Control measure</th><th>Measurement criteria</th></tr>
<tr><td>No impacts to other marine users outside of the OA from petroleum activities</td><td>Stakeholder engagement
Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone</td><td>Stakeholder consultation records</td></tr>
</table>

	information via biannual project updates for planned activities, or specific notification regarding major repair works	

6.1.2 Greenhouse gas emissions

The following activities have been identified as direct greenhouse gas (GHG) emission sources for planned hydrocarbon system activities under this EP:

- fugitive emissions.

While CAPL acknowledges that fugitive emissions may occur from the subsea hydrocarbon system in Commonwealth and State waters, these are considered to represent a minor proportion of fugitive emissions for the entire project. Fugitive emissions for the Wheatstone Project are estimated based on accepted NGERS emissions factors methodology, and therefore, any subsea component cannot easily be separated. As such, fugitive emissions estimates have been fully incorporated into the direct and indirect GHG emissions inventories (Sections 6.2.3.2 and 6.2.3.3) and subsequent risk assessment (Section 6.2.3.5) and have not been repeated here.

6.1.3 Planned discharges—Subsea operations

Source			
Activities identified as having the potential to result in planned subsea operational discharges are: • start-up and operations of the hydrocarbon system. The planned subsea operational discharges include small volumes of control fluids (from the subsea valves).			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Planned subsea operational discharges may result in: • localised and temporary reduction in water quality.	6	A change in ambient water quality may result in: • indirect impacts to fauna arising from chemical toxicity	6
Consequence evaluation			
Localised and temporary reduction in water quality Subsea operational fluid discharges are intermittent, non-continuous, and of short duration, and as such frequency of exposure is limited. Depending on the hydrocarbon system operating conditions, the frequency of valve actuations may range from less than daily to up to several times a day for each valve. Discharge volumes are expected to range from 0.001–0.03 m^3 per discharge, with predicted total volumes from any tree or manifold expected to be ~1–5 m^3 per year, equating to ~15–70 m^3 per year (Section 3.2.2.3). The valve discharges occur at the wells or near the drill centres, at water depths of ~119–240 m, and typically 5–7 m above the seabed (based on the size of the infrastructure). Due to the small discharge volumes within open marine waters (which are typically influenced by large-scale ocean currents and tides [Ref. 76]), rapid dispersion of fluids is expected to occur and the spatial extent of the discharges is expected to be limited to a small area in the water column around the source. The control fluids comprise primarily a water/glycol mix, at a typical ratio of ~40/60%, excluding minor concentrations of up to ~5% proprietary additives. The reduction in water quality caused by this release is temporary, as these discharges would dilute, disperse, and neutralise rapidly upon release. Based on nearfield dilution modelling, which considers currents, water column depth, discharge height above seabed, physical characteristics of the typical control fluids, and flow			

rates, a dilution of over 1:500 is anticipated within close proximity to the valve and before any fluids contact any seabed habitats (Ref. 77). As subsea discharges are highly influenced by natural dispersion and dilution processes, the extent of exposure is most influenced by the volume of the release. Consequently, the planned discharges are expected to result in a limited environmental impact, and the consequence level was determined as Incidental (6).		
Potential chemical toxicity As described above, these discharges are expected to result in temporary reductions in water quality within the immediate surroundings of the release location. The extent of this water quality reduction is limited to around the subsea wells and drill centres. The particular values and sensitivities identified as having the potential to be exposed to these discharges are: • ancient coastline at 125 m depth contour (KEF) • continental slope demersal fish communities (KEF) • commercial fisheries. Although these KEFs have been identified as having the potential to be exposed, as described in Section 4.3.5, the benthic habitat within the OA is known to comprise soft sediment infauna communities that are widespread and homogenous in the region. ROV footage of WST-3 confirms the drill centre is located in a soft-sediment location absent of sessile benthic organisms (Figure 4-17). ROV footage in the area of IAG-1, which is located at ~119 m depth, also confirms that the drill centre is located on soft sediments and sessile benthic organisms have not been noted (Figure 4-16]). Given that biologically important habitats tend to be found in areas of rocky escarpment rather than soft sediments (Ref. 27), exposure to habitats comprising high levels of diversity are not expected. The *North-West Marine Bioregional Plan* (Ref. 27) does not identify toxicity or chemical pollution/contaminants as a key threat to the continental slope demersal fish communities or ancient coastline at 125 m depth contour KEF. Given the rapid dilution and dispersion conditions, low bioaccumulation potential and the high biodegradability of the control fluids, and intermittent frequency of discharges, bioaccumulation in the receiving environment and sublethal impacts are expected to be limited. Consequently, the release of subsea discharges are expected to result in a limited environmental impact, and the consequence level was determined as Incidental (6).		
ALARP decision context justification		
Subsurface operational discharges associated with the operation of subsea infrastructure are commonplace and well-practiced within the industry. The control measures to manage the risk associated with these planned discharges are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL During stakeholder consultation, no objections or claims were raised regarding planned discharges from subsea operations arising from the activity. The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures and source		
Control measure	**Source**	
Hazardous materials selection process	As part of the hazardous materials selection process, hazardous materials that will be discharged to the environment will undergo a detailed environmental assessment, as per CAPL's *Hazardous Materials Management Procedure* (Ref. 54)	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Given the nature and scale of this activity, and with standard control measures in place, it is considered Remote (5) that this discharge	

	would result in any impact to the ecological function of the particular values and sensitivities present within the OA.	
Risk level	Very low (10)	
Determination of acceptability		
Principles of ESD	The potential impacts and risks associated with this aspect is limited to a short-term direct reduction in water quality in a localised area, which is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required	
Relevant environmental legislation and other requirements	No legislation or other requirements were considered relevant to this aspect.	
Internal context	This CAPL environmental performance standard / procedure was deemed relevant for this aspect: • *Hazardous Materials Management Procedure* (Ref. 54).	
External context	During stakeholder consultation, no objections or claims were raised regarding planned discharges from subsea operations arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No impacts to marine habitats or marine fauna outside of the OA from subsea discharges during petroleum activities	**Hazardous materials selection process** Subsea fluids planned for discharge are subject to the hazardous materials selection process as per the CAPL *Hazardous Materials Management Procedure*	Hazardous materials selection process assessment records (or similar)

6.1.4 Unplanned release—Loss of containment

Source
Activities identified as having the potential to result in a minor loss of containment (LOC) event: • start-up and operations of the hydrocarbon system. Based on the activities described in this EP, the following potential minor LOC scenarios were identified: • corrosion or mechanical failure/damage of flowlines resulting in a loss of various fluids including condensate, control fluids, or MEG[1] • corrosion or mechanical failure/damage of subsea valves, resulting in loss of control fluids[2] • corrosion or mechanical failure/damage of onshore trunkline resulting in loss of condensate[3]. [1] *A flowline loss of containment can result in the release of production fluids (gas and condensate): <58 m^3 of condensate over 5.1 days from a leak, or ~58 m^3 of condensate over 2 hours from a full-bore rupture (FBR) (Ref. 78). A flowline release (MEG flowline or umbilical) can result in smaller releases of MEG, process chemicals, and control fluids, estimated to range from 1–25 m^3, based on the volumes contained in the flowlines.*

[2] A valve loss of containment can result in control fluids leaking from the hydrocarbon system, resulting in ~1 m^3 per day. Based on the input from operations and engineering personnel, the approximate worst-case duration is conservatively estimated at ~90 days.

[3] A trunkline loss of containment (onshore) can result in the release of gas and condensate, ~<100 m^3. This volume is estimated based on flow and pressure at the onshore location, and the time taken to isolate the inventory.

Potential impacts and risks

Impacts	C	Risks	C
N/A	-	Unplanned release of hazardous material to the marine environment may result in: • indirect impacts to fauna arising from chemical toxicity	6
		Unplanned release of hazardous material to the onshore environment may result in: • soil and groundwater contamination	6

Consequence evaluation

Potential chemical toxicity

The largest offshore LOC event is estimated to be ~58 m^3 of condensate, and therefore this scenario has been used as the basis of this consequence evaluation. A subsea release of ~58 m^3 of condensate would be expected to temporarily change the water quality within the immediate vicinity of the release.

Previous modelling conducted for the Gorgon Project, for a 50 m^3 subsea release of condensate, predicted that the extent of exposure to the condensate was limited to within 22 m of the release location (Ref. 79). Given the depths and environmental conditions of the Gorgon field, it is expected that a similar extent of exposure would occur for a subsea release within the Wheatstone OA.

The values and sensitivities within the OA with the potential to be exposed to decreased water quality from an unplanned subsea LOC release include:

- Humpback Whale (migration)
- Pygmy Blue Whale (migration, distribution)
- Flatback Turtle (internesting buffer, nesting)
- Hawksbill Turtle (internesting buffer)
- Whale Shark (foraging)
- ancient coastline at 125 m depth contour (KEF)
- continental slope demersal fish communities (KEF)
- commercial fisheries.

Based on the nature of these unplanned releases, which are non-continuous and expected to occur in a location where no specific sedentary behaviours for values and sensitivities have been identified, the extent and severity of any potential impact is expected to be limited.

Given the nature of unplanned releases covered under this EP and the transient nature of identified values and sensitivities, fauna would need to pass directly through the plume almost immediately upon release to be impacted.

Any potential impact from such an event is expected to be limited, thus the consequence level was determined as Incidental (6).

Soil and groundwater contamination

The largest onshore LOC event is estimated to be ~100 m^3 of condensate, and therefore this scenario has been used as the basis of this consequence evaluation.

Given the onshore section of trunkline is covered by soil, the spatial extent of an onshore release would be limited to a relatively confined area around the trunkline, with most of the fluids likely to soak into the surrounding soil. Based upon Grimaz et al. (Ref. 80) it is anticipated that a release of 100 m^3 could result in up to ~1 m penetration depth into the soil profile. As such, no exposure to groundwater is expected to occur from minor LOC events.

No specific values or sensitivities (e.g., TECs) are present within the onshore OA.

Given the limited spatial exposure, buried trunkline, and the previously disturbed nature of the receiving environment, any potential impact from an onshore minor LOC event are expected to the limited. As such, the consequence level was determined as Incidental (6).	
ALARP decision context justification	
The operation of hydrocarbon systems is commonplace and well-practiced within the industry. The control measures to manage the risk associated with these unplanned discharges are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding planned discharges from subsea operations arising from the activity. The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.	
Good practice control measures and source	
Control measure	**Source**
Inspection and Monitoring Plan (IM Plan)	Inspections provide assurance that assets are in good condition and proactively identify maintenance or repair activities that may be required. The type and frequency of inspections of the hydrocarbon system will be undertaken in accordance with the *Wheatstone Upstream Subsea System Inspection and Monitoring Plan* (Ref. 21) and *Wheatstone Upstream Trunkline System Inspection and Monitoring Plan* (Ref. 22). The IM Plans also require that hydrocarbon system process monitoring (pressure, temperature and flow rates), fluid composition monitoring, and corrosion monitoring are undertaken. Inspection and monitoring results are assessed against acceptance criteria to allow early identification and management of potential anomalies through engineering assessment, maintenance, and repairs to ensure the integrity of the hydrocarbon system and prevent a loss of containment. Inspections are tracked via the computerised maintenance management system (CMMS).
Isolation valve function and verification tests	As mentioned in Sections 3.2.1.4, 3.2.2.3, and 3.3.2.9, the hydrocarbon system includes isolation valves to shut in inventories in the event of a release. This isolation can reduce the potential volumes of fluids released to the environment. If a spill is detected from the hydrocarbon system, these valves can be operated to potentially limit the volume released, as actioned through Source Control Procedures. Verification of the performance of these valves, including emergency isolation and shut down functionality, will be tested before introducing hydrocarbons.
Source control	Source control is part of the first actions taken to minimise the volume of fluids released and therefore reduce potential impacts and risks to the environment. CAPL has developed emergency operating procedures (EOPs) (Section 8.3.2.8) that provides guidance to operations personnel to detect, isolate, and stabilise non-routine events such as trunkline/flowline loss of containment scenarios. Source control is the initial action for spills and will be undertaken in accordance with documented EOPs including *Operability, Reliability, Maintainability – 1060 Platform – Response To Emergency Shutdown (ESD1)* (Ref. 75), which outlines the procedure for isolating and shutting down Wheatstone and Iago or third-party systems if required to manage the risk.
Wheatstone Downstream Emergency Response Plan (ERP)	Plans, processes, and procedures outline activities to control and respond to minor operational spills and are essential in ensuring a coordinated, consistent approach. For onshore spills, because the trunkline is buried or below ground for most of the terrestrial route,

	response activities will be limited, and undertaken in accordance with the *Wheatstone Downstream Emergency Response Plan* (Ref. 81).	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	The likelihood that a minor LOC event results in an Incidental (6) consequence was determined to be Unlikely (4). With the control measures in place, it was considered unlikely that a minor LOC event associated with this activity would occur, and even more unlikely that such an event would impact any of the identified values and sensitivities.	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	The risks associated with this aspect are expected to have a limited environmental impact, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No legislation or other requirements were considered relevant to this aspect.	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • IM Plans (Ref. 21; Ref. 22) • EOPs (Ref. 75) • Wheatstone Downstream ERP (Ref. 81).	
External context	During stakeholder consultation, no objections or claims were raised regarding LOC management arising from the activity	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No unplanned release of hydrocarbons / hazardous materials to the environment during petroleum activities	**IM Plan** Inspection and maintenance will include, but not be limited to: • a post-start-up inspection of the subsea hydrocarbon system within 24 months of start-up • inspections of the onshore PL 99 pipeline licence area in accordance with the IM Plan	CMMS records confirm • a post-start-up inspection of the subsea hydrocarbon system within 24 months of start-up • inspections of the onshore PL 99 pipeline licence area are undertaken in accordance with the IM Plan
	IM Plan Monitoring of hydrocarbon system pressure, temperature, flow rates and fluid composition	Records confirm monitoring of hydrocarbon system pressure, temperature, flow rates and fluid composition against acceptable

	against acceptable criteria and limits will be aligned with the IM Plan	criteria and limits are aligned with the IM Plan
	Isolation valve function and verification tests Isolation valves are tested to verify valve integrity and functionality prior to the introduction of hydrocarbons.	Integrity test records for the isolation valves confirm testing and valve functionality prior to the introduction of hydrocarbons
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	**Source control** The isolation steps of the source control / isolation procedures implemented within 30 mins if a spill is detected from the hydrocarbon system	Records demonstrate relevant isolation components of the source control procedures are implemented if a spill is detected from the hydrocarbon system.
	Wheatstone Downstream ERP Onshore trunkline spill response implemented as outlined in Wheatstone Downstream ERP if a spill is detected from the hydrocarbon system	Records confirm onshore trunkline spill response is undertaken in accordance with Wheatstone Downstream ERP

6.2 Platform

6.2.1 Physical presence—Other marine users

Source			
Activities identified as having the potential to result in an interaction with other marine users are: • permanent presence of the platform within the OA.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	Unplanned interactions with other marine uses may result in: • disruption to commercial shipping and fishing vessels	6
Consequence evaluation			
The spatial extent of the platform and safety exclusion zone equates to ~0.79 km^2 (500 m exclusion zone). As identified Section 4.4.1, there are two State commercial fisheries (Pilbara Line Fishery, Pilbara Trap Managed Fishery) that have recent fishing effort that overlaps with the OA. The extent to which the platform exclusion zone overlaps the management areas for these fisheries is estimated to be <1%. As identified in Section 4.4.1, one Commonwealth managed commercial trawl fishery (North West Slope Trawl Fishery) has a management area that overlaps with the OA. Fishing activity within the Commonwealth trawl fisheries is restricted to waters >200 m water depth. The platform, and its exclusion area is in water depths ~70 m. Therefore, the presence of the platform is not expected to cause any disruption to the North West Slope Trawl Fishery vessels or activities. The installation of the platform was completed in 2015 and to date no incidences of commercial fishing activities interacting with the infrastructure have been recorded. Consequently, the continued presence of the platform is not expected to result in a significant impact to commercial operations (via loss of catches). Any deviation required by these vessels around the platform is not expected to impact on the functions, interests, or activities of other marine users (as confirmed by stakeholder consultation records). The platform is located outside major shipping lanes and commercial marine traffic density around the platform is low (Section 4.4.2) indicating that it is not expected to affect major shipping channels or commercial shipping operators. Any deviation required by these vessels is not expected to impact on the functions, interests, or activities of other marine users (as confirmed by stakeholder consultation records). In summary, the physical presence of the platform is not expected to cause significant impacts to other marine users, and the risks are considered limited with potential consequences. Therefore, CAPL has ranked the potential consequence to other marine users from physical presence as Incidental (6).			
ALARP decision context justification			
The operation of offshore facilities is commonplace and well-practised nationally and internationally. The control measures to manage the risks associated with unplanned interactions with other marine users are well defined and understood by the industry. During stakeholder consultation, no objections or claims were raised regarding disturbance/disruption to other marine users arising from the petroleum activity. The risks arising from the physical presence of subsea infrastructure and support vessels to other marine users are considered lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.			

Good practice control measures and source	
Control measure	**Source**
CMMS	Ongoing maintenance of the platform navigation equipment ensures equipment is operational and provides situational awareness of

	maritime traffic movements, thereby reducing the risk of interference with other marine users. The equipment standards of performance are included in the Computerised Maintenance Management System (CMMS). Maintenance activities are managed through the CMMS (described in Section 8.3.2.3), which is used as the main asset and inventory management system within CAPL for performing and tracking maintenance activities.	
Stakeholder engagement	Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information. Communicating the activity details, location, and presence of vessels to other marine users ensures they are informed and aware, thereby reducing the risk of unplanned interactions.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	The platform is located outside major shipping lanes and high density shipping areas, and in an area of limited commercial fishing activity. The installation of the platform was completed in 2015 and to date no incidences of interaction with the infrastructure has been recorded. As such, CAPL consider that the likelihood of the consequence occurring is Unlikely (4).	
Risk level	Very low (9)	
Determination of Acceptability		
Principles of ESD	The risks associated with this aspect are associated with unplanned interactions causing incidental disruption to other marine users, which is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No legislation or other requirements were considered relevant to this aspect.	
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.	
External context	During stakeholder consultation, no objections or claims were raised regarding interaction with other marine users arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No impacts to other marine users outside of the OA from petroleum activities	**CMMS** Platform radar, navigational lighting and audio navigational equipment is maintained in accordance with the CMMS.	CMMS records show platform radar, navigational lighting and audio navigational equipment is maintained

	Stakeholder engagement Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information	Stakeholder consultation records

6.2.2 Air emissions

Air emissions from the platform will include criteria pollutants (e.g., oxides of nitrogen, carbon monoxide), air toxics (e.g., benzene, toluene, xylenes) and greenhouse gases (primarily carbon dioxide). Greenhouse gas emissions are risk assessed separately within Section 6.2.3.

Air emissions will occur at the platform predominantly from gas turbine exhausts and flaring (described in Section 3.3). The gas turbines are used to drive the electricity generators and the natural gas export compressors. The flare is used to safely dispose small flows of waste gas and to safely depressurise the facility in the event of a process upset. The compressors have not been required throughout the early years of operation however will now be progressively ramped up. Full compression is estimated to occur from around 2029.

Air emissions are associated with release from flares (HP and LP), gas turbine generator exhaust (x3), compressor turbine exhaust (x2), and fugitive emissions. The emissions profile will vary throughout the operational life of the facility dependant primarily upon the amount of compression required, and flaring rates.

Without compression a significant proportion of the natural resource would remain undeveloped. CAPL have identified that at the current time there are no reasonably practicable alternatives to compression available for implementation at the platform.

As described in Section 3.3.2.3, two flares (HP and LP) are used on the platform. The HP flare is used for upset, relief, and blowdown loads, and is therefore considered a safety critical element for platform operations. Blowdown flaring throughout operations to date has been a rare occurrence, while hydrate inhibition of flowlines using MEG has proven an effective management measure, further reducing the need to depressurise via the HP flare. At the current time, there is no reasonably practicable alternative to the use of the HP flare from a safety and integrity perspective. However, even if it were possible, this action would not be expected to result in a material reduction of impacts associated with air quality or greenhouse gas emissions.

The LP flare is used on a continuous basis for waste gas streams. LP flaring is inherent to the platform design associated with vessel blanketing and the induced gas flotation where fuel gas is applied for secondary produced water treatment. Alternative off-gas recovery systems to eliminate LP flaring were considered during FEED (Ref. 251). However, for the alternative designs involving off-gas recovery, the environmental benefit gained from a reduction in LP flaring emissions would be counteracted by increased power generation emissions associated with running the gas recovery compressors. Additionally, increased safety risks are associated with potential leak sources and potential exposure of the waste gas stream to personnel. Therefore, the use of an off-gas system is not considered to be a practicable alternative. The environmental benefit of a reduction in LP flaring would have negligible effects on air quality and greenhouse gas emissions.

An updated forecast of air emissions (i.e., key criteria pollutants, and air toxics) is shown in Table 6-2 for the free flow (based on historical reported actuals), early compression, and full compression operating scenarios.

Table 6-2: Summary of estimated annual platform air emissions

Emission	Units	Free-Flow (FY22)	Early compression (FY23-25)	Full compression (FY26+)
Key criteria pollutants and air toxics				
Carbon monoxide (CO)	tpa	691	358	487
Nitrogen oxides (NO_x)	tpa	210	515	1,019
Particulate matter <10 microns (PM_{10})	tpa	20	7	9
Particulate matter <2.5 microns ($PM_{2.5}$)	tpa	20	6	9
Volatile organic compounds (VOCs)	tpa	1,151	577	580
Sulfur dioxide (SO_2)	tpa	0.28	0.42	1.22

Timing for the early and full compression stages has been estimated based on contemporary data, however is dependent upon reservoir performance hence subject to change.

6.2.2.1 Guidelines—criteria pollutants

When considering the management of criteria pollutant air emissions, the National Environment Protection (Ambient Air Quality) Measure (NEPM AAQ) establishes quantifiable standards and goals against which ambient air quality can be assessed. The NEPM AAQ is aimed at achieving ambient air quality that allows for the adequate protection of human health and wellbeing. However, in the absence of other standards relevant to the air shed surrounding the platform, it is considered appropriate to use these standards as the criteria for comparison in this air quality assessment.

6.2.2.2 Risk assessment

Source			
Activities identified as having the potential to result in air emissions from the platform are: • combustion of natural gas as a fuel source • flaring.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Air emissions may result in: • localised and temporary reduction in air quality	6	N/A	–
Consequence evaluation			
Localised and temporary reduction in air quality Impacts from air emissions (criteria pollutants – including oxides of nitrogen, carbon monoxide and particulate matter and air toxics – including benzene) depend on discharge volume, frequency, duration of exposure, as well as the location and nature of the receiving environment. Air quality changes associated with emissions of criteria pollutants and air toxics are limited to the air shed local to the platform. Reservoir characterisation of Wheatstone fields indicates minimal levels of hydrogen sulfide in the reservoir fluids (<2 ppm) (Ref. 19). As such, combustion of the natural gas at the platform results			

in correspondingly low-level emissions of sulfur dioxide. For this reason, potential emissions of sulfur dioxide from the platform are not considered significant and not evaluated further. Air emissions dispersion modelling was performed based on system design to quantify and assess impacts from air emissions from the platform. Model assumptions and have been reviewed and modelling remains a conservative approach for the updated emissions forecast, and appropriate for comparison of the predicted emissions against guidelines. Modelling was conducted using a Gaussian, steady-state plume model (Ref. 252), using 1 year of meteorological data to capture most weather conditions and extended to an approximate grid of 25 km by 25 km surrounding the platform. Nitrogen dioxide, carbon monoxide, particulate matter and VOC were modelled using conservative emission rates in a screening approach. Nitrogen dioxide emissions from the facility were modelled on the assumption that all NO_x are present as NO_2. This assumption is conservative as the conversion of NO to NO_2 will be limited by the available O_3, allowing only a fraction of the available NO to react (~15–20%). VOC emissions modelling outputs can be evaluated against relevant NEPM standards by considering all emitted VOC is present as either benzene, toluene or xylene. This is a highly conservative approach given these constituents account for less than 1% of VOC emissions as reported. Modelling predicted maximum ambient concentrations to be substantially below the NEPM AAQ standards. Results included: • a maximum ambient NO_2 concentration of 0.02 ppm (compared to the NEPM 1 hour standard of 0.12 ppm) • a maximum ambient CO concentration of 0.01 ppm (compared to the NEPM 8-hour standard of 9 ppm) • a maximum ambient PM_{10} concentration of 0.14 µg/m^3 (compared to the NEPM 24-hr standard of 50 µg/m^3). While not modelled similar results would be expected for $PM_{2.5}$ (compared to the NEPM 24-hour standard of 25 µg/m^3). • a maximum ambient VOC concentration of 0.16 ppb (compared with 3 ppb, 100 ppb and 200 ppb NEPM annual standards for benzene, toluene and xylene respectively) Modelling demonstrates the concentrations of oxides of nitrogen, carbon monoxide, particulate matter and VOC's are predicted to be well below NEPM AAQ standards indicating there will be no significant degradation of ambient air quality. Updated emissions forecast data affirms emissions estimates for early and late compression will be similar in magnitude to those modelled prior to operations. The potential consequence of the air emissions from the platform causing air quality changes is therefore ranked as Incidental (6).	
ALARP decision context justification	
Offshore facility operations and subsequent air emissions arising from these facilities are commonplace both internationally and nationally. The control measures to manage the risk associated with air emissions are well defined and are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding air emissions arising from the activity. The impacts and risks arising from air emissions constitute lower-order impacts (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect.	
Good practice control measures and source	
Control measure	**Source**
Energy efficient design	During the design phase for the Wheatstone Project, energy efficient design features were incorporated to minimise power demand and in turn air emissions. Specifically, some of the equipment installed included the waste heat recovery units (WHRUs), high integrity valves and flanges, seawater heat exchange and lift pump configuration, aero derivative turbines, variable compression modes, condensate export pumps with variable speed drive.
CMMS	To ensure that all energy efficient features are operating appropriately, preventative maintenance regimes have been developed and incorporated into the CMMS. Maintenance activities are managed through CMMS which is used as the main asset and inventory management system within CAPL for performing and tracking maintenance activities.

Air emissions monitoring	The Platform Air Emissions Monitoring Program (Section 8.4.1.2) is designed to meet emissions reporting requirements. Gas compressor turbines, power generation turbines, diesel system, LP flared gas and HP flared gas, and pilot gas and purge gas are monitored to inform emissions reporting and management.
Platform emissions management	An *Emissions and Energy Management Plan* (EEMP) (Ref. 82) for the Wheatstone Platform accounts for all key GHG emission sources on the Platform, and describes the process for emissions allocation and reporting, emissions tracking and deviation management, and links to management of change processes and revision triggers to ensure that emissions are managed to ALARP. It includes an emissions management section involving setting of performance standards/targets for platform emissions and regular monitoring of performance against these standards to ensure that emissions are minimised as far as reasonably practicable. As part of emissions management, a leak detection and repair (LDAR) program is in place for the Wheatstone Platform. The LDAR program is implemented to detect fugitive emissions, and address the subsequent management or repair of sources of fugitive emissions.

Additional control measures and cost benefit analysis

Control measure	Benefit	Cost
N/A	N/A	N/A

Likelihood and risk level summary

Likelihood	N/A
Risk level	N/A

Determination of acceptability

Principles of ESD	The impact associated with this aspect is limited to a direct reduction in air quality for a localised area, which is not considered to have the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: • *National Environment Protection (Ambient Air Quality) Measure* • National Pollutant Inventory (Ref. 274).
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • Wheatstone Platform *Emissions and Energy Management Plan* (Ref. 82).
External context	During stakeholder consultation, no objections or claims were raised regarding air emissions arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.

Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No impacts to air quality outside of the OA from petroleum activities	**Energy efficient design** The energy efficient design features (including the WHRUs, valves and flanges, seawater lift pumps, aero derivative turbines, condensate	Records show installation is according to Commissioning Test Procedures

	export pumps) are installed, tested and commissioned according to the relevant Commissioning Test Procedures prior to hydrocarbon production	
	CMMS The compressors, power generators, flaring system, WHRUs and seawater lift pumps are maintained in accordance with CMMS	CMMS records show maintenance of compressors, power generators, flaring system, WHRUs and seawater lift pumps
	Air emissions monitoring Platform Air Emissions Monitoring Program implemented as per Section 8.4.1.2	Records confirm Air Emissions Monitoring Program is implemented
	Platform emissions management Platform emissions management will be implemented per the Wheatstone Platform EEMP, including monitoring performance against emissions targets, and managing emissions to ALARP	Records confirm the Wheatstone Platform EEMP is implemented

6.2.3 Greenhouse gas emissions

The Commonwealth government supports the implementation of mature technologies, including LNG, to support Australia's low emissions transformation (Ref. 261). The Commonwealth government views gas as part of the Commonwealth government's plan to reduce emissions without imposing new costs on households, while at the same time creating jobs, growing businesses and the economy (Ref. 262). The Commonwealth's *Australia's Long-Term Emissions Reduction Plan* does not require shut down of the gas export industry (Ref. 263). Under the plan, this industry will continue through to 2050 and beyond, supporting jobs and regional communities, and production will be higher in 2030 than it is today (Ref. 263). The Commonwealth predicts that there will be a significant proportion of gas in the electricity grid in 2050 (Ref. 263).

Australia is a signatory to the Paris Agreement and has recently (June 2022) lodged an updated Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCC) that commits Australia to reducing greenhouse gas (GHG) emissions by 43% below 2005 levels by 2030. Emissions for the year to September 2021 were ~19.8% below emissions in the year to June 2005 (the baseline year for Australia's 2030 target under the Paris Agreement) (Ref. 264). Recent emissions trends (based on emissions for the year to September 2021) show a ~0.8% decrease compared to the previous year (Ref. 264). It was reported that this decrease was due to several events and activities, including

- ongoing reductions in emissions from electricity
- lower fugitive emissions from declines in coal production
- increased transport emissions (reflecting recovery from COVID-19 restrictions)
- increased stationary energy emissions due to increased fuel combustion in the manufacturing sector
- increased emissions from agriculture due to continued recovery from drought (Ref. 264).

Since their peak in 2007, Australia's GHG emissions have declined ~22%, and are currently (to September 2021) at their lowest levels recorded in the National Inventory (Ref. 264).

The Commonwealth government has also recently (October 2021) announced an aspirational target of net zero emissions by 2050 (Ref. 266); however, this target has not been legislated and no management measures for industry have yet been defined or mandated.

6.2.3.1 Emissions boundaries

One of the main principles of GHG accounting and reporting is relevance, of which an integral aspect is defining an appropriate GHG emissions inventory boundary (Ref. 267).

The primary environmental approvals under both the Commonwealth EPBC Act and the WA EP Act were assessments based on project-level emissions. Under a secondary approval, such as this EP, the emissions boundary for a GHG assessment is inherently different from and more limited in scope than that of the primary approvals, as the EP covers only a subset of activities (as described in Section 3) associated with the Wheatstone Project. Consequently, the appropriate emissions boundary for this EP is also bound by this subset of activities.

It is also noted that when assessing at this activity-level, what may be characterised as an indirect emission under this EP, may become a direct emission associated with a different secondary approval (activity-level) or primary approval (project-level) boundary. Therefore, the GHG emissions inventory in this EP is presented with respect to direct and indirect emissions only and does not correspond to the internationally recognised scopes. The GHG emissions inventory in this EP will also not directly equate to values presented within primary environmental approvals, or to those reported under other (e.g., National Greenhouse and Energy Reporting scheme) legislation due to the differing boundaries and facility definitions. The direct and indirect emission sources that form the inventory for this EP are identified within the relevant subsections of Section 6.

While emission assessment boundaries and inventories may vary, the control measures adopted to manage GHG emissions to an ALARP and acceptable level are predominantly the same across primary and secondary approvals, as management typically occurs at the project level, and not at individual activity level.

6.2.3.2 Direct emissions

As described above, CAPL has defined the emissions boundary for the assessment of direct GHG emissions in relation to the planned petroleum activities[4] within the OA as described in Section 3 of this EP. The boundary includes relevant emissions associated with third-party assets that are within scope of this EP and while under CAPL operational control (Section 2.3.3). Any unplanned activities, including repairs, or emergency events, have been excluded from the emissions inventory.

[4] Where 'petroleum activity' is as defined within Regulation 4 of the OPGGS(E)R.

The following activities have been identified as direct emission sources[5] for planned platform activities under this EP:

- flaring
- gas compressor turbines
- gas turbine generators
- other (e.g., fugitives, diesel use for back-up generators, firewater pumps, cranes, vessels).

The compressors have not been required throughout the early years of operation, however, will be progressively ramped up, with full compression estimated to occur from around FY26.

Operational emissions performance from the first years of operation is presented in Table 6-3, aligned to financial year as per NGER reporting. Emissions estimates have been forecast in consideration of the operational performance of plant and equipment, and based on planned operating scenarios (i.e., compression stages and timing). A forecast of GHG emissions for the platform is shown in Table 6-4 for the free flow, early compression, and full compression operating scenarios, while Table 6-5 summarises approximate emissions by point source type.

Flared emissions are forecast to reduce from the prior period due to rectification of passing valves on the HP flare. The ‘other emissions’ category is forecast to increase slightly associated with revised NGER fugitive reporting requirements for platforms and produced water which will apply to the FY22 reporting year onwards. Updates to compressor emissions forecasts were made based on contemporary data including equipment configuration and forecast operating conditions, and the projected timing for compression stages which is a function of reservoir performance and arriving fluid characteristics. This involved integrating contemporary reservoir performance data from the Julimar-Brunello and Wheatstone-Iago fields, and re-validated compressor power requirements for the projected stages. Additional modelling of system performance was undertaken to validate key assumptions, and thereby forecast emissions. In early compression, power requirement of the smaller bundle (single compressor) was evaluated for the suction pressures that the compressor is likely to run at. In full compression, the compressor bundle is to be changed out for one of larger capacity, and a second compressor is anticipated to come online whereupon both compressors will be fully loaded. The timing for full compression is contingent upon reservoir performance outcomes.

Based on the forecast emissions estimates, annual direct GHG emissions for the activities under this EP are ~0.22–0.40 Mtpa CO_2-e (Table 6-5). In acknowledgement of the uncertainty in forecasting emissions, for the purposes of the risk assessment in Section 6.2.3.5, CAPL have evaluated the emissions estimate from the primary approval of 0.45 Mtpa CO_2-e (Ref. 25; Section 6.2.3.4)..

Planned activities under this EP are not expected to significantly vary, such that it would result in a significant change to the estimated annual direct emissions over

[5] The inventory provided is consistent with aspects reported under the National Greenhouse and Energy Reporting scheme for the Wheatstone Project. While planned helicopter operations (as described within Section 3.6.2) are associated with platform activities under this EP, this emission source is a minor contribution (~0.0003 Mtpa) and has not been incorporated into the subsequent forecast emissions shown in Table 6-4 and Table 6-5.

the next five-year in-force period of this EP. The Wheatstone Project has approval to operate until 2060 (Section 6.2.3.4).

Table 6-3: Annual platform greenhouse gas emissions to date

Emission (t CO_2e)	FY18	FY19	FY20	FY21
Flaring	100,979	54,176	300,107	306,503
Compressor Turbines	-	-	-	-
Gas Turbine Generators	45,037	49,456	52,135	52,153
Other emissions	10,311	5,554	4,739	4,775
Total	**156,327**	**109,187**	**356,981**	**363,430**

Table 6-4: Summary of estimated annual platform greenhouse gas emissions

Emission	Units	Free-Flow (FY22)	Early compression (FY23-25)	Full compression (FY26+)
Carbon dioxide (CO_2)	tpa	275,647	212,245	396,086
Methane (CH_4)	tpa	342	107	119
Nitrous oxide (N_2O)	tpa	9	4	4
Carbon dioxide equivalents	t CO_2e/yr	**286,799**	**216,000**	**400,500**

Timing for the early and full compression stages has been estimated based on contemporary data, however is dependent upon reservoir performance hence subject to change.

Table 6-5: Summary of estimated annual GHG emissions by point source type

Emission (t CO_2e)	Units	Free-Flow (FY22)	Early compression (FY23-25)	Full compression (FY26+)
Flaring	t CO_2-e/yr	229,272	55,000	55,000
Compressor Turbines	t CO_2-e/yr	-	97,000	286,000
Gas Turbine Generators	t CO_2-e/yr	48,665	55,000	50,500
Other emissions	t CO_2-e/yr	8,862	9,000	9,000
Total	t CO_2-e/yr	**286,799**	**216,000**	**400,500**

Timing for the early and full compression stages has been estimated based on contemporary data, however is dependent upon reservoir performance hence subject to change.

6.2.3.3 Indirect emissions

To determine the relevance of indirect emissions to the activities under this EP, CAPL undertook an assessment against the factors for determining what is an indirect consequence, in accordance with the *'Indirect consequences' of an action: Section 527E of the EPBC Act* Policy Statement. As an outcome of this assessment, the following activities have been identified as indirect emission sources for planned activities under this EP:

- gas processing at the onshore facilities at Ashburton North[6]

[6] The "gas processing at the onshore facilities at Ashburton North" incorporates several emission sources, including gas turbine drivers, gas turbine generators, heating, flaring, venting, diesel consumption, marine tugs, and fugitive emissions.

- transport and third party end-use of LNG, condensate and domestic gas products.

As the Wheatstone Project supplies both the Australian domestic and the international energy market, these third-party indirect emissions may occur across multiple global regions. A large percentage of LNG produced by the Wheatstone Project is supplied internationally under long-term contracts. This long-term export market is primarily Japan, with some exports to other countries including South Korea. These indirect emissions would be direct emissions for the end consumers and would also have to operate under other regulatory regimes, Australian, Japanese, and South Korean, to manage their emissions and any associated impacts.

Japan is a signatory to, and has ratified, the Paris Agreement. Japan initially submitted an Intended Nationally Determined Contribution to reduce its greenhouse gas emissions by 26% in fiscal year 2030 from its fiscal year 2013, however in 2021 former Prime Minister Suga declared that Japan would aim to reduce its GHG emissions by 46% in fiscal year 2030 from its fiscal year 2013 levels (Ref. 292; Ref. 293). Japan's implementation plan includes driving the shift to gas utilisation (such as high efficiency LNG thermal power plants), whilst in the longer term, decarbonising with moderate social costs using existing LNG infrastructure (Ref. 294), and promoting use of LNG fuel vessels of a lower environmental impact by establishing bunkering bases in Japanese ports (Ref. 294).

South Korea is a signatory to, and has ratified, the Paris Agreement. In December 2020, South Korea submitted an updated Nationally Determined Contribution to reduce its GHG emissions by 24.4% from 2017 GHG emissions levels by 2030 (Ref. 295). South Korea's implementation plan includes a "significant reduction of coal power generation" and "conversion to eco-friendly fuels such as LNG", and "expanding eco-friendly ships fuelled by LNG" (Ref. 295).

Based on the boundary and inventory described above, an estimate of annual indirect GHG emissions related to activities under this EP are shown in Table 6-. For the purposes of the risk assessment in Section 6.2.3.5, CAPL have evaluated a capacity adjusted onshore operations emissions estimate from the primary approval of 4.2 Mtpa CO_2-e (Ref. 25; Section 6.2.3.4).

Planned activities under this EP are not expected to significantly vary, such that it would result in a significant change to the estimated annual indirect emissions over the next five-year in-force period of this EP. The Wheatstone Project has approval to operate until 2060 (Section 6.2.3.4).

Table 6-6: Estimated indirect emissions associated with activities under this EP

Source	Annual estimated emissions ($MtCO_2e$)
Gas processing at the onshore facilities at Ashburton North[1]	4.2
Transport and third-party end use of products[2,3]	36.8

1. *Source EIS/ERMP (Ref. 25) for onshore facilities at Ashburton North operating at full 25 Mtpa capacity, capacity adjusted on forecast LNG production within the five-year in-force period of the EP.*
2. *Transport emissions estimated from shipping fuel consumption scaled for a representative year of production. Emissions factors sourced from IMO Resolution MEPC.245(66) (Ref. 303) and IPCC AR5 100-year global warming potentials (Ref. 304).*
3. *Emissions from third-party use of products calculated in alignment with methods in Category 11 of IPIECA's Estimating Petroleum Industry Value Chain (Scope 3) Greenhouse Gas Emissions (Ref. 305), including product quantity and fuel specific higher heating values, and the CO2, CH4 and N2O combustion emissions*

factors for each fuel type. Evaluation based upon production data from a representative year, applying API compendium methodologies (Ref. 306) and factors, and IPCC AR5 100-year GWP (Ref. 304).

6.2.3.4 Primary approvals

The Wheatstone Project was assessed through an Environmental Impact Statement / Environmental Review and Management Program assessment process under the WA EP Act and the Commonwealth EPBC Act.

The Wheatstone Project was approved by the WA Minister for Environment on 30 August 2011 by way of Ministerial Statement (MS) 873, and as amended by MS 903, MS 922, MS 931 and Attachments 1 to 4. On 30 January 2013, the WA Minister for Environment approved revised environmental protection outcomes under Condition 8.7 to allow for trunkline installation. On 22 April 2020, the WA Minister for Environment approved deletion of Conditions 6.12, 9.1 to 9.5, and 12.1 to 12.8 by way of MS 1130.

The then Commonwealth Minister for Sustainability, Environment, Water, Population and Communities approved the Wheatstone Project on 22 September 2011 (EPBC 2008/4469), with variations to EPBC 2008/4469 Conditions 2, 3, 5, 6, 8, 44, 45, 47, 54, 55, 56, 58, 66e, 71, 71A, and 71B made pursuant to Section 143 of the EPBC Act. The approval has effect until 31 December 2060.

Chapter 3 and Chapter 4 of the *Draft Environmental Impact Statement / Environmental Review and Management Proposed Wheatstone Project* (Ref. 25) set out the environmental impact assessment of GHG emissions. In that assessment it was estimated that the Wheatstone Project would emit approximately 0.45 Mtpa of GHG for the offshore component[7] (including the platform), and 9.9 Mtpa for the onshore component[8] (Ref. 25

6.2.3.5 Risk assessment

Source			
Activities identified as having the potential to result in GHG emissions are: • direct emissions from planned platform activities within scope of this EP • indirect emissions from activities associated with processing of gas at Ashburton North • indirect emissions from the transport and third party end-use of LNG, condensate and domestic gas produced by the Wheatstone Project.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
GHG emissions may result in: • contribution to the reduction of the global atmospheric carbon budget (by the amount of the direct and indirect GHG associated with activities under this EP)	6	A decrease in the global atmospheric carbon budget may result in: • contribution to the anthropogenic influence on the global climate system.	—

[7] The offshore component of the Wheatstone Project incorporates several emission sources including gas compressor turbines, gas power generation turbines, flaring (HP, LP, and pilot), back-up diesel generators, helicopters, and fugitive emissions (Ref. 25).

[8] The onshore component of the Wheatstone Project is equivalent to the “gas processing at the onshore facilities at Ashburton North” component, but at full 25 Mtpa capacity.

Consequence evaluation
Contribution to the reduction of the atmospheric carbon budget Direct GHG emissions from platform activities within scope of this EP are estimated to be ~0.45 Mtpa CO_2-e, and indirect GHG emissions from the processing of gas onshore at Ashburton North are estimated to be ~4.2 Mtpa CO_2-e[9]. Combined these emissions represent ~0.9% of national Australian emissions (when compared to September 2021 inventory) (Ref. 264). The direct (from activities within this EP) and indirect (from gas processing at the onshore facilities at Ashburton North) GHG emissions are within levels previously assessed and approved for the Wheatstone Project pursuant to the EP Act and EPBC Act. The indirect GHG emissions from the transport and third party end-use of LNG, condensate and domestic gas are estimated to be ~36.8 Mtpa CO_2-e[10,11]. According to the IPCC, Sixth Assessment Report for Working Group 1 (WG1 AR6), "the total anthropogenic effective radiative forcing (ERF) in 2019, relative to 1750, was 2.72 [1.96 to 3.48] Wm^{-2} (*medium confidence*) and has likely been growing at an increasing rate since the 1970s, [and]…Over 1750–2019, CO_2 increased by 131.6 ± 2.9 ppm (47.3%)."[12] The IPCC defines the term "carbon budget" as "refer[ing] to the maximum amount of cumulative net global anthropogenic CO_2 emissions that would result in limiting global warming to a given level with a given probability, taking into account the effect of other anthropogenic climate forcers. This is referred to as the total carbon budget when expressed starting from the pre-industrial period, and as the remaining carbon budget when expressed from a recent specified date. Historical cumulative CO_2 emissions determine to a large degree warming to date, while future emissions cause future additional warming. The remaining carbon budget indicates how much CO2 could still be emitted while keeping warming below a specific temperature level."[13] The remaining carbon budget for a 50% likelihood to limit global warming to 1.5°C, 1.7°C, and 2°C is respectively, 500 Gt CO_2, 850 Gt CO_2, and 1350 Gt CO_2.[14]. If the total direct and indirect GHG emissions are ~41.5 Mtpa CO_2-e, then this contributes ~0.1–0.3% to the reduction in the total remaining global carbon budget, which is a *de minimis* decrease. It is noted that this estimated contribution to the total global carbon budget is based the emissions estimates (including platform emissions [Section 6.2.3.2], IMR emissions [Section 6.4.5.1], and indirect emissions [Section 6.2.3.3]), operations continuing through to 2060 (i.e., current end of approval life), and with no allowance for future mitigation (including net zero aspirations, future technology or operational efficiencies, or future Australian regulatory or international policy requirements). According to the IEA (Ref. 272), an estimated 1.2 Gt of CO_2 could be abated in the short term by switching from coal to existing gas-fired plants, if relative prices and regulation are supportive. Although the IEA states that switching between unabated consumption of fossil fuels, on its own, does not provide a long-term solution, there is significant CO_2 and air quality benefits, from using less emission-intensive fuels such as natural gas (Ref. 272). It was also acknowledged by IEA (Ref. 272) that a limiting factor in the scale of switching from coal to gas, particularly in developing countries is the cost of importing gas. Therefore, realising the full global potential for switching would require an extra 450 billion cubic metres of gas to be produced each year (~12% of today's global gas production) to reduce the price of gas to a level which would disincentivise coal use in the developing world i.e., an increase in global gas production and reduction in its price may reduce use of coal and in turn reduce carbon emissions (Ref. 272). When used as a primary energy source, LNG has a number of benefits over other fossil fuels, including lower emissions of sulphur dioxide, particulate matter, and greenhouse gases. A

[9] Source EIS/ERMP (Ref. 25) for onshore facilities at Ashburton North, pro-rated and capacity adjusted.

[10] Transport emissions estimated from shipping fuel consumption scaled for a representative year of production. Emissions factors sourced from IMO Resolution MEPC.245(66) (Ref. 303) and IPCC AR5 100-year global warming potentials (Ref. 304).

[11] Emissions from third-party use of products calculated in alignment with methods in Category 11 of IPIECA's *Estimating Petroleum Industry Value Chain (Scope 3) Greenhouse Gas Emissions* (Ref. 305), including product quantity and fuel specific higher heating values, and the CO_2, CH_4 and N_2O combustion emissions factors for each fuel type. Evaluation based upon production data from a representative year, applying API compendium methodologies (Ref. 306) and factors, and IPCC AR5 100-year GWP (Ref. 304).

[12] IPCC, AR6, WG1, at TS-35

[13] IPCC, AR6, WG1, at SPM-48 footnote 43

[14] IPCC, AR6, WG1, at SPM-29 Table SPM.2

benchmarking assessment for the LNG processing emissions was undertaken during the *Draft Environmental Impact Statement/ Environmental Review and Management Proposed Wheatstone Project* (Ref. 25). This benchmarking assessment showed that the Wheatstone Project is within the range of emissions intensities compared to other Australian projects benchmarked (Ref. 25). The nominal project life of the Wheatstone Project (Section 3.1.2) is also considered to be consistent with the Commonwealth's Australia's *Long-Term Emissions Reduction Plan* and that the use of gas is expected to continue through the coming decades through to 2050 and beyond (Ref. 263). Therefore, the continued use of natural gas from the Wheatstone Project is expected to contribute to the displacement of the use of higher carbon intensive fossil fuel energy sources, which will have a corresponding reduction in potential fossil fuel emissions. Indirect emissions associated with the transport and third party end-use of LNG, condensate and domestic gas products is the largest category of emissions associated with Chevron's activities (Ref. 273). These types of indirect emissions are driven by global demand, which is in turn driven by economics, policy, regulation, and consumer behaviour on a global scale (Ref. 273). In summary, due to the relatively lower emissions intensity of natural gas compared to other fossil fuel alternatives, that natural gas is part of Australia's long-term emissions reduction plan, as well as the emissions reduction plans of the foreign jurisdictions to which the Wheatstone Project exports its products, and that it can be considered as supporting the global transition to lower carbon intensive fuels, and the overall *de minimis* contribution to the reduction of the global carbon budget from the Wheatstone Project, the impact of contribution to the global carbon budget has been evaluated as having the potential to result in an Incidental (6) consequence.
Contribution to anthropogenic influence on the global climate system As a contribution to the anthropogenic influence on the global climate system cannot be directly attributed to any one development, no consequence rating has been applied for this risk, however the following contextual evaluation is provided. *Changes to climate systems* As the Working Group I contribution to the Sixth Assessment Report (WGI AR6) of the Intergovernmental Panel on Climate Change (IPCC) acknowledges, "[c]limate change is a global phenomenon, but manifests differently in different regions" (Ref. 278). Moreover, the Summary for Policymakers to the same report states that "[h]istorical cumulative CO_2 emissions determine to a large degree warming to date, while future emissions cause future additional warming" (Ref. 279). Future emissions are relevant to remaining carbon budgets, which vary based on emissions scenarios, and "indicates how much CO_2 could still be emitted while keeping warming below a specific temperature level" (Ref. 279). The physical risks of climate change are varied and widespread, and CAPL acknowledge that disruption from natural or human causes beyond its control, include physical risks from hurricanes, severe storms, floods, heat waves, other forms of severe weather, wildfires, ambient temperature increases, and sea level rise (Ref. 273). According to the IPCC, among other things, global changes to the climate system can include the following: increase in global surface temperatures, changes to frequency and intensity of precipitation, sea level rise, retreat of glaciers and artic sea ice, changes to the intensity and frequency of certain extreme weather events and droughts (Ref. 280). Specifically, the IPCC projections for the Australia include: • **Droughts:** Additional regional changes in Australasia [. . .] include a significant decrease in April to October rainfall in southwest Western Australia, observed from 1910 to 2019 and attributable to human influence (*high confidence*[15]), which is *very likely* to continue in future. Agricultural and ecological and hydrological droughts have increased over southern Australia (*medium confidence*), and meteorological droughts have decreased over northern and central Australia (*medium confidence*). (. . .) Agricultural and ecological droughts are projected to increase in southern and eastern Australia (*medium confidence*) for a 2°C GWL."[16] • **Fire Weather Conditions**: "The number of evident attribution studies on compound events is limited. There is *medium confidence* that weather conditions that promote wildfires have become more probable in southern Europe, northern Eurasia, the USA, and Australia over the last century. In Australia a number of event attribution studies show that there is *medium*

[15] "The following terms have been used to indicate the assessed likelihood of an outcome or a result: virtually certain 99–100% probability, very likely 90–100%, likely 66–100%, about as likely as not 33–66%, unlikely 0–33%, very unlikely 0–10%, exceptionally unlikely 0–1%. Additional terms (extremely likely 95–100%, more likely than not >50–100%, and extremely unlikely 0–5%) may also be used when appropriate." IPCC AR6, SPM-4.

[16] IPCC AR6, WG1, TS-93.

confidence of increase in fire weather conditions due to human influence.”.[17] (. . .) Fire weather is projected to increase throughout Australia (high confidence) . . . .[18]

- **Precipitation:** “In the future, heavy precipitation and pluvial flooding are *very likely* to increase over northern Australia and central Australia, and they are *likely* to increase elsewhere in Australasia for global warming levels (GWLs) exceeding 2°C and with *medium confidence* for a 2°C GWL.”[19]
- **Relative Sea Level Rise: “**Relative sea level has increased over the period 1993–2018 at a rate higher than GMSL around Australasia (*high confidence*). Sandy shorelines have retreated around the region, except in southern Australia, where a shoreline progradation rate of 0.1 m yr–1 has been observed.”[20] . . . “Relative sea-level rise is virtually certain to continue in the oceans around Australasia, contributing to increased coastal flooding in low-lying areas (*high confidence*) and shoreline retreat along most sandy coasts (*high confidence*).”[21]
- **Snowfall:** “Snowfall is expected to decrease throughout the region at high altitudes in [] Australia (*high confidence*).”[22] (. . .) “Observations in Australia show that the snow season length has decreased by 5% in the last five decades. Furthermore, the date of peak snowfall in Australia has advanced by 11 days over the last 5 decades.”[23]
- **Tropical Cyclones:** “In Australia, the number of [tropical cyclones] has generally declined since 1982, and the frequency of intense TCs that make landfall in north eastern Australia has declined significantly since the 19th century (*medium confidence*). There is *high confidence* that cyclones making landfall along north eastern and north Australian coastlines will decrease in number and *low confidence* of an increase I their intensities for a 2°C global warming level as well as for the mid-century period with scenarios RCP4.5 and above, with the amplitude of changes increasing from RCP4.5 to RCP8.5. Decreases in frequency are projected for ‘east coast lows.’”[24]

Values and sensitivities vulnerable to climate change

The Working Group II contributions to the IPCC’s Sixth Assessment Report (WGII AR6) provides a summary of the observed impacts, adaptation and vulnerability (Ref. 281). The WGII AR6 report notes that “[c]limate trends and extreme events have combined with exposure and vulnerabilities to cause major impacts for many natural systems, with some experiencing or at risk of irreversible change in Australia (*very high confidence*)”[25] and that “[c]limate trends and extreme events have combined with exposure and vulnerabilities to cause major impacts for some human systems (*high confidence*)”[25]. The WGII AR6 report identifies nine key climate risks for the Australasian region:

- “Loss and degradation of coral reefs and associated biodiversity and ecosystem service values in Australia due to ocean warming and marine heatwaves (*very high confidence*)
- Loss of alpine biodiversity in Australia due to less snow (*high confidence*)
- Transition or collapse of alpine ash, snowgum woodland, pencil pine and northern jarrah forests in southern Australia due to hotter and drier conditions with more fires (*high confidence*)
- Loss of kelp forests in southern Australia and southeast New Zealand due to ocean warming, marine heatwaves and overgrazing by climate-driven range extensions of herbivore fish and urchins (*high confidence*)
- Loss of natural and human systems in low-lying coastal areas due to sea-level rise (*high confidence*)

[17] IPCC AR6, WGI, TS-74.
[18] IPCC AR6, WGI, TS-93.
[19] IPCC AR6, WGI, TS-93.
[20] IPCC AR6, WGI, TS-93.
[21] IPCC AR6, WGI, 12-57.
[22] IPCC AR6, WGI TS-93.
[23] IPCC AR6, WGI, TS-93-94.
[24] IPCC AR6, WGI, 12-54, 55.
[25] IPCC AR6, WGII, Australasia FS (Ref. 282).

- Disruption and decline in agricultural production and increased stress in rural communities in south-western, southern and eastern mainland Australia due to hotter and drier conditions (*high confidence*)
- Increase in heat-related mortality and morbidity for people and wildlife in Australia due to heatwaves (*high confidence*)
- Cascading, compounding and aggregate impacts on cities, settlements, infrastructure, supply-chains and services due to wildfires, floods, droughts, heatwaves, storms and sea-level rise (*high confidence*)
- Inability of institutions and governance systems to manage climate risks (*high confidence*)." [25]

A report by Australia's Biodiversity and Climate Change Advisory Group (Ref. 283) indicates that "[b]iodiversity is one of the most vulnerable sectors to climate change". The report also notes that "Australia's biodiversity is not distributed evenly over the continent but is clustered in a small number of hotspots with exceptionally rich biodiversity", and that these "include the Great Barrier Reef, south-west Western Australia, the Australian Alps, the Queensland Wet Tropics and the Kakadu wetlands" (Ref. 283). The report identifies "a few examples of recently observed changes in Australia's biota that are consistent with the emerging climate change 'signal' ", as genetic constitution, geographic ranges, life cycles, populations, ecotonal boundaries, ecosystems, and disturbance regimes (Table 1 within Ref. 283). Further, it is noted that "many of the most important impacts of climate change on biodiversity will be the indirect ones at the community and ecosystem levels, together with the interactive effects with existing stressors (Ref. 283).

DAWE have identified climate change as a key threat, specifically that "[a] changing climate is impacting our threatened animals, plants and environments. It is reducing the number of animals and plants, and reducing the places where they occur" (Ref. 284). DAWE also note that "[t]he changing climate is driving changes in species distribution and the composition and functioning of ecological communities, exacerbating the impacts of other pressures such as habitat fragmentation and invasive species" (Ref. 284).

Climate change is identified as a threat to some protected species, including marine turtles and whales. The *Recovery Plan for Marine Turtles in Australia* states that "[c]limate change is of particular concern to marine turtles because it is likely to have impacts across their entire range and at all life stages. Climate change is expected to cause changes in dispersal patterns, food webs, species range, primary sex ratios, habitat availability, reproductive success and survivorship" (Ref. 93). The *Conservation Management Plan for the Blue Whale* states: [c]limate change is expected to cause changes in migratory timing and destinations, population range, breeding schedule, reproductive success and survival of baleen whales, including blue whale species and subspecies" (Ref. 98).

The *North-west Marine Parks Network Management Plan 2018* identifies climate change as a pressure that may impact marine park values (Ref. 146). The management plan states that "[t]he impacts of climate change on the marine environment are complex and may include changes in sea temperature, sea level, ocean acidification, sea currents, increased storm frequency and intensity, species range extensions or local extinctions, all of which have the potential to impact on marine park values" (Ref. 146).

Anthropogenic influence on the climate system

Anthropogenic changes to the global climate system cannot be directly attributed to any one development or emission source or product, as they are the result of the net accumulation of global GHGs (emissions minus sinks) in the atmosphere since the industrial revolution.

Growing populations, rising incomes, and urbanisation are the principal forces behind energy-demand growth, as they typically lead to greater use of transportation, heating, cooling, lighting, and refrigeration (Ref. 273).

The changing regulatory and international initiatives on climate change (e.g., which may result in changing reduction targets and timeframes) will also influence the total global GHG emissions into the future – making a future prediction of changes to climate systems, inaccurate.

ALARP decision context justification

Offshore platform operations are common both nationally and internationally. The control measures to manage the impact associated with GHG emissions are well understood and implemented by industry and CAPL.

Currently, under international climate agreements, Australia has the following target to reduce GHG emissions: 43% below 2005 levels by 2030 (under the Paris Agreement). Recently, the Commonwealth government also announced an aspirational target of net zero emissions by 2050 (Ref. 266); however, this target has not been legislated and no management measures for industry have yet been defined or mandated.

CAPL have recently submitted a draft Greenhouse Gas Management Plan (GHGMP)[26] (Ref. 299) for the Wheatstone LNG Plant at Ashburton North to the EPA for review. In accordance with the requirements of the EPA's Environmental Factor Guideline on Greenhouse Gas Emissions (Ref. 301), the purpose of this GHGMP is to outline CAPL's plan for managing the GHG emissions for the Wheatstone LNG Plant, including planned contribution to the Western Australian Government's current aspiration of achieving net zero emissions by 2050 (Ref. 302). This GHGMP is intended to outline: • measures implemented through the design and early phase of operations to avoid or reduce GHG emissions • measures to avoid, reduce, and offset scope 1 GHG emissions during operations over the life of the proposal • interim and long-term aspirational emission reduction targets for scope 1 GHG emissions from the Ashburton North gas processing facility over the life of the proposal. The GHGMP is applicable to all Scope 1 GHG emissions from the current operational Wheatstone Development facilities outlined in MS 873. This includes all Scope 1 emissions from the Wheatstone LNG Plant Trains 1 and 2, Domgas Plant, and associated accommodation facility. There are also other, non-petroleum specific legislation that are related to GHG emissions reporting and management, such as the Commonwealth NGER Act and Safeguard Mechanism, to which the Wheatstone Project is required to comply. Therefore, given there is sufficient other legal mechanisms to monitor and report on the emissions associated with the Wheatstone Project (to which the activities within scope of this EP are just a component of), there is no uncertainty regarding the appropriateness of emissions reporting and management. CAPL is committed to conducting activities in an environmentally responsible manner and aims to implement best practice environmental management as part of a program of continuous improvement. This commitment to continuous improvement means that CAPL reviews the GHGMP periodically and considers measures to avoid, reduce and offset emissions, including advances in technology and/or operational processes, and considers adoption of those technologies that offer a practicable way of reducing GHG emissions per tonne of LNG. Reviews also address matters such as the overall design and effectiveness of the GHGMP, progress in environmental performance, changes in business conditions, and any relevant emerging environmental issues. Given the GHG emissions associated with the activities detailed in this EP result in a *de minimis* contribution to the reduction of the global carbon budget, CAPL considers this aspect to comprise a lower-order impact (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect. Notwithstanding this, CAPL has considered additional mitigation measures that could potentially lower the contribution to the reduction of the global carbon budget associated with the direct and indirect emissions arising from the activities covered in this EP.

Good practice control measures and source	
Control measure	**Source**
EP Act approval	The Wheatstone Project was approved by the WA Minister for Environment on 30 August 2011 by way of MS 873 (and as amended; refer to Section 6.2.3.4). Condition 19 of MS 922 requires the annual reporting of GHG emissions from the LNG and Domgas plant. CAPL meets this condition via reporting GHG emissions under the Commonwealth NGER Act. CAPL have recently submitted a draft GHGMP[26] (Ref. 299) for the Wheatstone LNG Plant at Ashburton North to the EPA for review. In accordance with the requirements of the EPA's Environmental Factor Guideline on Greenhouse Gas Emissions (Ref. 301), the purpose of this GHGMP is to outline CAPL's plan for managing the GHG emissions for the Wheatstone Project and the LNG Plant's planned contribution to the Western Australian Government's current aspiration of achieving net zero emissions by 2050 (Ref. 302).
EPBC Act approval	The Wheatstone Project was approved by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities on 22 September 2011 by way of EPBC 2008/4469 (and as amended; refer to Section 6.2.3.4).

[26] The draft GHGMP has been submitted for review purposes and is currently under consideration by the EPA.

National Greenhouse and Energy Reporting scheme	The Wheatstone Project (i.e., the facility as a whole) is required to report GHG emissions under *the National Greenhouse and Energy Reporting Act 2007* (NGER Act). From July 2016 emissions have been subject to a baseline in accordance with the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015. A revised Safeguard Mechanism baseline has been recently approved by the Clean Energy Regulator. This baseline will apply throughout the next 5-year in-force period of this EP. Consequently, CAPL will continue to monitor and report GHG emissions, and maintain a baseline, under this legislation.
Energy efficient design	During the design phase for the Wheatstone Project, energy efficient design features were incorporated to minimise power demand and in turn air emissions. Specifically, some of the equipment installed included the waste heat recovery units (WHRUs), high integrity valves and flanges, seawater heat exchange and lift pump configuration, aero derivative turbines, variable compression modes, condensate export pumps with variable speed drive.
CMMS	To ensure that all energy efficient features are operating appropriately, preventative maintenance regimes have been developed and incorporated into the CMMS. Maintenance activities are managed through CMMS which is used as the main asset and inventory management system within CAPL for performing and tracking maintenance activities.
Air emissions monitoring	The Platform Air Emissions Monitoring Program (Section 8.4.1.2) is designed to meet emissions reporting requirements. Gas compressor turbines, power generation turbines, diesel system, LP flared gas and HP flared gas, and pilot gas and purge gas are monitored to inform emissions reporting and management.
Platform emissions management	An *Emissions and Energy Management Plan* (EEMP) (Ref. 82) for the Wheatstone Platform accounts for all key GHG emission sources on the Platform, and describes the process for emissions allocation and reporting, emissions tracking and deviation management, and links to management of change processes and revision triggers to ensure that emissions are managed to ALARP. It includes an emissions management section involving setting of performance standards/targets for platform emissions and regular monitoring of performance against these standards to ensure that emissions are minimised as far as reasonably practicable. As part of emissions management, a leak detection and repair (LDAR) program is in place for the Wheatstone Platform. The LDAR program is implemented to detect fugitive emissions, and address the subsequent management or repair of sources of fugitive emissions.
Corporate governance	Chevron Corporation has set an aspirational target of net zero upstream Scope 1 and Scope 2 emissions by 2050, as well as reduction targets for two metrics: portfolio carbon intensity (PCI) and upstream carbon intensity (UCI) (Ref. 273). The PCI metric developed by Chevron Corporate represents “the carbon intensity across the full value chain associated with bringing products to market, including Scope 3 emissions"[27] (Ref. 273). It uses a representative value chain that includes emissions associated with bringing products to market, and emissions from their use. The Chevron PCI reduction target for 2028 (i.e., >5% reduction from 2016) are corporate level targets incorporating emissions from all Chevron operated assets and non-operated joint ventures. The timing of the Chevron reduction targets is aligned with the Global Stocktake process under the Paris Agreement (with the second Global Stocktake will occur in 2028). Within CAPL operational control, Scope 1 and Scope 2 emissions, and Wheatstone gas and liquids production data (used to calculate estimated Scope 3 emissions) are compiled, assured, and reported by CAPL to Chevron Corporate annually for inclusion in the PCI metric on an equity basis. Management strategies,

[27] Quote CCR (October 2021), at pg 38.

	projects or improvements that serve to reduce Wheatstone emissions per unit production will contribute to the overall PCI metric. The UCI metric developed by Chevron Corporate are equity-based “emission intensity metrics for oil production, gas production, flaring, and methane” (Ref. 273). The key Chevron UCI reduction targets for 2028 (i.e., 24 kg CO_2-e/boe [26% reduction from 2016] for gas production, 2 kg CO_2-e/boe [53% reduction from 2016] for methane, and 3 kg CO_2-e/boe for overall flaring [66% reduction from 2016]) are corporate level targets incorporating emissions from all Chevron operated assets and non-operated joint ventures. Australia has been identified as one of six corporate assets that will account for two-thirds of the financial commitment over the next four years to reduce UCI (Ref. 273). UCI includes Scope 1 and Scope 2 emissions. Within CAPL operational control, Wheatstone gas and liquids production, and Scope 1 and Scope 2 emissions data, are compiled, assured, and reported by CAPL to Chevron Corporate annually for inclusion in the UCI metric, which is depicted on an equity basis. Management strategies, projects, or improvements that serve to reduce Wheatstone emissions per unit production will contribute to the overall UCI metric. The PCI and UCI metric are described and publicly reported within the *Corporate Sustainability Report* (Ref. 276, Ref. 313) and *Climate Change Resilience* (Ref. 273). As identified in Table 2-5, Chevron Corporation is a corporate member of IPIECA (Table 2-5) and via that membership worked on the SDG Roadmap (Ref. 312). The *2021 Corporate Sustainability Report* describes Chevron’s contributions to the impact opportunities identified within the Roadmap (Ref. 313). Chevron Corporation is a signatory to the Methane Guiding Principles (Table 2-5), and publicly reports on activity against each of the principles (Ref. 311). Chevron Corporation is also a signatory to the Aiming for Zero Methane Emissions Initiative (Table 2-5), and as a signatory will annually report on methane emissions. Management strategies, projects, or improvements for the Wheatstone Project, including those related to initiatives or commitments made by Chevron Corporation, may be identified and implemented via the ‘emissions reduction review’ process or adaptive management processes (‘address uncertainty’ and ‘methane management) control measures.
Emissions reduction review	As a global company, Chevron operates in many jurisdictions that have enacted lower-carbon policies. CAPL regularly evaluates carbon emission reduction projects for opportunities to avoid, eliminate, or reduce emissions. Continual improvement processes, including but not limited to marginal abatement cost curve (MACC) evaluations, allow CAPL to rank emission reduction opportunities by their relative cost and abatement potentials. Given the sheer scale of the global challenge to address the global carbon budget, allocation of limited resources as efficiently and effectively as possible is critical to creating the greatest opportunity for success. Prioritizing efforts that curtail emissions at the lowest cost per tonne, irrespective of where or in which sectors those abatements occur, is the most economically efficient approach. The enterprise approach to drive emissions reductions in Chevron’s portfolio is the marginal abatement cost curve (MACC) process. Like supply stacks, MACCs can enable a visualization of abatement opportunities, showing their relative cost and abatement potential on a similar basis. The relevant stages in the MACC process are: • opportunity identification by CAPL cross-functional team (with input from all Wheatstone Joint Venture participants) • opportunity development and submission by CAPL • enterprise-wide portfolio optimisation / selection for funding • implementation and reporting by CAPL • project tracking and knowledge sharing to ensure constant learning and continuous improvement.

	The process is ongoing with MACC project selection for funding occurring annually. The scope of the MACC process is activities within CAPL operational control (e.g., with respect to Wheatstone Operations, this includes the onshore facilities at Ashburton North). CAPL provide input on appropriate assumptions for decision analysis, upon which the US-based Carbon Reduction team apply both deterministic and probabilistic analysis to assess emissions reduction opportunities, consistent with Chevron Decision Analysis practices. The US-based Carbon Reduction team use portfolio theory and efficient frontier analysis to identify a portfolio of opportunities to progress across the technology spectrum, segments, business units, and geographies.
Legislative and other requirements review	CAPL is committed to continual improvement and adaptive management processes, and regularly monitors for revised or contemporary Australian regulatory and/or relevant international guidelines or standards in relation to GHG (including methane) and carbon management. With specific reference to international shipping, CAPL is aware that the IMO is continually updating their mandatory measures to reduce emissions from international shipping. The commercial arrangements governing all export shipping engaged in loading cargoes from the Wheatstone Marine Terminal, requires CAPL and their partners to procure ships that comply with international and Australian standards, so to the extent that a ship’s Flag State, or AMSA as Port State, adopts IMO resolutions for measures to reduce emissions, these will apply to those third-party vessels (as well as Chevron Shipping vessels).
Address uncertainty	CAPL acknowledges the residual uncertainty associated with evaluation of environmental impacts and risks from the generation of GHG emissions. Uncertainty arises from advancements in climate science, revised forecasts in global energy mix, and subsequent changes in regulatory and policy requirements. These areas will evolve and new information will become available over the in-force period of this EP. As such, CAPL is committed to implementing an adaptive management process to ensure that impacts and risks associated with this aspect are continually reduced to ALARP and managed to acceptable levels. To address the residual uncertainty associated with impacts and risks from the generation of GHG emissions, the following adaptive management process will be implemented: • Monitor: – contemporary climate science in relation to Chevron Corporate climate risk management (as sourced from the periodic release of Chevron’s *Climate Change Resilience* report; Section 8.5) – historical and forecast global energy mix and associated emissions, including the role of Wheatstone product types – revised or contemporary Australian regulatory and/or relevant international guidelines or standards (as per ‘legislative and other requirements review’ control measure) • Evaluate: – review the accuracy of, and validate, the estimated downstream indirect GHG emissions associated with the Wheatstone Project – review and validate the environmental impact and risk assessment for GHG emissions to ensure that GHG emissions are being reduced to ALARP and managed to an acceptable level • Adjust and implement: – identify improvements (e.g., to emission estimates, consequence evaluation, control measures, determination of acceptability, etc.) and implement changes as required. CAPL will implement this adaptive management process annually during the in-force period of this EP. The results of the annual monitoring and evaluation will be documented internally by CAPL. Where this annual review identifies improvements, any changes to the EP will be managed as

	per the MoC (Section 8.3.2.2) and Environment Plan review (Section 8.5) processes.
Emissions management opportunities	Chevron supports the Paris Agreement and is committed to addressing climate change while continuing to deliver energy that supports society (Ref. 273). Chevron's approach to climate policy is to achieve emissions reductions as efficiently and effectively as possible (Ref. 273). This approach is actioned through global engagement, research and innovation, balanced and measured policy, and transparency. CAPL monitors new and evolving opportunities to work with business partners to seek to advance its ambition of managing emissions, including through industry partnerships, research agreements, and commercial opportunities for business diversification into lower carbon energy solutions and/or complimentary technologies for improved efficiency. This is an ongoing process, with opportunities identified, assessed, and implemented on an ad-hoc basis. With any significant technology development, these opportunities may develop over a medium to long term timeframe (i.e., greater than the 5-year in-force periods of EPs).
Methane management	CAPL is committed to implementing an adaptive management process to ensure that methane emissions for the Wheatstone Project are appropriately identified, evaluated, and managed to ALARP in alignment with Chevron Corporation strategies and adopted international guidelines. At a facility level, the following adaptive management process will be implemented by CAPL: • Monitor: – quantification and reporting of methane emissions in accordance with NGER requirements (as part of the 'National Greenhouse and Energy Reporting scheme' control measure) – methane emissions (as part of the Scope 1 and Scope 2 emissions data) are compiled, assured, and reported by CAPL to Chevron Corporate annually for inclusion in the upstream methane intensity metric, which is depicted on an equity basis – regular monitoring program for the detection of fugitive emissions (as per the 'platform emissions management' control measure) – revised or contemporary Australian regulatory and/or relevant international guidelines or standards (as per 'legislative and other requirements review' control measure) • Evaluate: – review the accuracy of the reported methane emissions associated with the Wheatstone Project – review of methane monitoring and mitigation technologies and approaches – opportunities to work with business partners to seek to advance emissions management (as per 'emissions management opportunities' control measure) • Adjust and implement: – Identify and evaluate potential management strategies, projects, or improvements for methane emissions management aligned with Chevron Corporation strategies and adopted international guidelines, and implement changes as required. CAPL will implement this adaptive management process annually during the in-force period of this EP. The results of the annual monitoring and evaluation will be documented internally by CAPL. Where this annual review identifies improvements, any changes to the EP will be managed as per the MoC (Section 8.3.2.2) and Environment Plan review (Section 8.5) processes.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
(Avoid) Use renewable electricity to power the platform	If a renewable energy source (e.g., solar) was available then the associated emissions from power generation from the gas turbines would be avoided. However, there is a limited space available for use on the platform, and the construction of any renewable energy source and supply from an alternate land source would require additional disturbances due to land clearing, and offshore cabling and bring in new environmental impacts.	The cost of implementing this control is currently considered grossly disproportionate to the level of risk reduction achieved. Consequently, the practicability of using renewable energy sources to avoided platform electricity emissions for the activities covered in this EP is not considered practicable.
(Avoid) Use renewable electricity to power the hydrocarbon system and Wheatstone LNG and Domgas Plants at Ashburton North	If a renewable energy source (e.g., solar) was available then the associated emissions from power generation from the gas turbines would be avoided. However, there are limitations for use of renewables associated with intermittency and the ability to store a large quantity of power, as well as a limited Development Envelope allowed for use at Ashburton North. The construction of any renewable energy source and supply would require an increase to the land disturbance allowed under existing environmental approvals and bring in new environmental impacts.	The cost of implementing this control is currently considered grossly disproportionate to the level of risk reduction achieved. Consequently, the practicability of using renewable energy sources to avoid emissions for the activities covered in this EP is not considered practicable.
(Reduce) Use of renewable electricity to reduce gas turbine power generation requirements	If a renewable energy source (either with or without battery storage) was available to supply some of the power requirements to the Wheatstone Platform and/or at the Wheatstone LNG and Domgas Plants at Ashburton North, then the associated emissions from power generation from gas turbines could be reduced. Acknowledging the limited space available either on the platform or within the existing Development Envelope at Ashburton North, and that the construction of any renewable energy source, storage, and supply would require an increase to the land disturbance allowed under existing environmental approvals and bring in new environmental impacts, the application of renewable power technology is considered for operating assets where appropriate.	The use of renewable energy sources to reduce power generation emissions at the platform or Ashburton North is not available for implementation at this time. However, Chevron are currently investigating the feasibility of renewable energy power projects that would allow a reduction in use of the existing gas turbine generators. As such, this cost-benefit analysis will be regularly re-assessed.
(Avoid) Eliminate HP flaring	The HP flare is used for upset, relief, and blowdown loads, and is therefore considered a safety critical element for platform operations. At the current time, there is no	The potential production and safety costs are disproportionate to the environmental benefit of avoiding flaring emissions, and is therefore

	reasonably practicable alternative to the use of the HP flare from a safety and integrity perspective. However, even if it were possible, this action would not be expected to result in a material reduction of impacts associated with GHG emissions.	not a reasonably practicable alternative.
(Avoid) Eliminate LP flaring	The LP flare is used on a continuous basis for waste gas streams. Alternative off-gas recovery systems to eliminate LP flaring were considered during FEED. However, for the alternative designs involving off-gas recovery, the environmental benefit gained from a reduction in LP flaring emissions would be counteracted by increased power generation emissions associated with running the gas recovery compressors such that overall net benefit would be reduced. Additionally, increased safety risks are associated with potential leak sources and potential exposure of the waste gas stream to personnel. Therefore, the use of an off-gas system is not considered to be a practicable alternative. The environmental benefit of a reduction in LP flaring would have negligible effects on GHG emissions.	The potential production and safety costs are disproportionate to the environmental benefit of avoiding flaring emissions, and is therefore not a reasonably practicable alternative.
(Reduce) Reduce LP flaring	The LP flare is used on a continuous basis for waste gas streams. Where feasible to retrofit, alternate process technology that serves to reduce or eliminate particular waste gas streams would subsequently reduce the total volume of LP flaring and associated GHG emissions.	There are technical constraints such that the cost of implementing existing alternative process technology is currently considered disproportionate to the level of risk reduction achieved, and as such has not been selected for implementation at this time. However, CAPL regularly evaluates carbon emission reduction projects, including those associated with alternative process technology for waste gas streams at the platform. These projects are incorporated into regular emission reduction reviews (refer to control measure description above), and where selected for implementation during an enterprise-wide selection process. As such, this cost-benefit analysis will be regularly re-assessed.
Likelihood and risk level summary		
Likelihood	N/A	
Risk level	N/A	
Determination of acceptability		
Principles of ESD	The impact associated with this aspect is a *de minimis* contribution to the reduction of the global carbon budget. The consequence associated with this aspect was evaluated as Incidental (6).	

	One of the UN 2030 Agenda sustainable development goals (SDGs) is “ensure access to affordable, reliable, sustainable and modern energy for all”. Chevron is “inspired” by the UN SDGs and “seek[s] to achieve a more sustainable future” through its business operations (Ref. 276). The principle of inter-generational equity is considered to be met for the Wheatstone Project. Energy is fundamental to society, and access to reliable and affordable energy sources is interlinked with their ability to sustainably develop and maintain health, diversity, and productivity for future generations (Ref. 277). Natural gas provides both a reliable and affordable energy source and is one of the lower emission fossil fuels. The continued use of natural gas is in line with Australia’s *Long-Term Emissions Reduction* Plan (Ref. 263), the natural gas from the Wheatstone Project is produced with a lower emissions intensity than other gas supplies on the North West Shelf, and the use of natural gas is considered to support the global transition to lower carbon intensive fuels. In addition, as described in Section 6.2.3.4, the current sales markets for the Wheatstone Project are countries that have also ratified the Paris Agreement and established their own NDCs for managing emissions. The Parties to the Paris Agreement acknowledge that climate change is a common concern of humankind and the Parties should consider their respective obligations, including intergenerational equity. By not materially or substantially contributing to Australia’s GHG emissions, the Wheatstone Project will support Australia’s global efforts to reach net zero by 2050. If Australia achieves its efforts to meet net zero by 2050, then it will contribute to global efforts to meet the objective of the Paris Agreement to “hold[] the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing 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”. Consequently, the principle of intergenerational equity is considered to be met because the Wheatstone Project is consistent with Australia’s carbon budget and therefore Australia’s efforts to keep warming to the Paris Agreement target of below 2°C above pre-industrial levels and reduce the risks and impacts of climate change, thereby ensuring that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The control measures identified and described above are considered to reduce this impact to ALARP. In particular, that GHG emissions from the Wheatstone Project will be managed to within an emissions footprint of ~4.65 Mtpa CO_2-e (Sections 6.2.3.2, 0, and 6.4.5.1), and also adaptively managed via the GHGMP (Ref. 299), the Wheatstone Platform Flare Minimisation and Optimisation Plan (Ref. 82), and EP review process (Section 8.5), demonstrates CAPL’s commitment to GHG management. Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: • *Environment Protection and Biodiversity Conservation Act 1999* (Cth) • *Environmental Protection Act 1986* (WA) • *National Greenhouse and Energy Reporting Act 2007* (Cth) • National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth) • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 97) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 96) • *Conservation Management Plan for the Southern Right Whale 2011-2021* (Ref. 195) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • Recovery Plan for the White Shark (Carcharodon carcharias) (Ref. 287)

	• *Recovery Plan for Marine Turtles in Australia* (Ref. 93). • *Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)* (Ref. 94) • Draft *Wildlife Conservation Plan for Seabirds* (Ref. 286) • *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 92).
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • *Climate Change Resilience* (Ref. 273) • *Wheatstone Platform Emissions and Energy Management Plan* (Ref. 82) • *Wheatstone LNG Plant: Greenhouse Gas Management Plan* (Ref. 299).
External context	During stakeholder consultation, no objections or claims were raised regarding greenhouse gas emissions arising from the activity.
Defined acceptable level	Climate change is listed as a threat to protected matters under documents made or implemented under the EPBC Act. As a reduction in the global carbon budget may result in changes to global climate systems, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. Specifically, the following action is defined within the *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) and the *Recovery Plan for Marine Turtles in Australia* (Ref. 93): • continue to meet Australia's international commitments to reduce GHG emissions As both of these species have the potential to be directly impacted by other environmental aspects arising from the activities detailed within this EP, CAPL has defined an acceptable level of impact as not materially or substantially contributing to Australia's GHG emissions, and as such, subsequently not preventing Australia meeting international GHG emission commitments. Australia is a signatory to the Paris Agreement and is currently committed to reducing GHG emissions by 43% below 2005 levels by 2030. The objective of the Paris Agreement includes to "hold[] the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing 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" (Article 2). The Commonwealth government acknowledges that "[a]chieving the Paris Agreement's global goals, including limiting warming to well below 2°C and reaching global net zero, will require practical action from all countries. Australia will play its part in the global effort to reach net zero emissions by 2050" (Ref. 263). Australia's plan and the global context is that "Australia recognises we must reduce emissions while accommodating countries' economic development goals, especially in the Asia- Pacific and Indo-Pacific regions. As well as reducing our own emissions, our plan focuses on how Australia can play a global leadership role through low emissions energy exports and contributions to innovation" (Ref. 263). Moreover, Australia has already reduced emissions by 20% since 2005 (Ref. 263). By providing low emission energy exports (LNG) and by not materially or substantially contributing to Australia's GHG emissions, the Wheatstone Project will support Australia's global efforts to reach net zero by 2050. If Australia achieves its efforts to meet net zero by 2050, then it will contribute to global efforts to keep warming to the Paris Agreement target of well below 2°C above pre-industrial levels and significantly reduce the risks and impacts of climate change. As discussed within the above consequence evaluation, based on the predicted emissions, the Wheatstone Project has a *de minimis* contribution to the reduction of the global carbon budget. Given that anthropogenic changes to the global climate system cannot be directly attributed to any one development or emission source or product, CAPL considers that the

	Wheatstone Project will meet the defined "acceptable level of impact as not materially or substantially contributing to Australia's GHG emissions, and as such, subsequently not preventing Australia meeting international GHG emission commitments" by managing their emissions to within an emissions footprint of ~4.65 Mtpa CO_2-e (Sections 6.2.3.2, 0, and 6.4.5.1). Additionally, there are other management plans (i.e., GHGMP [Ref. 299], Wheatstone Platform Flare Minimisation and Optimisation Plan [Ref. 82]), and other regulatory reporting mechanisms (i.e., the National Greenhouse and Energy Reporting scheme) in place to ensure that GHG emissions from the Wheatstone Project are adaptively managed in line with best practice and contemporary legislative and other requirements.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Do not materially or substantially contribute to Australia not meeting its international GHG emissions commitments by managing direct and indirect GHG emissions associated with the Wheatstone Project in Australia* to within an emissions footprint of 4.65 Mtpa CO_2-e	**EP Act approval** Because implementation of the EP Act Approval is a regulatory requirement, no EPS has been developed for this requirement.	
	EPBC Act approval Because implementation of the EPBC Act Approval is a regulatory requirement, no EPS has been developed for this requirement.	
	National Greenhouse and Energy Reporting scheme Because NGER reporting is a regulatory requirement, no EPS has been developed for this requirement. The Safeguard Mechanism establishes a GHG baseline. Baseline exceedance is required to be offset through the purchase of ACCUs.	
	Energy efficient design The energy efficient design features (including the WHRUs, valves and flanges, seawater lift pumps, aero derivative turbines, condensate export pumps) are installed, tested and commissioned according to the relevant Commissioning Test Procedures prior to hydrocarbon production	Records show installation is according to Commissioning Test Procedures
	CMMS The compressors, power generators, flaring system, WHRUs and seawater lift pumps are maintained in accordance with CMMS	CMMS records show maintenance of compressors, power generators, flaring system, WHRUs and seawater lift pumps
	Air emissions monitoring Platform Air Emissions Monitoring Program implemented as per Section 8.4.1.2	Records confirm Air Emissions Monitoring Program is implemented
	Platform emissions management Platform emissions management will be implemented per the Wheatstone Platform EEMP, including monitoring performance against emissions targets, and managing emissions to ALARP	Records confirm the Wheatstone Platform EEMP is implemented
	Emissions reduction review CAPL will implement its emissions reduction review to identify emissions reduction opportunities	Records show that annual review of emissions reduction opportunities was performed

	(within its operational control) for the Wheatstone Project to be included in an enterprise-wide selection process	
	Emissions reduction review CAPL will measure and investigate >5% annual increases to absolute Scope 1 and Scope 2 emissions or intensity	Records show that Wheatstone asset total emissions (t CO_2-e) and upstream intensity (t CO_2-e/t LNG) are measured, root cause of annual increases >5% are investigated, and where practicable, improvement opportunities are evaluated through the MACC process
	Corporate governance CAPL will support Chevron Corporate's aspiration of managing global upstream emissions by implementing management strategies, projects, or improvements for the Wheatstone Project selected during an enterprise-wide selection process	Records show that when upstream emissions management strategies, projects, or improvements have been selected for the Wheatstone Project, these are implemented as soon as reasonably practicable (with consideration given to the scope, planned turnaround schedule, and scale of the activity)
	Corporate governance CAPL will report Scope 1 and Scope 2 emissions data from the Wheatstone Project to Chevron Corporation annually for inclusion in the calculation of its UCI metric	Records show that annual emissions data from the Wheatstone Project was provided to Chevron Corporation
	Corporate governance CAPL will support Chevron Corporate's aspiration of managing global portfolio emissions by implementing management strategies, projects, or improvements for the Wheatstone Project selected during an enterprise-wide selection process	Records show that when portfolio emissions management strategies, projects, or improvements have been selected for the Wheatstone Project, these are implemented as soon as reasonably practicable (with consideration given to the scope, planned turnaround schedule, and scale of the activity)
	Corporate governance CAPL will report Scope 1 and Scope 2 emissions data from the Wheatstone Project to Chevron Corporation annually for inclusion in the calculation of its PCI metric	Records show that annual emissions data from the Wheatstone Project was provided to Chevron Corporation
	Methane management CAPL will undertake an annual adaptive management process to ensure that methane emissions are identified, evaluated, and managed to ALARP in accordance with Chevron Corporation strategies and adopted international guidelines, specifically including: • quantification and reporting of methane emissions in accordance with NGER requirements • reporting methane emissions data for the Wheatstone platform to Chevron	Records show that an annual adaptive management process addressing methane management was undertaken

	Corporation annually for inclusion in the calculation of its upstream methane intensity metric • review of the accuracy of the reported methane emissions associated with the Wheatstone Platform • review of methane monitoring and mitigation technologies and approaches • identify and evaluate potential management strategies, projects, or improvements for methane emissions management aligned with Chevron Corporation strategies and adopted international guidelines to be incorporated into the emissions reductions review process for the Wheatstone Project	
	Methane management If the above annual monitoring and evaluation identify improvement opportunities to manage methane emissions, then CAPL will implement these changes within this EP in accordance with the MoC (Section 8.3.2.2) and EP Review (Section 8.5) processes	As required, records show that the MoC and/or EP review process were undertaken in response to any improvement opportunities related to the management of methane emissions
Manage downstream indirect GHG emissions^ associated with Wheatstone Project	**Legislative and other requirements reviews** CAPL will undertake annual monitoring of revised or contemporary Australian regulatory requirements, and applicable international guidelines or standards, in relation to carbon management of downstream indirect GHG emissions	Records show that annual monitoring of revised or contemporary Australian regulatory requirements, and applicable international guidelines or standards, in relation to carbon management of downstream indirect GHG emissions was undertaken
	Address uncertainty CAPL will undertake an annual adaptive management process to address the residual uncertainty associated with impacts and risks from the generation of GHG emissions, specifically including: • monitoring the historical and forecast global energy mix and associated emissions, including the role of Wheatstone product types • review of the accuracy of estimated downstream indirect GHG emissions associated with the Wheatstone Project to validate the estimates used as	Records show that an annual adaptive management process addressing downstream indirect GHG estimates was undertaken

	the basis for the impact and risk assessment • review of the environmental impact and risk assessment for GHG emissions to ensure that GHG emissions are being reduced to ALARP and managed to an acceptable level.	
	Address uncertainty If the above annual monitoring and evaluation identify improvement opportunities to manage downstream indirect GHG emissions, then CAPL will implement these changes within this EP in accordance with the MoC (Section 8.3.2.2) and EP Review (Section 8.5) processes	As required, records show that the MoC and/or EP review process were undertaken in response to any improvement opportunities related to the management of downstream indirect GHG emissions
	Emissions management opportunities CAPL will evaluate opportunities to partner with organizations that promote and address GHG emissions reduction and carbon offsets in the LNG value chain, and advocate for LNG and natural gas as fuels of choice	Records show that opportunities to promote and address GHG emissions reduction and carbon offsets in the LNG value chain, and advocating for LNG and natural gas as fuels of choice have been evaluated annually
	Corporate governance CAPL will report production and emissions data from the Wheatstone Project to Chevron Corporation annually for inclusion in the calculation of its PCI metric	Records show that annual production and emissions data from the Wheatstone Project was provided to Chevron Corporation

** Where 'direct and indirect GHG emissions associated with Wheatstone Project in Australia' refers to the direct emissions associated with activities within this EP (Sections 6.2.3.2 and 6.4.5.1) plus the indirect emissions from processing gas at the onshore facilities at Ashburton North (Section 6.2.3.4); i.e., emissions within CAPL operational control.*

^ Where 'downstream indirect GHG emissions' refers to the emissions associated with transport, and third party end-use of LNG, condensate and domestic gas products.

6.2.4 Light emissions

<table>
<tr><th colspan="4">Source</th></tr>
<tr><td colspan="4">Activities identified as having the potential to result in light emissions are:
• navigation and operational lighting from the platform within the OA.</td></tr>
<tr><th colspan="4">Potential impacts and risks</th></tr>
<tr><th>Impacts</th><th>C</th><th>Risks</th><th>C</th></tr>
<tr><td>Light emissions may result in:
• localised and temporary change in ambient light.</td><td>6</td><td>A change in ambient light may result in:
• attractant for light-sensitive species and in turn affect predator-prey dynamics</td><td>6</td></tr>
<tr><th colspan="4">Consequence evaluation</th></tr>
<tr><td colspan="4">Localised and temporary change in ambient light
The platform lighting system includes general and emergency lighting to satisfy necessary safety, visibility, and task illumination requirements. Additionally, the flare tip (~150 m above sea level)</td></tr>
</table>

includes a small, constantly lit LP flare (Section 3.3.2.3). The HP flare is for upset conditions, and given it's non continuous and infrequent use is not discussed further in this evaluation. Monitoring undertaken by Woodside (Ref. 83) indicates that light density from navigational lighting on a MODU attenuated to below 1.0 lux and 0.03 lux at distances of ~300 m and ~1.4 km, respectively. Light densities of 1.0 lux and 0.03 lux are comparable to natural light densities experienced during deep twilight and during a quarter moon. Based on Woodside (Ref. 83), CAPL expects that the platform will result in temporary changes to ambient light emissions no larger than a radius of ~1.4 km. Operational and navigational lighting is expected to be similar in comparison to a MODU, therefore referencing this modelling is considered an appropriate approach for this consequence evaluation. Given the limited extent of the change arising from platform lighting, the impacts associated with a direct change in ambient light levels was determined to be Incidental (6).
Acting as an attractant to light-sensitive species and in turn affecting predator–prey dynamics There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding, or breeding behaviours of cetaceans. Cetaceans predominantly use acoustic senses rather than visual sources to monitor their environment (Ref. 84), so light is not considered to be a significant factor in cetacean behaviour or survival. Light-sensitive fauna (including reptiles, birds and fish) are the species most at risk from this aspect and thus are the focus of this evaluation. As identified in Section 4, several marine species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. Several BIAs also overlap with the OA, including: • Flatback Turtle, Hawksbill Turtle (internesting buffer) • Whale Shark (foraging) • Lesser Crested Tern, Wedge-tailed Shearwater (breeding). Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Ref. 85) and that lighting can attract birds from large catchment areas (Ref. 86). These studies indicate that migratory birds are attracted to lights from offshore platforms when travelling within a radius of 5 km from the light source, but their migratory paths are unaffected outside this zone (Ref. 87). The *National Light Pollution Guidelines* (Ref. 10) indicate that a 20 km buffer or exposure area can provide a general precautionary light impact limit based on observed effects of sky glow on marine turtle hatchlings demonstrated to occur at 15–18 km (Ref. 88; Ref. 89) and fledgling seabirds grounded in response to artificial light 15 km away (Ref. 90). At its closest, the OA is located ~50 km from the coast (Montebello Islands). As light emissions from the platform are expected to result in a change to ambient conditions up to a maximum of ~1.4 km from the vessel, no coastal areas (and therefore turtle hatchlings or fledgling seabirds) are expected to be exposed. The *Recovery Plan for Marine Turtles in Australia* (Ref. 93) identifies light emissions as a key threat because it can disrupt critical behaviours. However, the Recovery Plan also notes that critical behaviours are focused on nesting (therefore coastal areas), as well as disrupting hatchling orientation and sea-finding behaviours of hatchlings. Given the platform is located offshore, light emissions would not affect critical behaviours as described in the Recovery Plan. In addition, a study by Whittock et. al. (Ref. 91) reported that Flatback Turtles preference habitats within proximity of the coast and at relatively shallow depths during the internesting period. Specifically, during the study, a maximum distance from the nearest coast and maximum water depth of 27.8 km and <44 m respectively were recorded; and mean maximum distance away from the nearest coast and mean water depth being less than 6.1 km and <10 m respectively (Ref. 91). Given that the platform is located ~50 km from the nearest coast (Montebello Island), even though the Flatback Turtle internesting area may be exposed to changes in ambient light levels, due to the distance offshore and water depths (>70 m) it is very unlikely that this exposure would lead to any significant impact. Anthropogenic disturbance and artificial lighting is identified as a threat within the *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 92). However, only a small number of threatened or migratory bird species would be expected to be present in this area. Light emissions that attract a small number of individual seabirds Because light emissions have the potential to cause temporary impacts to a small number of protected species over the course of the activity, CAPL has ranked the consequence associated this impact as Incidental (6).

<table>
<tr><th colspan="3">ALARP decision context justification</th></tr>
<tr><td colspan="3">Offshore platform operations and subsequent light emissions are commonplace in offshore environments nationally and internationally.
During stakeholder consultation, no objections or claims were raised regarding light emissions arising from the activity.
The impacts and risks associated with light emissions are well understood, and considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.</td></tr>
<tr><th colspan="3">Good practice control measures and source</th></tr>
<tr><td>Control measure</td><td colspan="2">Source</td></tr>
<tr><td>None identified</td><td colspan="2">No controls have been applied for these impacts and risks as light management is a lower-order impact and risk; no industry standard controls are required for offshore light emissions where minimal impacts and risks are present.</td></tr>
<tr><th colspan="3">Additional control measures and cost benefit analysis</th></tr>
<tr><td>Control measure</td><td>Benefit</td><td>Cost</td></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><th colspan="3">Likelihood and risk level summary</th></tr>
<tr><td>Likelihood</td><td colspan="2">The platform is located in Commonwealth waters, ~50 km from nearest coast (Montebello Islands). The extent of exposure from measurable changes to ambient light is estimated to be limited to an area within ~1.4 km from the platform. As such the likelihood of exposing sensitive receptors resulting in the identified consequence was considered Remote (5).</td></tr>
<tr><td>Risk level</td><td colspan="2">Very low (10)</td></tr>
<tr><th colspan="3">Determination of acceptability</th></tr>
<tr><td>Principles of ESD</td><td colspan="2">The impacts and risks associated with this aspect is disruption to light-sensitive species behaviour, which given the location, is not considered as having the potential to affect biological diversity and ecological integrity.
The consequence associated with this aspect is Incidental (6).
Therefore, no further evaluation against the Principles of ESD is required.</td></tr>
<tr><td>Relevant environmental legislation and other requirements</td><td colspan="2">Legislation and other requirements considered for this aspect include:
• National Light Pollution Guidelines (Ref. 10)
• Recovery Plan for Marine Turtles in Australia (Ref. 93)
• Wildlife Conservation Plan for Migratory Shorebirds (Ref. 92).</td></tr>
<tr><td>Internal context</td><td colspan="2">No CAPL environmental performance standards / procedures were deemed relevant for this aspect.</td></tr>
<tr><td>External context</td><td colspan="2">During stakeholder consultation, no objections or claims were raised regarding light emissions arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td colspan="2">These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.</td></tr>
</table>

Environmental performance outcome	Performance standard / Control measures	Measurement criteria
N/A	N/A	N/A

6.2.5 Underwater sound

Source			
Activities identified as having the potential to result in underwater sound are: • start-up and operation of the platform. These activities result in the emission of continuous sound: **Continuous sound** The platform topsides generate airborne sound emissions, which may result in changes to ambient underwater sound levels. As machinery is mounted on the deck of the platform, most sound is transmitted to the marine environment from the air or radiated into the water via jacket legs and risers. During detailed design for the topsides, several studies and investigations were undertaken and limits for individual items of equipment have been set at a maximum above-sea noise level no greater than 80 dB(A) @1 m (general equipment limit). Sound generated by the valves and transmitted into the HP flare header can exceed 100 dB(A) @1 m externally. A study by Gales (Ref. 99) demonstrated that the strongest noise levels from platforms during production operations are of relatively low frequency (<100 Hz, mostly between 4-38 Hz), with sound levels of 110–130 dB re 1 µPa @100 m (Ref. 99). However, monitoring programs have shown that underwater sound from platforms is usually very low or not detectable (Ref. 100).			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Airborne sound emissions may result in: • localised and temporary change in ambient underwater sound.	6	N/A	-
Consequence evaluation			
Ambient underwater sound levels typically range from 45-60 dB re 1 µPa[28] in quiet regions (very calm, low wind seas and light shipping) to 80-100 dB re 1 µPa for more typical conditions, and >120 dB re 1 µPa during periods of high rain, strong winds and biological choruses from vocalising species (Ref. 101). As indicated by Gales (Ref. 99), underwater sound resulting from platform operations (110–130 dB re 1 µPa @100 m) is expected to be limited, and within typical ambient underwater sound levels. As such, airborne sound emissions associated with platform operations are expected to result in limited environmental impacts and consequently have been ranked as Incidental (6). Further to this, as sound emissions arising from platform operations are expected to be minimal and well within ambient underwater sound levels throughout all operations, no credible impacts to marine fauna have been identified or considered further.			
ALARP decision context justification			
Noise emissions associated with the operation of facilities are commonplace in offshore environments nationally and internationally. During stakeholder consultation, no objections or claims were raised regarding noise emissions arising from the activity. The impacts associated with noise emissions are considered lower-order impacts in accordance with Table 5-3, and impacts to marine fauna from these emissions are not expected. As such, CAPL applied ALARP Decision Context A for this aspect.			

[28] *Measure of underwater noise in terms of sound pressure. As dB is a relative measure, it must be referenced to a standard 'reference intensity', in this case 1 micro-Pascal (1 µPa), which is the standard reference that is used.*

Good practice control measures and source		
Control measure	**Source**	
None identified	No controls have been applied for these impacts as airborne sound management is a lower-order impact; no industry standard controls are required for offshore sound emissions where minimal impacts are present.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	N/A	
Risk level	N/A	
Determination of acceptability		
Principles of ESD	The impacts associated with this aspect are limited to localised, incidental changes in ambient underwater sound. As such, this aspect is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No legislation or other requirements were deemed relevant for above-surface noise emissions arising from platform operations.	
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.	
External context	During stakeholder consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity.	
Defined acceptable level	These impacts are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
N/A	N/A	N/A

6.2.6 Planned discharges—Produced water

Operation of the PW system is described in Section 3.3.2.6, and generates the environmental aspect of planned discharges of PW. Upon the introduction of well fluids into the hydrocarbon system, PW is physically separated from the well fluids at the platform, treated and discharged as per Section 3.3.2.6.

PW may contain various constituents such as metals, petroleum hydrocarbons (e.g., TPH, BTEX/MAH and PAH [predominantly naphthalene]), glycols (e.g., MEG and TEG), phenols, organic acids, NORMS, and residual process chemicals. Drilling completion fluid constituents may also be present during well clean-ups. During clean-up, MEG volumes discharged from the platform are predicted to be approximately 140–400 m^3 per well, usually discharged over one to eight days, with the discharge predominantly comprising MEG and water, with small concentrations of sodium bromide, filter cake/drilling muds (drilling completion fluids) and constituents in PW discussed above.

Baseline water column and sediment sampling as well as a benthic habitat survey was conducted prior to PW discharge, providing details on the water quality and habitats within the discharge zone (Ref. 28).

PW analysis and modelling, and a comprehensive field verification campaign (Section 6.2.6.2) have shown that dilutions exceed those required to meet environmental quality criteria (EQC) at a boundary 850 m from the platform (i.e., the discharge zone). Water quality samples taken during model verification works did not detect hydrocarbons (TPH and BTEX) at distances >5 m, or phenols at distances >15 m, from the platform. Metal concentrations (above background) were below EQC within ~25 m of the discharge point (Ref. 218).

In practice, the water quality of the PW plume will be evaluated by considering dilutions to the edge of the near field (discussed further in Section 6.2.6.2). The plume will notably be further diluted in the far field prior to reaching the discharge zone boundary.

6.2.6.1 Guidelines

Commonwealth guidance on water quality as directed by ANZG (Ref. 11) have been applied, recognising that waters around the platform are outside any marine protected areas, ~140 km from the mainland, ~70 m water depth, and is also in the vicinity of other oil and gas infrastructure and activities. As such, where available the 95% species protection (PC95) marine criteria[29] has been adopted from ANZG (Ref. 11) as the environmental trigger to assess impacts for a slightly-to-moderately disturbed system and are to be met at the discharge zone boundary.

6.2.6.2 Modelling

PW discharge modelling has been conducted to quantify and assess the extent of the highly buoyant PW discharge plume (including behaviour of dissolved and particulate constituents), which in turn is used to determine whether ANZG guidelines are met at the discharge zone boundary. Multiple phases of modelling have occurred:

- during the development of the EIS (Ref. 25)
- optimised during FEED (Ref. 170)
- refined in 2016 (Ref. 171)
- additional modelling 2018 (Ref. 216)

An in-field survey was also undertaken during 2018/2019 (Ref. 217) to provide field validation of modelling outputs.

Additional scenarios will continue to be modelled when required, as well as modelling verification (e.g., on trigger or during field sampling campaign), using relevant information from sampled fluid composition, field results, and baseline data, to improve the understanding of the behaviour of the PW plume and for future contingency planning.

[29] In some instances ANZG directs the use of the 99% species protection (PC99) value for slightly to moderately disturbed systems.

The EIS and FEED phase models were based on CORMIX (near field) and CMS-Flow (far field) while the operational modelling uses CORMIX (near field) and MIKE 3FM (far field). Modelling included various temperature, salinity, and flow rates encompassing the start to end of field life. The results show the size, location of the plume, achieved dilutions, and associated dissolved (represented by TPH) and particulate (represented by mercury) concentrations.

Near field (or CORMIX) modelling predicts dilutions at the edge of the near field region (NFR), and the extent of the NFR. The NFR varies with discharge flow rate, salinity/density, and temperature. These simulations can predict dilution at 850 m when it is within the NFR (i.e., near field extends past 850 m). For cases where the NFR is <850 m, the end-of-near-field dilution applies plus additional far-field dilution (which is not available from CORMIX in any reliable manner). For the range of anticipated flow rates up to the maximum design, and considering median current, modelling predicts the edge of the NFR to fall within 850 m, ranging from ~755 m to ~125 m for flow rates of 10 m^3/h and 265 m^3/h respectively (Ref. 171; Ref. 216). Dilutions are in excess of near-field predictions at the discharge zone boundary.

The in-field verification of dilutions undertaken in 2018 and discussed further below, showed the model to be conservative (with measured dilutions exceeding those modelled; refer to 'In-field modelling verification'), however not to the extent that the mixing zone boundary should be revised.

Dilution modelling and in-field verification indicate rapid dilutions occur within relatively close proximity to the discharge point, and hence over a discrete and localised spatial extent. Dilutions in the order of ~1,000 were predicted by CORMIX within ~20 m of the discharge point; while field measurements verified the plume was diluted by ~5,000 at ~30 m from the discharge point (Ref. 217). The large dilutions achieved within a relatively short distance is due to the small size of PW discharge, and the receiving environmental being of relatively energetic flow, with the plume traversing ~45 m to the surface as it rises buoyantly (Ref. 171).

For particulates, modelling shows accumulation is a function of particle size, with larger particle sizes dropping out of the plume faster, within closer proximity to the discharge point, leading to more rapid accumulation rates. For particulates, higher concentrations in sediment may be anticipated to occur closer to the platform. For current and anticipated levels of particulate metals (such as mercury), modelling does not indicate exceedance of ANZG sediment quality criteria. Should levels change beyond those anticipated, modelling indicates ANZG sediment quality criteria can continue to be met with treatment (such as filtration). Ongoing monitoring controls discussed in Section 8.4.1 and further modelling (as required) will enable identification of potential exceedances and allow for adaptive management / contingency actions as per Section 8.4.1.

In-field modelling verification

In November 2018, a comprehensive field campaign (Ref. 217; Ref. 220) was executed to validate that environmental guidelines were being achieved, and to validate model predictions. The campaign involved controlled injection of rhodamine WT (RWT) dye into CW and PW discharges from the platform, in conjunction with intensive in situ measurements of the resulting 'spiked' plumes. Field measurements involved sample retrieval and fluorometry directly from the vessel, fluorometry and sample retrieval from an ROV despatched to traverse the plume, and sensor measurements by ocean glider and an unmanned aerial vehicle (AUV) to ascertain marine conditions, map plume geometry, and quantify dilutions associated with the discharge plumes. An acoustic doppler current profiler (ADCP) and temperature string were deployed on a fixed mooring for the duration of the campaign.

The validation campaign was executed during environmental conditions which were weak in terms of tide, winds, waves, as well as total and residual flows, and under conditions with reasonably strong ambient stratification (Ref. 217).

The results from a comparison between the RWT measured dilutions and the CORMIX predictions showed:

- lowest dilutions measured within 50 m of the platform align well with the envelope of CORMIX predictions
- further afield, the lowest measured dilutions were typically an order of magnitude higher than the envelope of centreline dilutions predicted by CORMIX
- two notable dye concentration peaks measured at ~500 m and ~700 m from the platform showed the closest alignment to CORMIX centreline dilutions, while still being roughly a factor of two more dilute than predictions (Ref. 217).

It is acknowledged that the envelope of centreline dilutions predicted by CORMIX is based on a series of static conditions (i.e., both PW discharge, and ambient conditions, are assumed to be constant, whereas in reality both are temporally variable). As such, it can be overly conservative to compare the full envelope of all possible CORMIX solutions against all field measurements (Ref. 217).

The results of the field campaign strongly suggest that typical near and far field methodologies, including the CORMIX approach applied at the approval stage of the Wheatstone Project, conservatively underpredict the PW plume dilution at the 850 m discharge zone boundary of the Wheatstone Platform (Ref. 217). This appears to be due to platform-induced turbulence (local flow concentration through the platform and associated turbulence around the base, legs, and structural cross-members) which induces additional mixing in the lee of the platform (Ref. 217). Additional conservatism is introduced into the model when considering the prevailing conditions during the field survey which occurred during a period of ambient stratification, neap tides, and small residual current speeds (which generally reduce dilutions) (Ref. 217; Ref 218).

Mixing zone for risk assessment

Based on average daily flow rates overboard since start-up, PW discharge flow rates have varied ~10–50 m^3/h. The rate of PW discharge varies during normal operations based on several factors including presence of cut water within online wells, and production rates. Planned activities under this EP are not expected to significantly vary, such that it would result in a significant change to the estimated PW discharge volume or characteristics over the next five-year in-force period of this EP.

These operational PW discharge flow rates (~10–50 m^3/h) are well within the ranges (10–265 m^3/h) used in previously modelling scenarios, and as discussed above, the modelling and verification study have confirmed the mixing zone boundary is appropriate for the current state of operations across a range of conditions that are likely to be experienced (e.g., higher salinity, differing metocean conditions, etc.).

In addition, monitoring data to date from the Platform Waste Water Discharges Monitoring Program (Section 8.4.1) have not indicated an exceedance of the EQC at the edge of the mixing zone boundary.

As such, CAPL consider that the previously determined mixing zone (~850 m from the platform) therefore remains appropriate for the range of conditions likely to be experienced by the platform during the in-force period of this EP, and this mixing zone is appropriate for use in the following risk assessment.

6.2.6.3 Risk Assessment

<table>
<tr><th colspan="4">Source</th></tr>
<tr><td colspan="4">Activities identified as having the potential to result in planned discharges from the platform are:
• produced water treatment system.</td></tr>
<tr><th colspan="4">Potential impacts and risks</th></tr>
<tr><th>Impacts</th><th>C</th><th>Risks</th><th>C</th></tr>
<tr><td rowspan="2">Planned discharges of produced water may result in:
• localised and temporary reduction in water and sediment quality.</td><td rowspan="2">4</td><td>A change in ambient water or sediment quality may result in:
• indirect impacts to fauna arising from chemical toxicity</td><td>5</td></tr>
<tr><td>• indirect impacts to marine habitats arising from connectivity or chemical toxicity</td><td>4</td></tr>
<tr><th colspan="4">Consequence evaluation</th></tr>
<tr><td colspan="4">Localised and temporary reduction in water and sediment quality
The spatial extent of water quality changes associated with the PW discharge is expected to be limited to the discharge zone (850 m). At the boundary of the discharge zone, all constituent concentrations are predicted to meet ANZG PC95 guidelines (Ref. 11) or be equivalent to reference site concentrations. Within the discharge zone, constituents may be at concentrations above the ANZG guidelines.
The PW plume is dynamic and moving constantly depending on the tides, currents, winds, and internal waves; and the plume largely remains in the upper water column due to the positively buoyant characteristics of the discharge (Ref. 170; Ref. 171). Due to the temporal variability and limited spatial extent of the plume, comparison to EQC derived from ecotoxicological tests typically conducted over 24-96 hours, is likely conservative compared with more representative, shorter environmental exposure durations (Ref. 219; Ref. 258). In terms of the spatial extent for seabed interaction, the modelling predicts the plume may reach the seabed only once substantially diluted and therefore well below ANZG trigger guidelines.
Any particulate fallout from the PW plume leading to accumulation is a function of particle size, with larger particle sizes dropping out of the plume faster, within closer proximity to the discharge point. Modelling does not indicate exceedance of ANZG sediment quality criteria.
Given that the extent of change in ambient water and sediment quality is expected to be within 850 m of the platform, and for the duration of platform operations, CAPL has ranked the consequence as Moderate (4).</td></tr>
<tr><td colspan="4">Potential impacts to marine fauna and marine habitats
Based on the spatial extent of the water quality changes and potential interaction with the seabed, identified environmental values and sensitivities that may be exposed to PW include the ridgeline benthic habitats, ridgeline fish communities, and migrating or foraging whale sharks or cetaceans (Section 4.3.1). Although there is no evidence to suggest the level of diversity is greater in the platform area than the remaining area of the ridgeline (Ref. 28), the hard substratum habitats at the platform ridgeline are included in this assessment.
Potential impacts to the identified environmental values and sensitivities depend on the nature of the constituents in the PW discharge:</td></tr>
</table>

- The aquatic toxicity of MEG is very low; and is on the OSPAR list of substances that are considered to pose little or no risk to the environment once released (PLONOR) and is not expected to result in adverse impacts to habitats or fauna.
- The toxicity of TEG was reviewed by Ballantyne and Snellings (Ref. 229) and was reported to have LC_{50} values at gram per litre concentrations, indicating that the compound is effectively non-toxic by US EPA criteria. This is consistent with the Offshore Chemical Notification Scheme (OCNS) that has assessed TEG via the Chemical Hazard Assessment and Risk Management (CHARM) and assigned the lowest CHARM rating of Gold.
- Dispersed oil can be ingested by marine fauna, leading to toxicity-related impacts, causing adverse health impacts to marine biota (Ref. 147, Ref. 161). Fish and shellfish are particularly sensitive to oil exposure, and certain toxins can bioaccumulate. However, the toxicity of an oil is related to the bioavailability of the hydrocarbon components. The soluble or semi-soluble hydrocarbon components of a dispersed oil may dissolve and become bioavailable. Dissolved oils generally have a high toxicity, due to constituents such as BTEX, PAHs, and phenols, amongst others. Studies have shown that PAHs typically exert the most toxic effects due to their semi-soluble and not highly volatile nature, such that they can persist in the environment long enough for prolonged exposure to occur (Ref. 120). While BTEX may be a more abundant component of the oil in PW, it is highly volatile, and is typically rapidly lost either during treatment, initial mixing or through volatilisation once at water surface (Ref. 120; Ref. 259; Ref. 260). BTEX is also not known to accumulate to a large degree in marine organisms (Ref. 260).
- A variety of metals may be present in PW in varying concentrations, including aluminium, barium, boron, chromium, cobalt, iron, manganese, molybdenum, nickel, and strontium. Some metals can cause adverse impacts to the marine environment, while others are a necessary component to maintain life, with some being essential at low concentrations, but potentially toxic at high concentrations (Ref. 230). Mercury and its compounds can have high acute (short-term) and high chronic (long-term) toxicity on marine fauna. Particulate mercury in PW is typically in the form of the insoluble mercury sulfide (HgS). Mercury sulfide particulates are likely to settle near the point of discharge due to their high density and relative stability as a solid within sediments.
- A range of process chemicals (Section 3.3.2.5) may be present in very low concentrations in the PW discharge however are not expected to change the risk profile of the treated PW outside the discharge zone.
- During well clean-ups, drill completion fluids may be present within the PW discharge. Drill fluid additives are typically either completely inert in the marine environment, naturally occurring benign materials, or readily biodegradable organic polymers with a very fast rate of biodegradation in the marine environment (Ref. 6). Examples of drilling additives typically used include sodium chloride, potassium chloride, bentonite (clay), cellulose polymers, guar gum, barite, and calcium carbonate (Ref. 6).

Marine fauna

Fish communities of the ridgeline may be exposed to the water quality changes, while migrating cetaceans and foraging whale sharks may occasionally also intersect the discharge zone.

As the plume is dynamic and moving constantly depending on the tides, currents, winds, and internal waves, transient biota such as migrating whales or whale sharks, are unlikely to be exposed to constituent concentrations for extended durations. Given the limited spatial extent of water quality changes (~850 m from the platform), the infrequent and short duration of the potential interaction of these fauna with the PW plume, and that only a small proportion of the migrating/foraging population can intersect the discharge plume, the potential impacts to large mobile marine fauna are expected to be short-term and localised. Therefore, the remainder of this consequence assessment is focussed on the fish communities of the ridgeline.

Of the constituents present in the PW discharge, hydrocarbons (such as TPH, BTEX (MAH) and PAHs), phenols, organic acids, and metals in their concentrated forms have the potential for acute and chronic affects to marine biota.

Fish (including those associated with the ridgeline habitat), may be exposed to low concentrations of hydrocarbons and other constituents in the water column within the discharge zone. However, the plume is strongly buoyant and interaction with the seafloor will only occur after vertical mixing of this plume. For example, TPH discharged at 30 mg/L requires 600 dilutions in order to be diluted below detection by method EP080/071 at ALS (50 µg/L) and 4,300 dilutions to be below chronic low reliability trigger criteria of 7 µg/L suggested by Tsvetnenko (Ref. 162). Modelled dilutions and field verification for routine operations shows dilutions to be in excess of these values at the edge of the NFR for discharge rates up to 150 m^3/h (noting that this is achieved at ~155 m from the platform). Additional dilutions will occur in the far field as well as in the vertical plane prior to contacting the seabed. Further, some fish are able to metabolise and excrete hydrocarbons, potentially reducing physiological effects to fish exposed to PW hydrocarbons (Ref. 231).

It is not predicted that PW hydrocarbons will have long lasting and permanent impacts on fish populations. For example, Bakke et al. (Ref. 231) reported that Alkylphenols and PAHs in PW are rapidly metabolised in Atlantic cod (*Gadus morhua*). Similarly, King et al (Ref. 232) reported hydrocarbon-degrading bacteria in the liver and bile of fish collected from their study on the NWS. Bakke et al. (Ref. 231), who reviewed individual, population and ecosystem level biological responses to PW further concluded that the spatial scale of impact from PW discharge was insufficient to impact populations of marine organisms. Reed and Hetland (Ref. 233) reported that north Atlantic species of demersal fishes exposed to Alkylphenols associated with PW was too low to impact the reproductive viability of the stocks of these species. King et al. (Ref. 232) found that populations of two species of fish (*Carangoides* sp. and *Plectropomus* sp.) near a platform discharging PW into the NWS, Australia, may have been exposed to chronic, low levels of hydrocarbon pollution. However, they suggested that this result is inconclusive given that there was evidence that 'impact' and reference populations of these species, at the Montebello Islands, were being exposed to hydrocarbons seeping naturally into the marine environment.

In summary, based on the review of available literature, and considering the nature of the PW hydrocarbon constituents, the substantial dilution before the plume reaches the seabed and associated ridgeline fish communities, it is predicted there will be no acute and chronic impacts to fish populations on the ridgeline or other adjacent habitats.

Fishes can also bioaccumulate heavy metals through food and via water, but uptake by individuals and by different species of fish is dependent on many factors including the metal's form (inorganic versus organic), water chemistry and behavioural traits (feeding, range) of the fish species in the receiving environment. Ref. 234 reviewed acute and chronic toxicity of metals relating to a variety of fish species and found mercury (inorganic and methyl) and copper to be the most toxic. Some heavy metals, such as mercury are persistent and can bioaccumulate (Ref. 235); however some fish species may be able to metabolise metals potentially reducing the risk of accumulating lethal concentrations (Ref. 236). PW sampling has detected low levels of mercury, although it is not consistently detected. Modelling and verification shows 1,000-5,000 dilutions within close proximity to the discharge. For bioaccumulating substances such as mercury, the ANZG 99% inorganic (dissolved) mercury criteria is anticipated to be met within this region. Therefore, the spatial extent of the zone where bioaccumulating substances exceed WQ guidelines is predicted to be small.

The long-term effects of metals on fish populations are not straightforward to predict given most studies examining the toxicity of metals on fishes were laboratory based and often characterized by treatment concentrations that free ranging fish in the wild are unlikely to be exposed to for even short durations. Further, given the size of the mixing zone relative to available habitat and the wide distribution of most fish species in the region it is unlikely sufficient number of fish will be exposed to concentrations over a duration that would illicit a population level response. For this reason, the ecosystem function of fishes in the area is not predicted to be impacted.

In summary, exposure of constituents such as metals to fish communities, could result in localised toxic effects on individual fish, but with no ecosystem function changes or chronic level impacts to fish populations. The potential consequences of water quality changes from the PW discharge are localised and long-term impacts to individual marine fauna, ranked as Minor (5).

<u>*Marine habitats*</u>

The PW discharge plume is buoyant and will move towards the surface soon after discharge (Ref. 170; Ref. 171). In the unlikely event dissolved constituents in the plume contact the seabed; this would occur post the plume reaching the surface, where modelling shows ANZG criteria will be met. Further dilutions would then occur from the surface, though ~70 m water column to the seabed.

Particulate fallout from the PW discharge may deposit on the seabed. Based on the modelling results, for the spatial extent of seabed/sediment interaction, particulate fallout from the PW plume is likely to be highest within the vicinity of the platform, and metals deposition (such as mercury) is predicted to meet the ANZG sediment triggers based on sampled concentrations and forecast flowrates (Ref. 171). Should flow rates or composition change beyond those anticipated, modelling indicates sediment quality criteria can continue to be met with treatment (such as filtration).

As per Section 4.3.5, seabed adjacent to the platform area appears to have only an occasional coverage (2–10% cover) of an array of benthic sessile invertebrates (Ref. 28). The platform ridgeline habitats are considered in this assessment to take into account that hard substratum can provide habitats that generally support higher amounts of benthic fauna (Ref. 27). As per Section 4.3.5, the ridgeline habitat includes gorgonians and sponges which may be exposed to very diluted PW (with dissolved constituents in the water column) and particulate metals depositing at the seabed.

The potential for PW to reduce connectivity of organisms is based on the conservative premise of an 850 m discharge boundary, which, in the worst case that all benthic organisms and habitats within the mixing zone were affected, would cover the width of the ridgeline, potentially fragmenting this habitat in two. Given the positive buoyancy of the PW, any diluted constituents are highly unlikely to contact the sea floor, and only heavy particulate matter, such as some metals, have the potential to sink and directly impact organisms. As such, the potential to impact benthic organisms is reduced, and connectivity of pelagic organisms that are largely transitory is highly unlikely to be impacted.

Marine organisms maintain connectivity among populations via movement of individuals at different life-history stages. In the marine environment the most prevalent mechanism of movement is the movement of gametes from broadcast spawning taxa with oceanographic currents (Ref. 238). Due to the broadcast spawning strategy and pelagic larval stage of most marine organisms, they have less reliance on habitat continuity to maintain population connectivity than terrestrial species, which can be affected by habitat fragmentation at even small scales (e.g., Ref. 245; Ref. 243). Evidence of maintained connectivity among fragmented habitats in marine organisms can be seen in deeper sea populations separated by thousands of kilometres (Ref. 256; Ref. 257). These principles of connectivity are considered in the design of marine reserves, and established literature suggest that connectivity among reserves is maintained even when they are separated by distances of tens of kilometres (Ref. 240; Ref. 244).

Broadcast spawners release gametes into open water for fertilization and larvae development. Gametes and larvae are transported with oceanographic currents, which can influence population structure (Ref. 242; Ref. 239). Broadcast spawning corals, such as those in the sub-class Hexacorralia, can maintain high levels of genetic connectivity among populations separated by up to 25 km (Ref. 243), with the average dispersal distance of mobile and sessile invertebrates being between 25 km and 150 km (Ref. 244). Gorgonians, a dominant taxa on the ridgeline, are largely broadcast spawners.

Not all marine species are broadcast spawners with a pelagic larval stage, and examples include species that brood eggs or embryos. Brooders do not broadcast spawn gametes, but instead take some level of parental care of eggs and embryos, either through nesting, guarding, substrate spawning or similar such mechanisms. Some taxa, such as some gorgonians (Ref. 237) and fish are brooders and have a more limited dispersal range compared to broadcast spawning species (Ref. 238). However, even brooding invertebrates, such as some gorgonians can maintain connectivity over distances on the order of kilometres (Ref. 241).

Therefore, even in the worst case that 850 m of benthic habitat and species around the platform are affected by PW (likely a significant overestimate since PW is buoyant, and modelling and verification indicates high levels of dilution in the order of ~1,000-5,000 in close proximity to the discharge point), there are unlikely to be any significant effects of the PW on habitat connectivity due to fragmentation. When considering the potential for the platform to fragment a section of the ridgeline, the fragmented distance is minor compared to dispersive capability of taxa, even brooders.

Corals and other marine invertebrates, including bivalves, can take up contaminants, such as heavy metals, via seawater or through feeding (Ref. 182). In some locations, such as the NWS, this may occur independent of human activity because oil seeps naturally from the seafloor (Ref. 232) or there is metal bearing substratum. For corals, the uptake of heavy metals through feeding can involve polyp capture of particulate matter, contaminants adhering to sediment or in plankton (Ref. 182). A review of literature was undertaken to better understand the potential risk of acute and chronic impacts to the marine habitats and communities (e.g., gorgonians and sponges) on the ridgeline from PW constituents.

In terms of constituents, the review focused on heavy metals and PAHs that may accumulate in some organisms. There are a limited number of toxicological studies relating to sponges and gorgonians, and especially to taxa found in the lower euphotic zone or relating to sea fans without zooxanthellae. The effects of contaminants on shallow water zooxanthellae corals (e.g., Ref. 182) are better understood, but extrapolations of these findings to deep water non-zooxanthellae corals may be uninformative. For example, Bastidas and Garcia (Ref. 246) found that zooxanthellae in a host coral of the species *Porites astreoides* accumulated more mercury than the polyp tissue.

The literature suggested that acute impacts to gorgonians and sponges from contaminants, under the applied experimental treatments, are non-lethal, at least for adult colonies. Non-lethal responses associated with heavy metals and hydrocarbons included sclerite sloughing, mucus secretion and tissue necrosis in gorgonians (Ref. 181; Ref. 182). Physiological responses, such as change in respiration rates, were also apparent in at least one species of gorgonian as a result

of thermal stress (Ref. 248). In terms of sponges, PAHs and heavy metals may inhibit the settlement of larvae (Ref. 183; Ref. 249). The long-term or chronic effects of heavy metals and other contaminants on these organisms are not well documented and are difficult to predict. One reason for this is that most experiments assessing the effects of contaminants occur over weeks or months. In contrast, discharges will normally last years or decades. Experimental treatment levels (concentrations) may also be unrealistically high over ecologically relevant spatial scales. Another reason is that most reported field-based studies investigating marine community level responses to discharges relating to semi-enclosed water bodies, such as bays, or coastal waters (Ref. 250). In terms of PW at the platform, discharge will be in waters ~70 m deep and in a dispersive, open water environment ~140 km off the mainland. Some organisms may accumulate heavy metals and PAHs independent of human actions. For instance, oil seeps in the NWS might be contributing hydrocarbon into marine waters and thus organisms are exposed naturally to chronic concentrations of hydrocarbons (Ref. 232). It is unclear if this would increase or decrease their sensitivity to exposure of hydrocarbons from other sources. Some gorgonians and other marine organisms are known to accumulate heavy metals and other contaminants (Ref. 182). However, there is potential for gorgonians to eliminate heavy metals through mucus secretion and other mechanisms (Ref. 246; Ref. 182) and azooxanthellate hard corals, such as *Tubastraea*, can incorporate metals into skeleton without suffering obvious signs of stress (Ref. 182). Although heavy metals and PAHs can potentially result in sub-lethal and lethal effects to individual corals under experimental conditions, it is unclear if discharges of PW, especially in deep water and dispersive marine environment will have a population or ecosystem level response. This will depend on the total population at risk from PW discharge. If impacts remain localised (i.e., within the predicted mixing zone) it is a reasonable assumption that population and ecosystem level responses are not predicted. As mentioned previously, modelling has predicted that gorgonians and sponges inside the discharge zone may be exposed to constituents above ANZG guidelines and that the populations outside will remain unaffected by PW discharge. This prediction is supported, in part, by Burns et al. (Ref. 247) who investigated the dispersion and fate of PW discharge from a platform in waters ~20-24 m deep off the NWS. Using bioaccumulation assessments of oysters and water quality modelling, the authors concluded that potential biological impacts from oil would remain largely within ~900 m of the discharge point. They also noted that due to degradation and dissipation processes there was no long-term build-up of contaminants in sediment (Ref. 247). Similarly, Bakke et al. (Ref. 231), who reviewed individual, population and ecosystem level biological responses to PW in Norway waters, also concluded that the spatial scale of impact from PW discharge was insufficient to impact populations of marine organisms. In summary, heavy metals associated with PW have the greatest potential for acute and chronic toxicity effects on marine biota. PAHs can have chronic toxic effects but are less persistent compared with some metals. Additionally, results to date have shown PAH comprises predominantly of naphthalene, often with other individual PAH analytes not being consistently detected and naphthalene values have not resulted in an exceedance of ANZG guidelines at the boundary. Over the years, the deposition of metals (including mercury) around the platform could have toxic effects on marine biota associated with the ridgeline, however based on modelling and PW analysis, exceedance of ANZG sediment quality criteria is not anticipated. Should flow rates or composition change beyond those anticipated, modelling indicates sediment quality criteria can continue to be met with treatment (such as filtration). Additionally, if metals are taken-up by gorgonians and sponges, the effects will not necessarily lead to lethal effects in adults. Some organisms, such as gorgonians, have the capacity to metabolise heavy metals and other constituents such as PAHs. However, some metals, depending on the concentration, may inhibit larvae settlement. Ongoing PW analysis, as well as modelling and verification, indicate the risk of potential impacts to the marine habitat outside the boundary is anticipated to be incidental. That is, exposure of habitat and marine life to PW is anticipated to have a limited environmental impact outside the boundary. However, within the boundary (predominantly in closer proximity to the platform), there is increased risk of environmental impact, especially for habitat and fixed organisms such as gorgonians and sponges. The footprint will be localized; however in a worst case scenario, recovery of specific species may be classified as long term. Therefore, the potential impact from PW discharge to the ridgeline habitat is ranked as Moderate (4).
ALARP decision context justification
Offshore facility operations and subsequent planned discharges arising from these facilities are commonplace both internationally and nationally. The control measures to manage the risk

associated with planned discharges are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding planned discharges of PW from the activity. The impacts and risks arising from planned discharges of PW constitute lower-order impacts (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect. Notwithstanding this, CAPL has also considered additional mitigation measures that could potentially lower the risk associated with PW discharges during well clean-up activities.	
Good practice control measures and source	
Control measure	**Source**
Hazardous materials selection process	As part of the hazardous materials selection process, hazardous materials that will be discharged to the environment will undergo a detailed environmental assessment, as per CAPL's *Hazardous Materials Management Procedure* (Ref. 54)
PW treatment	The PW treatment system was selected to provide primary and secondary treatment, and tertiary treatment if required, to ensure the 30 mg/L daily average TPH concentration, during normal operations, is met. To manage periods of variable PW composition, for example during well clean-ups, the PW treatment system (or equivalent temporary package) may be utilised. It is possible that during well clean-ups the TPH in the discharge will exceed a 30 mg/L daily average for ~1–8 days for each well. During well clean-up activities PW discharge will not exceed a 100 mg/L TPH daily average, and a 30 mg/L TPH monthly average, to limit the mass load during activities. Modelling and verification (as discussed in Section 6.2.6.2) indicate that TPH will not be detectable in-field within close proximity to the discharge location during normal operations and well clean-ups and the EPO will be met. The daily average TPH is determined using manual laboratory samples. In addition, an analyser is used for process trending to evaluate water quality in between sampling events. If the analyser is off-line or not trending in accordance with expectations, a daily average will be calculated using not less than 4 laboratory samples.
PW monitoring	<u>Routine laboratory sampling</u> Laboratory sampling and analysis will be used to monitor performance of the system. During normal operations, platform laboratory analysis (typically using a Horiba or similar) shall be normally undertaken twice every 24 hours, or not less than 4 times per 24 hours during periods where the analyser is offline or not trending in accordance with expectations. During well clean-up activities, platform laboratory analysis shall be undertaken not less than 4 times per 24 hours. The laboratory TPH analyses methodology will likely be as per ASTM D7066 – Standard Test Method for dimer/trimer of chlorotrifluoroethylene (S-316) Recoverable Oil and Grease and Nonpolar Material by Infrared Determination or similar. The laboratory TPH analysis methodology will be verified at a minimum 6-monthly by a NATA certified laboratory. The laboratory sampling equipment and analysis equipment is routinely calibrated in accordance with WHS Procedure for *the Determination of TPH and Oil and Grease in Aqueous Solutions using Horiba OCMA-550* (WS2-1804-PRO-00156) or equivalent. <u>Analyser used to monitor trends</u> An analyser is used for process trending of the PW discharge and may provide an early indication of an increasing TPH discharge value. Continuous monitoring of hydrocarbons in PW is challenging given the complexity of the fluid mixture, its time variable composition with operational status, and the specificity of sensor response to a particular

	physical or chemical variable within the hydrocarbon mixture being analysed. To improve accuracy of TPH measurement in the PW discharge stream – and subsequently improve environmental management outcomes – a smart analyser solution was developed, which integrates real-time process data from throughout the Wheatstone platform with the best available analyser technology through machine learning algorithms to improve surveillance of TPH levels in the PW. While the dataset of the smart analyser project is small and analysis is still being undertaken on applicability, performance testing has shown acceptable results. The smart analyser integrates data from multiple equipment sources on the platform, including the existing online analyser. There are over 400 features currently used by the smart analyser algorithms to predict trends in TPH concentrations of the PW discharge. The use of such a high number of features within the predictive analysis allows for contingency should any of the equipment supplying this data be temporarily out of service—if this were to occur, the unreliable data would fall in importance rankings used within the predictive analysis algorithms of the smart analyser but would not prevent the smart analyser from still predicting TPH concentrations. The smart analyser is currently being operationalised, and the required IT architecture being developed for deployment within the existing platform operational system. The online analyser in conjunction with any enhancements associated with the smart analyser project will apply the most representative trend inputting to an alarm, alerting operators should the TPH concentration approach a threshold for management response in order to maintain water quality in accordance with the EPO (i.e., the intent is that both analysers will be operational on the platform). <u>Waste Water Discharges Monitoring Program</u> The Platform Waste Water Discharges Monitoring Program (Section 8.4.1.1) is designed to ensure the nature, extent, and potential effect of the PW and other discharges are assessed, and helps determine changes to water quality, sediment quality, and marine habitats. For normal operations the monitoring program includes: topsides monitoring, field sampling, model verification, and WET testing (or equivalent) and where practicable, allows adaptive management changes to occur. During well clean-up activities, the monitoring program includes topsides sampling to protect the environment, confirm discharges are in-line with those anticipated, allow adaptive management to occur where practicable and inform future campaigns (Section 8.4.1.1.9).
Operating manual and procedures	The *PW Treatment System Operating Manual* (Ref. 72) and *PW High OIW Content Procedure* (Ref. 73) will be implemented when data indicate a potential exceedance of TPH, including data from manual laboratory sampling results (>30 mg/L TPH during normal operations) and analyser outputs (exceedance defined in High OIW content procedure [Ref. 73]). The manual and procedure detail actions to be taken by platform operators to check that the reported data are correct, and, if required, detail corrective actions to be undertaken to address the exceedance. <u>The *PW Treatment System Operating Manual*</u> (Ref. 72) provides information relating to the safe and efficient operation of the PW treatment system. The manual includes a dedicated Environmental Information section summarising OIW targets, sampling and analyser details, and link to the *PW High OIW Content Procedure* (Ref. 73). As per the Manual, the PW system alarm alerts operators should trends approach upper specifications, and also refers to actions in the *High OIW Content Procedure*. The Manual describes initial response and operator actions to respond to the alarm. Steps include field checks, additional manual sampling, checking the analyser results against samples analysed in the platform laboratory and production actions (e.g., correcting chemical injection settings and checking equipment

	performance). If OIW concentrations continue to increase after implementing the corrective actions, additional steps to choke back on high water wells (i.e., reducing high water flows) and directing off-specification PW to rich MEG tank where it can be reprocessed slowly (limited capacity) can be taken. The *PW High OIW Content Procedure* (Ref. 73) provides clear and precise instructions to manage a high TPH content in the PW discharge. The procedure is implemented when there is a high alarm (i.e., analyser alarm) in the PW discharge header or where an individual manual laboratory sample (i.e., not a daily average) returns a level above 30 mg/L during normal operations. The procedure includes steps/actions taken by production, laboratory and CCR personnel to manage the TPH in discharged PW to below the 30 mg/L daily average during normal operations, including re-sampling, treatment system checks, production actions and diverting over spec PW (confirmed by laboratory sample) inboard if required for re-processing prior to release. *The PW High OIW Content Procedure* (Ref. 73) is designed such that operators follow a tiered response that aims achieve the 30 mg/L daily average as far as practicable. *Well Clean Up Procedures* For each well clean-up campaign, specific procedures are developed in accordance with the Waste Water Discharges Monitoring Program (Section 8.4.1.1.9). These procedures identify and describe the specific steps/actions taken by platform operators to manage the TPH in discharged PW to below the 100 mg/L daily average and 30 mg/L monthly average as far as practicable during well clean-up activities. Where there is a high TPH analyser alarm or a manual laboratory sample above 100 mg/L, then the steps/actions (e.g., re-sampling, diverting, tertiary treatment, etc.) as defined in the procedure are implemented. A separate limit (100 mg/L daily average) for non-routine and short-duration activities such as well clean-ups, provides a proportional approach to enable start-up of wells, and assist in ongoing OIW management. The inclusion of a 30 mg/L monthly average during non-routine events ensures that the total equivalent loading over a longer (monthly) duration is consistent with that expected during normal operations.	
CMMS	To ensure that the PW treatment system instrumentation and equipment, including the analysers, are operating appropriately, preventative maintenance regimes have been developed and incorporated into the CMMS. Maintenance activities are managed through CMMS which is used as the main asset and inventory management system within CAPL for performing and tracking maintenance activities. Through ongoing maintenance, the operability of the system is optimised, reducing the risk of insufficient PW treatment.	
CMS	CAPL uses a competency management system (CMS) to track and manage competencies and required training for the operations workforce to ensure minimum levels are met and that personnel are trained and competent to undertake their duties.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
Storage, treatment and disposal (without discharging) during well clean up	A comprehensive assessment of possible options for managing well clean-up discharges was undertaken (Ref. 298). In summary, eight offshore and onshore treatment and disposal alternatives were considered, including treatment in	All alternatives resulted in significant additional safety, environmental, logistical, operational, and financial costs (Ref. 298). These costs were primarily related to the storage requirements of the well clean-up fluids on the platform (as opposed to discharging), prior to

	other CAPL facilities and recycling options. The potential environmental benefit is the elimination of the localised and temporary changes to water quality around the platform and therefore reducing the potential exposure to marine values. However, given the infrequent and short duration (~1–8 days per well) of well clean-up discharges, and the inert nature of the additional drilling fluids (a constituent not typically part of the PW discharge), limited environmental benefit may be achieved from an alternate storage and disposal pathway compared to marine discharge. In addition, the extra storage requirements on the platform, the additional transfers from the platform, and the burden of onshore treatment, also introduce new environmental impacts and risks.	transport to shore. To enable storage, extra tanks would be required on the platform, imposing additional space and weight requirements for the once-off well clean-ups. Modifying the platform to allow temporary storage of well clean-up fluids, would require significant financial expenditure. Transferring the tanks to support vessels would require increased handling and lifting operations, therefore exposing personnel to health and safety risks. Additionally, limited onshore facilities are available to treat, recycle, and/or dispose of such fluids. Therefore, the significant costs of storing, treating and disposing of the fluids are grossly disproportionate to the negligible environmental gain (of avoiding the short-duration well clean-up discharges) and are not a reasonably practicable alternative.
Likelihood and risk level summary		
Likelihood	Given the nature and scale of this activity with standard control measures in place, it is considered Remote (5) that these discharges would result in any impact to the ecological function of the particular values and sensitivities present within the OA.	
Risk level	Low (8)	
Determination of acceptability		
Principles of ESD	The potential impacts and risks associated with this aspect are spatially limited to an area around the platform, which is not considered as having the potential to affect biological diversity and ecological integrity. The highest consequence associated with this aspect is Moderate (4). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No legislation or other requirements were considered relevant to this aspect.	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • *Hazardous Materials Management Procedure* (Ref. 54) • *PW Treatment System Operating Manual* (Ref. 72) • *PW High OIW Content Procedure* (Ref. 73) • *WHS Procedure for the Determination of TPH and Oil and Grease in Aqueous Solutions using Horiba OCMA-550* (Ref. 74) • *Waste Water Discharges Management Plan* (Ref. 307).	
External context	During stakeholder consultation, no objections or claims were raised regarding planned discharge of produced water arising from the activity.	

Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Meet ANZG guidelines* to avoid changes to water quality and sediment quality outside the discharge zone boundary	**Hazardous materials selection process** Hazardous materials discharged through the PW system are subject to the hazardous materials selection process as per the CAPL *Hazardous Materials Management Procedure*	Hazardous materials selection process assessment records (or similar).
	PW treatment PW is treated through the PW treatment system so that during normal operations the concentration of PW discharge does not exceed 30 mg/L TPH (daily average)**	Records (laboratory) indicate that the PW discharge TPH concentration does not exceed 30 mg/L (daily average) during normal operations**
	PW treatment PW is treated through the PW treatment system (or equivalent) so that during well clean-up campaigns the concentration of PW discharge does not exceed 100 mg/L TPH (daily average) or 30 mg/L TPH (monthly average)	Records (laboratory) indicate concentration of PW discharge does not exceed 100 mg/L TPH daily average, or 30 mg/L TPH monthly average during well clean-up campaigns
	PW monitoring During normal operations TPH concentration is measured: • routinely by the laboratory (normally twice every 24 hours)*** • laboratory samples 4 times per 24 hours during periods where the analyser is offline or not trending in accordance with expectations***	Records during normal operations confirm TPH concentrations are measured routinely by the laboratory (normally twice every 24 hours or 4 times per 24 hours during periods where the analyser is offline or not trending in accordance with expectations)***
	PW monitoring During well clean-up campaigns TPH concentration is measured: • routinely by the laboratory (normally 4 samples every 24 hours)	Records during well clean-up campaigns confirm TPH concentrations are measured routinely by the laboratory (normally 4 samples every 24 hours)
	PW monitoring The predictive analysis associated with the smart analyser will be retrained, and performance tested, following operational deployment on the platform on a risk-based frequency	Records confirm that the smart analyser was retrained, and performance tested, as required
	PW monitoring The Platform Waste Water Discharges Monitoring Program is	Records confirm the Platform Waste Water Discharges Monitoring Program is implemented

	implemented in accordance with Section 8.4.1	
	PW monitoring The laboratory TPH analysis methodology verified at a minimum 6-monthly by a NATA certified laboratory	Records confirm offshore laboratory TPH analysis methodology verification is undertaken at least every 6 months via NATA approved laboratory
	PW monitoring PW sampling equipment and laboratory analysis equipment is routinely calibrated in accordance with WHS Procedure for the Determination of TPH and Oil and Grease in Aqueous Solutions using Horiba OCMA-550 (WS2-1804-PRO-00156), or equivalent.	Laboratory and/or calibration records confirm PW sampling equipment and laboratory analysis equipment is routinely calibrated in accordance with WHS Procedure WS2-1804-PRO-00156), or equivalent.
	Operating manual and procedures During normal operations, PW Operating Manual tiered response and High OIW Content Procedure is implemented if: • manual laboratory sample >30 mg/L TPH • analyser trending indicates potential exceedance of TPH as defined in High OIW Content Procedure	Records confirm PW Operating Manual tiered response and PW – High OIW Content Procedure is implemented if required
	Operating manual and procedures During well clean-up campaigns, response actions/steps are implemented in accordance with the procedure if: • manual laboratory sample of >100 mg/L • trending indicates potential exceedance of TPH	Records confirm that procedure response actions are implemented if required
	CMMS PW treatment system is operational and maintained in accordance with the CMMS.	CMMS records demonstrate maintenance of PW treatment system.
	CMMS Critical equipment supporting the smart analyser**** are maintained in accordance with CMMS	Laboratory and/or calibration records
	CMS Personnel taking samples and analysing samples are competent to ABU – 1645 Produced Water Treatment System – Comprehensive Review and CAPL Laboratory Manual standards.	Records demonstrate personnel taking samples and analysing samples have the required competency.

Notes:
** PC95 species protection criteria has been adopted from ANZG (Ref. 11), where available*
*** With the exception of well clean-ups*
**** Laboratory sampling frequency may be revised in line with the process outline in Section 8.4.1.1.8.*
***** Where 'critical equipment supporting the smart analyser' are those that provide features as input into the predictive analysis algorithm of the smart analyser.*

6.2.7 Planned discharges—Wastewater

6.2.7.1 Seawater system and cooling water

To prevent marine growth, sodium hypochlorite is continuously dosed in the platform seawater system lift pumps so that the whole seawater system is chlorinated, resulting in the discharge of cooling water with slight traces of residual chlorine. Hypochlorite is also intermittently injected into other caissons that are in contact with seawater (for ~15 minutes, once or twice a day). The discharge temperature will be around 30-40 °C but may reach 50 °C on occasion.

The continuous dosing of the seawater lift pumps and the subsequent continuous CW discharge is the greatest volume of discharge and therefore is the focus of this assessment. Based upon the operation of the platform over the past four years, CW discharges have averaged a volume in the order of ~80,000–1,000,000 m^3/day. The continuous injection of hypochlorite into the seawater system results in the residual chlorine concentration discharged at 0–0.2 ppm via the CW caisson.

Modelling Results

Cooling Water discharge modelling has been conducted to quantify and assess the extent of the strongly buoyant discharge plume. The following modelling has occurred:

- during the development of the EIS (Ref. 25).
- optimised during FEED (Ref. 170)
- refined in 2016 (Ref. 171)
- validation of the model in 2018/19 (Ref. 217).

The EIS and FEED phase models were based on CORMIX (near field) and CMS-Flow (far field) while the refined ongoing modelling uses CORMIX (near field) and MIKE 3FM (far field). The results show the size, concentration of residual chlorine and location of the plume and where the plume temperatures approach ambient conditions.

Modelling predicts that for the maximum CW discharge volume, the maximum extent for plumes to dilute to the ANZG WQ criteria of 3 ppb for chlorine extends ~600 m from the platform (Ref. 170).

The models predict that the CW plume is strongly buoyant and will not be in contact with the seabed prior to extensive dilution (Ref. 25 ; Ref. 170; Ref. 171). The residual chlorine in the plume dilutes more than the 67 times required to meet the ANZG management guidelines before the plume first reaches the sea surface, then mixes further horizontally and vertically before potentially contacting the seabed in the far field.

The CW plume temperatures are predicted to be close to ambient conditions well within the near-field, typically within 3 °C of ambient within ~250 m from the platform (Ref. 25; Ref. 172). CORMIX predicts dilutions of 1000 to 10 000 (which is within 0.05 °C of ambient temperature) within the boundary zone and without contact of the seabed in the nearfield (Ref. 170; Ref. 171).

Model verification

In November 2018, a comprehensive field campaign (Ref. 217; Ref. 220) was executed to confirm that that the required dilutions with regard to environmental guidelines were being achieved, and to validate model predictions. The campaign involved controlled injection of Rhodamine WT (RWT) dye into CW and PW discharges from the platform, in conjunction with intensive in situ measurements of the resulting ‘spiked’ plumes. Field measurements involved sample retrieval and fluorometry directly from the vessel, fluorometry and sample retrieval from an ROV despatched to traverse the plume, and sensor measurements by ocean glider and an unmanned aerial vehicle (AUV) to ascertain marine conditions, map plume geometry, and quantify dilutions associated with the discharge plumes. An acoustic doppler current profiler (ADCP) and temperature string were deployed on a fixed mooring for the duration of the campaign.

As a result of the open caisson design, flowrate and free-falling discharge from platform level within the caisson, the CW plume was observed to contain a very high content of entrained air. This air content, which was not considered in previous CW plume assessments, clearly dominates the near-field behaviour of the waste stream until the air is lost to the atmosphere (Ref. 217).

The results of the field campaign strongly suggest that nearfield mixing was drastically underestimated given the presence of entrained air (i.e., model predictions are highly conservative). Consequently, the monitoring indicates that the initial discharge zone of 850 m is conservative and remains appropriate for continued operations of the facility.

6.2.7.2 Drainage

The discharge from open drains is intermittent, with the oil-water treatment system designed to meet a discharge concentration of 15 mg/L or less. Discharge rates will vary significantly according to the sources of open drains effluents, including firewater and rain/stormwater. Drainage water can contain traces of emulsified oil and grease, diesel, hydraulic oil, lubricants, cleaning fluids, and similar contaminants, and low concentrations of sodium hypochlorite will be present from the routine caisson dosing and occasional draining of systems (such as tempered water, HVAC, firewater main and potable water).

During platform maintenance, breaking containment of vessels, opening lines, high-pressure cleaning, and topping up and changing fluids may be performed. During these processes, most fluids will be captured in drip trays or the drainage system and passed through the oil-water treatment system; however, occasionally, depending on the location of the equipment on the topsides, discharges may bypass the drainage system (e.g., firewater main).

Fire protection system testing is mandatory for safety requirements and will result in ~5 m^3 of foam discharging through the grating on the topsides several times per year. If the active fire protection system is used, treated sea water with low concentrations of hypochlorite may be released to the ocean.

6.2.7.3 Sewage, greywater, brine and food

Sewage discharge is ~30 m^3/day during normal operations workforce rates (POB 96), and 33–52 m^3/day during occasional and short-term peak workforce periods. Due to the low discharge rate, the sewage and greywater discharge is predicted by modelling to be highly diluted within the near-field, with no far-field impact (Ref. 25). The kitchen waste system includes a macerator, which discharges to the ocean through a dedicated discharge pipe. Brine is discharged as wastewater from the reverse osmosis process (potable and demineralised water), and is predicted to be ~6–15 m^3/hour with salinity levels ~31% higher than the receiving open-ocean environment. Local wave, tide, and wind action enhance the brine plume diffusion and mixing immediately on discharge and the brine plume will be rapidly diluted and dispersed by ambient currents (Ref. 25). At a discharge depth of 40 m, the sewage effluent was buoyant, typically diluted by a factor of ~2000 by the time it reached the surface of the water column (Ref. 25) and still further diluted before potentially remixing vertically in the column and contacting the seabed.

For greywater and brine, based on the forecast biodegradability, depth of discharges, and exposure of the discharges to open ocean currents, no detectable impacts to background water and sediment quality are forecast (Ref. 25) and are therefore not discussed further below. No detectable impacts to marine sediment quality are forecast for any these discharges (Ref. 25).

6.2.7.4 Risk assessment

Source			
Activities identified as having the potential to result in planned discharges are: • start-up and operation of the platform. The types of planned discharges include CW, drainage, fire-fighting foam, sewage, greywater, food wastes, brine, and potable water.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Planned discharges from the platform may result in: • localised and temporary reduction in water quality.	5	A change to ambient water quality may result in: • indirect impacts to fauna arising from chemical toxicity • changes to predator / prey dynamics	6
Consequence evaluation			
Localised and temporary reduction to water quality To understand the extent of exposure, CW has been selected as a case study to enable a conservative assessment to be undertaken given it comprises the largest volume and is a continuous discharge. As detailed previously, infield monitoring has validated that the extent to which water quality may be affected by these discharges is no more than 850 m. Given that the platform is located within a highly dispersive, open ocean location, these planned discharges are subject to extensive and rapid dilution by open ocean currents and tides (Ref. 172). In-field monitoring has validated the assumption that they dilute rapidly and do not persist long in the marine environment. On the basis that these discharges will result in a localized change to the environment with impacts that are short in duration, CAPL has ranked the consequence associated this impact as Minor (5).			
Potential chemical toxicity Changes to ambient water quality associated with various planned releases may occur up to ~850 m from the platform. The values and sensitivities with the potential to be exposed to toxicity effects within this area include: • Pygmy Blue Whale (distribution) • Whale Sharks (foraging) • Flatback Turtle (internesting) • Ridgeline habitat and associated communities. Infield monitoring (Ref. 217) confirmed that due to entrained air, the plume is strongly buoyant, thus exposure to benthic habitats such as the ridgeline habitat will not occur. Consequently, this has not been considered further. According to the *Marine Bioregional Plan for the North-West Marine Region* (Ref. 27), nutrient pollution is only listed as a pressure for turtles, but potential impacts are limited to discharges nearshore. Additionally, the *Recovery Plan for Marine Turtles in Australia* (Ref. 93) lists chemical discharges as a threat. Although the discharge plume intersects the Flatback Turtle internesting			

BIA, Whittock et. al. (Ref. 91) reported that Flatback Turtles preference habitats within proximity of the coast and at relatively shallow depths during the internesting period. Specifically, during the study, a maximum distance from the nearest coast and maximum water depth of 27.8 km and <44 m respectively was recorded, with the mean maximum distance away from the nearest coast and mean water depth being less than 6.1 km and <10 m respectively (Ref. 91). Given that the platform is located ~50 km from the nearest coast, even though the Flatback turtle internesting area may be exposed to changes in water quality, due to the distance offshore, these discharges are not expected to result in any significant impacts. The *Blue Whale Recovery Plan* (Ref. 98) states that marine pollution can have a variety of possible consequences for Blue Whales at an individual and population level, or indirectly through harming their prey or the ecosystem. Marine pollution is not listed as a threat within the *Conservation Advice (Rhincodon typus) Whale Shark* (Ref. 95). As both cetacean species and whale sharks are highly mobile, they are not expected to be exposed to the discharge plume for a prolonged period of time thus any impacts are expected to be limited. Given that all the discharges are positively buoyant, and as they are all discharged in water depths >35 m, on release they will rise through the water column and subsequently dilute and disperse quickly. The platform is located within an open water dispersive environment thus discharges are subject to rapid dilution and dispersion. Monitoring has verified that impacts are limited in extent within close proximity of the discharge location and consequently, prolonged exposure to transient marine fauna species are not expected. Given the rapid dilution and dispersion conditions, and the transient nature of marine fauna, bioaccumulation in the receiving environment and sublethal impacts are expected to be limited. Consequently, the release of waste water discharges are expected to result in a limited environmental impact, and the consequence level was determined as Incidental (6).
Changes to predator/prey dynamics At a discharge depth of >35 m, the sewage effluent is buoyant, and the expected low volumes of these discharges are expected to dilute and dissipate to surface waters above the discharge point of the platform. Effects on environmental receptors along the food chain – fish, reptiles, birds, and cetaceans – are not expected beyond the immediate vicinity of the discharges in deep open waters (Ref. 173). Given that sewage discharges are positively buoyant, only pelagic species are likely to be impacted with no exposures to benthic habitat expected. The values and sensitivities with the potential to be affected by changes in predator/prey dynamics within 850 m of the platform include: • Whale sharks (foraging) • Lesser Crested Tern, Wedge-tailed Shearwater (breeding). Studies into the effects of nutrient enrichment from offshore sewage discharges indicate that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed areas (Ref. 174) and suggest that zooplankton composition and distribution in areas associated with sewage dumping grounds are not affected. However, if any changes in phytoplankton or zooplankton abundance and composition occur, they are expected to be localised, typically returning to background conditions within tens to a few hundred metres of the discharge location (Ref. 175; Ref. 176; Ref. 177). Given the distance from shore, these incidental discharges are not expected to influence foraging behaviours of seabirds (specifically the Wedge-tailed Shearwater), and thus are not considered further. As described above, plankton communities are not affected by sewage discharges, but if they are, such effects would be highly localised (expected to return to background conditions within tens to a few hundred metres of the discharge location). Consequently, impacts to Whale Shark foraging behaviours are not expected, and thus are not considered further. Although fish have the potential to be attracted to these discharges, any attraction and consequent change to predator/prey dynamics is expected to be limited to the area of the release and thus is expected to result in localised feeding behavioural changes to fish species. Given the rapid dilution of the discharged material, such behavioural changes will be temporary in nature and not expected to significantly alter existing predator/prey dynamics. Overall, a change in water quality as a result of sewage or food discharges are unlikely to cause a change in behaviour of marine fauna at a measurable level and will not result in a change in the viability of the population or ecosystem As water quality changes are predicted to be rapidly dispersed, and the discharges are not expected to adversely affect marine habitats and fauna, any increased predation is not expected

to result in more than a limited environmental impact. CAPL has thus ranked the potential consequence as Incidental (6).	
ALARP decision context justification	
Planned discharges from offshore facilities are commonplace nationally and internationally. The control measures to manage the risk associated with these planned discharges are well defined and are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding vessel discharges arising from the activity. The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.	
Good practice control measures and source	
Control measure	**Source**
Hypochlorite dosing	The hypochlorite dosing package is commissioned, tested and calibrated during initial start-up. The seawater system has been designed to meet the continuous hypochlorite dosing levels that ensure the entire system achieves a residual chlorine content of up to 0.2 ppm discharged through the CW caisson.
CMMS	Through ongoing maintenance, the dosing package and seawater system will be maintained, thereby ensuring the system is operating at optimal capacity and reducing the risk of elevated residual chlorine levels.
	The drainage and oily water system will be maintained, thus ensuring the system is operating at optimal capacity to treat oily water.
Oil-water treatment system	Potential oil contaminated streams from the platform drainage system are treated through the oil-water treatment system, prior to discharge at or below 15 mg/L, and is verified through laboratory sampling and analysis. The platform drainage system design ensures potentially oil-contaminated streams will be directed to the slops tank, where they will undergo coarse OIW separation, and then further processed in the slops water secondary treatment package before discharge through the open drains caisson. Treated water from the package is discharged to the open drains caisson while the recovered oil is returned to the oil compartment of the slops tank. The Product Design Specifications are to achieve <15 mg/L in the discharged treated water (Ref. 178; Ref. 179). The design of the open drains system is based on an optimisation between providing sufficient capture, storage, and treatment of cyclonic rainfall and the size and weight of such structural storage. The system is designed to meet 15 mg/L, which is standard in the marine and oil and gas industry. Commissioning tests and routine laboratory sampling verifies the adequacy of the treatment system to confirm that it achieves 15 mg/L. The secondary treatment package vessel includes differential pressure and level alarms which can indicate poor separation of oil. These alarms trigger response actions by platform personnel in accordance with the Slops Water Secondary Treatment Package section of the Hazardous and Non Hazardous Drains Systems Operating Manual Volume 1 – Process and Equipment Description (Ref. 178). The system is tested and calibrated if the response to the alarm indicates the oily water treatment is not achieving 15 ppm.
Hazardous materials selection process	As part of the hazardous materials selection process, hazardous materials that will be discharged to the environment will undergo a detailed environmental assessment, as per CAPL's *Hazardous Materials Management Procedure* (Ref. 54)

Sewage treatment system	Sewage will be macerated through the sewage treatment system prior to discharge. Macerating sewage is standard industry practice, ensuring the substance disperses in the receiving environment with minimal effects to water quality. The sewage treatment plant and food waste macerator is maintained. Regular maintenance ensures the system is operating and functioning as intended.	
Food waste discharge	Food waste macerated and discharged at a particle size ≤25 mm is standard marine industry practice; this size ensures that the discharges are rapidly diluted and dispersed by ambient ocean currents (Ref. 25) with minimal effects to water quality.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and Risk Level Summary		
Likelihood	With the numerous controls in place, the expected volumes, concentrations, and types of fluids discharged, rapid dispersion, and the predicted limited spatial extent of water quality changes, it is considered Remote (5) that these discharges would result in any impact to the ecological function of the particular values and sensitivities present within the OA.	
Risk Level	Very low (10)	
Determination of Acceptability		
Principles of ESD	The potential impacts and risks associated with this aspect are spatially limited to an area around the platform, which is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered for this aspect include: • *Marine Bioregional Plan for the North-West Marine Region* (Ref. 27) • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • *Recovery Plan for Marine Turtles in Australia* (Ref. 93).	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • *Hazardous Materials Management Procedure* (Ref. 54) • *Hazardous and Non Hazardous Drains Systems Operating Manual Volume 1 – Process and Equipment Description* (Ref. 178).	
External context	During stakeholder consultation, no objections or claims were raised regarding wastewater discharges arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	

Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No impacts to marine habitats or marine fauna outside of the OA from platform discharges during petroleum activities	**Hypochlorite dosing** The seawater system (continuous dosing) meets the residual chlorine discharge limit of 0.2 ppm for CW and ongoing monitoring is performed in accordance with Table 8-12	Laboratory (LIMS) records demonstrate the seawater system CW discharge meets the residual chlorine limit of 0.2 ppm for continuous dosing and ongoing monitoring is in accordance with Table 8-12
	CMMS Maintenance of the dosing package and seawater system is in accordance with the CMMS	CMMS records of the dosing package and seawater system
	CMMS The oil-water treatment system is maintained in accordance with the CMMS	CMMS records show maintenance of the oil-water treatment system
	Oil-water treatment system Oily water is treated through the oil-water treatment system to meet the 15 mg/L discharge concentration	Laboratory records of weekly analyses (when discharging) show the oil-water treatment system meets the 15 mg/L discharge concentration
	Oil-water treatment system Response to alarms (for the Slops Water Secondary Treatment Package) are in accordance with *Hazardous and Non Hazardous Drains Systems Operating Manual Volume 1 – Process and Equipment Description*	Records show response to alarms (for the Slops Water Secondary Treatment Package) in accordance with *Hazardous and Non Hazardous Drains Systems Operating Manual Volume 1 – Process and Equipment Description*
	Hazardous materials selection process Fluids planned for discharge are subject to the hazardous materials selection process as per the CAPL *Hazardous Materials Management Procedure*	Hazardous materials selection process assessment records (or similar)
	Sewage treatment system Sewage is discharged after being macerated through the sewage treatment plant during routine operations	Records verify sewage is discharged after maceration through the sewage treatment plant during routine operations
	Sewage treatment system The sewage treatment system and food waste system are maintained	Inspection records (or equivalent) demonstrate maintenance of the sewage treatment system and food waste system
	Sewage treatment system Shut-downs and alarms are investigated and critical macerator operability issues rectified prior to restart of equipment	Inspection records (or equivalent) verify operability issues rectified
	Food waste discharge	Records verify that food discharged is macerated to

	Discharged food waste is macerated through the food waste system to particle sizes ≤25 mm during routine operations	≤25 mm when discharged during routine operations

6.2.8 Unplanned release—Waste

<table>
<tr><th colspan="4">Source</th></tr>
<tr><td colspan="4">Activities identified as having the potential to result in the unplanned release of waste are:
• start-up and operation of the platform.
Because waste is generated on board the platform, inappropriate management and storage has the potential to result in a release to the environment.</td></tr>
<tr><th colspan="4">Potential impacts and risks</th></tr>
<tr><th>Impacts</th><th>C</th><th>Risks</th><th>C</th></tr>
<tr><td>N/A</td><td>-</td><td>Unplanned release of waste to the environment may result in:
• marine pollution resulting in entanglement or injury of marine fauna</td><td>6</td></tr>
<tr><th colspan="4">Consequence Evaluation</th></tr>
<tr><td colspan="4">If hazardous or non-hazardous waste is lost overboard, the extent of exposure to the environment is limited.
Marine fauna most at risk from marine pollution include marine reptiles and seabirds, through ingestion or entanglement (Ref. 93; Ref. 180). Ingestion or entanglement has the potential to limit feeding or foraging behaviours and thus can result in marine fauna injury or death. Although marine debris is identified as being of concern to marine reptile species under the North-west Marine Bioregional Plan (Ref. 27), the risk is associated with ‘land-sourced plastic garbage, fishing gear from recreational and commercial fishing abandoned into the sea, and ship-sourced, solid non-biodegradable floating materials disposed of at sea’. This type of waste is not associated with the activities described under this EP and given the restricted exposures and the limited quantity of waste with the potential to cause marine pollution that is expected to be generated from petroleum activities, it is expected that any impacts from marine pollution would result in limited impacts to individuals. Thus, CAPL ranked this consequence as Incidental (6).</td></tr>
<tr><th colspan="4">ALARP decision context justification</th></tr>
<tr><td colspan="4">Offshore facility operations, and the subsequent management of waste, are commonplace and well-practiced activities within the industry.
The control measures to manage the risk associated with an accidental release of waste are well defined via legislative requirements that are considered standard industry practice. There is a good understanding of the release pathways, and the control measures required to manage these events are well understood and implemented by the petroleum industry and CAPL.
During stakeholder consultation, no objections or claims were raised regarding waste management arising from the activity.
An unplanned release of waste is a lower-order risk in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.</td></tr>
<tr><th colspan="4">Good practice control measures and source</th></tr>
<tr><th>Control measure</th><th colspan="3">Source</th></tr>
<tr><td>Waste management</td><td colspan="3">Waste management strategies are in place for platform operations, and are aimed at preventing both accidental pollution, and pollution from routine operations. These waste management strategies describe various requirements that are to be applied when managing waste offshore; specifically, that lidded bins are available for use in open areas of the platform, and that records are maintained of waste transferred.</td></tr>
</table>

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	Marine pollution arising from mismanaged waste offshore has occurred previously in the industry but is not expected to occur during these activities, given the control measures in place. As such, the likelihood of incidental consequences to values and sensitivities from an unplanned release of waste is considered Remote (5).
Risk Level	Very low (10)

Determination of acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to individuals and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no additional evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • *Marine Bioregional Plan for the North-West Marine Region* (Ref. 27) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • *Recovery Plan for Marine Turtles in Australia* (Ref. 93).
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.
External context	During stakeholder consultation, no objections or claims were raised regarding waste management arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.

Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No uncontrolled release of waste to the environment during petroleum activities	**Waste management** Platform waste is managed by: • lidded bins are provided in open areas of the platform where waste has a risk of being blown to the ocean (e.g., general waste, loose plastic) • records of waste transferred from the platform will be maintained	Records confirm that platform waste management is being implemented, specifically including presence of lidded bins and waste transfer records

6.2.9 Unplanned release—Loss of containment

Source			
Activities identified as having the potential to result in a minor LOC event: • start-up and operation of the platform. Based on the activities described in this EP, the following potential minor LOC scenarios were identified: • corrosion, mechanical failure/damage, or fire/explosion during hydrocarbon processing, resulting in a loss of production fluids[1] • mechanical failure/damage of platform infrastructure, resulting in the loss of MEG[2] • mechanical failure/damage, or human error during bunkering, resulting in loss of various fluids including diesel, MEG, or TEG[3] • mechanical failure/damage during crane activities, resulting in loss of hydraulic fluids[4] • mechanical failure/damage, or human error during storage and handling, resulting in loss of various fluids including diesel, chemicals, or waste[5]. *[1] A hydrocarbon processing LOC may result in the release of production fluids, ~<50 m^3. This maximum credible volume is based on the largest individual condensate inventories, calculated in the platform Safety Case release scenarios (Ref. 17).* *The diesel storage tank has a capacity of 135 m^3; however, the location and design of this tank is such that a LOC scenario was deemed as non-credible during the risk assessment process.* *Note: as the platform is not a floating facility but is resting on the seabed, a topside loss of containment event leading to an explosion would not result in structural collapse/integrity failure (Ref. 17). Instead, an explosion on the topsides could result in individual production fluid inventories being released to the ocean. It is expected that maximum credible volumes associated with this event are ~<50 m^3 (Ref. 17).* *[2] A vessel collision with the platform legs may result in the release of MEG from the storage tanks (~<60 m^3 of MEG over 4 hours).* *A study was conducted to evaluate the ship collision hazards to the platform, with the overall objective to determine which vessels have sufficient impact energy to cause progressive collapse of the facility. It was concluded that for all vessels associated with these activities, drift-off and drive-off collisions have insufficient impact energies to cause platform collapse (Ref. 17). Furthermore, the above-deck height of the vessels is low enough that they would clear the bottom of the deck, or only cause minor damage to the topsides structure. It was further concluded that a supply vessel collision would result in minor structural damage due to insufficient impact energy (Ref. 17).* *[3] Platform bunkering – single point failure may result in the release of diesel, MEG, TEG (~10 m^3 over 15 minutes). This volume was identified as 15 minutes of transfer at the full pumping rate as per AMSA Guidance on oil spill planning (Ref. 147). Diesel has the highest potential impact to receptors and therefore is the worst-case release for this group of spill scenarios.* *[4] Hydraulic systems – single point failure (~<10 m^3 of hydraulic fluids). This volume is based on the volumes of hydraulic fluids stored in the crane hydraulic system.* *[5] Bulk storage and handling on the topsides single point failure may result in substances reaching the marine environment (~<10 m^3).*			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Unplanned release of hazardous material to the marine environment may result in: • indirect impacts to fauna arising from chemical toxicity	6
Consequence evaluation			
The largest platform LOC event is estimated to be ~50–60 m^3 of condensate or MEG, and therefore these scenarios has been used as the basis of this consequence evaluation. A surface release of ~50–60 m^3 of condensate or MEG would be expected to temporarily change the water quality within the immediate vicinity of the release. The aquatic toxicity of MEG is very low; and is on the OSPAR list of substances that are considered to pose little or no risk to the environment once released (PLONOR), and is not expected to result in adverse impacts to habitats or fauna Once on the surface, condensate will rapidly evaporate with only a small proportion dispersing in the surface layers of the water column under moderate winds and mixing conditions (Section 7.1.2.1).			

The values and sensitivities within the OA the potential to be exposed to decreased water quality from an unplanned surface LOC release include: • Humpback Whale (migration) • Pygmy Blue Whale (distribution) • Whale Shark (foraging) • Flatback Turtle (internesting buffer) • Whale Shark (foraging). Based on the nature of these unplanned releases, which are non-continuous and expected to occur in a location where no specific sedentary behaviours for values and sensitivities have been identified, the extent and severity of any potential impact is expected to be limited. Given the nature of unplanned releases covered under this EP and the transient nature of identified values and sensitivities, fauna would need to pass directly through the plume almost immediately upon release to be impacted. Any potential impact from such an event is expected to be limited, thus the consequence level was determined as Incidental (6).	
ALARP decision context justification	
Operation of offshore facilities is commonplace and well-practised both nationally and internationally. The control measures to manage the risk associated with these unplanned discharges are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding planned discharges from subsea operations arising from the activity. The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.	
Good practice control measures and source	
Control measure	**Source**
CMMS	The diesel, MEG, and TEG tanks have high-level alarms that trigger an audible alarm to stop bunkering. This ensures operators are made aware of overfilling, and reduces the potential for spills. Routine testing ensures the alarms are functioning correctly.
	Ongoing maintenance of the platform navigation equipment ensures equipment is operational and provides situational awareness of maritime traffic movements, thereby reducing the risk of interference with other marine users. The equipment standards of performance are included in the Computerised Maintenance Management System (CMMS). Maintenance activities are managed through the CMMS (described in Section 8.3.2.3), which is used as the main asset and inventory management system within CAPL for performing and tracking maintenance activities.
	Platform bunkering hoses, hydraulic hoses, chemical and diesel storage areas, cranes, and hydrocarbon processing systems are maintained. The spill scenarios assessment determined that spills can occur from bunkering hoses, hydraulic hoses, chemical and diesel storage areas, dropped objects from cranes, and hydrocarbon processing systems. Therefore, regular inspections and maintenance ensures the mechanical and structural integrity of these systems is maintained. This reduces the risk of mechanical failure that results in spills associated with the processing, storage, handling, and transfer of liquids.
Spill kits and drip trays	Spill kits will be provided on the platform to allow personnel to respond to minor leaks and spills and reduce the risk of spills/leaks reaching the ocean. Drip trays are available to capture drips and leaks, where safe to do so.
MSW process	The CAPL ABU Permit to Work (PTW) system and the CAPL ABU Managing Safe Work OE process (Section 8.3.1.1) outlines a process to identify, risk assess, communicate, mitigate and control hazards

	associated with work that has the potential to adversely impact health, the environment and safety. The PTW system requires a permit to be authorised for SIMOPs activities (e.g. operations and maintenance activities taking place in the same area), including lifting activities and activities with the potential for dropped objects. Permits are issued on a case-by-case basis and require an activity-specific hazard and risk assessment to be completed, and if a combination of activities has the potential to impact on each other, associated activity-specific procedures are developed according to PTW and Managing Safe Work standards and procedures. The PTW system applies to both CAPL-contracted personnel and vessels, and to third-parties, such as Woodside who is required under the Julimar-Brunello FOSA to comply with the PTW system prior to conducting vessel and rig based activities on subsea infrastructure in proximity to the platform.	
Source control	The platform pipework includes numerous isolation valves including the RESDV, to ensure any loss of containment is minimised to isolated areas (as detailed in the relevant Safety Case [Ref. 18]). Testing and commissioning these valves prior to hydrocarbon introduction, ensures they are functioning correctly and capable of isolating fluids in the processing pipework, therefore reducing the risk of loss of containment scenarios. Source control, such as using the platform isolation valves, is an initial response action that can limit the volume released, thus minimising environmental impacts. CAPL has developed EOPs (1060 Platform – Response To Emergency Shutdown (ESD1) Ref. 75) for the operation of the platform that provide guidance to Operations personnel to detect, isolate, and stabilise non-routine events.	
MSRE process	The MSRE process (Ref. 52) ensures that various legislative requirements and CAPL standards are met. Specifically, for vessels and crew undertaking bunkering and transfers, this includes: • a dedicated radio channel is agreed between vessel and receiving facility before commencing activity • checklists are completed prior to transfers.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	The various prevention and mitigation controls outlined above ensure the likelihood of platform operational spills are minimised, with impacts to marine fauna and habitats ranked as Unlikely (4).	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No legislation or other requirements were considered relevant to this aspect.	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect:	

	• EOPs (Ref. 75) • Wheatstone Downstream ERP (Ref. 81).	
External context	No comments regarding on-platform spill events were received by stakeholders during consultation.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control Measure**	**Measurement criteria**
No unplanned release of hydrocarbons / hazardous materials to the environment during petroleum activities	**CMMS** High-level alarms of platform storage tanks are operational and routinely tested in accordance with the CMMS	CMMS records show high-level alarms are operational and tested
	CMMS Platform radar, navigational lighting and audio navigational equipment is maintained in accordance with the CMMS	CMMS records show platform radar, navigational lighting and audio navigational equipment is maintained
	CMMS Inspection and maintenance of platform hydraulic hoses, storage tanks, cranes, and hydrocarbon processing systems are in accordance with the CMMS	Records show inspection and maintenance of platform hydraulic hoses, storage tanks, cranes, and hydrocarbon processing systems
	MSW process SIMOPS activities, heavy lifting activities, and activities with potential for dropped objects, will be managed in accordance with the permitting and management requirements of the Upstream and Gas Permit to Work procedure and Simultaneous Operations Standard in the Managing Safe Work OE Process	Records confirm CAPL-authorised Permit to Work documentation has been developed in accordance with the Upstream and Gas Permit to Work procedure and Simultaneous Operations Standard in the Managing Safe Work OE Process for SIMOPS activities, heavy lifting activities, and activities with potential for dropped objects
	MSRE process Prior to commencing bunkering or transfers: • a dedicated radio channel is agreed between vessel and platform • checklists are completed	Records confirm that bunkering or transfers are undertaken in accordance with MSRE processes
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	**Spill kits and drip trays** Spill kits and drip trays are available on the platform	Inspection records confirm spill kits and drip trays are available on the platform
	Source control Isolation steps of the source control / isolation procedures (are implemented if a release is detected from the platform hydrocarbon processing systems	Records demonstrate relevant components (isolation steps) of the source control procedures are implemented if a release is detected from the platform hydrocarbon processing systems

6.3 Inspection, Maintenance, and Repairs

6.3.1 Subsea IMR

6.3.1.1 Seabed disturbance

Source
Activities identified as having the potential to result in seabed disturbance are: • subsea IMR operations within the OA.

Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Seabed disturbance may result in: • alternation of marine habitats.	5	N/A	-

Consequence evaluation
As benthic habitats upstream of the platform mostly comprise unvegetated, soft, and unconsolidated sediments with a low but varying degree of benthic invertebrate habitation (Section 4.3.5), seabed disturbance from IMR activities conducted on infrastructure upstream of the platform are not considered to pose any credible hazards to benthic habitats and communities. Consequently, benthic habitats downstream of the platform will form the focus of this evaluation. Subsea IMR activities are expected to result in disturbance to the seabed within close proximity of subsea infrastructure. This type of activity is targeted to the specific area above or adjacent to the infrastructure within the OA, typically resulting in only a small area being affected. The largest area of seabed disturbance predicted to occur from IMR activities is associated with a major pipeline repair, which could result in ~800 m^2 of seabed disturbance (Section 3.4.1). This indicative seabed disturbance area represents <1% of the OA. The particular values and sensitivities within the OA with the potential to be impacted by seabed disturbance include: • continental slope demersal fish communities (KEF) • ancient coastline at 125 m depth contour (KEF) • ridgeline habitat and associated communities. Although these values and sensitivities have been identified as having the potential to be impacted from IMR activities, any planned disturbance will be in close proximity of existing infrastructure. As this area has been historically disturbed, any additional disturbance is expected to have limited environmental impact. Given the nature of the receiving environment within the OA, performing IMR activities is not expected to affect ecosystem function or connectivity of communities. As such, CAPL has ranked the consequence as Minor (5).

ALARP decision context justification
Seabed disturbance from IMR activities is commonplace; the activities causing this aspect are practised nationally and internationally. The control measures to manage the impacts associated with seabed disturbance are well understood and implemented by the industry. During stakeholder consultation, no objections or claims were raised regarding seabed disturbance arising from the activity. The impacts associated with seabed disturbance are considered lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures and source	
Control measure	**Source**
Inspection, monitoring and maintenance (IMM) acceptance criteria	IMR activities are undertaken only when necessary, in accordance with pre-determined IMM acceptance criteria. Acceptability of identified anomalies in subsea infrastructure is guided by predetermined acceptance criteria which define allowable identifiable defects, degradation or limits, thereby ensuring that IMR activities are undertaken as required to maintain system integrity.

IMR work procedures	Activity specific work procedures are developed and address Hazard Identification and Risk Assessment (HIRA) findings, including any additional controls identified for implementation.	
Activity-specific HIRA	The HIRA will include HSE Specialist participation to identify and assess potential environmental impacts and risks associated with the specific maintenance or repair campaign proposed. The HIRA will consider relevant information, which may include: • proximity to potentially sensitive environmental receptors • other known activities and/or impacts that have occurred at that location • material minimisation • alternative materials • alternative execution methodologies • learnings from previous comparable IMR activities/campaigns. Where the HIRA identifies that risks and impacts are potentially greater than those assessed in this EP, the management of change process will be triggered (Section 8.3.2.2).	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	N/A	
Risk level	N/A	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect is limited to localised short-term effects that are not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered for this aspect include: • *Marine Bioregional Plan for the North-West Marine Region* (Ref. 27)	
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.	
External context	During stakeholder consultation, no objections or claims were raised regarding seabed disturbance arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential risks associated with the activity are not inconsistent with any recovery plan, conservation advice, or relevant bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Reduce the risk of impacts to sensitive environmental receptors^ within the OA from petroleum activities	**IMM acceptance criteria** IMR activities undertaken only when necessary (in accordance with pre-determined IMM acceptance criteria)	Records show that IMR activities undertaken only when necessary (in accordance with pre-determined IMM Acceptance Criteria)
	Activity-specific HIRA Activity-specific HIRA undertaken prior to	Records show that activity-specific HIRA undertaken prior to

	maintenance or repair activity commencing	maintenance or repair activity commencing
	IMR work procedures IMR activity specific work procedures developed and implemented	Records show that activity specific work procedures are developed for each IMR activity and address HIRA findings, including any additional controls identified for implementation

^ *"Sensitive environmental receptors" as identified within the activity-specific HIRA*

6.3.1.2 Greenhouse gas emissions

The following activities have been identified as direct emission sources for planned subsea IMR activities under this EP:

- fuel consumption from equipment during planned subsea IMR activities within the OA.

Any equipment (e.g., AUV, ROV) used to support subsea IMR activities are powered by the support vessel itself, and as such these do not represent an additional emission source to that already accounted for by the vessel. As such, these emissions estimates have been fully incorporated into the field support direct GHG emissions inventory (Section 6.4.5.1) and subsequent risk assessment (Section 6.4.5.3).

6.3.1.3 Underwater sound

Source			
Activities identified as having the potential to result in underwater sound are: • IMR marine acoustic surveys (SSS or MBES) within the OA. These activities result in the emission of the impulsive sounds.			
Potential Impacts and Risks			
Impacts	**C**	**Risks**	**C**
Underwater sound emissions may result in: • localised and temporary change in ambient underwater sound.	5	A change in ambient underwater sound may result in: • behavioural disturbance • auditory impairment, temporary threshold shift (TTS), permanent threshold shift (PTS), recoverable or non-recoverable injury to marine fauna	5
Consequence Evaluation			
Localised and temporary change in ambient underwater sound Anthropogenic underwater sound emitted during subsea IMR activities will result in a temporary change in local ambient sound levels. Underwater broadband ambient sound spectrum levels range from 45–60 dB re 1 µPa in quiet regions (light shipping and calm seas) to 80–100 dB re 1 µPa for more typical conditions, and >120 dB re 1 µPa during periods of high winds, rain or 'biological choruses' (many individuals of the same species vocalise near simultaneously in reasonably close proximity to each other) (Ref. 101). Low-frequency ambient sound levels (20–500 Hz) are frequently dominated by distant shipping plus some great whale species. Light weather-related sounds will be in the 300–400 Hz range, with wave conditions and rainfall dominating the 500–50,000 Hz range (Ref. 101). Survey techniques are expected to emit various frequencies between 12 and 500 kHz; maximum at-source sound pressure levels are ~238 dB re 1 µPa (peak) (Ref. 184). Further to this, Lurton (Ref. 185) indicate medium to high-frequency MBES systems do not normally exceed source levels of 215–220 dB re 1 µPa @ 1 m and SSS has been previously measured with a peak source level of 210 dB re 1 µPa @ 1 m.			

Given the details above, the consequence of subsea IMR activities causing a change in ambient underwater sound has been assessed as Minor (5) as it will result in a localised and short-term environmental impact.

Exposure Criteria

Mid-frequency (dolphins, toothed whales, beaked whales, bottlenose whales [e.g., Indo-Pacific Humpback and Spotted Bottlenose dolphins, Killer Whale, Sperm Whale]) and low-frequency (baleen whales [e.g., Blue, Bryde's, Fin, Humpback, Sei, Antarctic Minke whales]) cetaceans have been identified as having the potential to be present within the OA. Exposure criteria for these species is included in Table 6-7.

Exposure criteria for marine turtles is provided in Table 6-8. Behavioural responses have been taken from McCauley et al. (Ref. 188) who reported that exposure to airgun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa , with turtles observed to increase their swimming activity at received sound levels of ~166 dB re 1 µPa .

Noise exposure criteria for fish is provided in Table 6-9.

Table 6-7: Noise exposure criteria (impulsive sounds) for mid-frequency and low-frequency cetaceans

Cetacean Hearing Group	PTS onset thresholds (received level) (Ref. 186)	TTS onset thresholds (received level) (Ref. 186)	Behavioural Response (Ref. 187)
Low--frequency cetaceans	L_{pk}: 219 dB $L_{E,\ 24h}$: 183 dB	L_{pk}: 213 dB $L_{E,\ 24h}$: 168 dB	$L_{pk:}$ 160 dB
Mid-frequency cetaceans	L_{pk}: 230 dB $L_{E,\ 24h}$: 185 dB	L_{pk}: 224 dB $L_{E,\ 24h}$: 170 dB	$L_{pk:}$ 160 dB

Peak sound pressure level (Lp,0-pk) has a reference value of 1 µPa, and weighted cumulative sound exposure level (LE,p) has a reference value of 1µPa2 s. The subscript also describes the accumulation period (being 24 hours).

Table 6-8: Noise exposure criteria (impulsive sounds) for marine turtles

PTS onset thresholds (received level) (Ref. 189)	TTS onset thresholds (received level) (Ref. 189)	Behavioural Response (Ref. 188)
L_{pk}: 232 dB $L_{E,\ 24h}$: 204 dB	L_{pk}: 226 dB $L_{E,\ 24h}$: 189 dB	L_{pk}: 166-175 dB

Table 6-9: Noise exposure criteria (impulsive sounds) for fish

Hearing Group	Non-recoverable injury / potential mortal injury (Ref. 190)	Recoverable Injury (Ref. 190)	TTS onset thresholds (received level) (Ref. 190)
Fish without swim bladders	L_{pk}: 213 dB $L_{E,\ 24h}$: 219 dB	L_{pk}: 213 dB $L_{E,\ 24h}$: 216 dB	$L_{E,\ 24h}$: 186 dB
Fish with swim bladders	L_{pk}: 207 dB $L_{E,\ 24h}$: 207 dB	L_{pk}: 207 dB $L_{E,\ 24h}$: 203 dB	$L_{E,\ 24h}$: 186 dB

Impulsive sound (IMR acoustic surveys)

<u>Marine Mammals</u>

Behavioural disturbance

Modelling undertaken by Zykov (Ref. 191) indicates that sound levels associated with the site survey would exceed the behavioural response noise exposure criteria of 160 dB re 1 µPa (Table 6-7) within 290 m of the Vessel.

Within the OA, both mid-frequency cetaceans (e.g., Spotted Bottlenose Dolphin, Killer and Sperm whales) and low-frequency cetaceans (e.g., Blue, Bryde's, Fin, Humpback and Sei whales) have the potential to be present.

If migrating cetaceans were present, CAPL does not expect that exposure to sound levels from the site survey would result in a significant change to migration behaviours or displace species outside of the BIA given the limited exposure (within 290 m) above the behaviour impact thresholds and broad spatial area associated with intersecting BIAs.

Furthermore, given the nature of any site survey (limited to one-two days) and as marine mammal species are expected to display transient (not sedentary) behaviours within the EMBA, duration of exposure (even to levels above the impact threshold) would be very limited. As such, the only potential impacts expected would be short-term behavioural effects to individuals, which were evaluated as Minor (5).

TTS and PTS

Modelling undertaken by Zykov (Ref. 191) indicates that sound levels associated with the site survey would may exceed the TTS and PTS noise exposure criteria of 168 dB re 1 μPa^2.s and 183 dB re 1 μPa^2.s respectively (Table 6-7) within 20 m of the source. Further to this, Zykov (Ref. 191) indicates that SPL levels of 208 dB re 1 μPa would only occur within 20 m of the source.

On this basis, neither TTS or PTS is not expected to occur given that, to exceed the TTS and PTS threshold levels, marine mammals would need to remain within 20 m of the vessel over a 24-hour period. Further to this, the duration of the activity is limited to one-two days, consequently, TTS and PTS effects associated with the site survey has not been considered further.

Turtles

Behavioural disturbance

Modelling undertaken by Zykov (Ref. 191) indicates that sound levels associated with a site survey over sandy substrate would likely exceed the behavioural response noise exposure criteria of 166 dB re 1 μPa (Table 6-8) within 290 m of the Vessel.

On the basis that only transient individual turtles are expected to be encountered within the OA (refer to continuous assessment) any behavioural response would likely be limited to a small number of individuals. Consequently, given the potential for short-term effects to species, the consequence was ranked as Minor (5).

TTS and PTS

Modelling undertaken by Zykov (Ref. 191) indicates that sound levels associated with a site survey over sandy substrate would likely exceed the TTS and PTS exposure criteria of 189 dB re 1 μPa^2.s and 204 dB re 1 μPa^2.s respectively (Table 6-8) within 20 m of the source. Further to this, SPL is not expected to be above TTS or PTS onset threshold criteria (>226 dB re 1 μPa) given the source level (~215–220 dB re 1 μPa @ 1m) is likely below which these impacts will occur.

On this basis, neither TTS or PTS is not expected to occur given that, to exceed the cumulative TTS and PTS threshold levels, turtles would need to remain within 20 m of the vessel over a 24-hour period. Further to this, the duration of the activity is limited to one-two days, consequently, TTS and PTS effects associated with the site survey has not been considered further.

Fish

Behavioural disturbance

In lieu of specific behavioural noise exposure criteria for fish species, CAPL applied the most conservative noise exposure criteria for Fish being 158 dB re 1 μPa (Table 6-9) to inform the evaluation for this potential impact. Modelling undertaken by Zykov (Ref. 191) indicates that sound levels associated with the site survey would exceed the behavioural response noise exposure criteria within ~290 m of the source.

Behavioural impacts are expected to be limited to an initial startle reaction before behaviours return to normal or result in fish moving away from the area (Ref. 192). Although both Pelagic and Demersal fish species are likely to be present within the affect area, demersal species that may reside around existing subsea infrastructure are likely to be most affected by this activity. However, as site surveys covered under this EP are limited to one-two days, and as the survey is conducted across the entire field, any species that move away from the area are likely to return once sound levels return to normal.

As such, any potential impacts are expected to be limited, with short-term effects to species, and were ranked as Minor (5).

TTS, recoverable injuries and non-recoverable injuries

Modelling undertaken by Zykov (Ref. 191) indicates that any exceedance of the TSS, recoverable injury and non-recoverable injury exposure criteria of 186 dB re 1 μPa^2.s (for fish with and without swim bladders), 203 dB re 1 μPa^2.s and 207 dB re 1 μPa^2.s (both for fish with swim bladders) (Table 6-9) would be limited to within 20 m of the source.

For TTS and more severe impacts to occur, fish species would need to be exposed to sound levels within close proximity (<20 m) of the source over a 24-hour period. Given common behavioural responses in fish such as c-startle reaction and avoidance, any exposure to SPL or SEL levels are not expected to occur as individuals would be expected to avoid the area prior to exceeding noise exposure criteria. Given the nature of the activity and as behavioural responses are likely to prevent exceedance of criteria, TTS and more severe impacts to fish are not considered further.

ALARP decision context justification		
Offshore acoustic surveys are commonplace and well-practised nationally and internationally. The application of control measures to manage impacts and risks arising from this aspect are well defined, understood by the industry, and are considered standard industry practice. During stakeholder consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity. Although some species that are known to be sensitive to underwater sound have the potential to be exposed to underwater noise above exposure criteria during these activities, the impacts and risks arising from underwater sound emissions are considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect. Notwithstanding this, CAPL has considered additional mitigation measures that could potentially lower the risk to Pygmy Blue Whales associated with underwater sound emissions arising from the activities covered in this EP.		
Good practice control measures and source		
Control measure	**Source**	
EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans	The requirements to manage interactions between vessels and cetaceans are detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans. These regulations describe strategies to ensure whales are not harmed during offshore interactions with people. By implementing these control measures and managing interactions with cetaceans near the vessels or any site surveys, the potential impacts from underwater sound are limited.	
Biodiversity Conservation Regulations 2018	The requirements to manage interactions with marine fauna (including cetaceans, Whale Sharks, and Dugongs) and relevant separation distances are detailed in the WA Biodiversity Conservation Regulations 2018. By implementing these control measures and managing interactions with marine fauna near the vessels or any site surveys, the potential impacts from underwater sound are limited.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
Limiting the duration and frequency of IMR activities during peak sensitive periods of the year for Pygmy Blue Whales	The migration periods for the Pygmy Blue Whale are April to August (northbound) and November to late-December (southbound). However, as described in the consequence evaluation the estimated distances for TTS hearing impairment[30] is ~20 m from the sound source. This distance is well within the no-approach zones required under EPBC regulations, and as such no injury to Pygmy Blue Whales is predicted to occur from underwater sound generated by subsea IMR activities. As such limiting IMR activities to a 5-month period each year, outside of Pygmy Blue Whale migration period, is not considered to provide any additional environmental benefit.	N/A

[30] Recent Commonwealth guidance has defined "injury to Blue Whales" as both PTS and TTS hearing impairment, as well as any other form of physical harm arising from anthropogenic sources of underwater noise (Ref. 308)

Use of marine fauna observations during night-time or poor visibility for vessel-based activities	Use of marine fauna observers (MFOs) may be used to assist in detecting the presence of individuals or groups of cetaceans during daylight hours under good visibility conditions only. Use of acoustic monitoring (e.g., passive acoustic monitoring [PAM]) is most effective for detecting odontocetes (toothed cetaceans, e.g., orcas, dolphins, Sperm Whales) that produce clicks and whistles that can be more readily differentiated from low frequency vessel noise, than low frequency calls by baleen whales (e.g., Humpback, Pygmy Blue, Fin, Sei, Bryde's Whales). As such PAM is not considered to be appropriate for use in detecting baleen whales such as Pygmy Blue Whales.	The significant additional cost of using MFOs or PAM operators on board for the duration of an IMR vessel activity when there may be few or no detections of the targeted low-frequency whale species (i.e., Pygmy Blue Whale) during night-time or poor visibility conditions is considered grossly disproportionate to any limited environmental benefit. Therefore, control measure has not been adopted for use.
Limiting the duration and frequency of IMR activities during peak sensitive periods of the year for Whale Sharks	The OA intersects with a foraging BIA for Whale Sharks. This foraging BIA is associated with a northward migration from the Ningaloo Reef seasonal aggregation area along the 200 m isobath during July to November (Ref. 95). As described in the consequence evaluation the estimated distances for TTS, recoverable injuries, or non-recoverable injuries is ~20 m from the sound source. This distance is within the no-approach zones required under Biodiversity Conservation Regulations 2018, and as such no auditory impairment or injury to Whale Sharks is predicted to occur from underwater sound generated by subsea IMR activities.	N/A
Likelihood and risk level summary		
Likelihood	Baleen whales may exhibit behavioural avoidance when sound levels are at or above 160 dB re 1 µPa (Ref. 187). Baleen whales display a gradation of behavioural responses to pulsed sound, suggesting that acoustic discharges are audible to whales at considerable distances from the source. As described above, other species such as turtles and fish are expected to initially practice avoidance behaviours in response to sound emissions, and thus the likelihood of underwater sound from these activities resulting in longer-term impact is very unlikely (Ref. 192; Ref. 194). Although localised and temporary behaviour disturbance may occur, it is unlikely that this would result in any impact to a sensitive life stage of the fauna identified. Consequently CAPL consider the likelihood of the consequence occurring as being Rare (6).	
Risk level	Very ow (10)	
Acceptability summary		
Principles of ESD	The impacts and risks associated with this aspect are limited to localised, short-term behavioural changes. On the assumption that this potential impact occurs during a sensitive life stage, CAPL would not expect these	

	activities to affect migration, or foraging behaviours, nor impact on individuals or the wider population. As such, this aspect is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered applicable for this aspect include: • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans • Biodiversity Conservation Regulations 2018 • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • *Recovery Plan for Marine Turtles in Australia* (Ref. 93).
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.
External context	During stakeholder consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, given that underwater sound is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. The *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) specifies the following relevant action: • anthropogenic noise in BIAs will be managed such that any Blue Whale continues to utilise the area without injury, and is not displaced from a foraging area. No other specific relevant actions were identified within other documents implemented under the EPBC Act. The OA does not intersect with a foraging BIA for the Pygmy Blue Whale (Table 4-2). The nearest foraging BIA occurs ~105 km southwest of the OA, offshore from North West Cape; and as such is not exposed to underwater sound emissions resulting from activities under this EP. Therefore, CAPL has defined an acceptable level of impact as no injury to marine fauna.

Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No injury or mortality to marine fauna within the OA from petroleum activities	**EPBC Regulations 2000 and Biodiversity Conservation Regulations 2018** Vessels will implement caution and no approach zones, where practicable: • caution zone (300 m either side of whales and 150 m either side of dolphins)– vessels must operate at ≤6 knots within this zone, maximum of three vessels within zone, and vessels should not enter if a calf is present	Induction materials include relevant marine fauna caution and no approach zone requirements
		Training records confirm offshore personnel involved in IMR activities have completed the induction
		Vessel records show if marine fauna interaction occurred within caution or approach zones, and what mitigation (e.g., divert or slow vessel) measure was implemented

	• no approach zone (300 m to the front and rear of whales and 100 m either side; 300 m for whale calves; 150 m to front and rear of dolphins and 100 m either side; 100 m from dugongs; 30 m from whale sharks)–vessels should not enter this zone, and should not wait in front of the direction of travel or an animal or pod, or follow directly behind.	

6.3.1.4 Planned discharges—Subsea operations

Source			
Activities identified as having the potential to result in planned subsea operational discharges are: • subsea IMR operations within the OA. The types of planned subsea operational discharges include small volumes of control fluids, hydraulic fluids, MEG, acid-water mix, preservation fluids, chemical dye, scale inhibitor, production fluids, and chemically treated potable water.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Planned IMR discharges may result in: • localised and temporary reduction in water quality.	6	A change in ambient water quality may result in: • indirect impacts to fauna arising from chemical toxicity.	6
Consequence evaluation			
Localised and temporary reduction in water quality The release of minor quantities of MEG, production fluids, acid-water mix, and control fluids during IMR activities may result in a localised and temporary reduction in water quality around the discharge point. Discharge of small volumes of these fluids are predicted to disperse and dilute rapidly while floating rapidly towards the surface. The spatial extent is likely to be limited to the water column, and only in a range of metres from the discharge point. IMR discharges along the trunkline, where no maintenance activities are planned, are expected to be limited to typical minor hydraulic releases from ROVs during routine inspections and potentially minor discharges of acid-water mix, if required to remove calcareous marine growth from the single SSIV located ~100 m downstream of the platform prior to pigging. A typical acid–water mix discharge may comprise 20 L, however, a 200 L discharge (representing a more conservative estimate), would be expected to quickly dilute and neutralise as it reacts with the calcareous material being removed from the subsea infrastructure. Maintenance activities are planned only for subsea infrastructure upstream of the platform. Depending on the location along the hydrocarbon system that the IMR activity occurs, environmental values and sensitivities that may be present in the vicinity of water quality changes include fish communities (ancient coastline and continental slope) and ridgeline habitats. Any discharges during IMR activities are expected to result in limited environmental impacts. As subsea discharges are highly influenced by natural dispersion and dilution processes, the extent of exposure is most influenced by the volume of the release. Consequently, the planned discharges are expected to result in a limited environmental impact, and the consequence level was determined as Incidental (6).			
Potential chemical toxicity As described above, these discharges are expected to result in temporary reductions in water quality within the immediate surroundings of the release location. The extent of this water quality reduction is limited to around the subsea infrastructure. The particular values and sensitivities within the OA identified as having the potential to be exposed to these discharges are: • ancient coastline at 125 m depth contour (KEF)			

- continental slope demersal fish communities (KEF)
- commercial fisheries.

Although these KEFs have been identified as having the potential to be exposed, as described in Section 4.3.5, surveys indicate that the seabed in the OA around the subsea infrastructure such as flowlines and drill centres, mostly comprises unvegetated, soft, and unconsolidated sediments with a low but varying degree of benthic invertebrate habitation. Given that biologically important habitats tend to be found in areas of rocky escarpment rather than soft sediments (Ref. 27), exposure to habitats comprising high levels of diversity are not expected. The *North-West Marine Bioregional Plan* (Ref. 27) does not identify toxicity or chemical pollution/contaminants as a key threat to the continental slope demersal fish communities KEF.

Given the rapid dilution and dispersion conditions, low bioaccumulation potential and the high biodegradability of the control fluids, and intermittent frequency of discharges, bioaccumulation in the receiving environment and sublethal impacts are expected to be limited. Consequently, the release of subsea discharges are expected to result in a limited environmental impact, and the consequence level was determined as Incidental (6).

ALARP decision context justification

Subsea discharges associated with IMR activities are commonplace and well-practiced within the industry. The control measures to manage the risk associated with these planned discharges are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL

During stakeholder consultation, no objections or claims were raised regarding planned discharges from subsea IMR activities arising from the activity.

The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures and source

Control measure	Source
Hazardous materials selection process	As part of the hazardous materials selection process, hazardous materials that will be discharged to the environment will undergo a detailed environmental assessment, as per CAPL's *Hazardous Materials Management Procedure* (Ref. 54)
Activity-specific HIRA	The HIRA will include HSE Specialist participation to identify and assess potential environmental impacts and risks associated with the specific maintenance or repair campaign proposed. The HIRA will consider relevant information, which may include: • proximity to potentially sensitive environmental receptors • other known activities and/or impacts that have occurred at that location • material minimisation • alternative materials • alternative execution methodologies • learnings from previous comparable IMR activities/campaigns. Where the HIRA identifies that risks and impacts are potentially greater than those assessed in this EP, the management of change process will be triggered (Section 8.3.2.2).
IMR work procedures	Activity specific work procedures are developed and address HIRA findings, including any additional controls identified for implementation.

Additional control measures and cost benefit analysis

Control measure	Benefit	Cost
N/A	N/A	N/A

Likelihood and risk level summary

Likelihood	Given the nature and scale of this activity, and with standard control measures in place, it is considered Rare (6) that this discharge would

	result in any impact to the ecological function of the particular values and sensitivities present within the OA.
Risk level	Very low (10).
Determination of acceptability	
Principles of ESD	The potential impacts and risks associated with this aspect is limited to a short-term direct reduction in water quality in a localised area, which is not considered as having the potential to affect biological diversity and ecological integrity. Accordingly, the consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	No environmental legislation or other requirements were deemed relevant for this aspect.
Internal context	This CAPL environmental performance standard / procedure was deemed relevant for this aspect: • *Hazardous Materials Management Procedure* (Ref. 54).
External context	During stakeholder consultation, no objections or claims were raised regarding discharges arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.

Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No impacts to marine habitats or marine fauna outside of the OA from subsea discharges during petroleum activities	**Hazardous materials selection process** Subsea fluids planned for discharge are subject to the hazardous materials selection process as per the CAPL *Hazardous Materials Management Procedure*	Hazardous materials selection process assessment records (or similar)
	IMR work procedures IMR activity specific work procedures developed and implemented	Records show that activity specific work procedures are developed for each IMR activity and address HIRA findings, including any additional controls identified for implementation
	Activity-specific HIRA Activity-specific HIRA undertaken prior to maintenance or repair activity commencing	Records show that activity-specific HIRA undertaken prior to maintenance or repair activity commencing

6.3.1.5 Unplanned release—Loss of containment

Source
Activities identified as having the potential to result in a minor loss of containment (LOC) event: • subsea IMR operations within the OA. Based on the activities described in this EP, the following potential minor LOC scenarios were identified:

- mechanical failure/damage of ROV/AUV resulting in a loss of hydraulic fluid[1].

[1] Offshore single point failure of the ROV hydraulic systems could result in hydraulic fluid release to the marine environment, ~<1 m^3.

Potential Impacts and Risks

Impacts	C	Risks	C
N/A	-	Unplanned release of hazardous material to the environment may result in: • indirect impacts to fauna arising from chemical toxicity	6

Consequence Evaluation

As the potential release volumes are small (~1 m^3), the extent of water quality changes is only likely to be a few metres in the water column around the release, prior to dispersion and dilution. The potential spills from an ROV performing IMR activities would have negligible changes to water quality, with the no identified potential consequences to environmental values.

Depending on the location of the IMR activities along the hydrocarbon system, the environmental values in the vicinity can include fish communities. Interaction of fish immediately after the fluid release has the worst-case potential of acute effects on individuals.

Because a release would disperse and dilute rapidly, the potential consequence is limited to a short time after the release. The potential consequences to marine fauna from of a change of water quality from an ROV release could be limited. No adverse effects to fish communities are predicted. Therefore, the consequence was ranked as Incidental (6).

ALARP Decision Context Justification

Offshore operations including IMR and vessel operations are commonplace and well-practiced industry activities. The control measures to manage the risk associated with LOC scenarios from these activities are well defined via legislative requirements that are considered standard industry practice. There is a good understanding of potential spill sources, and the control measures required to managed these are well understood and implemented by the petroleum industry and CAPL.

During stakeholder consultation, no objections or claims were raised regarding unplanned discharges from subsea IMR activities arising from the activity.

The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures and source

Control measure	Source
None identified	No controls have been applied for these impacts and risks as subsea IMR minor LOC management is a lower-order impact and risk; no industry standard controls are required for offshore minor LOC events where minimal impacts and risks are present.

Additional control measures and cost benefit analysis

Control measure	Benefit	Cost
N/A	N/A	N/A

Likelihood and risk level summary

Likelihood	The likelihood that a minor LOC event results in an Incidental (6) consequence was determined to be Remote (5). With the control measures in place, it was considered unlikely that a minor LOC event associated with this activity would occur, and even more unlikely that such an event would impact any of the identified values and sensitivities.
Risk level	Very low (10).

Determination of acceptability		
Principles of ESD	The risks associated with this aspect are expected to have a limited environmental impact, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No environmental legislation or other requirements were deemed relevant for this aspect.	
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.	
External context	During stakeholder consultation, no objections or claims were raised regarding minor LOC management arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
N/A	N/A	N/A

6.3.2 Onshore IMR

6.3.2.1 Physical presence—Terrestrial fauna

Source			
Activities identified as having the potential to result in an interaction with terrestrial fauna are: • excavations left open overnight.			
Potential Impacts and Risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Unplanned interactions with terrestrial fauna may result in: • injury or death of terrestrial fauna.	6
Consequence Evaluation			
Although no significant habitat for terrestrial fauna is known to occur within the OA, mobile fauna have the potential to be encountered. Excavation associated with the petroleum activity relates to onshore IMR and is expected to be infrequent. However, if excavation is undertaken and left open overnight, there is a potential for fauna to be attracted for shelter and fauna entrapment, injury, or increased predation resulting in mortality could occur (Ref. 102; Ref. 103). Any fauna trapping within an open trench is expected to impact at individual and not population levels. Based upon the nature of the activities covered under this EP, any fauna incidents (if any) are expected to be low in numbers. As such, the consequence has been ranked as Incidental (6).			
ALARP Decision Context Justification			
The pathways for interacting with fauna are well understood. Management measures for these hazards are also well understood and implemented by the industry. During stakeholder consultation, no objections or claims were raised regarding terrestrial fauna impacts arising from the activities.			

The risks associated with physical interaction with terrestrial fauna are considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures and source		
Control measure	**Source**	
Fauna management	The implementation of fauna exclusion and egress management measures where fauna traps are present are considered good practice to reduce likelihood of entrapment, whilst providing means of egress if the initial exclusionary barriers fail. Specifically, CAPL will consider egress controls and physical barriers will be implemented, where required, in excavations left open overnight. Any fauna found, will be removed by a trained fauna handler.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Given the amount of vehicle and excavation activity planned within the onshore ROW, and with the control measures in place, the likelihood of the activities causing a fauna death or injury is Remote (5).	
Risk level	Very low (10).	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect is limited to individuals and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No environmental legislation or other requirements were deemed relevant for this aspect.	
Internal context	CAPLs environmental performance standards / procedures considered relevant to this aspect include: • *Wheatstone Operations – Downstream Green Guide Environmental Manual* (Ref. 105).	
External context	During stakeholder consultation, no objections or claims were raised regarding this aspect.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No injury or mortality to terrestrial fauna within the OA from petroleum activities	**Fauna management** Fauna exclusion measures will be considered for any excavations deeper than 500 mm that is planned to be open for greater than 12 hours. Suitable exclusion measures may include fauna fencing, lids, or covers. Where	Records confirm fauna exclusion or fauna egress measures have been considered and approved by CAPL for activities requiring excavation deeper than 500 mm that is planned to be open for greater than 12 hours.

	complete exclusion is not practicable for such excavations, fauna exit ramps, scramble nets, or other egress measures will be considered.	
	Fauna management Fauna handling of injured fauna, where required, is undertaken by a trained fauna handler.	CAPL Wildlife Database records confirm fauna interactions were conducted by trained fauna handlers.

6.3.2.2 Ground disturbance

Source			
Activities identified as having the potential to result in ground disturbance are: • temporary excavation of onshore pipeline during inspection or repairs.			
Potential Impacts and Risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Ground disturbance[31] may result in: • inadequate reinstatement.	6
Consequence Evaluation			
Bell-hole access may be required infrequently (e.g., every ~5 years) during onshore IMR, or during unplanned pipeline repair activities (Section 3.4.2). If ground disturbance did occur, it would occur within the short ~1 km length of trunkline between the end of the microtunnel and the onshore end point (Figure 2-2). The ground above and adjacent to the pipeline in this part of PL 99 has already been disturbed through previous construction activities, remains cleared, and is within the Ashburton North Strategic Industrial Area (ANSIA) and the disturbance footprint approved under MS 873. No significant habitat is known to occur within the OA. The risk of inadequate site reinstatement for this location is minimal as there is no social impact (i.e., no other land users functions, interests, or activities would be affected), and no ecological impact given the previous and ongoing disturbance due to its location within the ANSIA. As such, CAPL has ranked the consequence as Incidental (6).			
ALARP Decision Context Justification			
The pathways for ground disturbance are well understood. Management measures for these hazards are also well understood and implemented by the industry. During stakeholder consultation, no objections or claims were raised regarding ground disturbance impacts arising from the activities. The risks associated with ground disturbance are considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.			

Good practice control measures and source	
Control measure	**Source**
Top-cover management	Any excavated soil material will be appropriately stockpiled within a previously disturbed area to enable it to be reinstated following the relevant IMR activity.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

[31] Given the approximate depth of bell-holes (~0.5 m; Section 3.4.2), and that the presence of PASS is considered to occur at or below the water table (Section 4.3.6), there is no credible risk associated with acid sulphate soils from ground disturbance, and as such this has not been evaluated.

Likelihood and risk level summary		
Likelihood	Given the limited amount of excavation activity planned within the onshore ROW, and with the control measures in place, the likelihood of the activities resulting in inadequate reinstatement is Rare (6).	
Risk level	Very low (10).	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect is limited to individuals and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No environmental legislation or other requirements were deemed relevant for this aspect.	
Internal context	CAPLs environmental performance standards / procedures considered relevant to this aspect include: • *Wheatstone Operations – Downstream Green Guide Environmental Manual* (Ref. 105).	
External context	During stakeholder consultation, no objections or claims were raised regarding this aspect.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No ground disturbance beyond the OA from petroleum activities	**Top-cover management** If any excavation works are required: • soil material will be appropriately stockpiled within a previously disturbed area • soil material will be reinstated following the completion of the IMR activity	Records show excavated soil material was stored within a previously disturbed area, and reinstated following IMR activities

6.3.2.3 Greenhouse gas emissions

The following activities have been identified as direct emission sources for planned onshore IMR activities under this EP:

- fuel combustion by equipment during planned onshore IMR activities within the OA.

While CAPL acknowledges that emissions may occur from the onshore IMR activities, these are considered to represent a negligible proportion of total emissions for the entire Wheatstone Project. As such, these onshore IMR emissions estimates have been incorporated into the field support direct GHG emissions inventory (Section 6.4.5.1) and subsequent risk assessment (Section 6.4.5.3) and have not been repeated here.

6.3.2.4 Dust emissions

Onshore IMR activities may include the environmental aspect of dust, as personnel and vehicle movements are required along the onshore pipeline section. The short (~1 km) onshore pipeline section lays in between berms, is backfilled with soil, and vegetation is absent or kept sparse to enable inspections. The pipeline embankment slopes are protected by rock.

The exposed onshore area is short and narrow. Vegetation near the pipeline is common in the wider region and is not unique or particularly sensitive to windblown dust. Dust levels are not expected to be above natural levels in the area. Rainfall during the wet season removes dust on leaf and stem surfaces. A long-term monitoring program that investigated impacts of dust on vegetation for a significant development in the Pilbara over a 5-year period, where significantly higher volumes of vehicles (heavy and light) and earthworks were present, determined that no adverse impacts occurred to plant health or vegetation communities as a result of construction dust loads (Ref. 196).

No change or effect on vegetation health beyond natural variation is expected from dust and therefore dust is not a credible hazard to the environment.

6.3.2.5 Light emissions

Onshore IMR activities may include the environmental aspect of artificial lighting. IMR night works are not planned; however, in exceptional circumstances night works may be required for short durations (e.g., depending on the severity and risk of the repair requirement; Section 3.4.2.2), with the use of temporary lighting limited to only that necessary to illuminate safe work areas. As described in Section 3.4.2.2 onshore IMR activities are restricted to the ~1 km of trunkline between the end of the microtunnel and the onshore end point. In the unlikely event that IMR lighting is required, the lights would be limited to this small length of the trunkline, generate minimal sky glow, and only be used for short periods. Sky glow brightness decreases steeply with distance from the light source via an inversely proportional relationship:

$$intensity \propto \frac{1}{distance^{2.5}}$$

The nearest turtle nesting beach is several kilometres from the area, and foredunes are expected to further obscure any light glow generated by lighting used within the PL 99 ROW. In addition, any light sources from IMR activities will be negligible in relation to lighting associated with neighbouring onshore facilities. Given the location and negligible exposure of artificial light, there are no credible hazards to fauna.

6.3.2.6 Fire

Due to the nature and scope of onshore IMR activities occurring within the ~1 km length of trunkline between the end of the microtunnel and the onshore end point, and that these activities occur within cleared areas, a fire event resulting from these activities was not deemed credible.

In the event of fire emergency unrelated to the petroleum activities under this EP, the management of such events within the pipeline licence is managed at a project-level via the *Wheatstone Downstream Emergency Response Plan* (Ref. 81).

6.3.2.7 Non-indigenous species

Source			
Activities identified as having the potential to result in the introduction of a non-indigenous species (NIS) are: • presence of NIS on vehicles (or other plant/equipment) undertaking IMR activities within the OA.			
Potential Impacts and Risks			
Impacts	**C**	**Risks**	**C**
N/A	-	An introduction or spreading of a NIS may result in: • displacement of, or compete with, native species, ecosystems or communities.	5
Consequence Evaluation			
If a NIS is translocated to the OA and subsequently become established, they may out-compete native plants, leading to loss of native flora species, changes in the structure and composition of vegetation communities, and changes in flora diversity. Once established and if not controlled, further proliferation of weeds can occur, which can be difficult to eradicate. However, the licence area (as illustrated in Figure 2-2) is primarily exposed soil with minimal vegetation. As such, the environmental impact of introducing a NIS, is expected to be minimal. Therefore, the potential consequence of the introduction of a NIS resulting in damage to local onshore habitats and terrestrial vegetation is ranked as minor (5).			
ALARP Decision Context Justification			
The pathways for the introduction and spread of NIS are well understood, with ground disturbing activities common for onshore oil and gas activities in WA. Management measures for these hazards are also well understood and implemented by the industry. During stakeholder consultation, no objections or claims were raised regarding spills arising from the activities. The risks associated with the introduction of new weeds are considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.			

Good practice control measures and source	
Control measure	**Source**
Weed hygiene inspections	Vehicles comply with weed hygiene requirements for vehicle movement detailed in *Wheatstone Operations – Downstream Green Guide Environmental Manual* (Ref. 105), specifically the vehicles and plant working off existing cleared areas and roads are weed-free and have a weed inspection certificate prior to arriving onsite. Inspecting vehicles and machinery for weeds is a standard practice for weed prevention. Inspection and monitoring of the licence area for new or declared weed species will enable early detection and removal. This will occur every two years (in accordance with Condition 16-1(iii) of MS 873).

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	Given the size of the onshore area and that most of the site will be covered by hardstand (roads), there is a limited area of exposed soil with the potential to become colonised by weeds. With the administrative controls in place, the likelihood of introducing weeds resulting in damage to habitats is ranked as rare (6).

Risk level	Very low (10).	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect is limited environmental affects and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No environmental legislation or other requirements were deemed relevant for this aspect.	
Internal context	CAPLs environmental performance standards / procedures considered relevant to this aspect include: • *Wheatstone Operations –Downstream Green Guide Environmental Manual* (Ref. 105).	
External context	During stakeholder consultation, no objections or claims were raised regarding NISs arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No introduction and establishment of non-indigenous species within the OA due to petroleum activities	**Weed hygiene inspections** Vehicles comply with weed hygiene requirements for vehicle movement detailed in *Wheatstone Operations – Downstream Green Guide Environmental Manual*, specifically that vehicles and& plant working off existing cleared areas and roads are to be weed free and have a weed inspection certificate prior to arriving onsite	Completed weed hygiene checklists
	Weed hygiene inspections Biennial monitoring and removal of declared or new weed species in the licence area	Records show inspection and removal of declared or new weed species in the licence area

6.3.2.8 Unplanned release—Loss of containment

Source
Activities identified as having the potential to result in a minor loss of containment (LOC) event: • IMR operations within the OA. Based on the activities described in this EP, the following potential minor LOC scenarios were identified: • mechanical failure/damage of hazardous materials storage resulting in a loss of diesel or other fluid[1]. [1] *Onshore LOC could result in diesel or chemicals being released to the onshore environment, ~<1 m³ based on the predicted volumes used for IMR activities.*

Potential Impacts and Risks

Impacts	C	Risks	C
N/A	-	Unplanned release of hazardous material to the onshore environment may result in: • soil and groundwater contamination	6

Consequence Evaluation

A minor LOC of diesel (or other fluids) onshore resulting in a <1 m^3 is the largest spill scenarios associated with onshore IMR activities.

Given the onshore section of trunkline is covered by soil, the spatial extent of an onshore release would be limited to a relatively confined area around the trunkline, with most of the fluids likely to soak into the surrounding soil. Based upon Grimaz et al. (Ref. 80) it is anticipated that a release of 1 m^3 could result in up to ~<0.5 m penetration depth into the soil profile. As such, no exposure to groundwater is expected to occur from minor LOC events.

No specific values or sensitivities (e.g., TECs) are present within the onshore OA.

Given the limited spatial exposure, buried trunkline, and the previously disturbed nature of the receiving environment, any potential impact from an onshore minor LOC event are expected to the limited. As such, the consequence level was determined as Incidental (6).

ALARP Decision Context Justification

Onshore IMR operations are commonplace nationally and internationally. The source of spills arising from these activities is well understood, and control measures to manage the risk well defined via measures that are considered standard industry practice.

During stakeholder consultation, no objections or claims were raised regarding minor LOC management arising from the activity.

The risks associated with an accidental release arising from IMR activities are considered lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures and source

Control measure	Source
Secondary containment	All hazardous material liquids (including chemicals and regardless of volume) shall be stored in secondary containment and as per SDS, in accordance with the *Wheatstone Operations – Downstream Green Guide Environmental Manual* (Ref. 105).
Spill kits and drip trays	Hazardous material transfer activities (e.g., chemical and hydrocarbon transfer) require the use of spill trays and absorbent mats to prevent the spill of hazardous material, in accordance with the *Wheatstone Operations – Downstream Green Guide Environmental Manual* (Ref. 105). Spill kits will be provided to allow personnel to respond to minor leaks and spills and reduce the risk of spills/leaks reaching the environment. Drip trays are available to capture drips and leaks, where safe to do so.

Additional control measures and cost benefit analysis

Control measure	Benefit	Cost
N/A	N/A	N/A

Likelihood and risk level summary

Likelihood	IMR activities are expected to be infrequent, with small volumes of diesel or other fluids potentially being released. With the controls in place, the likelihood of spills impacting soil and groundwater is ranked as Unlikely (4).
Risk level	Very low (9).

Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect is limited to temporary environmental affects and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No environmental legislation or other requirements were deemed relevant for this aspect.	
Internal context	CAPLs environmental performance standards / procedures considered relevant to this aspect include: • *Wheatstone Operations – Downstream Green Guide Environmental Manual* (Ref. 105).	
External context	During stakeholder consultation, no objections or claims were raised regarding LOC management arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No unplanned release of hydrocarbons / hazardous materials to the environment during petroleum activities	**Secondary containment** All hazardous material liquids shall be stored in secondary containment	Records show that all hazardous material liquids were stored in secondary containment
	Spill kits and drip trays Hazardous material transfer activities require the use of spill trays and absorbent mats	Records show that spill kits and/or absorbent mats were used for any hazardous material transfers
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	**Spill kits and drip trays** Spill kits and drip trays are available for use (where hazardous materials/dangerous goods are temporarily stored and/or handled within the ROW during onshore IMR).	Records show spill kits and drip trays are available for use (where hazardous materials/dangerous goods are temporarily stored and/or handled within the ROW during onshore IMR).

6.4 Field Support

6.4.1 Physical presence—Other marine users

Source			
Activities identified as having the potential to result in an interaction with other marine users are: • temporary presence of vessels within the OA during IMR activities.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Unplanned interactions with other marine uses may result in: • disruption to commercial shipping and fishing vessels.	6
Consequence evaluation			
The use of support vessels during IMR activities has the potential to result in a disruption to other marine users, including commercial shipping or fishing vessels. As identified in Section 4.4.1, one Commonwealth managed commercial fishery (North West Slope Trawl Fishery) has a management area that overlaps with the OA. The extent to which the OA overlaps this trawl fishery management area is <1%. Fishing activity within the Commonwealth trawl fisheries is restricted to waters >200 m water depth. The entire fishery has a small number of active permits and vessels (e.g., seven permits and four vessels were active during the 2018-2019 season [Ref. 1]). As identified in Section 4.4.1, several State managed commercial fisheries (Mackerel, Onslow Prawn. Pilbara Crab, Pilbara Line, Pilbara Trap, Marine Aquarium, and Specimen Shell) have management areas and recent fishing activity that overlaps with the OA. However, fishing activity is relatively low with small numbers of vessels in operation (Figure 4-18 to Figure 4-24). The OA is also located outside major shipping lanes and commercial marine traffic density within the OA is low (Figure 4-26) indicating that the IMR activity is not expected to affect major shipping channels or commercial shipping operators. In summary, the physical presence of support vessels undertaking activities within the OA is not expected to cause significant impacts to commercial fishing and shipping vessels, and the consequences are considered limited in nature. Therefore, the potential disturbance/disruption impacts to other marine users from the physical presence of the platform is ranked as Incidental 6).			
ALARP decision context justification			
Offshore commercial vessel operations are commonplace and well-practised nationally and internationally. The control measures to manage the risks associated with unplanned interactions with other marine users are well defined and understood by the industry. During stakeholder consultation, no objections or claims were raised regarding disturbance/disruption to other marine users arising from the petroleum activity. The risks arising from the physical presence of vessels are considered lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.			

Good practice control measures and source	
Control measure	**Source**
Stakeholder engagement	Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information. Communicating the activity details, location, and presence of vessels to other marine users ensures they are informed and aware, thereby reducing the risk of unplanned interactions. For planned IMR activities this notification will occur via the regular project updates provided by CAPL to WAFIC for dissemination to commercial fisheries (Table 2-8). For a major repair resulting from an unplanned event, a specific notification will be released detailing the location and duration of any works required (Table 2-8).

Maritime safety information	Maritime safety information, such as AUSCOAST navigational warnings, are issued by the Joint Rescue Coordination Centre (JRCC) Australia, part of AMSA. Under the *Navigation Act 2012*, the AHO is also responsible for maintaining and disseminating navigational charts and publications, including providing safety-critical information to mariners (including any change to prohibited/restricted areas, obstructions to surface navigation, etc.) via the Notice to Mariners system. Notice to Mariners can be permanent or temporary notifications. Where required for an IMR activities, AUSCOAST and/or Notice to Mariners will be issued; thus enabling other marine users to also safely plan their activities.	
Marine Safety Reliability and Efficiency (MSRE) process	CAPL's *ABU MSRE Corporate OE Process* (Ref. 52) ensures that various legislative requirements are met. These include: • crew meet the minimum standards for safely operating a vessel, including watchkeeping requirements • navigation, radar equipment, and lighting meets industry standards. These requirements will ensure that direct vessel radio contact is available to other marine users operating in this area to enable ease of communication in highlighting risks and nearby exclusion zones.	
Managing Safe Work (MSW) process	CAPL's *Managing Safe Work OE Process* (Ref. 51) ensures that workplace safety and health hazards are assessed and managed. The permit to work (PTW) system is part of this process and includes simultaneous operations (SIMOPS) and hazard analysis. Where required under the MSW process, a SIMOPS Plan will be developed to identify and manage hazards arising from IMR activities requiring multiple vessels within the same area.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Due to the nature and scale of vessel activities within the scope of this EP, the slow-moving nature of vessels within the OA, the likelihood of interaction with other marine users or a vessel collision with marine fauna is considered low. Based upon previous experience, in the OA, CAPL consider that the likelihood of the consequence occurring is Remote (5).	
Risk level	Very low (10)	
Determination of acceptability		
Principles of ESD	The risks associated with this aspect are associated with unplanned interactions causing individual fauna death / incidental disruption to other marine users, which is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • Commonwealth *Navigation Act 2012*.	
Internal context	These CAPL environmental performance standards / procedures were deemed relevant for this aspect: • MSRE process (Ref. 52)	

External context	During stakeholder consultation, no objections or claims were raised regarding interaction with other marine users arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No impacts to other marine users outside of the OA from petroleum activities	**Stakeholder engagement** Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information via biannual project updates for planned activities, or specific notification regarding major repair works	Stakeholder consultation records
	Maritime safety information Where required, Notice to Mariners and/or AUSCOAST warnings are issued prior to commencing offshore IMR work	Record of lodgement of notification to relevant agency
	MSRE process Vessels will meet the crew competency, navigation equipment, and radar requirements of the MSRE process	Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the MSRE process
	MSW process Where required, CAPL will develop and implement SIMOPS Plan(s) to manage IMR activities	Records indicate that MSW process has been applied, and where identified as relevant, a SIMOPS Plan has been developed and implemented

6.4.2 Physical presence—Marine fauna

Source			
Activities identified as having the potential to result in an interaction with marine fauna are: • temporary presence of vessels within the OA during IMR activities.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Unplanned interactions with marine fauna may result in: • injury or death of marine fauna.	6
Consequence evaluation			
Surface-dwelling fauna are the species most at risk from this aspect and thus are the focus of this evaluation. As identified in Section 4.3, several marine species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. Several BIAs also overlap with the OA, including: • Pygmy Blue Whale (migration, distribution) • Humpback Whale (migration)			

- Whale Shark (foraging)
- Flatback Turtle (internesting, nesting)
- Hawksbill Turtle (internesting).

The *Recovery Plan for Marine Turtles in Australia* (Ref. 92) identifies vessel disturbance as a key threat; however, it also notes that this is particularly an issue in shallow coastal foraging habitats. Given vessel activity in shallow water is limited to intermittent inspection activities and unplanned repair activities, vessel disturbance to turtles is not evaluated further, and the focus of this evaluation is on cetaceans and sharks, as they provide a representative case to enable an indicative consequence evaluation to be undertaken.

A review of the documents made or implemented under the EPBC Act for all shark and cetacean species likely to be present within the OA (i.e., Whale Sharks [Ref. 95], Fin Whale [Ref. 96], Sei Whale [Ref. 97], Blue Whale [Ref. 98] and Southern Right Whale [Ref. 195]) indicates that either vessel disturbance or interaction (such as collisions) as a key threat to the recovery of the species.

For all cetacean species likely to be present within the OA, these documents indicate that management actions are limited to reporting of incidents via the national database (refer to the identified control measures) and ensuring that the risk of vessel strike is assessed (see the following text below).

Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels and facilities. The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when near a vessel, while others are curious and often approach vessels that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster-moving vessels (Ref. 197).

The *Conservation Management Plan for the Blue* Whale 2015–2025 (Ref. 97) indicates that although all forms of vessels can collide with whales, severe or lethal injuries are more likely to occur by larger or faster vessels. Laist *et al.* (Ref. 198) found that larger vessels with reduced manoeuvrability moving >10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling faster than 14 knots. Given that vessels that will be stationary or slow moving whilst undertaking the activities within the scope of this EP, any interaction with marine fauna would not be expected to cause severe injuries.

There have been recorded instances of cetacean deaths in Australian waters (e.g. a Bryde’s Whale in Bass Strait in 1992) (Ref. 199), although the data indicates deaths are more likely to be associated with container ships and fast ferries. Mackay *et al.* (Ref. 200) report that four fatal and three non-fatal collisions with Southern Right Whales were recorded in Australian waters between 1950 and 2006, with one fatal and one non-fatal collision reported between 2007 and 2014.

A review of the documents made or implemented under the EPBC Act for Whale Sharks indicate that management actions should consider minimising offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations (Ningaloo Reef, Christmas Island and the Coral Sea). On the basis that vessels activities are minimised to the smallest practicable extent (as also driven by economic considerations), the high-density foraging BIA is not located within the OA, and given that the nature and scale of IMR activities over the course of this EP are limited the activity is considered to be consistent with all relevant management actions.

Whale Sharks are known to spend considerable time close to the surface increasing their vulnerability to vessel strike. Whale sharks tagged off Western Australia (Ref. 201, Ref. 202) spent ~25% of their time less than 2 metres from the surface and greater than 40% of their time in the upper 15m of the water columns. Spending such considerable time within the 15 m of the surface leaves them vulnerable to collision with smaller vessels as well as larger commercial vessels that have drafts greater than 20 m below the surface. A search of the National Database did not identify any previous incidences of vessel strikes with Whale Sharks, indicating that although the risk is possible, previous events are limited in frequency. Although the OA overlaps the Whale Shark foraging BIA, vessels will be stationary or slow-moving whilst implementing the activities within the scope of this EP.

Consequently, incidences of fauna strike are not expected considering the slow vessel speed, the low number of vessels within the OA at any one time and the very low (cetaceans) and no (whale sharks) reports of fauna strikes.

If a fauna strike occurred and resulted in death, it is not expected to have a detrimental effect on the overall population; this event would result in a limited environmental impact (individual impacts); thus, fauna strike is evaluated as having the potential to result in an Incidental (6) consequence.

ALARP decision context justification		
Offshore commercial vessel operations are commonplace and well-practised nationally and internationally. The control measures to manage the risk associated with fauna strike are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding interaction with marine fauna arising from the activity. The risks arising from the physical presence of vessels are considered lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures and source		
Control measure	**Source**	
EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans	The requirements to manage interactions between vessels and cetaceans are detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans. These regulations describe strategies to ensure whales are not harmed during offshore interactions with people. By implementing these control measures and managing interactions with cetaceans near the vessels or any site surveys, the potential impacts from underwater sound are limited.	
Biodiversity Conservation Regulations 2018	The requirements to manage interactions with marine fauna (including cetaceans, Whale Sharks, and Dugongs) and relevant separation distances are detailed in the WA Biodiversity Conservation Regulations 2018.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Due to the nature and scale of vessel activities within the scope of this EP, the slow-moving nature of vessels within the OA, and the limited area of operation, the likelihood of a vessel collision with marine fauna is considered low. Based upon previous experience, in the OA, CAPL consider that the likelihood of the consequence occurring is Remote (5).	
Risk level	Very low (10)	
Determination of acceptability		
Principles of ESD	The risks associated with this aspect are associated with unplanned interactions causing individual fauna death / incidental disruption to other marine users, which is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans • Biodiversity Conservation Regulations 2018 • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 97) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 96)	

	• *Conservation Management Plan for the Southern Right Whale 2011-2021* (Ref. 195) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • *Recovery Plan for Marine Turtles in Australia* (Ref. 93).	
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.	
External context	During stakeholder consultation, no objections or claims were raised regarding interaction with marine fauna arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, given that vessel strike is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. The Conservation Advices for Blue Whales, Sei Whales, Fin , and Southern Right Whales (Ref. 98; Ref. 97; Ref. 96; Ref. 195) all specify the following action: • ensure all vessel strike incidents are reported in the National Ship Strike Database. This action is incorporated into reporting requirements under this EP (Section 8.4).	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No injury or mortality to marine fauna within the OA from petroleum activities	**EPBC Regulations 2000 and Biodiversity Conservation Regulations 2018** Vessels will implement caution and no approach zones, where practicable: • caution Zone (300 m either side of whales and 150 m either side of dolphins)– vessels must operate at ≤6 knots within this zone, maximum of three vessels within zone, and vessels should not enter if a calf is present • no approach zone (300 m to the front and rear of whales and 100 m either side; 300 m for whale calves; 150 m to front and rear of dolphins and 100 m either side; 100 m from dugongs; 30 m from whale sharks)–vessels should not enter this zone, and should not wait in front of the direction of travel or an animal or pod, or follow directly behind.	Induction materials include relevant marine fauna caution and no approach zone requirements
		Training records confirm offshore personnel involved in IMR activities have completed the induction
		Vessel records show if marine fauna interaction occurred within caution or approach zones, and what mitigation (e.g., divert or slow vessel) measure was implemented

6.4.3 Seabed disturbance

Source
Activities identified as having the potential to result in seabed disturbance are: • vessel anchoring.

Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Seabed disturbance may result in: • alternation of marine habitats.	6	N/A	–

Consequence evaluation
Although anchoring is not a routine activity, it has been carried through as a contingent activity in the event a different vessel is required onsite to conduct IMR activities, or anchoring is required within the OA due to a significant weather event. As detailed by NERA (Ref. 106), 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. This indicative seabed disturbance area represents <1% of the OA. The particular values and sensitivities within the OA with the potential to be impacted by seabed disturbance include: • ancient coastline at 125 m depth contour (KEF) • continental slope demersal fish communities (KEF) • ridgeline habitat and associated communities. Although these values and sensitivities have been identified as having the potential to be impacted from vessel anchoring activities, any disturbance will be in close proximity of existing infrastructure. As this area has been historically disturbed, any additional disturbance is expected to have limited environmental impact. Given the nature of the receiving environment within the OA, undertaking rare and infrequent vessel anchoring activities is not expected to affect ecosystem function or connectivity of communities. As such, CAPL has ranked the consequence as Incidental (6).

ALARP decision context justification
Vessel anchoring is commonplace; the activities causing this aspect are practised nationally and internationally. The control measures to manage the impacts associated with seabed disturbance are well understood and implemented by the industry. During stakeholder consultation, no objections or claims were raised regarding seabed disturbance arising from the activity. The impacts associated with seabed disturbance are considered lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures and source	
Control measure	**Source**
MSRE process	CAPL's *ABU MSRE Corporate OE Process* (Ref. 52) ensures that various legislative requirements are met including that vessels will meet the crew competency, navigation equipment, and radar requirements.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	N/A
Risk level	N/A

Determination of acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to localised short-term effects that are not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.

Relevant environmental legislation and other requirements	No environmental legislation or other requirements were deemed relevant for this aspect.	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 52).	
External context	During stakeholder consultation, no objections or claims were raised regarding seabed disturbance arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Reduce the risk of impacts to sensitive environmental receptors^ within the OA from petroleum activities	**MSRE process** Vessels will meet the crew competency, navigation equipment, and radar requirements of the MSRE process	Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the MSRE process

^ *"Sensitive environmental receptors" as identified within the activity-specific HIRA (Section 6.3.1.1)*

6.4.4 Air emissions

Source			
Activities identified as having the potential to result in air emissions are: • combustion of marine fuel from vessels within the OA during IMR activities.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Air emissions may result in: • localised and temporary reduction in air quality.	6	N/A	-
Consequence evaluation			
Modelling was undertaken for nitrogen dioxide (NO_2) emissions from MODU power generation for another offshore project (Ref. 213). NO_2 is the focus of the modelling because it is considered the main (non-greenhouse) atmospheric pollutant of concern, with larger predicted emission volumes compared to other pollutants, and has potential to impact on human health (as a proxy for environmental receptors). Results of this modelling indicate that on an hourly average, there is the potential for an increase in ambient NO_2 concentrations of 0.0005 ppm within 10 km of the emission source and an increase of <0.1 µg/m^3 (0.00005 ppm) in ambient NO_2 concentrations >40 km away. The *National Environmental Protection (Ambient Air Quality) Measure* (NEPM) recommends that hourly exposure to NO_2 is <0.12 ppm with annual average exposure <0.03 ppm. Given that referencing this modelling is considered overly conservative as the volume of fuel required for power generation is expected to be significantly less for support vessels when compared to MODU operations, and as the highest hourly averages (0.00039 ppm or 0.74 µg/m^3) were restricted to a distance ~5 km from the MODU (Ref. 213), exposures from vessel activities covered under this EP would be well below NEPM standards and thus any impacts were considered to be Incidental (6).			

ALARP decision context justification	
Offshore commercial vessel operations and subsequent air emissions arising from these activities are commonplace in offshore environments, both nationally and internationally. The control measures to manage the risk associated with atmospheric emissions are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding air emissions arising from the activity. The impacts arising from atmospheric emissions constitute lower-order impacts (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect.	
Good practice control measures and source	
Control measure	**Source**
Reduced sulfur content fuel	Sulfur content of diesel/fuel oil complies with Marine Order 97 and Regulation 14 of MARPOL 73/78 Annex VI. Only low-sulfur (0.50 mass % concentration [m/m]) fuel oil will be used to minimise sulfur oxides (SO_x) emissions when available
Marine Order 97: Marine Pollution Prevention – Air Pollution	Prior to commencement of IMR activities, the MSRE process (Ref. 52) is used to verify that all vessels comply with Marine Order 97: Marine Pollution Prevention – Air Pollution (appropriate to vessel class) for emissions from combusting fuel, including: • Vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a current international energy efficiency (IEE) certificate • All vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI • Vessel engine nitrous oxides (NO_x) emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	N/A
Risk level	N/A
Determination of acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to a direct reduction in air quality for a localised area for a short time, which is not considered to have the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: • Marine Order 97 • MARPOL 73/78
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 52).
External context	During stakeholder consultation, no objections or claims were raised regarding air emissions arising from the activity.

Defined acceptable level	These impacts are inherently acceptable as they are lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No impacts to air quality outside of the OA from petroleum activities	**Reduced sulfur content fuel** Only low-sulfur (0.50 mass % concentration [m/m]) fuel oil will be used to minimise SO_x emissions when available.	Bunker receipts verify the use of low-sulfur fuel oil
	Marine Order 97: Marine Pollution Prevention – Air Pollution Prior to commencement of IMR activities, the following will be verified, as per the MSRE process: • vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a current international energy efficiency (IEE) certificate • all vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI • Vessel engine nitrous oxides (NOx) emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.	OVIS report / ABU Marine OE Inspection Checklist confirms vessels hold IAPP and IEE certificates, and a SEEMP is in place (as appropriate to class), and NO_x emission levels comply with regulations

6.4.5 Greenhouse gas emissions

6.4.5.1 Direct emissions

As described in Section 6.2.3.1, CAPL has defined the emissions boundary for the assessment of direct GHG emissions in relation to the planned petroleum activities[32] within the OA as described in Section 3 of this EP. Any unplanned activities, including repairs, or emergency events, have been excluded from the emissions inventory.

The following activities have been identified as direct emission sources for planned field support activities under this EP:

- fuel combustion by vessels during planned subsea IMR activities within the OA
- fuel combustion by vehicles or plant during planned onshore IMR activities within the OA.

Any equipment (e.g., AUV, ROV) used to support IMR activities are powered by the support vessel itself, and as such these don’t represent an additional emission source to that already accounted for by the vessel. In addition, while helicopter operations are described within Section 3.6.2, these are not a routine planned

[32] Where ‘petroleum activity’ is as defined within Regulation 4 of the OPGGS(E)R.

activity and are only associated with longer IMR scopes (e.g., repairs), and therefore have not been accounted for within this emissions inventory.

Given the proximity of the Ashburton North facility to PL 99 (Figure 2-2), and limited number of days of planned inspection works (up to ~10–15 days per year), this emission source is a negligible contribution and has not been quantified for incorporation into the emissions estimate.

Based on the boundary and inventory described above, an estimate of annual direct GHG emissions for the activities under this EP is ~0.002 Mtpa CO_2-e[33]. Planned activities under this EP are not expected to significantly vary, such that it would result in a significant change to the above estimated annual direct emissions over the next five-year in-force period of this EP. The Wheatstone Project has approval to operate until 2060 (Section 6.2.3.4).

6.4.5.2 Indirect emissions

To determine the relevance of indirect emissions to the activities under this EP, CAPL undertook an assessment against the factors for determining what is an indirect consequence, in accordance with the *'Indirect consequences' of an action: Section 527E of the EPBC Act* Policy Statement. As an outcome of this assessment, the following activities have been identified as indirect emission sources for planned activities under this EP:

- gas processing at the onshore facilities at Ashburton North[34]
- transport and third party end-use of LNG, condensate and domestic gas products.

These activities and relevant emissions estimates are consistent with those presented in Section 6.2.3.3, and have not been repeated here.

6.4.5.3 Risk assessment

Source			
Activities identified as having the potential to result in GHG emissions are: • direct emissions from planned field support activities within scope of this EP • indirect emissions from activities associated with processing of gas at Ashburton North • indirect emissions from the transport and third party end-use of LNG, condensate and domestic gas produced by the Wheatstone Project.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
GHG emissions may result in: • contribution to the reduction of the global atmospheric carbon budget (by the amount of the direct and indirect GHG associated with activities under this EP)	6	A decrease in the global atmospheric carbon budget may result in: • contribution to the anthropogenic influence on the global climate system.	—
Consequence evaluation			
Contribution to the reduction of the atmospheric carbon budget			

[33] Emissions calculation is based on 100 days of vessel activity, and using NGER energy content and emissions factors (Ref. 285).

[34] The “gas processing at the onshore facilities at Ashburton North” incorporates several emission sources, including gas turbine drivers, gas turbine generators, heating, flaring, venting, diesel consumption, marine tugs, and fugitive emissions.

Direct GHG emissions from field support activities within scope of this EP are estimated to be ~0.002 Mtpa CO_2-e, and indirect GHG emissions from the processing of gas onshore at Ashburton North are estimated to be ~4.2 Mtpa CO_2-e[35]. Combined these emissions represent ~0.8% of national Australian emissions (when compared to September 2021 inventory) (Ref. 264). The direct (from activities within this EP) and indirect (from gas processing at the onshore facilities at Ashburton North) GHG emissions are within levels previously assessed and approved for the Wheatstone Project pursuant to the EP Act and EPBC Act.

The indirect GHG emissions from the transport and third party end-use of LNG, condensate and domestic gas are estimated to be ~36.8 Mtpa CO_2-e[36,37].

According to the IPCC, Sixth Assessment Report for Working Group 1 (WG1 AR6), “the total anthropogenic effective radiative forcing (ERF) in 2019, relative to 1750, was 2.72 [1.96 to 3.48] Wm^{-2} (*medium confidence*) and has likely been growing at an increasing rate since the 1970s, [and]…Over 1750–2019, CO_2 increased by 131.6 ± 2.9 ppm (47.3%).”[38]

The IPCC defines the term “carbon budget” as “refer[ing] to the maximum amount of cumulative net global anthropogenic CO_2 emissions that would result in limiting global warming to a given level with a given probability, taking into account the effect of other anthropogenic climate forcers. This is referred to as the total carbon budget when expressed starting from the pre-industrial period, and as the remaining carbon budget when expressed from a recent specified date. Historical cumulative CO_2 emissions determine to a large degree warming to date, while future emissions cause future additional warming. The remaining carbon budget indicates how much CO2 could still be emitted while keeping warming below a specific temperature level.”[39]

The remaining carbon budget for a 50% likelihood to limit global warming to 1.5°C, 1.7°C, and 2°C is respectively, 500 Gt CO_2, 850 Gt CO_2, and 1350 Gt CO_2.[40].

If the total direct and indirect GHG emissions are ~41.5 Mtpa CO_2-e, then this contributes ~0.1–0.3% to the reduction in the total remaining global carbon budget, which is a *de minimis* decrease. It is noted that this estimated contribution to the total global carbon budget is based the emissions estimates (including platform emissions [Section 6.2.3.2], IMR emissions [Section 6.4.5.1], and indirect emissions [Section 6.2.3.3]), operations continuing through to 2060 (i.e., current end of approval life), and with no allowance for future mitigation (including net zero aspirations, future technology or operational efficiencies, or future Australian regulatory or international policy requirements).

According to the IEA (Ref. 272), an estimated 1.2 Gt of CO_2 could be abated in the short term by switching from coal to existing gas-fired plants, if relative prices and regulation are supportive. Although the IEA states that switching between unabated consumption of fossil fuels, on its own, does not provide a long-term solution, there is significant CO_2 and air quality benefits, from using less emission-intensive fuels such as natural gas (Ref. 272).

It was also acknowledged by IEA (Ref. 272) that a limiting factor in the scale of switching from coal to gas, particularly in developing countries is the cost of importing gas. Therefore, realising the full global potential for switching would require an extra 450 billion cubic metres of gas to be produced each year (~12% of today’s global gas production) to reduce the price of gas to a level which would disincentivise coal use in the developing world i.e., an increase in global gas production and reduction in its price may reduce use of coal and in turn reduce carbon emissions (Ref. 272).

When used as a primary energy source, LNG has a number of benefits over other fossil fuels, including lower emissions of sulphur dioxide, particulate matter, and greenhouse gases. A benchmarking assessment for the LNG processing emissions was undertaken during the *Draft Environmental Impact Statement/ Environmental Review and Management Proposed Wheatstone Project* (Ref. 25). This benchmarking assessment showed that the Wheatstone Project is within the range of emissions intensities compared to other Australian projects benchmarked (Ref. 25).

The nominal project life of the Wheatstone Project (Section 3.1.2) is also considered to be consistent with the Commonwealth’s Australia’s *Long-Term Emissions Reduction Plan* and that the use of gas is expected to continue through the coming decades through to 2050 and beyond (Ref. 263). Therefore, the continued use of natural gas from the Wheatstone Project is expected to contribute to the displacement of the use of higher carbon intensive fossil fuel energy sources, which will have a corresponding reduction in potential fossil fuel emissions.

Indirect emissions associated with the transport and third party end-use of LNG, condensate and domestic gas products is the largest category of emissions associated with Chevron’s activities (Ref. 273). These types of indirect emissions are driven by global demand, which is in turn driven by economics, policy, regulation, and consumer behaviour on a global scale (Ref. 273).

In summary, due to the relatively lower emissions intensity of natural gas compared to other fossil fuel alternatives, that natural gas is part of Australia’s long-term emissions reduction plan, as well as the emissions reduction plans of the foreign jurisdictions to which the Wheatstone Project

exports its products, and that it can be considered as supporting the global transition to lower carbon intensive fuels, and the overall *de minimis* contribution to the reduction of the global carbon budget from the Wheatstone Project, the impact of contribution to the global carbon budget has been evaluated as having the potential to result in an Incidental (6) consequence.
Contribution to anthropogenic influence on the global climate system Refer to consequence evaluation provided in Section 6.2.3.5.
ALARP decision context justification
Field support activities are common both nationally and internationally. The control measures to manage the impact associated with GHG emissions are well understood and implemented by industry and CAPL. Currently, under international climate agreements, Australia has the following target to reduce GHG emissions: 43% below 2005 levels by 2030 (under the Paris Agreement). Recently, the Commonwealth government also announced an aspirational target of net zero emissions by 2050 (Ref. 266); however, this target has not been legislated and no management measures for industry have yet been defined or mandated. CAPL have recently submitted a draft GHGMP[41] (Ref. 299) for the Wheatstone for the Wheatstone LNG Plant at Ashburton North to the EPA for review. In accordance with the requirements of the EPA's Environmental Factor Guideline on Greenhouse Gas Emissions (Ref. 301), the purpose of this GHGMP is to outline CAPL's plan for managing the GHG emissions for the Wheatstone LNG Plant, including planned contribution to the Western Australian Government's current aspiration of achieving net zero emissions by 2050 (Ref. 302). This GHGMP is intended to outline: • measures implemented through the design and early phase of operations to avoid or reduce GHG emissions • measures to avoid, reduce, and offset scope 1 GHG emissions during operations over the life of the proposal • interim and long-term aspirational emission reduction targets for scope 1 GHG emissions from the Ashburton North gas processing facility over the life of the proposal. The GHGMP is applicable to all Scope 1 GHG emissions from the current operational Wheatstone Development facilities outlined in MS 873. This includes all Scope 1 emissions from the Wheatstone LNG Plant Trains 1 and 2, Domgas Plant, and associated accommodation facility. There are also other, non-petroleum specific legislation that are related to GHG emissions reporting and management, such as the Commonwealth NGER Act and Safeguard Mechanism, to which the Wheatstone Project is required to comply. Therefore, given there is sufficient other legal mechanisms to monitor and report on the emissions associated with the Wheatstone Project (to which the activities within scope of this EP are just a component of), there is no uncertainty regarding the appropriateness of emissions reporting and management. CAPL is committed to conducting activities in an environmentally responsible manner and aims to implement best practice environmental management as part of a program of continuous improvement. This commitment to continuous improvement means that CAPL reviews the GHGMP periodically and considers measures to avoid, reduce and offset emissions, including advances in technology and/or operational processes, and considers adoption of those technologies that offer a practicable way of reducing GHG emissions per tonne of LNG. Reviews also address matters such as the overall design and effectiveness of the GHGMP, progress in

[35] Source EIS/ERMP (Ref. 25) for onshore facilities at Ashburton North, pro-rated and capacity adjusted.

[36] Transport emissions estimated from shipping fuel consumption scaled for a representative year of production. Emissions factors sourced from IMO Resolution MEPC.245(66) (Ref. 303) and IPCC AR5 100-year global warming potentials (Ref. 304).

[37] Emissions from third-party use of products calculated in alignment with methods in Category 11 of IPIECA's *Estimating Petroleum Industry Value Chain (Scope 3) Greenhouse Gas Emissions* (Ref. 305), including product quantity and fuel specific higher heating values, and the CO_2, CH_4 and N_2O combustion emissions factors for each fuel type. Evaluation based upon production data from a representative year, applying API compendium methodologies (Ref. 306) and factors, and IPCC AR5 100-year GWP (Ref. 304).

[38] IPCC, AR6, WG1, at TS-35

[39] IPCC, AR6, WG1, at SPM-48 footnote 43

[40] IPCC, AR6, WG1, at SPM-29 Table SPM.2

[41] The draft GHGMP has been submitted for review purposes and is currently under consideration by the EPA.

environmental performance, changes in business conditions, and any relevant emerging environmental issues. Given the GHG emissions associated with the activities detailed in this EP result in a *de minimis* contribution to the reduction of the global carbon budget, CAPL considers this aspect to comprise a lower-order impact (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect. Notwithstanding this, CAPL have considered additional mitigation measures that could potentially lower the contribution to the reduction of the global carbon budget associated with the direct and indirect emissions arising from the activities covered in this EP.	
Good practice control measures and source	
Control measure	**Source**
EP Act approval	The Wheatstone Project was approved by the WA Minister for Environment on 30 August 2011 by way of MS 873 (and as amended; refer to Section 6.2.3.4). Condition 19 of MS 922 requires the annual reporting of GHG emissions from the LNG and Domgas plant. CAPL meets this condition via reporting GHG emissions under the Commonwealth NGER Act. CAPL have recently submitted a draft GHGMP[41] (Ref. 299) for the Wheatstone LNG Plant at Ashburton North to the EPA for review. In accordance with the requirements of the EPA's Environmental Factor Guideline on Greenhouse Gas Emissions (Ref. 301), the purpose of this GHGMP is to outline CAPL's plan for managing the GHG emissions for the Wheatstone Project and the LNG Plant's planned contribution to the Western Australian Government's current aspiration of achieving net zero emissions by 2050 (Ref. 302).
EPBC Act approval	The Wheatstone Project was approved by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities on 22 September 2011 by way of EPBC 2008/4469 (and as amended; refer to Section 6.2.3.4).
National Greenhouse and Energy Reporting scheme	The Wheatstone Project (i.e., the facility as a whole) is required to report GHG emissions under *the National Greenhouse and Energy Reporting Act 2007* (NGER Act). From July 2016 emissions have been subject to a baseline in accordance with the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015. A revised Safeguard Mechanism baseline has been recently approved by the Clean Energy Regulator. This baseline will apply throughout the next 5-year in-force period of this EP. Consequently, CAPL will continue to monitor and report GHG emissions, and maintain a baseline, under this legislation.
Corporate governance	Chevron Corporation has set an aspirational target of net zero upstream Scope 1 and Scope 2 emissions by 2050, as well as reduction targets for two metrics: portfolio carbon intensity (PCI) and upstream carbon intensity (UCI) (Ref. 273). The PCI metric developed by Chevron Corporate represents "the carbon intensity across the full value chain associated with bringing products to market, including Scope 3 emissions"[42] (Ref. 273). It uses a representative value chain that includes emissions associated with bringing products to market, and emissions from their use. The Chevron PCI reduction target for 2028 (i.e., >5% reduction from 2016) are corporate level targets incorporating emissions from all Chevron operated assets and non-operated joint ventures. The timing of the Chevron reduction targets is aligned with the Global Stocktake process under the Paris Agreement (with the second Global Stocktake will occur in 2028). Within CAPL operational control, Scope 1 and Scope 2 emissions, and Wheatstone gas and liquids production data (used to calculate estimated Scope 3 emissions) are compiled, assured, and reported by CAPL to Chevron Corporate annually for inclusion in the PCI metric on an equity basis. Management strategies,

[42] Quote CCR (October 2021), at pg 38.

	projects or improvements that serve to reduce Wheatstone emissions per unit production will contribute to the overall PCI metric. The UCI metric developed by Chevron Corporate are equity-based “emission intensity metrics for oil production, gas production, flaring, and methane” (Ref. 273). The key Chevron UCI reduction targets for 2028 (i.e., 24 kg CO_2-e/boe [26% reduction from 2016] for gas production) are corporate level targets incorporating emissions from all Chevron operated assets and non-operated joint ventures. Australia has been identified as one of six corporate assets that will account for two-thirds of the financial commitment over the next four years to reduce UCI (Ref. 273). UCI includes Scope 1 and Scope 2 emissions. Within CAPL operational control, Wheatstone gas and liquids production, and Scope 1 and Scope 2 emissions data, are compiled, assured, and reported by CAPL to Chevron Corporate annually for inclusion in the UCI metric, which is depicted on an equity basis. Management strategies, projects, or improvements that serve to reduce Wheatstone emissions per unit production will contribute to the overall UCI metric. The PCI and UCI metric are described and publicly reported within the *Corporate Sustainability Report* (Ref. 276, Ref. 313) and *Climate Change Resilience* (Ref. 273). As identified in Table 2-5, Chevron Corporation is a corporate member of IPIECA (Table 2-5) and via that membership worked on the SDG Roadmap (Ref. 312). The *2021 Corporate Sustainability Report* describes Chevron’s contributions to the impact opportunities identified within the Roadmap (Ref. 313). Management strategies, projects, or improvements for the Wheatstone Project, including those related to initiatives or commitments made by Chevron Corporation, may be identified and implemented via the ‘emissions reduction review’ process or adaptive management processes (‘address uncertainty’ and ‘methane management) control measures.
Emissions reduction review	As a global company, Chevron operates in many jurisdictions that have enacted lower-carbon policies. CAPL regularly evaluates carbon emission reduction projects for opportunities to avoid, eliminate, or reduce emissions. Continual improvement processes, including but not limited to marginal abatement cost curve (MACC) evaluations, allow CAPL to rank emission reduction opportunities by their relative cost and abatement potentials. Given the sheer scale of the global challenge to address the global carbon budget, allocation of limited resources as efficiently and effectively as possible is critical to creating the greatest opportunity for success. Prioritizing efforts that curtail emissions at the lowest cost per tonne, irrespective of where or in which sectors those abatements occur, is the most economically efficient approach. The enterprise approach to drive emissions reductions in Chevron’s portfolio is the marginal abatement cost curve (MACC) process. Like supply stacks, MACCs can enable a visualization of abatement opportunities, showing their relative cost and abatement potential on a similar basis. The relevant stages in the MACC process are: • opportunity identification by CAPL cross-functional team (with input from all Wheatstone Joint Venture participants) • opportunity development and submission by CAPL • enterprise-wide portfolio optimisation / selection for funding • implementation and reporting by CAPL • project tracking and knowledge sharing to ensure constant learning and continuous improvement. The process is ongoing with MACC project selection for funding occurring annually. The scope of the MACC process is activities within CAPL operational control (e.g., with respect to Wheatstone Operations, this includes the onshore facilities at Ashburton North). CAPL provide input on appropriate assumptions for decision analysis, upon which the US-based Carbon Reduction team apply both deterministic and probabilistic analysis to assess emissions reduction opportunities,

	consistent with Chevron Decision Analysis practices. The US-based Carbon Reduction team use portfolio theory and efficient frontier analysis to identify a portfolio of opportunities to progress across the technology spectrum, segments, business units, and geographies.
Marine Order 97: Marine Pollution Prevention – Air Pollution	Prior to commencement of IMR activities, the MSRE process (Ref. 52) is used to verify that all vessels comply with Marine Order 97: Marine Pollution Prevention – Air Pollution (appropriate to vessel class) for emissions from combusting fuel, including: • Vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a current international energy efficiency (IEE) certificate • All vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI • Vessel engine nitrous oxides (NOx) emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.
IMR vessel supply contract	While IMR vessels are not on permanent hire by CAPL, there is currently a contract in place with a vessel supplier. A new component within the ‘request for tender’ documentation for vessel supply is being developed by CAPL; this additional information will allow CAPL to incorporate an evaluation of CO_2 emissions within the tender evaluation process. It is expected that this new additional scope within the evaluation process will be in place for when the next IMR vessel supply contract is released for tender.
Legislative and other requirements review	CAPL is committed to continual improvement and adaptive management processes, and regularly monitors for revised or contemporary Australian regulatory and/or relevant international guidelines or standards in relation to GHG and carbon management. With specific reference to international shipping, CAPL is aware that the IMO is continually updating their mandatory measures to reduce emissions from international shipping. The commercial arrangements governing all export shipping engaged in loading cargoes from the Wheatstone Marine Terminal, requires CAPL and their partners to procure ships that comply with international and Australian standards, so to the extent that a ship’s Flag State, or AMSA as Port State, adopts IMO resolutions for measures to reduce emissions, these will apply to those third-party vessels (as well as Chevron Shipping vessels).

Address uncertainty	CAPL acknowledges the residual uncertainty associated with evaluation of environmental impacts and risks from the generation of GHG emissions. Uncertainty arises from advancements in climate science, revised forecasts in global energy mix, and subsequent changes in regulatory and policy requirements. These areas will evolve and new information will become available over the in-force period of this EP. As such, CAPL is committed to implementing an adaptive management process to ensure that impacts and risks associated with this aspect are continually reduced to ALARP and managed to acceptable levels.
	To address the residual uncertainty associated with impacts and risks from the generation of GHG emissions, the following adaptive management process will be implemented:
	• Monitor:
	  – contemporary climate science in relation to Chevron Corporate climate risk management (as sourced from the periodic release of Chevron’s *Climate Change Resilience* report; Section 8.5)
	  – historical and forecast global energy mix and associated emissions, including the role of Wheatstone product types
	  – revised or contemporary Australian regulatory and/or relevant international guidelines or standards (as per ‘legislative and other requirements review’ control measure)
	• Evaluate:

	– review the accuracy of, and validate, the estimated downstream indirect GHG emissions associated with the Wheatstone Project – review and validate the environmental impact and risk assessment for GHG emissions to ensure that GHG emissions are being reduced to ALARP and managed to an acceptable level • Adjust and implement: – identify improvements (e.g., to emission estimates, consequence evaluation, control measures, determination of acceptability, etc.) and implement changes as required. CAPL will implement this adaptive management process annually during the in-force period of this EP. The results of the annual monitoring and evaluation will be documented internally by CAPL. Where this annual review identifies improvements, any changes to the EP will be managed as per the MoC (Section 8.3.2.2) and Environment Plan review (Section 8.5) processes.	
Emissions management opportunities	Chevron supports the Paris Agreement and is committed to addressing climate change while continuing to deliver energy that supports society (Ref. 273). Chevron's approach to climate policy is to achieve emissions reductions as efficiently and effectively as possible (Ref. 273). This approach is actioned through global engagement, research and innovation, balanced and measured policy, and transparency. CAPL monitors new and evolving opportunities to work with business partners to seek to advance its ambition of managing emissions, including through industry partnerships, research agreements, and commercial opportunities for business diversification into lower carbon energy solutions and/or complimentary technologies for improved efficiency. This is an ongoing process, with opportunities identified, assessed, and implemented on an ad-hoc basis. With any significant technology development, these opportunities may develop over a medium to long term timeframe (i.e., greater than the 5-year in-force periods of EPs).	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
(Avoid) Use non-hydrocarbon powered vessels	If non-hydrocarbon (e.g., hydrogen) powered vessels were used for the program, CAPL could avoid emissions associated with fuel combustion from IMR support vessels. However, for activities under this EP, this avoidance of emissions is minimal (fuel combustion from IMR vessels was estimated at 0.002 Mtpa CO_2-e; Section 6.4.5.1) on both a project and global scale. Consequently, the benefit would be negligible.	No commercially viable vessels are currently available to implement the activities discussed in this EP. Consequently, the practicability of using vessels with alternative fuel sources to avoid direct emissions is not considered practicable.
(Reduce) Always use lower carbon intensive vessels	If vessels utilising a lower carbon intensive power source (e.g., dual-fuel, LNG, hybrid, battery-supported, etc.) were always used for the program, CAPL could reduce emissions associated with typical marine fuel combustion from IMR support vessels. However, for activities under this EP, this reduction of emissions is minimal ((fuel combustion from IMR vessels was estimated at 0.002 Mtpa CO_2-e; Section 6.4.5.1) on both a project and global scale. Consequently, the benefit would be negligible.	IMR vessels are supplied under an ongoing contract with CAPL. IMR vessels are considered vessels of opportunity from within the suppliers' fleet, with the selection based on the location, type, and availability of suitable vessels, for the individual IMR scope/s. Most IMR vessels are sourced from southeast Asia (e.g., Singapore) or within Australian waters; and have previously included diesel electric vessels (i.e., vessels with lower marine fuel consumption).

		Any delay to IMR schedules and operational activities due to waiting on the availability of a specific power-sourced vessel introduces the potential of production delays and safety costs that are disproportionate to the environmental benefit of reducing GHG emissions. In addition, sourcing vessels from other regions introduces greater transit emissions to relatively short-term IMR scopes. Consequently, it is not currently considered practicable to always use vessels with alternative power sources to reduce direct GHG emissions.
(Reduce) Use of electric powered vehicles	If electric powered vehicles were used for the program, CAPL could substitute emissions sources associated with fuel combustion from onshore IMR vehicles. However, for activities under this EP, this reduction of emissions is negligible (Section 6.4.5.1) on both a project and global scale. Consequently, the benefit would also be negligible.	The cost of implementing this control is grossly disproportionate to the level of risk reduction achieved. Consequently, the practicability of using electric vehicles to substitute emission sources for the activities covered in this EP is not considered practicable.
(Reduce) Use lower carbon intensive vessels	If non-hydrocarbon (e.g., hydrogen) powered vessels were used for the program, CAPL could avoid emissions associated with fuel combustion from IMR support vessels. However, for activities under this EP, this avoidance of emissions is minimal (fuel combustion from IMR vessels was estimated at 0.002 Mtpa CO_2-e; Section 6.4.5.1) on both a project and global scale. Consequently, the benefit would be negligible.	No commercially viable vessels are currently available to implement the activities discussed in this EP. Consequently, the practicability of using vessels with alternative fuel sources to avoid direct emissions is not considered practicable.
(Avoid) Use renewable electricity to power the hydrocarbon system and Wheatstone LNG and Domgas Plants at Ashburton North	If a renewable energy source (e.g., solar) was available then the associated emissions from power generation from the gas turbines would be avoided. However, there are limitations for use of renewables associated with intermittency and the ability to store a large quantity of power, as well as a limited Development Envelope allowed for use at Ashburton North. The construction of any renewable energy source and supply would require an increase to the land disturbance allowed under existing environmental approvals and bring in new environmental impacts.	The cost of implementing this control is currently considered grossly disproportionate to the level of risk reduction achieved. Consequently, the practicability of using renewable energy sources to avoid emissions for the activities covered in this EP is not considered practicable.
(Reduce) Use of renewable electricity to reduce gas turbine power	If a renewable energy source (either with or without battery storage) was available to supply some of the power requirements to the	The use of renewable energy sources to reduce power generation emissions at the platform or Ashburton North is not

generation requirements	Wheatstone Platform and/or at the Wheatstone LNG and Domgas Plants at Ashburton North, then the associated emissions from power generation from gas turbines could be reduced. Acknowledging the limited space available either on the platform or within the existing Development Envelope at Ashburton North, and that the construction of any renewable energy source, storage, and supply would require an increase to the land disturbance allowed under existing environmental approvals and bring in new environmental impacts, the application of renewable power technology is considered for operating assets where appropriate.	available for implementation at this time. However, Chevron are currently investigating the feasibility of renewable energy power projects that would allow a reduction in use of the existing gas turbine generators. As such, this cost-benefit analysis will be regularly re-assessed.
Likelihood and risk level summary		
Likelihood	N/A	
Risk level	N/A	
Determination of acceptability		
Principles of ESD	The impact associated with this aspect is a *de minimis* contribution to the reduction of the global carbon budget. The consequence associated with this aspect was evaluated as Incidental (6). One of the UN 2030 Agenda sustainable development goals (SDGs) is “ensure access to affordable, reliable, sustainable and modern energy for all”. Chevron is “inspired” by the UN SDGs and “seek[s] to achieve a more sustainable future” through its business operations (Ref. 276). The principle of inter-generational equity is considered to be met for the Wheatstone Project. Energy is fundamental to society, and access to reliable and affordable energy sources is interlinked with their ability to sustainably develop and maintain health, diversity, and productivity for future generations (Ref. 277). Natural gas provides both a reliable and affordable energy source and is one of the lower emission fossil fuels. The continued use of natural gas is in line with Australia’s *Long-Term Emissions Reduction* Plan (Ref. 263), the natural gas from the Wheatstone Project is produced with a lower emissions intensity than other gas supplies on the North West Shelf, and the use of natural gas is considered to support the global transition to lower carbon intensive fuels. In addition, as described in Section 6.2.3.3, the current sales markets for the Wheatstone Project are countries that have also ratified the Paris Agreement and established their own NDCs for managing emissions. The Parties to the Paris Agreement acknowledge that climate change is a common concern of humankind and the Parties should consider their respective obligations, including intergenerational equity. By not materially or substantially contributing to Australia’s GHG emissions, the Wheatstone Project will support Australia’s global efforts to reach net zero by 2050. If Australia achieves its efforts to meet net zero by 2050, then it will contribute to global efforts to meet the objective of the Paris Agreement to “hold[] the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing 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”. Consequently, the principle of intergenerational equity is considered to be met because the Wheatstone Project is consistent with Australia’s carbon budget and therefore Australia’s efforts to keep warming to the Paris Agreement target of below 2°C above pre-industrial levels and reduce the risks and impacts of climate change, thereby ensuring that the health,	

	diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The control measures identified and described above are considered to reduce this impact to ALARP. In particular, that GHG emissions from the Wheatstone Project will be managed to within an emissions footprint of ~4.65 Mtpa CO_2-e (Sections 6.2.3.2, 0, and 6.4.5.1), and also adaptively managed via the GHGMP (Ref. 299), and EP review process (Section 8.5), demonstrates CAPL's commitment to GHG management. Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: • *Environment Protection and Biodiversity Conservation Act 1999* (Cth) • *Environmental Protection Act 1986* (WA) • *National Greenhouse and Energy Reporting Act 2007* (Cth) • National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth) • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 97) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 96) • *Conservation Management Plan for the Southern Right Whale 2011-2021* (Ref. 195) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • Recovery Plan for the White Shark (Carcharodon carcharias) (Ref. 287) • *Recovery Plan for Marine Turtles in Australia* (Ref. 93). • *Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)* (Ref. 94) • Draft *Wildlife Conservation Plan for Seabirds* (Ref. 286) • *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 92).
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • *Climate Change Resilience* (Ref. 273) • *Wheatstone LNG Plant: Greenhouse Gas Management Plan* (Ref. 299).
External context	During stakeholder consultation, no objections or claims were raised regarding greenhouse gas emissions arising from the activity.
Defined acceptable level	Climate change is listed as a threat to protected matters under documents made or implemented under the EPBC Act. As a reduction in the global carbon budget may result in changes to global climate systems, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. Specifically, the following action is defined within the *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) and the *Recovery Plan for Marine Turtles in Australia* (Ref. 93): • continue to meet Australia's international commitments to reduce GHG emissions As both of these species have the potential to be directly impacted by other environmental aspects arising from the activities detailed within this EP, CAPL has defined an acceptable level of impact as not materially or substantially contributing to Australia's GHG emissions, and as such, subsequently not preventing Australia meeting international GHG emission commitments. Australia is a signatory to the Paris Agreement and is currently committed to reducing GHG emissions by 43% below 2005 levels by 2030. The

<table>
<tr><td></td><td colspan="2">objective of the Paris Agreement includes to “hold[] the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing 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” (Article 2). The Commonwealth government acknowledges that “[a]chieving the Paris Agreement’s global goals, including limiting warming to well below 2°C and reaching global net zero, will require practical action from all countries. Australia will play its part in the global effort to reach net zero emissions by 2050” (Ref. 263). Australia’s plan and the global context is that “Australia recognises we must reduce emissions while accommodating countries’ economic development goals, especially in the Asia- Pacific and Indo-Pacific regions. As well as reducing our own emissions, our plan focuses on how Australia can play a global leadership role through low emissions energy exports and contributions to innovation” (Ref. 263). Moreover, Australia has already reduced emissions by 20% since 2005 (Ref. 263). By providing low emission energy exports (LNG) and by not materially or substantially contributing to Australia’s GHG emissions, the Wheatstone Project will support Australia’s global efforts to reach net zero by 2050. If Australia achieves its efforts to meet net zero by 2050, then it will contribute to global efforts to keep warming to the Paris Agreement target of well below 2°C above pre-industrial levels and significantly reduce the risks and impacts of climate change.

As discussed within the above consequence evaluation, based on the predicted emissions, the Wheatstone Project has a de minimis contribution to the reduction of the global carbon budget. Given that anthropogenic changes to the global climate system cannot be directly attributed to any one development or emission source or product, CAPL considers that the Wheatstone Project will meet the defined “acceptable level of impact as not materially or substantially contributing to Australia’s GHG emissions, and as such, subsequently not preventing Australia meeting international GHG emission commitments” by managing their emissions to within an emissions footprint of ~4.65 Mtpa CO_2-e (Sections 6.2.3.2, 0, and 6.4.5.1). Additionally, there are other regulatory management plans (i.e., the GHGMP), and other regulatory reporting mechanisms (i.e., the National Greenhouse and Energy Reporting scheme) in place to ensure that GHG emissions from the Wheatstone Project are adaptively managed in line with best practice and contemporary legislative and other requirements.</td></tr>
<tr><th>Environmental performance outcome</th><th>Performance standard / Control measure</th><th>Measurement criteria</th></tr>
<tr><td rowspan="4">Do not materially or substantially contribute to Australia not meeting its international GHG emissions commitments by managing direct and indirect GHG emissions associated with the Wheatstone Project in Australia* to within an emissions footprint of 4.65 Mtpa CO_2-e</td><td colspan="2">EP Act approval
Because implementation of the EP Act Approval is a regulatory requirement, no EPS has been developed for this requirement.</td></tr>
<tr><td colspan="2">EPBC Act approval
Because implementation of the EPBC Act Approval is a regulatory requirement, no EPS has been developed for this requirement.</td></tr>
<tr><td colspan="2">National Greenhouse and Energy Reporting scheme
Because NGER reporting is a regulatory requirement, no EPS has been developed for this requirement. The Safeguard Mechanism establishes a GHG baseline. Baseline exceedance is required to be offset through the purchase of ACCUs.</td></tr>
<tr><td>Emissions reduction review
CAPL will implement its emissions reduction review to identify emissions reduction opportunities (within its operational control) for the Wheatstone Project to be included in an enterprise-wide selection process</td><td>Records show that annual review of emissions reduction opportunities was performed</td></tr>
</table>

	Emissions reduction review CAPL will measure and investigate >5% annual increases to absolute Scope 1 and Scope 2 emissions or intensity	Records show that Wheatstone asset total emissions (t CO_2-e) and upstream intensity (t CO_2-e/t LNG) are measured, root cause of annual increases >5% are investigated, and where practicable, improvement opportunities are evaluated through the MACC process
	Corporate governance CAPL will support Chevron Corporate's aspiration of managing global upstream emissions by implementing management strategies, projects, or improvements for the Wheatstone Project selected during an enterprise-wide selection process	Records show that when upstream emissions management strategies, projects, or improvements have been selected for the Wheatstone Project, these are implemented as soon as reasonably practicable (with consideration given to the scope, planned turnaround schedule, and scale of the activity)
	Corporate governance CAPL will report Scope 1 and Scope 2 emissions data from the Wheatstone Project to Chevron Corporation annually for inclusion in the calculation of its UCI metric	Records show that annual emissions data from the Wheatstone Project was provided to Chevron Corporation
	Corporate governance CAPL will support Chevron Corporate's aspiration of managing global portfolio emissions by implementing management strategies, projects, or improvements for the Wheatstone Project selected during an enterprise-wide selection process	Records show that when portfolio emissions management strategies, projects, or improvements have been selected for the Wheatstone Project, these are implemented as soon as reasonably practicable (with consideration given to the scope, planned turnaround schedule, and scale of the activity)
	Corporate governance CAPL will report Scope 1 and Scope 2 emissions data from the Wheatstone Project to Chevron Corporation annually for inclusion in the calculation of its PCI metric	Records show that annual emissions data from the Wheatstone Project was provided to Chevron Corporation
	Marine Order 97: Marine Pollution Prevention – Air Pollution Prior to commencement of IMR activities, the following will be verified, as per the MSRE process: • vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a current international energy efficiency (IEE) certificate • all vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI • Vessel engine nitrous oxides (NOx) emission levels will	OVIS report / ABU Marine OE Inspection Checklist confirms vessels hold IAPP and IEE certificates, and a SEEMP is in place (as appropriate to class), and NOx emission levels comply with regulations

	comply with Regulation 13 of MARPOL 73/78 Annex VI.	
	IMR vessel supply contract The tender evaluation for the IMR vessel supply contract will include an evaluation of CO_2 emissions	Records indicate that tender evaluation for the IMR vessel supply contract included a consideration of vessel CO_2 emissions
Manage downstream indirect GHG emissions^ associated with Wheatstone Project	**Legislative and other requirements reviews** CAPL will undertake annual monitoring of revised or contemporary Australian regulatory requirements, and applicable international guidelines or standards, in relation to carbon management of downstream indirect GHG emissions	Records show that annual monitoring of revised or contemporary Australian regulatory requirements, and applicable international guidelines or standards, in relation to carbon management of downstream indirect GHG emissions was undertaken
	Address uncertainty CAPL will undertake an annual adaptive management process to address the residual uncertainty associated with impacts and risks from the generation of GHG emissions, specifically including: • monitoring the historical and forecast global energy mix and associated emissions, including the role of Wheatstone product types • review of the accuracy of estimated downstream indirect GHG emissions associated with the Wheatstone Project to validate the estimates used as the basis for the impact and risk assessment • review of the environmental impact and risk assessment for GHG emissions to ensure that GHG emissions are being reduced to ALARP and managed to an acceptable level.	Records show that an annual adaptive management process addressing downstream indirect GHG estimates was undertaken
	Address uncertainty If the above annual monitoring and evaluation identify improvement opportunities to manage downstream indirect GHG emissions, then CAPL will implement these changes within this EP in accordance with the MoC (Section 8.3.2.2) and EP Review (Section 8.5) processes	As required, records show that the MoC and/or EP review process were undertaken in response to any improvement opportunities related to the management of downstream indirect GHG emissions
	Emissions management opportunities CAPL will evaluate opportunities to partner with organizations that promote and address GHG emissions reduction and carbon offsets in the LNG value chain, and	Records show that opportunities to promote and address GHG emissions reduction and carbon offsets in the LNG value chain, and advocating for LNG and natural gas as fuels of choice have been evaluated annually

	advocate for LNG and natural gas as fuels of choice	
	Corporate governance CAPL will report production and emissions data from the Wheatstone Project to Chevron Corporation annually for inclusion in the calculation of its PCI metric	Records show that annual production and emissions data from the Wheatstone Project was provided to Chevron Corporation

** Where 'direct and indirect GHG emissions associated with Wheatstone Project refers to the direct emissions associated with activities within this EP (Sections 6.2.3.2 and 6.4.5.1) plus the indirect emissions from processing gas at the onshore facilities at Ashburton North (Section 6.2.3.4); i.e., emissions within CAPL operational control.*

^ Where 'downstream indirect GHG emissions' refers to the emissions associated with transport, and third party end-use of LNG, condensate and domestic gas products.

6.4.6 Light emissions

Source			
Activities identified as having the potential to result in light emissions are: • navigation and operational lighting from vessels within the OA during IMR activities.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Light emissions may result in: • localised and temporary change in ambient light.	6	A change in ambient light may result in: • attractant for light-sensitive species and in turn affect predator-prey dynamics	6
Consequence evaluation			
Localised and temporary change in ambient light Monitoring undertaken by Woodside (Ref. 83) indicates that light density from navigational lighting on a MODU attenuated to below 1.0 lux and 0.03 lux at distances of ~300 m and ~1.4 km, respectively. Light densities of 1.0 lux and 0.03 lux are comparable to natural light densities experienced during deep twilight and during a quarter moon. Based on Woodside (Ref. 83), CAPL expects that the platform will result in temporary changes to ambient light emissions no larger than a radius of ~1.4 km. Operational and navigational lighting is expected to be similar in comparison to a MODU, therefore referencing this modelling is considered an appropriate approach for this consequence evaluation. Given the limited extent of the change arising from navigational lighting, the impacts associated with a direct change in ambient light levels was determined to be Incidental (6).			
Acting as an attractant to light-sensitive species and in turn affecting predator–prey dynamics There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding, or breeding behaviours of cetaceans. Cetaceans predominantly use acoustic senses rather than visual sources to monitor their environment (Ref. 166), so light is not considered to be a significant factor in cetacean behaviour or survival. Light-sensitive fauna (including reptiles, birds and fish) are the species most at risk from this aspect and thus are the focus of this evaluation. As identified in Section 4.3, several marine species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. Several BIAs and/or critical habitat also overlap with the OA, including: • Flatback Turtle (internesting buffer, nesting) • Hawksbill Turtle (internesting buffer) • Green Turtle (internesting critical habitat) • Whale Shark (foraging) • Lesser Crested Tern, Wedge-tailed Shearwater (breeding). The *National Light Pollution Guidelines* (Ref. 10) indicate that a 20 km buffer or exposure area can provide a general precautionary light impact limit based on observed effects of sky glow on			

marine turtle hatchlings demonstrated to occur at 15–18 km (Ref. 163; Ref. 164) and fledgling seabirds grounded in response to artificial light 15 km away (Ref. 165).

Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Ref. 167) and that lighting can attract birds from large catchment areas (Ref. 168). These studies indicate that migratory birds are attracted to lights from offshore platforms when travelling within a radius of 5 km from the light source, but their migratory paths are unaffected outside this zone (Ref. 169). Although the OA (associated with the nearshore trunkline) is located adjacent to the coast, vessel activities are expected to be conducted at least 1 km from the coast given the trunkline is installed under the seabed via a microtunnel. Although light emissions have the potential to expose the coast (i.e., within ~1.4 km from the vessel), given the magnitude of the activities covered under this EP, it is not expected that coast would be exposed for a prolonged period of time, or frequently, and thus any impacts would be limited. For the remainder of the OA, any artificial emissions from the vessel that attract a small number of individual seabirds are not expected to result in any impact to the individual or to the greater population.

The *Recovery Plan for Marine Turtles in Australia* (Ref. 92) identifies light emissions as a key threat because it can disrupt critical behaviours, such as nesting, hatchling orientation, sea finding, and dispersal behaviour. The *Recovery Plan for Marine Turtles in Australia* (Ref. 92) defines the critical habitat for nesting for each species at a stock level. The closest nesting critical habitats to the OA include coastal islands which have been identified as nesting habitat for Flatbacks, Greens, and/or Hawksbill turtles (Ref. 92). The closest island to the trunkline is Ashburton Island, ~1.8 km from the trunkline. As light emissions from support vessels are expected to result in a change to ambient conditions up to a maximum of ~1.4 km from the vessel, no island areas (and therefore no adult nesting turtles, or turtle hatchlings) are expected to be exposed.

Flatback Turtles are also known to nest on Ashburton Delta, on the mainland near Project infrastructure (Ref. 289). Although the OA (associated with the nearshore trunkline) is located adjacent to the coast, vessel activities are expected to be conducted at least 1 km from the coast given the trunkline is installed under the seabed via a microtunnel. Although light emissions have the potential to expose the coast (i.e., within ~1.4 km from the vessel), given the magnitude of the activities covered under this EP, it is not expected that coast would be exposed for a prolonged period of time, or frequently, and thus any impacts would be limited.

The *Recovery Plan for Marine Turtles in Australia* (Ref. 92) defines the critical habitat for internesting as a distance seaward from nesting critical habitat of 60 km for Flatbacks and 20 km for other marine turtle species. As described in Section 3.4.1.2, there are no planned maintenance or repair activities for the nearshore trunkline during operations. As such, any IMR activities for the nearshore trunkline are associated with inspection activities only. Although light emissions have the potential to expose (i.e., within ~1.4 km from the vessel) ocean areas that may be used for internesting, given the magnitude of the activities covered under this EP, it is not expected that these would be exposed for a prolonged or frequent, or frequent, periods of time and thus any impacts would be limited.

Anthropogenic disturbance and artificial lighting is identified as a threat within the *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 92). However, only a small number of threatened or migratory bird species would be expected to be present in this area. Light emissions that attract a small number of individual seabirds are not expected to result in any impact to the individual or to the greater population.

Artificial light may result in varied ecological changes to fish, including changes to predatory behaviour and abundance (Ref. 314, Ref. 317), altering hatching success (Ref. 315), acting as an attractant for plankton (Ref. 316), or altering circadian behavioural rhythms (Ref. 317).

The Whale Shark BIA is associated with foraging behaviours during northward migration from the Ningaloo Reef seasonal aggregation area, along the 200 m isobath during July to November (Ref. 95). Light has not been identified as a key threat for the Whale Shark (Ref. 95). Although light emissions have the potential to expose (i.e., within ~1.4 km from the vessel) ocean areas that may be used by Whale Sharks during their northern migration, it is not expected that they would be exposed for prolonged or frequent periods of time due to the IMR activities under this EP, and thus any impacts would be limited.

Because light emissions have the potential to cause temporary impacts to a small number of protected species over the course of the activity, CAPL has ranked the consequence associated this impact as Incidental (6).

<table>
<tr><th colspan="3">ALARP decision context justification</th></tr>
<tr><td colspan="3">Offshore commercial vessel operations and subsequent light emissions arising from these activities are commonplace in offshore environments nationally and internationally.
During stakeholder consultation, no objections or claims were raised regarding light emissions arising from the activity.
The impacts and risks associated with light emissions are well understood, and considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.</td></tr>
<tr><th colspan="3">Good practice control measures and source</th></tr>
<tr><th>Control measure</th><th colspan="2">Source</th></tr>
<tr><td>MSRE process</td><td colspan="2">CAPL's ABU MSRE Corporate OE Process (Ref. 52) ensures that various legislative requirements are met. This includes ensuring that lighting sufficient for navigational, safety and emergency requirements are met, as appropriate to vessel class.</td></tr>
<tr><td>IM Plan</td><td colspan="2">The type of inspections of the hydrocarbon system will be undertaken in accordance with the Wheatstone Upstream Subsea System Inspection and Monitoring Plan (Ref. 21) and Wheatstone Upstream Trunkline System Inspection and Monitoring Plan (Ref. 22). Inspections will be undertaken with a frequency determined using a risk-based approach; and the frequency of maintenance and repair activities will be dependent on the results of inspections (Section 3.4.1).
Where practicable, planned IMR activities will be scheduled to avoid critical habitat within turtle nesting season (September to March). If scheduling of activities outside these spatial and temporal requirements is not practicable, an activity-specific HIRA assessment will be conducted.</td></tr>
<tr><td>Activity-specific HIRA</td><td colspan="2">Where IMR activities are required to be undertaken at night within critical habitat and during Flatback Turtle nesting season (September to March), an activity-specific HIRA will be conducted to identify and manage risks to marine turtles. If potential significant activity-related stressors to marine turtles are present, these management measures will be considered where practicable:
• vessels working at night within critical habitat and during turtle season will be required to reduce lighting to the minimum required for safe operations
• no 'lit' vessel will be moored within 1.5 km of nesting beach buffer zones (as defined in the Wheatstone Conservation Significant Marine Fauna Interaction Management Plan [Ref. 288]).</td></tr>
<tr><th colspan="3">Additional control measures and cost benefit analysis</th></tr>
<tr><th>Control measure</th><th>Benefit</th><th>Cost</th></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><th colspan="3">Likelihood and risk level summary</th></tr>
<tr><td>Likelihood</td><td colspan="2">Due to the nature and scale of this petroleum activity vessel activities are predominantly occurring within offshore waters away from the coastline. As such the likelihood of exposing sensitive receptors resulting in the identified consequence was considered Remote (5).</td></tr>
<tr><td>Risk level</td><td colspan="2">Very low (10)</td></tr>
<tr><th colspan="3">Determination of acceptability</th></tr>
<tr><td>Principles of ESD</td><td colspan="2">The impact associated with this aspect is disruption to light-sensitive species' behaviour, which given the location, is not considered as having the potential to affect biological diversity and ecological integrity.
The impact associated with this aspect is Incidental (6).</td></tr>
</table>

	Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered for this aspect include: • Commonwealth Navigation Act 2012 • National Light Pollution Guidelines (Ref. 10) • Recovery Plan for Marine Turtles in Australia (Ref. 93) • Wildlife *Conservation Plan for Migratory Shorebirds* (Ref. 92) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95).
Internal context	CAPLs environmental performance standards / procedures considered relevant to this aspect include: • *Wheatstone Conservation Significant Marine Fauna Interaction Management Plan* (Ref. 288).
External context	During stakeholder consultation, no objections or claims were raised regarding light emissions arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, given that light pollution is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. The *Recovery Plan for Marine Turtles in Australia* (Ref. 93) specifies the following relevant action: • artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats. No other specific relevant actions were identified within other documents implemented under the EPBC Act. The OA does intersect with critical habitat as identified within the Recovery Plan for Flatback, Green, and Hawksbill Turtles (Table 4-4). Therefore, CAPL has defined an acceptable level of impact as no displacement of marine fauna from critical habitat.

Environmental performance outcome	Performance standard / Control measure	Measurement criteria
Avoid displacement of marine fauna from critical habitat during nesting seasons from petroleum activities	**MSRE process** Vessels will meet the lighting requirements of the MSRE process	Records indicate that vessels meet lighting requirements of the MSRE process
	IM Plan Where practicable, planned IMR activities will be scheduled to avoid critical habitat within turtle nesting season (September to March)	Records show that planned IMR activities were scheduled to avoid critical habitat during nesting season, where practicable
	Activity-specific HIRA Where IMR activities are required to be undertaken at night within critical habitat and during turtle nesting season (September to March), an activity-specific HIRA will be undertaken prior to IMR activity commencing	Records show that activity-specific HIRA undertaken prior to IMR activity commencing

	Activity-specific HIRA Where required, these management measures will be considered where practicable: • vessels working at night within critical habitat and during turtle nesting season will be required to reduce lighting to the minimum required for safe operations • no 'lit' vessel will be moored within 1.5 km of nesting beach buffer zones (as defined in the Wheatstone Conservation Significant Marine Fauna Interaction Management Plan [Ref. 292]).	Inspection records during night operations within critical habitat and during nesting season confirm only minimum lighting for safe operations is used Vessel records during night operations within critical habitat and during nesting season confirm mooring >1.5 km from nesting beach buffer zones

6.4.7 Underwater sound

Source

Activities identified as having the potential to result in underwater sound are:

- vessels or helicopter operations within the OA.

These activities result in the emission of continuous sounds.

Potential impacts and risks

Impacts	C	Risks	C
Underwater sound emissions may result in: • localised and temporary change in ambient underwater sound.	5	A change in ambient underwater sound may result in: • behavioural disturbance • auditory impairment, temporary threshold shift (TTS), permanent threshold shift (PTS), recoverable or non-recoverable injury to marine fauna	5

Consequence evaluation

Localised and temporary change in ambient underwater sound

Anthropogenic underwater sound emitted during the field support (vessel or helicopter) activities will result in a temporary change in local ambient sound levels.

Underwater broadband ambient sound spectrum levels range from 45–60 dB re 1 µPa in quiet regions (light shipping and calm seas) to 80–100 dB re 1 µPa for more typical conditions, and >120 dB re 1 µPa during periods of high winds, rain or 'biological choruses' (many individuals of the same species vocalise near simultaneously in reasonably close proximity to each other) (Ref. 101). Low-frequency ambient sound levels (20–500 Hz) are frequently dominated by distant shipping plus some great whale species. Light weather-related sounds will be in the 300–400 Hz range, with wave conditions and rainfall dominating the 500–50,000 Hz range (Ref. 101).

Studies of underwater sound generated from propellers of offshore vessels when holding position indicate highest measured SPL up to 137 dB re 1 µPa and 120 dB re 1mPa at 405 m and ~3-4 km from the sound source (Ref. 203). When underway at ~12 knots vessel sound of 120 dB re 1 µPa was recorded at 0.5–1 km (Ref. 203).

Sound emitted from helicopter operations is typically below 500 Hz (Ref. 222). The peak-received level diminishes with increasing helicopter altitude, but the duration of audibility often increases with increasing altitude. Estimates of SPL for helicopters range 149–162 dB re 1 µPa (Ref. 197 Ref. 223). Richardson et al. (Ref. 197) report that helicopter sound was audible in air for four minutes before it passed over underwater hydrophones, but detectable under water for only 38 seconds at 3 m depth, and 11 seconds at 18 m depth.

Given the details above, the consequence of vessel or helicopter operations causing a change in ambient underwater sound has been assessed as Minor (5) as it will result in a localised and short-term environmental impact.

Exposure Criteria

Mid-frequency (dolphins, toothed whales, beaked whales, bottlenose whales [e.g., Indo-Pacific Humpback and Spotted Bottlenose dolphins, Killer Whale, Sperm Whale]) and low-frequency (baleen whales [e.g., Blue, Bryde's, Fin, Humpback, Sei, Antarctic Minke whales]) cetaceans have been identified as having the potential to be present within the OA. Exposure criteria for these species is included in Table 6-10.

Exposure criteria for marine turtles is provided in Table 6-11. Behavioural responses have been taken from McCauley et al. (Ref. 188) who reported that exposure to airgun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa , with turtles observed to increase their swimming activity at received sound levels of ~166 dB re 1 µPa .

Noise exposure criteria for fish is provided in Table 6-12.

Table 6-10: Noise exposure criteria (continuous sounds) for mid-frequency and low-frequency cetaceans

Cetacean Hearing Group	PTS onset thresholds (received level) (Ref. 186)	TTS onset thresholds (received level) (Ref. 186)	Behavioural Response (Ref. 187)
Low--frequency cetaceans	$L_{E,\ 24h}$: 199 dB	$L_{E,\ 24h}$: 179 dB	$L_{pk:}$ 120 dB
Mid-frequency cetaceans	$L_{E,\ 24h}$: 198 dB	$L_{E,\ 24h}$: 178 dB	$L_{pk:}$ 120 dB

Table 6-11: Noise exposure criteria (continuous sounds) for marine turtles

PTS onset thresholds (received level) (Ref. 189)	TTS onset thresholds (received level) (Ref. 189)	Behavioural Response (Ref. 188)
$L_{E,\ 24h}$: 220 dB	$L_{E,\ 24h}$: 200 dB	—

Table 6-12: Noise exposure criteria (continuous sounds) for fish

Hearing Group	Recoverable Injury (Ref. 190)	TTS onset thresholds (received level) (Ref. 190)
Fish without swim bladders	—	—
Fish with swim bladders (involved in hearing)	$L_{E,\ 48h}$: 170 dB	$L_{E,\ 12h}$: 158 dB

Continuous sound (vessel and helicopter operations)

Acoustic modelling undertaken by Woodside for pipelay and support vessels (Ref. 204) is considered suitable to inform potential sound exposures from this activity as the vessels are expected to be similar (or smaller) in size to those modelled thus source sound levels are expected to be similar (or smaller), and the physical environment of the operational area is comparable.

The modelling also provides an indication of cumulative sound exposures by considering sound emissions from multiple sources at a single location. In reality, as multiple sound sources will occur at a distance from each other, the model exaggerates near field sound levels and is therefore considered highly conservative.

On the basis that multiple vessels have the potential to be within the OA during IMR activities activity, CAPL acknowledge the potential for cumulative sound emissions. However, modelling of sound exposure levels (SEL) and SEL exposure criteria assumes that transient species would be exposed over a 24 hour period. This is considered highly unlikely as species with the potential to be exposed are mobile and expected to transit through the area, thus cumulative impacts are not expected to arise from this activity.

The outcomes of this modelling are summarised throughout the subsequent risk and impact assessment.

In the absence of modelling, the maximum estimate of SPL from helicopter operations (162 dB re 1 µPa) has been used for the purposes of this consequence evaluation. With the exception of cetaceans, this maximum estimate is below peak SPL noise exposure criteria (and therefore not discussed further in the evaluation for marine reptiles or fish). Similarly, given the nature of helicopter operations (i.e., crew transfers) covered under this EP, exposure to sound from this source for an extended period (e.g., 12 or 24 hours) is not credible, and as such, comparison against the cumulative sound exposure level criterions is not relevant.

Marine Mammals

Behavioural disturbance

Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to 120 dB re 1 µPa was ~4.9 km (Ref. 204).

As the OA overlaps a migration BIA for the Pygmy Blue and Humpback whales, there is the potential for a larger number of cetaceans to be present during migration periods. However, given the open-water environment, the close distance to the vessel before a behavioural response is likely to occur, and limited number of vessels in the field, it is not expected that the activity would result in a significant change to migration behaviours or displace species outside of the BIA.

Estimates of SPL for helicopters range 149–162 dB re 1 µPa (Ref. 197; Ref. 223), which is above the NMFS criterion for behavioural disturbance. However, the spatial and temporal extent of the potential exposure to underwater sound from helicopters is limited (e.g., 38 seconds at 3 m depth, and 11 seconds at 18 m depth; Ref. 197). The helicopter operations covered under this EP (i.e., crew transfers for longer IMR campaigns) are also expected to be infrequent. Therefore, given the limited nature of the exposure, potential impacts from helicopters on cetacean behaviour are not evaluated further.

Consequently, only localised short-term behavioural impacts to transient individuals have the potential to arise from these activities and have therefore been evaluated as Minor (5).

TTS and PTS

The NMFS recommend applying a noise exposure criterion of 179 dB re µPa^2.s and 178 dB re µPa^2.s for low and mid frequency cetaceans respectively (Table 6-10).

Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to SEL_{48h} of 170 dB re µPa^2.s was <0.010 km, and to a SEL_{12h} threshold of 158 dB re µPa^2.s was <0.097 km (Ref. 204). Given that the noise exposure criteria for marine mammals for TTS and PTS is based on a SEL_{24h} at similar or higher thresholds (Table 6-10), these distances (<10–100 m) are considered a conservative estimate.

On this basis, neither TTS or PTS is likely to occur, as exceedance of the TTS and PTS threshold levels require marine mammals to remain within <10–100 m of the vessel over a 24-hour period, which is not credible.

Consequently, TTS and PTS from continuous sound sources has not been considered further.

Turtles

Behavioural disturbance

Although pulsed sounds are expected to result in different impacts to that of continuous sounds, in lieu of appropriate continuous noise exposure criteria for turtles, CAPL has applied noise exposure criteria associated with impulsive sound sources. Specifically, 166 dB re 1 µPa (Table 6-11) has been selected as a conservative threshold to inform the evaluation for this potential impact.

Acoustic modelling for support vessels indicates that the maximum radial distance in any direction from the source to 166 dB re 1 µPa was 0.046 km. Therefore, turtles would need to be located close to the vessels in order to display some form of avoidance behaviour.

Although the OA overlaps the Flatback Turtle internesting BIA, Whittock et. al. (Ref. 91) reported that Flatback Turtles preference habitats within proximity of the coast and at relatively shallow depths during the internesting periods. Specifically, during the study, a maximum distance from the nearest coast and maximum water depth of 27.8 km and <44 m respectively was recorded, with the mean maximum distance away from the nearest coast and mean water depth being less than 6.1 km and <10 m respectively (Ref. 91). This suggests that although the OA overlaps the Flatback turtle internesting BIA, due to the distance offshore and increasing water depths it would be very unlikely that turtles would be aggregating within the majority of the OA (noting that higher presence may be expected within the nearshore OA located adjacent to the mainland coast near the shore crossing). Consequently, only a small number of transient marine turtles are expected to be present.

If individual marine turtles do come within close proximity (i.e. < 0.046 km) to a vessel, the behavioural responses are expected to be limited to increased swimming activity / avoidance thus impacts would be temporary in nature. Consequently, only short-term behavioural impacts to individuals have the potential to arise from these activities and have therefore been evaluated as Minor (5).

TTS and PTS

A noise exposure criterion of 200 dB re μPa^2.s and 220 dB re μPa^2.s for TTS and PTS respectively (Table 6-11). Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source a SEL_{48h} threshold of to 170 dB re μPa^2.s was <0.010 km, and to a SEL_{12h} threshold of 158 dB re μPa^2.s was <0.097 km (Ref. 204). Given that the noise exposure criteria for marine turtles for TTS and PTS is based on a SEL_{24h} at higher thresholds (Table 6-11), these distances (<10–100 m) are considered a conservative estimate.

On this basis, TTS and PTS is not expected to occur given that, exceedance of noise exposure criteria requires turtles to remain in vicinity (<10–100 m) of the vessel over a 24-hour period.

Consequently, TTS and PTS from continuous sound sources has not been considered further.

Fish including sharks and rays

Behavioural disturbance

Due to a lack of data on behavioural impacts to fish from continuous sound sources, CAPL has applied noise exposure criteria associated with TTS. Specifically, a noise exposure criterion of 158 dB 1μPa^2.s (Table 6-12) has been selected as a conservative threshold to inform the evaluation for this potential impact. Acoustic modelling for support vessels indicate that sound levels would exceed the behavioural response noise exposure criteria of 156 dB 1μPa^2.s within 0.097 km of the source.

Pelagic fish species are likely to be transient through the OA. If the fish are within the immediate vicinity of the sound source, behavioural responses are expected to be limited to an initial startle reaction before either returning to normal, or resulting in the fish moving away from the area (Ref. 192).

Demersal fish species may reside around existing subsea infrastructure (i.e., if it is providing suitable artificial habitat) within the OA. However, given the water depths within most of the OA, the sound levels at the seabed are expected to be below impact thresholds.

Consequently, behavioural impacts to pelagic and demersal fish are expected to be limited to the duration of the activity and given the small extent of exposure, only short-term behavioural effects (specifically to pelagic species) are predicted. As such the consequence was evaluated as Minor (5).

TTS and Recoverable injury

Popper *et al.* (Ref. 190) propose noise levels criteria for fish with swim bladders involved in hearing at 170 dB re 1 μPa over 48 hours for a recoverable injury, and 158 dB re 1 μPa over 12 hours for TTS. For fish species with a swim bladder involved in hearing, acoustic modelling indicates that the maximum radial distance in any direction from the source to 170 re 1μPa^2.s and 158 dB 1μPa^2.s was <0.010 km and 0.097 km respectively (Ref. 204).

Pelagic fish species are likely to be transient through the OA. Given their transient nature, these fish are not expected to remain within close proximity (~10–100 m) of a sound source for extended periods (12–48 hours) such that an injury due to continued sound exposure would occur.

Demersal fish species may reside around existing subsea infrastructure (i.e., if it is providing a suitable artificial habitat) within the OA. However, given the water depths within most of the OA, the sound levels at the seabed are expected to be below impact thresholds and thus exposure to demersal species is not expected.

On this basis, neither TTS nor recoverable injury to fish are considered credible, and have therefore not been considered further.

ALARP decision context justification

Offshore commercial vessel operations are commonplace and well-practised nationally and internationally. The application of control measures to manage impacts and risks arising from this aspect are well defined, understood by the industry, and are considered standard industry practice.

During stakeholder consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity.

Although some species that are known to be sensitive to underwater sound have the potential to be exposed to underwater noise above exposure criteria during these activities, the impacts and risks arising from underwater sound emissions are considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect. Notwithstanding this, CAPL has also considered additional mitigation measures that could potentially lower the risk to Pygmy Blue Whales associated with underwater sound emissions arising from the activities covered in this EP.

Good practice control measures and source	
Control measure	**Source**
EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	The requirements to manage interactions between vessels and cetaceans are detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans. These regulations describe strategies to ensure whales are not harmed during offshore interactions with people. By implementing these control measures and managing interactions with cetaceans near the vessels or any site surveys, the potential impacts from underwater sound are limited.
Biodiversity Conservation Regulations 2018	The requirements to manage interactions with marine fauna (including cetaceans, Whale Sharks, and Dugongs) and relevant separation distances are detailed in the WA Biodiversity Conservation Regulations 2018. By implementing these control measures and managing interactions with marine fauna near the vessels or any site surveys, the potential impacts from underwater sound are limited.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
Limiting the duration and frequency of IMR activities during peak sensitive periods of the year for Pygmy Blue Whales	The migration periods for the Pygmy Blue Whale are April to August (northbound) and November to late-December (southbound). However, as described in the consequence evaluation the estimated distances for TTS hearing impairment[43] is ~10–100 m from the sound source. These distances are within the no-approach zones required under EPBC regulations, and as such no injury to Pygmy Blue Whales is predicted to occur from underwater sound generated by field support activities. As such limiting IMR activities to a 5-month window each year, outside of Pygmy Blue Whale migration period, is not considered to provide any additional environmental benefit.	N/A
Use of routine marine fauna observations during night-time or poor visibility for vessel-based activities	Use of marine fauna observers (MFOs) may be used to assist in detecting the presence of individuals or groups of cetaceans during daylight hours under good visibility conditions only. Use of acoustic monitoring (e.g., passive acoustic monitoring [PAM]) is most effective for detecting odontocetes (toothed cetaceans, e.g., orcas, dolphins, Sperm Whales) that produce clicks and whistles that can be more readily differentiated from low frequency vessel noise, than low frequency calls by baleen whales (e.g., Humpback, Pygmy	The significant additional cost of using MFOs or PAM operators on board for the duration of an IMR vessel activity when there may be few or no detections of the targeted low-frequency whale species (i.e., Pygmy Blue Whale) during night-time or poor visibility conditions is considered grossly disproportionate to any limited environmental benefit. Therefore, control measure has not been adopted for use.

[43] Recent Commonwealth guidance has defined “injury to Blue Whales” as both PTS and TTS hearing impairment, as well as any other form of physical harm arising from anthropogenic sources of underwater noise (Ref. 308)

	Blue, Fin, Sei, Bryde's Whales). As such PAM is not considered to be appropriate for use in detecting baleen whales such as Pygmy Blue Whales.	
Limiting the duration and frequency of IMR activities during peak sensitive periods of the year for Whale Sharks	The OA intersects with a foraging BIA for Whale Sharks. This foraging BIA is associated with a northward migration from the Ningaloo Reef seasonal aggregation area along the 200 m isobath during July to November (Ref. 95). As described in the consequence evaluation the estimated distances and duration for TTS or recoverable injury to occur requires a Whale Shark to remain consistently within ~10–100 m from the sound source for extended (12–48 hours) periods. Given the duration component of the exposure, and expected transient presence of Whale Sharks on their northward migration, auditory impairment or injury to Whale Sharks is not predicted to occur. As such limiting IMR activities to a 7-month window each year, outside of Whale Shark migration/foraging periods, is not considered to provide any additional environmental benefit.	N/A

Likelihood and risk level summary	
Likelihood	Baleen whales may exhibit behavioural avoidance when sound levels are at or above 160 dB re 1 µPa (Ref. 187). Baleen whales display a gradation of behavioural responses to pulsed sound, suggesting that acoustic discharges are audible to whales at considerable distances from the source, but that they are not disrupted from normal activities such as vessel operations (Ref. 193), particularly during migration. As described above, other species such as turtles and fish are expected to initially practice avoidance behaviours in response to sound emissions, and thus the likelihood of underwater sound from these activities resulting in longer-term impact is very unlikely (Ref. 192; Ref. 194). Although localised and temporary behaviour disturbance may occur, it is unlikely that this would result in any impact to a sensitive life stage of the fauna identified. Consequently, CAPL consider the likelihood of the consequence occurring as being Rare (6).
Risk level	Very low (10)
Acceptability summary	
Principles of ESD	The impacts and risks associated with this aspect are limited to localised, short-term behavioural changes. On the assumption that this potential impact occurs during a sensitive life stage (such as migration), CAPL would not expect these activities to affect migration, internesting, or foraging behaviours, nor impact on individuals or the wider population. As such, this aspect is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no further evaluation against the Principles of ESD is required.

<table>
<tr><td>Relevant environmental legislation and other requirements</td><td colspan="2">Legislation and other requirements considered applicable for this aspect include:
EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans
Biodiversity Conservation Regulations 2018
Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 98)
Conservation Advice Rhincodon typus Whale Shark (Ref. 95)
Recovery Plan for Marine Turtles in Australia (Ref. 93).</td></tr>
<tr><td>Internal context</td><td colspan="2">No CAPL environmental performance standards / procedures were deemed relevant for this aspect.</td></tr>
<tr><td>External context</td><td colspan="2">During stakeholder consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td colspan="2">These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.
However, given that underwater sound is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents.
The Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 98) specifies the following relevant action:
anthropogenic noise in BIAs will be managed such that any Blue Whale continues to utilise the area without injury, and is not displaced from a foraging area.
No other specific relevant actions were identified within other documents implemented under the EPBC Act.
The OA does not intersect with a foraging BIA for the Pygmy Blue Whale (Table 4-2). The nearest foraging BIA occurs ~105 km southwest of the OA, offshore from North West Cape; and as such is not exposed to underwater sound emissions resulting from activities under this EP.
Therefore, CAPL has defined an acceptable level of impact as no injury to marine fauna.</td></tr>
<tr><th>Environmental performance outcome</th><th>Performance standard / Control measure</th><th>Measurement criteria</th></tr>
<tr><td rowspan="3">No injury or mortality to marine fauna within the OA from petroleum activities</td><td rowspan="3">EPBC Regulations 2000 and Biodiversity Conservation Regulations 2018
Vessels will implement caution and no approach zones, where practicable:
caution zone (300 m either side of whales and 150 m either side of dolphins)– vessels must operate at ≤6 knots within this zone, maximum of three vessels within zone, and vessels should not enter if a calf is present
no approach zone (300 m to the front and rear of whales and 100 m either side; 300 m for whale calves; 150 m to front and rear of dolphins and 100 m</td><td>Induction materials include relevant marine fauna caution and no approach zone requirements</td></tr>
<tr><td>Training records confirm offshore personnel involved in IMR activities have completed the induction</td></tr>
<tr><td>Vessel records show if marine fauna interaction occurred within caution or approach zones, and what mitigation (e.g., divert or slow vessel) measure was implemented</td></tr>
</table>

	either side; 100 m from dugongs; 30 m from whale sharks)–vessels should not enter this zone, and should not wait in front of the direction of travel or an animal or pod, or follow directly behind.	

6.4.8 Invasive marine pests

Source			
Activities identified as having the potential to result in the introduction of an invasive marine pest (IMP) are: • planned discharged of ballast water or the presence of biofouling on vessels undertaking IMR activities within the OA.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	-	An introduction of an IMP may result in: • displacement of, or compete with, native species.	2
Consequence evaluation			
IMPs are likely to have little or no natural competition or predators, thus potentially outcompeting native species for food or space, preying on native species, or changing the nature of the environment. It is estimated that Australia has >250 introduced marine pests, and that approximately one in six introduced marine species becomes a pest (Ref. 206). The particular values and sensitivities within the OA with the potential to be impacted by the introduction of an IMP within the OA include: • continental slope demersal fish communities (KEF) • ancient coastline at 125 m depth contour (KEF) • ridgeline habitat and associated communities. Although two KEFs were identified as having the potential to be exposed, as described in Section 4.5, within the OA, they are known to comprise soft sediment infauna communities. The ridgeline comprises a hard substratum that supports higher amounts of benthic fauna (such as sponges and soft corals), it is located within a relatively undisturbed area within deep-waters. Once established, some pests can be difficult to eradicate (Ref. 207) and therefore there is the potential for a long-term change in habitat structure. Highly disturbed shallow water and coastal marine environments (such as marinas) have been found to be more susceptible to colonisation than open-water environments, where the number of dilutions and the degree of dispersal is high (Ref. 208; Ref. 209; Ref. 210; Ref. 211). Although Invasive Species are identified as being of concern to marine reptile species under the *North-west Marine Bioregional Plan* (Ref. 27), the risk is associated with terrestrial based invasive marine species thus is not relevant to the activities covered under this EP. If an IMP was introduced, and if it did colonise an area, there is the potential for that colony to spread outside the OA resulting in a widespread long-term impact, therefore resulting in a Severe (2) consequence.			
ALARP decision context justification			
Offshore commercial vessel operations, and subsequent planned discharges, are commonplace and well-practised locally, nationally, and internationally. The causes resulting in an introduction of an IMP from a planned release of ballast water or hull biofouling are well understood by the industry and CAPL. The control measures to manage the risk associated with the introduction of an IMP are well defined via legislative requirements that are considered standard industry practice. These control measures are well understood and implemented by the petroleum industry and CAPL. Specifically, CAPL has worked in the region for over 10 years, thus has a demonstrated understanding of industry requirements and their operational implementation in these areas.			

<table>
<tr><td colspan="3">The risk of introducing an IMP is considered a lower-order risk in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.</td></tr>
<tr><td colspan="3">Good practice control measures and source</td></tr>
<tr><td>Control measure</td><td colspan="2">Source</td></tr>
<tr><td>Quarantine procedure</td><td colspan="2">CAPL’s Quarantine Procedure Marine Vessels (Ref. 59) provides information about quarantine compliance to CAPL, contractors, and others associated with marine vessels. The procedure also ensures that the requirements of various legislative or relevant guidelines are met, including:
• undertaking biofouling risk assessments in line with the with the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Ref. 212) and WA Vessel Check system
• requirements for biofouling management plans and/or biofouling record books, in accordance with the Control and Management of Ships’ Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) MPEC.207(62) 2011 (Ref. 9)
The quarantine procedure requires that all relevant biofouling information is provided to enable suitable risk assessments to be completed.</td></tr>
<tr><td>Maritime Arrivals Reporting System (MARS)</td><td colspan="2">Under the Commonwealth Biosecurity Act 2015, pre-arrival information must be reported through MARS before a vessel arrives in Australian waters.</td></tr>
<tr><td>Ballast water management</td><td colspan="2">The Australian Ballast Water Management Requirements (Ref. 7) describes the management requirements for ballast water exchange, including:
• non-discharge of ‘high-risk’ ballast water in Australian ports or waters
• full ballast exchange outside Australian territorial seas
documentation of all ballast exchange activities.</td></tr>
<tr><td>Anti-fouling certificate</td><td colspan="2">The Commonwealth Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 enacts Marine Order 98 (Marine pollution – anti-fouling systems). This marine order describes the conditions for when an antifouling certificate is required.</td></tr>
<tr><td colspan="3">Additional control measures and cost benefit analysis</td></tr>
<tr><td>Control measure</td><td>Benefit</td><td>Cost</td></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="3">Likelihood and risk level summary</td></tr>
<tr><td>Likelihood</td><td colspan="2">As the scale of vessel activities within shallow waters is limited, and with the well-known and implemented IMP control measures in place, it is considered Rare (6) that an IMP would be introduced resulting in impacts to the ecological functions of the KEFs or ridgeline habitat.</td></tr>
<tr><td>Risk level</td><td colspan="2">Low (7)</td></tr>
<tr><td colspan="3">Acceptability summary</td></tr>
<tr><td>Principles of ESD</td><td colspan="2">The potential impact associated with this aspect is a widespread long-term impact to benthic communities, which are expected to comprise soft sediment communities. The introduction of an IMP to these communities has the potential to affect biological diversity and ecological integrity.
The consequence associated with this aspect is Severe (2).
Therefore, further evaluation against the remaining Principles of ESD is required.
There is little uncertainty associated with this aspect as the activities and cause pathways are well known and the activities are well regulated and managed. The habitat within the OA is known from baseline studies, thus the understanding of benthic habitat at these locations is well understood (Section 4.3.5). As such, there is limited scientific uncertainty associated with this aspect; consequently the precautionary principle has not been applied.</td></tr>
</table>

Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • Commonwealth *Biosecurity Act 2015* • Commonwealth *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (enacted by Marine Order 98 [Marine pollution – anti-fouling systems]) • *Australian Ballast Water Management Requirements* (Ref. 7) • *Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines)* MPEC.207(62)) 2011 (Ref. 9) • *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry* (Ref. 212).	
Internal context	This CAPL environmental performance standard / procedure was deemed relevant for this aspect: • *Quarantine Procedure Marine Vessels* (Ref. 59)	
External context	During stakeholder consultation, no objections or claims were raised regarding IMPs arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No introduction and establishment of invasive marine pests within the OA due to petroleum activities	**Quarantine procedure** All marine vessels undertaking activities in the OA must meet the relevant requirements of the *Quarantine Procedure Marine Vessels*, including that where required: • biofouling risk assessments are completed biofouling management plans and/or biofouling record books are available.	Records confirm that relevant vessels meet requirements of the *Quarantine Procedure Marine Vessels*
	Maritime arrivals reporting system Vessels entering into the Australian territorial sea from outside Australian territory will complete pre-arrival reporting (unless Excepted under Biosecurity Determination 2016), in accordance with the *Biosecurity Act 2015*	Records confirm that international vessels completed pre-arrival reporting (or can demonstrate meeting conditions for an exception)
	Ballast water management International marine vessels will be required to comply with the key *Australian Ballast Water Management Requirements*, which are: • non-discharge of 'high-risk' ballast water in Australian ports or waters • full ballast exchange outside Australian territorial seas • documentation of all ballast exchange activities.	For international marine vessels, records show compliance with the Australian Ballast Water Management Requirements
	Antifouling certificate Marine vessels greater than 400 GT with an anti-foul coating are to maintain up-to-	Records or inspection reports (or equivalent) confirm that

	date international antifouling coating certification in accordance with *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* and/or the International Convention on the Control of Harmful Anti-fouling Systems on Ships	international antifouling coating certifications are up-to-date

6.4.9 Planned discharges—Vessel operations

<table>
<tr><th colspan="4">Source</th></tr>
<tr><td colspan="4">Activities identified as having the potential to result in planned discharges are:
• vessels operations (during IMR activities) within the OA.
The types of planned vessel discharges include deck wash-water, fire-fighting foam, sewage, greywater, food wastes, cooling water, and oily bilge water.</td></tr>
<tr><th colspan="4">Potential impacts and risks</th></tr>
<tr><th>Impacts</th><th>C</th><th>Risks</th><th>C</th></tr>
<tr><td>Planned discharges from vessels may result in:
• localised and temporary reduction in water quality.</td><td>6</td><td>A change in ambient water quality may result in:
• changes to predator-prey dynamics.</td><td>6</td></tr>
<tr><th colspan="4">Consequence evaluation</th></tr>
<tr><td colspan="4">Localised and temporary reduction to water quality
Open marine waters are typically influenced by regional wind and large-scale ocean current patterns resulting in the rapid mixing of surface and near-surface waters—where vessel discharges would occur (Ref. 173). Vessel discharges would occur in these surface and near-surface waters. Therefore, nutrients from sewage, or other similar, discharges will not accumulate or lead to eutrophication due to the highly dispersive environment (Ref. 173). This outcome was verified by sewage discharge monitoring for another offshore project (Ref. 205), which determined that a 10 m^3 sewage discharge reduced to ~1% of its original concentration within 50 m of the discharge location. In addition, monitoring at distances 50 m, 100 m, and 200 m downstream, and at five different water depths, confirmed that discharges were rapidly diluted and no elevations in water quality monitoring parameters (e.g., total nitrogen, total phosphorous, and selected metals) were recorded above background levels at any station. This modelling was based on volumes that far exceed volumes expected during support vessel operations. Therefore, the extent of impacts are expected to be localised to the discharge location.
Monitoring of desalination brine of continuous wastewater discharges (including cooling water) undertaken by Woodside for its Torosa South-1 drilling program in the Scott Reef complex found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being <1 °C above ambient within 100 m (horizontally) of the discharge point, and 10 m vertically (Ref. 205).
A vessel’s bilge system is designed to safely collect, contain and dispose of oily water so that discharge of hydrocarbons to the marine environment is minimised or avoided. Bilge water is processed via an oil-water separator before being discharged to sea. Discharge is intermittent and occurs at or near surface waters. As such, oily bilge discharges are expected to readily dilute and disperse under the action of waves and currents in surface waters. In addition, once exposed to air, any volatile components of the oil will readily evaporate.
Testing of fire-fighting deluge systems onboard vessels often leads to a release of fire-fighting foams offshore. Toxicological effects from these types of foams is typically only associated with prolonged or frequent exposures, such as on land and in watercourses near firefighting training areas (Ref. 224; Ref. 225). These conditions are not consistent with the use under this EP where use of the systems may arise once or twice over the duration of this EP. In their diluted form (as applied in the event of a fire or test), fire-fighting foams are generally considered to have a relatively low toxicity to aquatic species (Ref. 226; Ref. 227) and further dilution of the foam mixtures in dispersive aquatic environments may then occur before there is any substantial demand for dissolved oxygen (Ref. 228).
Consequently, CAPL believes that the change in water quality from these standard discharges is limited to a localised area and returns to ambient following completion of the discharge; therefore, any impacts are Incidental (6).</td></tr>
</table>

Changes to predator / prey dynamics		
The overboard discharge of sewage and macerated food waste creates a localised and temporary food source for scavenging marine fauna or seabirds, whose numbers may temporarily increase as a result, thus increasing the food source for predatory species. However, the rapid consumption of this food waste by scavenging fauna, and physical and microbial breakdown, ensures that the impacts of food waste discharges are insignificant and temporary and that all receptors that may potentially be in the water column are not impacted. The values and sensitivities within the OA with the potential to be affected by changes in predator–prey dynamics include: • Whale Shark (foraging) • Fish communities (associated with the various KEFs). Effects on environmental receptors along the food chain—fish, reptiles, birds, and cetaceans—are not expected beyond the immediate vicinity of the discharge in open waters (Ref. 173). Studies into the effects of nutrient enrichment from offshore sewage discharges indicate that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed areas (Ref. 174) and suggest that zooplankton composition and distribution in areas associated with sewage dumping grounds are not affected. However, if any changes in phytoplankton or zooplankton abundance and composition occur, they are expected to be localised, typically returning to background conditions within tens to a few hundred metres of the discharge location (Ref. 175; Ref. 176; Ref. 177). As described above, plankton communities are not affected by sewage discharges, but if they are, such effects would be highly localised (expected to return to background conditions within tens to a few hundred metres of the discharge location). Consequently, subsequent indirect impacts to other marine fauna are not expected, and thus are not considered further. Although fish are likely to be attracted to these discharges, any attraction and consequent change to predator–prey dynamics is expected to be limited to close to the release and thus is expected to result in localised impacts to species. Any increased predation is not expected to result in more than a limited environmental impact; therefore, the consequence is Incidental (6).		
ALARP decision context justification		
Offshore commercial vessel operations, and subsequent planned discharges, are commonplace and well-practiced locally, nationally, and internationally. The control measures to manage the risk associated with these planned discharges are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding vessel discharges arising from the activity. The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures and source		
Control measure	**Source**	
MARPOL 73/78 sewage discharge	Marine Order 96 (Sewage) gives effect to MARPOL 73/78 Annex IV. MARPOL is the International Convention for the Prevention of Pollution from Ships is aimed at preventing both accidental pollution and pollution from routine operations.	
MARPOL 73/78 food waste discharge	Marine Order 95 (Marine pollution prevention – garbage) gives effect to MARPOL 73/78 Annex V, which details the conditions in which macerated and unmacerated food waste can be discharged to the environment.	
MARPOL 73/78 oily bilge discharge	Marine Order 91 (Marine pollution prevention – oil) gives effect to MARPOL 73/78 Annex I, which details the conditions by which oily bilge is authorized to be discharged to the environment.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

<table>
<tr><th colspan="3">Likelihood and risk level summary</th></tr>
<tr><td>Likelihood</td><td colspan="2">Given the nature and scale of this activity with standard control measures in place, it is considered Rare (6) that these discharges would result in any impact to the ecological function of the particular values and sensitivities present within the OA.</td></tr>
<tr><td>Risk Level</td><td colspan="2">Very low (10)</td></tr>
<tr><th colspan="3">Determination of acceptability</th></tr>
<tr><td>Principles of ESD</td><td colspan="2">The potential impact associated with this aspect is limited to a short-term direct reduction in water quality in a localised area, which is not considered as having the potential to affect biological diversity and ecological integrity.
Accordingly, the consequence associated with this aspect is Incidental (6).
Therefore, no further evaluation against the Principles of ESD is required.</td></tr>
<tr><td>Relevant environmental legislation and other requirements</td><td colspan="2">Legislation and other requirements considered relevant to this aspect include:
• Marine Order 91
• Marine Order 95
• Marine Order 96
• MARPOL 73/78 Annex I, IV and V</td></tr>
<tr><td>Internal context</td><td colspan="2">These CAPL environmental performance standard / procedures were deemed relevant for this aspect:
• MSRE process (Ref. 52).</td></tr>
<tr><td>External context</td><td colspan="2">During stakeholder consultation, no objections or claims were raised regarding discharges arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td colspan="2">These impacts and risks are inherently acceptable as they are lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.</td></tr>
<tr><th>Environmental performance outcome</th><th>Performance standard / Control measure</th><th>Measurement criteria</th></tr>
<tr><td rowspan="2">No impacts to marine habitats or marine fauna outside of the OA from vessel discharges during petroleum activities</td><td>MARPOL 73/78 sewage discharge
Offshore discharge of sewage from vessels will be in accordance with these MARPOL 73/78 Annex IV requirements:
• An IMO approved comminution and disinfection system to discharge (greater than 3 nm from the nearest land); or
• An IMO approved Sewage Treatment Plant at any location; or
• Untreated sewage discharged ≥12 nm from the nearest land while the vessel is proceeding at no less than 4 knots.</td><td>Records show sewage is discharged in accordance with MARPOL 73/78 Annex IV, including current International Sewage Pollution Prevention (ISPP) Certificate (for marine vessels >400 T or certified to carry more than 15 persons)</td></tr>
<tr><td>MARPOL 73/78 food waste discharge
Offshore discharge of food waste from vessels will be in accordance with these MARPOL 73/78 Annex V requirements:
• macerated to no greater than 25 mm and when the marine vessel is at least 3 nm from the nearest land; or</td><td>Records show food waste is discharged in accordance with MARPOL 73/78 Annex V</td></tr>
</table>

	• unmacerated when the marine vessel is at least 12 nm from the nearest land.	
	MARPOL 73/78 oily bilge water discharge Oily bilge water will be discharged to marine environment only when the concentration is <15 ppm in accordance with MARPOL 73/78, Annex I: • through an IMO approved on board oil-water separator; and • when the marine vessel is en route.	Records show oily bilge water is discharged in accordance with MARPOL 73/78 Annex I, including current International Oil Pollution Prevention (IOPP) Certificate

6.4.10 Unplanned release—Waste

Source			
Activities identified as having the potential to result in the unplanned release of waste are: • vessel operations (during IMR activities) within the OA. Because waste is generated on board vessels, inappropriate management and storage has the potential to result in a release to the environment.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
• N/A	-	Unplanned release of waste to the environment may result in: • marine pollution resulting in entanglement or injury of marine fauna	6
Consequence evaluation			
If hazardous / non-hazardous waste is lost overboard, the extent of exposure to the environment is limited. Marine fauna most at risk from marine pollution include marine reptiles and seabirds, through ingestion or entanglement (Ref. 93; Ref. 95). Ingestion or entanglement has the potential to limit feeding or foraging behaviours and thus can result in marine fauna injury or death. Although marine debris is identified as being of concern to marine reptile species under the *North-west Marine Bioregional Plan* (Ref. 27), the risk is associated with ‘land-sourced plastic garbage, fishing gear from recreational and commercial fishing abandoned into the sea, and ship-sourced, solid non-biodegradable floating materials disposed of at sea’. This type of waste is not associated with the activities described under this Plan and given the restricted exposures and the limited quantity of waste with the potential to cause marine pollution that is expected to be generated from this program, it is expected that any impacts from marine pollution would result in limited impacts to individuals. Thus, CAPL ranked this consequence as Incidental (6).			
ALARP decision context justification			
Offshore commercial vessel operations, and the subsequent management of waste, are commonplace and well-practiced activities within the industry. The control measures to manage the risk associated with an unplanned release of waste are well defined via legislative requirements that are considered standard industry practice. There is a good understanding of the release pathways, and the control measures required to manage these events are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding waste management arising from the activity. An unplanned release of waste is a lower-order risk in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.			

Good practice control measures and source	
Control measure	**Source**
Marine Order 95 (Marine pollution prevention – garbage)	MARPOL 73/78 is the International Convention for the Prevention of Pollution from Ships and is aimed at preventing both accidental pollution, and pollution from routine operations. Specifically, MARPOL 73/78 Annex V requires that a garbage management plan and garbage record book is in place and implemented and describes various requirements that are to be applied when managing waste offshore. Marine Order 95 (Marine pollution prevention – garbage) gives effect to MARPOL 73/78 Annex V.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	Marine pollution arising from mismanaged waste offshore has occurred previously in the industry but is not expected to occur during these activities, given the control measures in place. As such, the likelihood of incidental consequences to values and sensitivities from an unplanned release of waste is considered Remote (5).
Risk level	Very low (10)

Determination of acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to individuals and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no additional evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • Marine Order 95 • MARPOL 73/78 • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • *Recovery Plan for Marine Turtles in Australia* (Ref. 93) • *National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016* (Ref. 180)
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.
External context	During stakeholder consultation, no objections or claims were raised regarding waste management arising from the activity.
Defined acceptable level	These impacts are inherently acceptable as they are lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.

Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No uncontrolled release of waste to the environment during petroleum activities	**Marine Order 95 (Marine pollution prevention – garbage)** Marine vessels >100 T (or certified to carry >15 persons) will have a	OVIS report / ABU Marine OE Inspection Checklist verifies that a Garbage Management Plan is

	Garbage Management Plan on board, in accordance with MARPOL 73/78 Annex V	on board marine vessels >100 T or certified to carry >15 persons
	Marine Order 95 (Marine pollution prevention – garbage) Marine vessels >400 T (or certified to carry >15 persons) will have a Garbage Record Book on board, in accordance with MARPOL 73/78 Annex V	Current and completed Garbage Record Book (for marine vessels >400 T or certified to carry >15 persons)
	Marine Order 95 (Marine pollution prevention – garbage) For waste that is incinerated on board a marine vessel, the incinerator is to be IMO-approved and the waste incinerated is to be recorded in accordance with MARPOL 73/78 Annex V	Current International Air Pollution Prevention (IAPP) Certificate (for marine vessels >400 T or certified to carry >15 persons)
		Current and completed Garbage Record Book (for marine vessels >400 T or certified to carry >15 persons).

6.4.11 Unplanned release—Loss of containment

Source

Activities identified as having the potential to result in a minor loss of containment (LOC) event:

- vessel operations within the OA.

Based on the activities described in this EP, the following potential minor LOC scenarios were identified:

- mechanical failure/damage or human error of hazardous materials storage resulting in a loss of diesel or other fluid[1]
- mechanical failure/damage or human error during bunkering resulting in a loss of marine fuel[2].

[1] A range of hydrocarbons and other hazardous chemicals / materials are likely to be present during start-up and operation activities; however, the maximum credible volume associated with a single-point failure was estimated to be ~1 m^3 based on the loss of an entire intermediate bulk container due to rupture while handling.

[2] AMSA (Ref. 147) suggests the maximum credible spill volume from a refuelling incident with continuous supervision is approximately the transfer rate × 15 minutes. Assuming failure of dry-break couplings and an assumed 200 m^3/h transfer rate (based on previous operations), this equates to an instantaneous spill volume of ~50 m^3.

Potential impacts and risks

Impacts	C	Risks	C
N/A	-	Unplanned release of hazardous material to the environment may result in: • indirect impacts to fauna arising from chemical toxicity	5

Consequence evaluation

Upon release, a loss of 50 m^3 of a hazardous product (such as light hydrocarbons [diesel] or chemicals) would be expected to change the water quality of both surface and pelagic waters.

The environmental impacts associated with a surface release of 50 m^3 of marine diesel oil (MDO) or other hazardous materials are expected to be much less than those associated with a loss of hydrocarbons from a vessel collision (Section 7.2), and thus are not evaluated in detail here.

The values and sensitivities within the OA with the potential to be exposed to decreased water quality from a minor LOC surface release include:

- Humpback Whale (migration)
- Pygmy Blue Whale (migration and distribution)
- Flatback Turtle (internesting buffer, nesting)

<table>
<tr><td colspan="3">

- Hawksbill Turtle (internesting buffer)
- Whale Shark (foraging).

Based on the nature of these unplanned releases, which are non-continuous and expected to occur in a location where no specific sedentary behaviours for values and sensitivities have been identified, the extent and severity of any potential impact is expected to be limited.

Given the nature of unplanned releases covered under this EP and the transient nature of identified values and sensitivities, fauna would need to pass directly through the plume almost immediately upon release to be impacted.

Any potential impact from such an event is expected to be short term and limited to a small number of individuals, thus the consequence level was determined as Minor (5).
</td></tr>
<tr><th colspan="3">ALARP decision context justification</th></tr>
<tr><td colspan="3">

Offshore vessel operations are commonplace and well-practised offshore activities. The control measures to manage the risk associated with minor LOC scenarios from these activities are well defined via legislative requirements that are considered standard industry practice. There is a good understanding of potential spill sources, and the control measures required to managed these are well understood and implemented by the petroleum industry and CAPL.

During stakeholder consultation, no objections or claims were raised regarding minor LOC management arising from the activity.

These risks are lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.
</td></tr>
<tr><th colspan="3">Good practice control measures and source</th></tr>
<tr><th>Control measure</th><th colspan="2">Source</th></tr>
<tr><td>MSRE process</td><td colspan="2">

The MSRE process (Ref. 52) ensures that various legislative requirements and CAPL standards are met. Specifically, pre-mobilisation inspections may include:

- visual checks of accessible equipment and hydraulic hoses for defects
- confirmation that dry-break couplings or similar automated stop devices are available for use on marine vessels that are refuelled at sea
- secondary containment is available for hydrocarbons and chemicals stored on the deck of marine vessels
- bunkering procedures are available.
</td></tr>
<tr><td>Ship Oil Pollution Emergency Plan (SOPEP)/ Shipboard Marine Pollution Emergency Plan</td><td colspan="2">

MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil) requires that each vessel has an approved SOPEP in place.

To prepare for a spill event, the SOPEP details:

- response equipment available to control a spill event
- review cycle to ensure that the SOPEP is kept up to date
- testing requirements, including the frequency and nature of these tests.

In the event of a spill, the SOPEP details:

- reporting requirements and a list of authorities to be contacted
- activities to be undertaken to control the discharge of oil
- procedures for coordinating with local officials.
</td></tr>
<tr><th colspan="3">Additional control measures and cost benefit analysis</th></tr>
<tr><th>Control measure</th><th>Benefit</th><th>Cost</th></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><th colspan="3">Likelihood and risk level summary</th></tr>
<tr><td>Likelihood</td><td colspan="2">The likelihood that a minor LOC event results in a Minor (5) consequence was determined to be Remote (5). With the control measures in place, it was considered very unlikely that a minor LOC event associated with this</td></tr>
</table>

	activity would occur, and even more unlikely that such an event would impact any of the identified values and sensitivities, which are known to be transient and unlikely to be present at the exact location of the minor LOC.	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • Marine Order 91, Marine pollution prevention – oil • MARPOL 73/78	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: MSRE process (Ref. 52).	
External context	During stakeholder consultation, no objections or claims were raised regarding minor LOC management arising from the activity.	
Defined acceptable level	These impacts are inherently acceptable as they are lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No unplanned release of hydrocarbons / hazardous materials to the environment during petroleum activities	**MSRE process** Prior to commencement of IMR activities, the following will be undertaken during a pre-mobilisation vessel inspection, as per the MSRE process: • visual checks of accessible equipment and hydraulic hoses for defects • confirmation that dry-break couplings or similar automated stop devices are available for use on marine vessels that are refuelled at sea • confirmation that secondary containment is available for hydrocarbons and chemicals stored on the deck of marine vessels.	OVIS report / ABU Marine OE Inspection Checklist confirms that equipment and hydraulic hoses are visually free of defects, dry-break couplings or similar are available for use, and, and secondary containment is available on the deck of the marine vessel
	MSRE process Refuelling is undertaken in accordance with CAPL-approved refuelling / bunkering procedures, which include the appropriate weather / sea / visibility conditions, as determined by the Vessel Master.	Records confirm that refuelling is undertaken in accordance with CAPL-approved refuelling / bunkering procedure

Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	**SOPEP** Marine vessels >400 T will carry on board a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL 73/78 Annex I – Prevention of Oil Pollution	OVIS report / ABU Marine OE Inspection Checklist confirms an approved SOPEP is on board marine vessels >400 T
		Inspection records (or similar) show drills conducted in accordance with SOPEP
		Inspection records (or similar) show spill kits available in accordance with SOPEP
	SOPEP In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP (or equivalent)	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill.

7 environmental impact and risk assessment and management—emergency events and response

This section provides an evaluation of the impacts and risks associated with emergency events/response appropriate to the nature and scale of each impact and risk, details the control measures that are used to reduce the risks to ALARP and to an acceptable level, and identifies the associated environmental performance outcomes, performance standards, and measurement criteria.

Table 7-1 summarises the impacts and risks that were identified and evaluated for this activity.

Table 7-1: Summary of impact and risk evaluation—emergency events and response

Section	Aspect	Impact	Risk			Decision context	ALARP	Acceptable
		C^	C^	L	R			
7.1	Unplanned release—	–	5	5	9	A	Yes	Yes
7.2	Unplanned release—vessel collision event	–	5	5	9	A	Yes	Yes
7.3.4.1	Ground disturbance—shoreline spill response	–	5	5	9	A	Yes	Yes
7.3.4.2	Physical presence—oiled wildlife response	–	5	5	9	A	Yes	Yes

C = consequence, L = likelihood, R = risk

^ Where an aspect is identified as having both potential impacts and risks, the highest-level consequence was evaluated in detail to ensure that justification is provided to support the highest consequence level for that aspect.

7.1 Unplanned release—hydrocarbon system

Operation of the subsea hydrocarbon system introduces the potential for an unplanned release of gas and condensate. An evaluation of all spill scenarios associated with the hydrocarbon system was completed and the following scenarios identified:

- LOC event (Section 7.1.1.1)
- loss of well integrity event (Section 7.1.1.2)
- loss of effective well control event (Section 7.1.1.3)
- minor defect in flowline or production pipeline (Section 7.1.1.4)
- major defect in flowline or production pipeline (Section 7.1.1.5).

Based upon the scenario evaluation, a major defect in flowline or production pipeline was deemed to present the worst-case credible spill scenario under this EP and has been used as the basis for the risk assessment.

7.1.1 Scenario evaluation

7.1.1.1 LOC event

Corrosion or mechanical failure/damage of flowlines or subsea values may result in a release of condensate, control fluids, or MEG. CAPL defined the worst-case credible scenario as a ~58 m^3 release of condensate from a flowline. This scenario was deemed feasible for the activities undertaken in this EP. The risk associated with this scenario is evaluated in Section 6.1.4

7.1.1.2 Loss of well integrity

Section 12.2.2 of the NOPSEMA-accepted *Wheatstone Project: Producing Phase Well Operations Management Plan* (Ref. 8) describes the different well control events and levels of emergency response associated with these situations. Under the WOMP, CAPL categorise well control into two categories:

- loss of well integrity—where integrity of the well has been compromised, but the well remains under control (which would prompt a Level 1 or Level 2 well control emergency response)
- loss of effective well control—where control of the well has been lost (which would require a Level 3 well control emergence response).

Section 9.7.2 of the WOMP (Ref. 8) identifies that a loss of well integrity during start-up and production operations has the potential to occur by:

- mechanical failure (leak in A annulus or leak in production casing)
- overpressure (overpressure of annulus leading to burst casing)
- corrosion (corrosions leading to loss of tubing or casing integrity)
- erosion of barriers through excessive solids production
- operating error (incorrect operation of valves or controls, or SIMOPS clashes)
- dropped objects onto the well envelope (potential damage to subsea tree).

As detailed in the WOMP, primary and secondary barriers are in place to mitigate well integrity impacts during start-up and production operations. These barriers include:

- subsea tree (primary)
- production conduit pressure envelope (primary)
- “A” annulus pressure envelope (secondary).

In addition to this, an emergency (tertiary) barrier is in place being the SCSSV flapper valve.

Based upon the activities within scope of this EP, CAPL has calculated that a worst-case credible spill scenario associated with a loss of well integrity event is limited to the contents of the well above the SCSSV flapper valve. This equates to 20.5 m^3 for Wheatstone wells, 18.8 m^3 for Iago wells, and 5.5 m^3 for JDP wells. These volumes are based on the capacity of the production tubing conduit between the SCSSV flapper valve and the subsea tree located at the wellhead.

If a loss of well integrity event was to occur for any of the Wheatstone or Iago wells, following any closing of valves by the Operations work group (managed from the control room on the Wheatstone Platform), the shut-in well would be handed over to the ABU Wells work group as detailed in Section 3.2.1.1.1. Any subsequent works (e.g., well intervention) to address the well integrity issue would become planned activities implemented under the NOPSEMA-accepted *Wheatstone Project: Wheatstone Well Intervention and Infill Drilling Environment Plan* (Ref. 6). The risks, management measures, response and capability arrangements for well intervention activities are covered under the separate accepted EP (Ref. 6) and are not assessed here.

Similarly, if a loss of well integrity event was to occur for any of the JDP wells, following any closing of valves by the Operations work group (managed from the control room on the Wheatstone Platform), the shut-in well would be handed over to Woodside as detailed in Section 2.3.3 and Section 3.2.1.1.1. Any subsequent works (e.g., well intervention) to address the well integrity issue would become planned activities for Woodside, and as such not assessed here.

7.1.1.3 Loss of effective well control

As detailed in the WOMP, a loss of effective well control event is identified as a feasible risk during well construction and well interventions activities (Ref. 8). Well construction and intervention activities are not within the scope of this EP (Section 2.3.2); they are covered within the NOPSEMA-accepted *Wheatstone Project: Wheatstone Well Intervention and Infill Drilling Environment Plan* (Ref. 6).

As well construction and intervention activities are not included within the scope of this EP, CAPL does not consider a loss of effective well control to be a feasible risk associated with the activities within this EP. Consequently, this scenario is not assessed further here.

7.1.1.4 Minor defect in flowline or production pipeline

Modelling was undertaken by Intecsea (Ref. 78) to understand indicative release rates prior to isolation of leaks from the Wheatstone trunkline. Results indicate that release rates prior to isolation did not vary significantly with location of release, and were estimated at ~0.01 kg/s for 2 mm defects, <1 kg/s for 15 mm defects, and <10 kg/s for 50 mm defects (Ref. 78).

Based on a time before isolation at 24 hours, no depressurisation of the pipeline, and a release duration of up to 30 days, a total of up to ~663 m^3, ~4,310 m^3, and ~1,060 m^3 was predicted to be released in a leak located near the platform, mid-trunkline, and nearshore respectively (Ref. 78).

However, due to the slow daily release rate, the properties of the hydrocarbon fluid (including highly volatile and evaporating once reaching the surface), and the high dispersion and dilution that would occur in an open ocean environment, the exposure due to a minor leak is considered to be limited in nature and scale.

7.1.1.5 Major defect in flowline or production pipeline

Upon evaluating the risks associated with activities covered under this EP, CAPL considers that a major defect in a flowline or trunkline is the most credible (but unlikely) unplanned event. Specifically, a full-bore rupture (FBR) was selected as the worst-case major defect event.

For the purpose of this risk assessment, modelling to determine the credible spill volumes from a FBR event was completed for three locations along the trunkline: inner (nearshore), middle, and outer (platform) (Ref. 78).

Results indicated it would conservatively take ~2 hours to detect and isolate the trunkline following a FBR, based on the time it takes for the arrival pressure at the LNG Plant to drop from maximum operating pressure to below the minimum arrival pressure, assuming no isolation of flow into the trunkline. Such a drop in delivery pressure at the downstream plant will trigger alarm/detection and production would cease.

Consequently, a FBR at the middle location would result in ~3,710 m^3 of condensate fluids being released within ~7.2 hours, which includes the 2 hours required for detection and isolation (Ref. 78). This is the largest volume released of the three scenarios, as the middle location FBR would be fed by product from both upstream and downstream of the rupture location. The inner nearshore location and the outer platform location would result in smaller spill volumes due to reasons associated with the depth and pressure at those sites (Ref. 78).

Discussions with RPS suggested that using a constant release rate based on the volume and duration of release would be representative given the conservatism built into the initial spill release volume calculations. In reality, the release rate is likely to decrease over time as the trunkline depressurises and as surrounding hydrostatic pressure from the water reduces the flow and volume.

7.1.2 Spill modelling

CAPL commissioned RPS to conduct spill modelling to inform the risk assessment associated with a major defect event.

Two models were used as part of the spill modelling: OILMAP-DEEP was used to simulate the nearfield multiphase plume rise dynamics from the subsea release, and a three-dimensional oil spill model (SIMAP) was used to simulate the drift, spread, weathering and fate of the spilled oil (Ref. 107). Modelling was conducted using a stochastic approach, where multiple simulations (using the same spill parameters) were conducted, but under varying meteorological and oceanographic conditions.

Table 7-2 summarises the model settings; Table 7-3 summarises the hydrocarbon properties for the trunkline condensate; and Table 7-4 and Table 7-5 describe the modelled environmental exposure and impact thresholds respectively.

Table 7-2: Major defect spill scenario model settings

Parameter	Details	
Release Location	Nearshore trunkline	Middle trunkline
Latitude	21°35’33.44” S	20°44’51.66” S
Longitude	114°57’37.30” E	114°51’52.14” E
Water Depth	10 m	115 m
Oil type	Trunkline condensate	Jansz condensate
Simulation spill type	Subsea	
Simulation spill volume	3,000 m^3	4,000 m^3
Simulation spill duration	25 hours	7 hours
Total simulation duration	30 days	
Number of randomly selected spill simulation start times	100 per season (300 total)	
Seasons modelled	Summer (October to March) Transitional (April and September) Winter (May to August)	

Table 7-3: Physical properties and boiling point ranges for Trunkline condensate

Characteristic	Value
Density	770.0 kg/m^3 (at 15 °C)
Dynamic viscosity	1.248 cP (at 20 °C)

Characteristic	Value			
Pour point	-24 °C			
API gravity	52.3 API			
Classification	Group I, non persistent oil			
Boiling point	Volatile <180 °C	Semi-volatile 180–265 °C	Low volatility 265–380 °C	Residual >380 °C
	62.1%	22.4%	12.8%	2.7%

Table 7-4: Hydrocarbon environmental exposure thresholds

Environmental exposure threshold^	Justification
Surface ≥1 g/m² (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the surface exposure threshold at ≥1 g/m². This threshold is used to establish a planning area for scientific monitoring (Ref. 108).
In-water (dissolved) ≥10 ppb (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the in-water (dissolved) exposure threshold at ≥10 ppb. This threshold is used to establish a planning area for scientific monitoring (specifically, for water quality) (Ref. 108).
In-water (entrained) ≥10 ppb (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the in-water (entrained) exposure threshold at ≥10 ppb. This threshold is used to establish a planning area for scientific monitoring (specifically, for water quality) (Ref. 108).
Shoreline ≥10 g/m² (low)	CAPL has set the shoreline exposure threshold at ≥10 g/m². This threshold is consistent with the low exposure value for shoreline oil within NOPSEMA's oil spill modelling bulletin (Ref. 108).

^ Environmental exposure thresholds have been used to define the EEA, and the presence of environmental values and sensitivities within this area have been identified in Section 4. These exposure thresholds and the spatial extent of the EEA is not used as part of the environmental impact and risk assessment presented below.

Table 7-5 Hydrocarbon environmental impact thresholds

Environmental impact threshold	Justification
Surface ≥1 g/m² (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the surface impact threshold for socio-economic effects at ≥1 g/m². This threshold is equivalent to ~1,000 L/km² or a layer thickness of ~1 µm. At this concentration, oil on the water surface is expected to be visible. The Bonn Agreement Oil Appearance Code (Ref. 109) describes a 0.3–5.0 µm thick oil layer as having a rainbow-coloured appearance. Due to this visibility, there is the potential to impact nature-based activities (such as tourism) via a reduction in aesthetics.
Surface ≥10 g/m² (moderate)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the surface impact threshold for ecological effects at ≥10 g/m². This threshold is equivalent to ~10,000 L/km² or a layer thickness of ~10 µm. The Bonn Agreement Oil Appearance Code (Ref. 109) describes a 5–50 µm thick oil layer as having a metallic appearance. This threshold is considered by NOPSEMA to approximate the lower limit of harmful effects to birds and marine mammals (Ref. 108). This threshold is consistent with observations ranging from physical oiling to toxicity effects for marine fauna within literature, including French et al. (Ref. 110), French-McCay (Ref. 111), Engelhardt (Ref. 112), Clark (Ref. 113), Geraci and St. Aubin (Ref. 114) and Jenssen (Ref. 115).

Environmental impact threshold	Justification
In-water (dissolved) ≥50 ppb (moderate)	Laboratory studies have shown that dissolved oil exert most of the toxic effects of oil on aquatic biota (e.g., Carls et al. [Ref. 116], Nordtug et al. [Ref. 117], Redman [Ref. 118]). Being soluble, the dissolved oil can be taken up by organisms directly from the water column by absorption through external surfaces and gills, as well as through the digestive tract. In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the in-water (dissolved) impact threshold for sublethal ecological effects at ≥50 ppb. This threshold is considered by NOPSEMA to approximate potential toxic effects, particularly sublethal effects to sensitive species (Ref. 108). This threshold is based on an instantaneous concentration, and therefore only requires the dissolved oil to be at this concentration for one-hour (based on minimum model time-step) to trigger this threshold.
In-water (dissolved) ≥4,800 ppb.hrs (moderate)	Toxicity is the relative ability of a substance to cause adverse effects; and this relative ability is dependent on factors including both dose and duration. As such, CAPL has set the in-water (dissolved) impact threshold for lethal ecological effects at ≥4,800 ppb.hrs. This threshold is based on the instantaneous concentration (50 ppb) recommended by NOPSEMA but also applies a duration component of 96 hours. Therefore, dissolved oil needs to be at this concentration consistently for 96 hours to trigger this threshold. French-McCay (Ref. 119) reviewed toxicity data for marine biota exposed to dissolved oil and found that 95% of species and life stages exhibited 50% population mortality (LC50) for total PAH concentrations between 6–400 ppb (with an average of 50 ppb) after 96 hours exposure.
In-water (entrained) ≥100 ppb (high)	Entrained oil are insoluble droplets suspended in the water column, and as such exposure pathways are direct contact with external tissue or direct oil consumption. In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the in-water (entrained) impact threshold for sublethal ecological effects at ≥100 ppb. This threshold is considered by NOPSEMA as appropriate for informing risk evaluation (Ref. 108). This threshold is based on an instantaneous concentration, and therefore only requires the entrained oil to be at this concentration for one-hour (based on minimum model time-step) to trigger this threshold. French-McCay (Ref. 120) identified that if total hydrocarbons in entrained oil droplets was to be evaluated as a risk, 100 ppb would be an extremely conservative sublethal threshold.
In-water (entrained) ≥9,600 ppb.hrs (high)	CAPL has set the in-water (entrained) impact threshold for lethal ecological effects at ≥9,600 ppb.hrs. This threshold is based on the instantaneous concentration (100 ppb) recommended by NOPSEMA but also applies a duration component of 96 hours. Therefore, entrained oil needs to be at this concentration consistently for 96 hours to trigger this threshold. It is however noted that entrained oil, especially when in weathered state, is typically not considered toxic.
Shoreline ≥10 g/m^2 (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the shoreline impact threshold for socio-economic effects at ≥10 g/m^2. This threshold is equivalent to ~10 mL/m^2 or ~2 teaspoons/m^2. At this concentration, oil on the shoreline is expected to be visible. Due to this visibility, there is the potential to impact nature-based activities (such as tourism or recreational use) via a reduction in aesthetics.
Shoreline ≥100 g/m^2 (moderate)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 108), CAPL has set the shoreline impact threshold for ecological effects at

Environmental impact threshold	Justification
	≥100 g/m². This threshold is equivalent to ~100 mL/m² or 20 teaspoons/m². French et al. (Ref. 110) and French-McCay (Ref. 111) define shoreline oil accumulation at ≥100 g/m² as potentially harmful to wildlife (including invertebrates, birds, furbearing aquatic mammals and marine reptiles), based on studies for sub-lethal and lethal impacts. Impacts on vegetated habitats (such as saltmarsh and mangroves) have been observed at higher concentrations of shoreline oil. Observations by Lin and Mendelssohn (Ref. 121) demonstrated that loadings of >1,000 g/m² of oil during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing oil impacts on mangroves (e.g., Grant et al. [Ref. 122], Suprayogi and Murray [Ref. 123]).

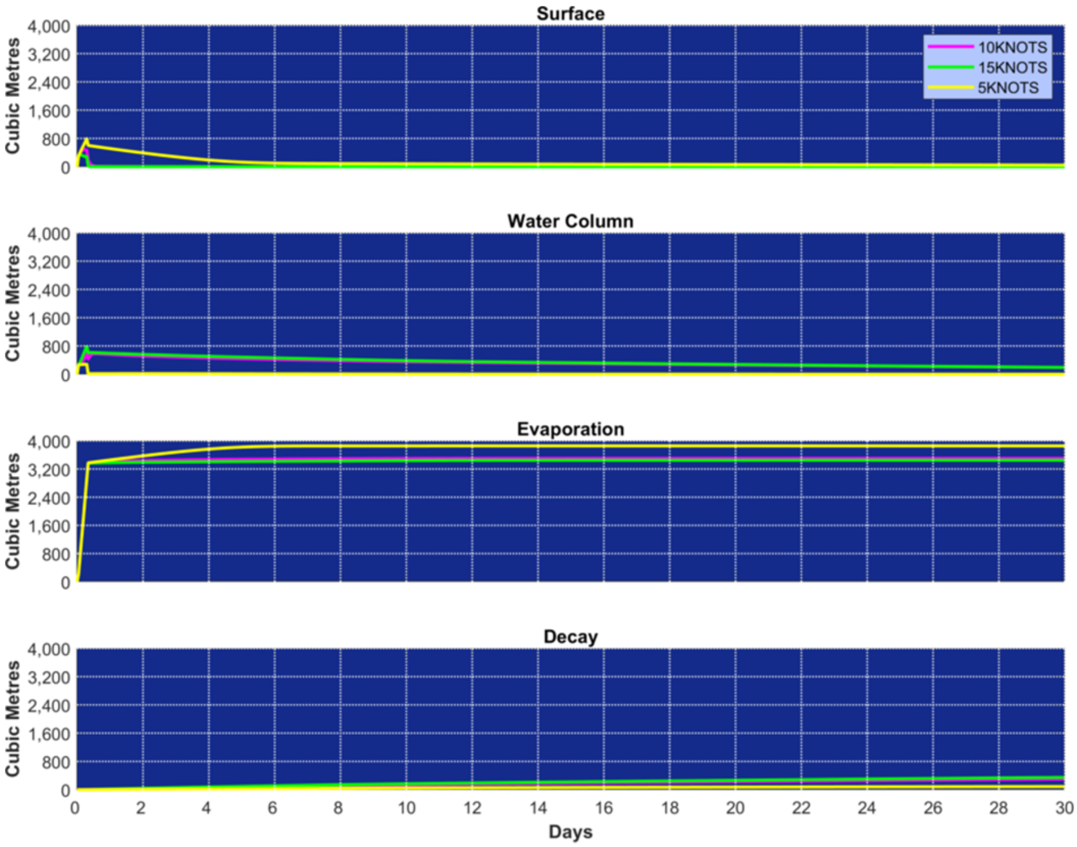
^ Environmental impact thresholds have been used to define the EMBA, and the presence of environmental values and sensitivities within this area have been identified in Section 4. These impact thresholds and the spatial extent of the EMBA is used as part of the environmental impact and risk assessment presented below.

7.1.2.1 Weathering and fate

The trunkline condensate is a mixture of several oil types (i.e., a mixture of oils originating from Wheatstone, Iago, and JDP). The trunkline condensate is non-persistent oil, with a density of 770.0 kg/m³, an API of 52.3, and a low pour point (−24 °C) (Table 7-3). The low viscosity (1.248 cP) indicates that this oil will spread quickly when released and will form a thin film on the sea surface, increasing the evaporation rate.

Generally, 62.1% of the trunkline condensate mass should evaporate within the first 12 hours (boiling point <180 °C); a further 22.4% should evaporate within the first 24 hours (boiling point 180°C–265 °C); and an additional 12.8% should evaporate over several days (boiling point 265°C–380 °C). Approximately 2.7% (by mass) of the trunkline condensate will not evaporate at atmospheric temperatures. These compounds will persist in the environment.

Figure 7-1 shows predicted weathering for a subsea release of 4,000 m³ over 7 hours of the trunkline condensate (tracked for 30 days) under three static wind conditions. Predictions show that under all wind conditions, >80% of the slick volume evaporated within the initial 24 hours, demonstrating the highly evaporative nature of this condensate once on the sea surface.



(Source: Ref. 107)

Figure 7-1: Predicted weather of a subsea release of 4,000 m³ over 7 hours under three static wind conditions

7.1.2.2 Modelling outputs

Stochastic modelling outputs from RPS (Ref. 107) are summarised in Table 7-6 having regard to the particular values and sensitivities within the EMBA as identified in Section 4.

For the 3,000 m³ nearshore trunkline FBR:

- The maximum distance from the release location to the ≥1 g/m² visible impact threshold was ~47 km west-southwest (winter), and ~14 km west-southwest (winter) for the ≥10 g/m² impact threshold.
- The probability of contact to any shoreline at ≥10 g/m² was 46%, 59% and 88% in summer, transitional and winter months, respectively. The minimum time before shoreline contact was ~1 hour and the maximum volume of oil ashore was ~225.7 m³ (winter). The maximum length of shoreline exposed at ≥10 g/m² was ~6 km, at ≥100 g/m² was ~5 km, and at ≥1,000 g/m² was ~2 km (all occurring during winter).
- Dissolved oil at ≥50 ppb impact threshold was predicted to occur; however, remained in the surface layers (<20 m water depth) only. Dissolved oil at ≥4,800 ppb.hrs impact threshold was predicted to occur; however, remained in the surface layer (<10 m water depth) only.
- Entrained oil at ≥100 ppb impact threshold was predicted to occur; however, remained in the surface layers (<20 m water depth during summer; <10 water depth during winter and transitional) only. Entrained oil at ≥9,600 ppb.hrs

impact threshold was predicted to occur; however, remained in the surface layer (<10 m water depth) only.

For the 4,000 m^3 middle trunkline FBR:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~61 km south (summer), and ~55 km west-southwest (transitional) for the ≥10 g/m^2 impact threshold.
- No shoreline accumulation above impact thresholds was predicted to occur during any season.
- Dissolved oil at ≥50 ppb impact threshold was predicted to occur; however, remained in the surface layers (<20 m water depth) only. Dissolved oil at ≥4,800 ppb.hrs impact threshold was predicted to occur; however, remained in the surface layer (<10 m water depth) only.
- Entrained oil at ≥100 ppb impact threshold was predicted to occur; however, remained in the surface layers (<20 m water depth) only. Entrained oil at ≥9,600 ppb.hrs impact threshold was predicted to occur; however, remained in the surface layer (<10 m water depth) only.

Table 7-6: Major defect spill modelling EMBA receptor exposure summary

Sensitivity	Name	Surface^		In-water (dissolved)^		In-water (entrained)^		Shoreline^	
		≥1 g/m²	≥10 g/m²	≥50 ppb	≥4,800 ppb.hrs	≥100 ppb	≥9,600 ppb.hrs	≥10 g/m²	≥100 g/m²
		(probability of exposure, minimum time to exposure)		(probability of exposure)		(probability of exposure)		(probability of exposure, minimum time to exposure, mean length of shoreline)	
AMP	Gascoyne	—	—	0–1%	—	0–7%	0–1%	—	—
	Montebello	—	—	—	—	0–2%	0–1%	—	—
	Ningaloo	—	—	—	—	0–10%	0–1%	—	—
KEF	Ancient coastline at 125 m depth contour	0–100%, ~1 hour	0–100%, ~1 hour	0–82%	0–74%	0–73%	0–75%	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	0–21%, ~1 hour	0–4%, ~0.75 days	0–1%	—	0–17%	0–1%	—	—
	Commonwealth waters adjacent to Ningaloo Reef	—	—	—	—	0–10%	0–1%	—	—
	Continental slope demersal fish communities	—	—	0–8%	—	0–35%	0–15%	—	—
	Exmouth Plateau	—	—	—	—	0–3%	—	—	—
	Glomar Shoals	—	—	—	—	—	—	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast *(inferred from Cape Range IBRA)*	0–100%, ~1 hour	0–82%, ~1 hour	0–100%	0–92%	0–100%	0–2%	—	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	—	—	0–6%	—	0–12%	0–1%	—	—

^ Values shown represent the variation in probability, shortest minimum time to exposure, and longest mean length of shoreline from both scenarios modelled. Actual probabilities of exposure for listed sensitivities vary greatly between each individual scenario and season.

7.1.3 Risk assessment

Source			
The operation of the subsea hydrocarbon system has the potential for an unplanned release of gas, condensate, control fluid, or MEG to occur. Based on the activities described in this EP, the following potential scenarios were identified: • LOC event[1] • loss of well integrity[2] • minor or major defect in flowline or production pipeline[3] *[1] Corrosion or mechanical failure/damage of flowlines or subsea values may result in a release of condensate, control fluids, or MEG. CAPL defined the worst-case credible scenario as a ~58 m^3 release of condensate from a flowline. This scenario is risk assessed within Section 6.1.4.* *[2] As detailed in Section 7.1.1.2, a loss of well integrity scenario will result in a release limited to the volume of the production tubing conduit between the SCSSV flapper valve and the wellhead. This equates to 20.5 m^3 for Wheatstone wells, 18.8 m^3 for Iago wells, and 5.5 m^3 for JDP wells.* *[3] As detailed in Section 7.1.1.5, modelling indicates that a subsea release of up to 3,710 m^3 could result from a major defect scenario.*			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	—	The potential environmental impacts associated with hydrocarbon exposures from a vessel collision event are:	
		• marine pollution resulting in acute and chronic impacts to marine fauna	5
		• smothering of subtidal and intertidal habitats	5
		• indirect impacts to commercial fisheries	5
		• reduction in amenity resulting in impacts to tourism and recreation.	5
Consequence evaluation			

Marine pollution resulting in acute and chronic impacts to marine fauna

Marine mammals

Marine mammals may be exposed to hydrocarbons from an oil spill at the water surface or within the water column. Marine mammals can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 124; Ref. 125).

Direct contact with hydrocarbons may result in skin and eye irritation, burns to mucous membranes of eyes and mouth, and increased susceptibility to infection (Ref. 126). However, direct contact with surface oil is considered to have little deleterious effect on whales, possibly due to the skin's effectiveness as a barrier. Furthermore, effect of oil on cetacean skin is probably minor and temporary (Ref. 126). French-McCay (Ref. 127) identifies that a ≥10 g/m^2 oil thickness threshold has the potential to impart a lethal dose to the species; however, also estimates a probability of 0.1% mortality to cetaceans if they encounter these thresholds based on the proportion of the time spent at surface.

The physical impacts from ingested hydrocarbons with subsequent lethal or sublethal impacts are applicable; however, the susceptibility of cetaceans varies with feeding habits. Baleen whales are not particularly susceptible to ingestion of oil in the water column as they feed by skimming the surface (i.e., they are more susceptible to surface slicks). Toothed whales and dolphins may be susceptible to ingestion of dissolved and entrained oil as they gulp feed at depth. As highly mobile species, in general it is very unlikely that these animals will be constantly exposed to concentrations of hydrocarbons in the water column for continuous durations (e.g., >48–96 hours) that would lead to chronic effects.

Studies have shown little impact on Bottlenose Dolphins after hydraulic and mineral oil immersion and ingestion, although there was evidence of temporary skin damage in dolphins and a Sperm Whale from contact with various oil products including crude oil (Ref. 126; Ref. 128).

Marine mammals are vulnerable if they inhale volatiles when they surface within a hydrocarbon slick. For the short period that they persist, vapours from the spill are a significant risk to mammal health, with the potential to damage mucous membranes of the airways and the eyes, which will reduce the health and potential survivability of an animal. Inhaled volatile hydrocarbons are transferred rapidly to the bloodstream and may also accumulate in tissues (Ref. 126).

Stochastic modelling was used to identify BIAs for marine mammals that may be exposed to hydrocarbon concentrations greater than impact thresholds within the EMBA. These were:

- Humpback Whale (migration, resting)
- Pygmy Blue Whale (distribution, migration, foraging)
- Dugongs (breeding, calving, foraging, nursing).

As these species are considered most sensitive to surface exposures, deterministic analysis for the largest sea surface swept area was utilised to understand the potential extent and duration of exposure. Of the scenarios modelled, (deterministic analysis from the middle trunkline 4,000 m^3 subsea condensate release was selected for use given it presents the most conservative surface hydrocarbon exposure extent. The maximum area for visible floating oil was predicted to occur ~1.75 days after the spill started and covered ~37 km^2. Using the Pygmy Blue Whale migration BIA as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA.

Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any marine mammal population would be exposed above the defined impact exposure thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.

Reptiles

Marine reptiles may be exposed to hydrocarbons from an oil spill at the water surface or on the shoreline. Marine reptiles can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 129).

Marine turtles are vulnerable to the effects of oil at all life stages: eggs, hatchlings, juveniles, and adults. Several aspects of turtle biology and behaviour place them at risk, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations (Ref. 130). Oil effects on turtles can include impacts to the skin, blood, digestive, and immune systems, and increased mortality due to oiling.

Shoreline hydrocarbons can impact turtles coming ashore at nesting beaches. Eggs may also be exposed during incubation, potentially resulting in increased egg mortality and detrimental effects on hatchlings. Hatchlings may be particularly vulnerable to toxicity and smothering as they emerge from the nests and make their way over the intertidal area to the water (Ref. 129).

BIAs for the Flatback Turtle, Loggerhead Turtle, Green Turtle, and Hawksbill Turtle may be exposed to hydrocarbon concentrations greater than the impact thresholds. The behaviours associated with these BIAs include aggregation, basking, foraging, internesting, mating, and nesting.

The deterministic analysis for the largest volume of oil ashore (from the nearshore trunkline 3,000 m^3 condensate release) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~225 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~5 km. Therefore, as the extent and duration of exposure to shorelines and associated nesting areas is expected to be limited, the potential for environmental impacts would also be limited.

Deterministic analysis for largest sea surface swept area indicates the maximum area for visible floating oil was predicted to occur ~1.75 days after the spill started and covered approximately 37 km^2 (from the 4,000 m3 middle trunkline scenario) Using the Hawksbill Turtle internesting BIA around Thevenard Island as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <2% of the entire BIA. This information indicates that if a spill event occurred during the nesting season, it is unlikely to impact entire local nesting populations.

Based on an assessment of the predicted magnitude and duration of surface and shoreline oil, it is expected that only a small proportion of any marine reptile population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.

Fishes, including sharks and rays

Fish, including sharks and rays, may be exposed to hydrocarbons from an oil spill within the water column. Most fish do not break the sea surface, and therefore the risk from surface oil is not relevant; however, some shark species (including Whale Sharks) feed in surface waters, so there is also the potential for surface hydrocarbons to be ingested.

Potential effects include damage to the liver and lining of the stomach and intestine, and toxic effects on embryos (Ref. 131). Fish are most vulnerable to oil during embryonic, larval and juvenile life stages. However, very few studies have demonstrated increased mortality of fish as a result of oil spills (Ref. 132; Ref. 133; Ref. 134).

Demersal fish are not expected to be impacted given the presence of dissolved and entrained oil above impact thresholds is predicted only in the surface layers (<20 m water depth) only.

Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons are typically insufficient to cause harm (Ref. 135). Pelagic species are also generally highly mobile and as such are not likely to suffer extended exposure (e.g., >48–96 hours) at concentrations that would lead to chronic effects due to their patterns of movement. Near the sea surface, fish can detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Ref. 136). Fish that have been exposed to dissolved hydrocarbons can eliminate the toxicants once placed in clean water; hence, individuals exposed to a spill are likely to recover (Ref. 137). Marine fauna with gill-based respiratory systems, including Whale Sharks, are expected to have higher sensitivity to exposures of entrained oil.

BIAs for fishes including sharks and rays that may be exposed to hydrocarbon concentrations greater than impact thresholds include:

- Whale Shark (foraging).

As Whale Sharks are sensitive to both in water and surface hydrocarbon exposures, deterministic analysis for the largest sea surface swept area were analysed to provide an indication of the potential exposure and possible impact. Deterministic analysis for largest sea surface swept area the maximum area for visible floating oil was predicted to occur ~1.75 days after the spill started and cover ~37 km^2. Comparing this area to the Whale Shark foraging BIA, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA.

Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any fish population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.

Seabirds and shorebirds

Birds may be exposed to hydrocarbons from an oil spill at the water surface (e.g., foraging, resting) or on the shoreline (e.g., roosting, nesting).

Birds that rest at the water's surface (e.g., shearwaters) or surface-plunging birds (e.g., terns, boobies) are particularly vulnerable to surface hydrocarbons (Ref. 138; Ref. 130). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 139). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 139).

Breeding BIAs for the Fairy Tern, Lesser Crested Tern, Roseate Tern, and Wedge-tailed Shearwater may be exposed to hydrocarbon concentrations greater than impact thresholds.

The deterministic analysis for the largest volume of oil ashore (from the 3,000 m^3 nearshore trunkline release) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~225 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~5 km. Therefore, as the extent and duration of exposure to shorelines and associated breeding environments is expected to be limited, the potential for environmental impacts would also be limited.

Deterministic analysis for largest sea surface swept area the maximum area for visible floating oil was predicted to occur ~1.75 days after the spill started and cover ~37 km^2 (from the 4,000 m3 middle trunkline release). Using the Wedge-tailed Shearwater breeding BIA surrounding Thevenard Islands as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <2% of the entire BIA. This information indicates that if a spill event occurred during the nesting season, it is unlikely to impact entire local nesting populations.

Based on an assessment of the predicted magnitude and duration of surface and shoreline oil, it is expected that only a small proportion of any seabird population would be exposed above the

defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.
Smothering of subtidal and intertidal habitats *Coral* Direct contact of hydrocarbons to coral can cause smothering, resulting in a decline in metabolic rate, and may cause varying degrees of tissue decomposition and death. A range of impacts may also result from toxicity, including partial mortality of colonies, reduced growth rates, bleaching, and reduced photosynthesis (Ref. 140; Ref. 141). Stochastic modelling predicted coral reefs associated with the following key values or sensitivities within the EMBA (Table 4-11) have the potential to be exposed to hydrocarbon concentrations above impact thresholds: • Ningaloo Coast (World Heritage Property, National Heritage Place). No surface exposure at the ≥10 g/m^2 impact threshold was predicted for the Ningaloo Coast area (Table 7-6). Therefore, impacts from smothering within intertidal areas due to surface oil is not expected to occur. The probability of exposure to dissolved (≥50 ppb) or entrained oil (≥100 ppb) at the Ningaloo Coast area varied (0–100%) depending on the spill location (Table 7-6); however, stochastic modelling showed all dissolved and entrained oil remained in the surface waters layers. As such, exposure to coral reefs in deeper waters at Ningaloo is not predicted to occur. For assessment of other coral habitats that occur within the EMBA (e.g., around some of the Pilbara islands), the deterministic analysis for the largest sea surface swept area (from the 4.000 m^3 middle trunkline condensate scenario) indicates the maximum area for visible floating oil was predicted to occur ~1.75 days after the spill started and cover ~37 km^2. Given hydrocarbons are likely to wash ashore quickly in nearshore environments, exposure to intertidal habitats would likely be brief. As the extent and duration of exposure to nearshore environments is expected to be limited the potential for environmental impacts would also be limited. Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any coral habitat would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause smothering was ranked as Minor (5). *Mangroves and intertidal mudflats* Shoreline hydrocarbons can have smothering and toxic effects on mangroves and intertidal mudflats. Acute and chronic impacts to the health of mangrove communities can occur via pneumatophore smothering and exposure to the toxic volatile fraction of the hydrocarbons (Ref. 142). Intertidal mudflats, which are typically sheltered and have a large surface area for oil absorption, can trap oil, potentially causing toxicity impacts to infauna. Intertidal mudflats are very sensitive to oil pollution because the oil enters lower layers of the mudflats where a lack of oxygen prevents the oil from decomposing (Ref. 142). Mangroves and intertidal mudflats associated with key values and sensitivities (e.g., the Ningaloo Coast; Table 4-11) within the EMBA were not predicted to be exposed to shoreline hydrocarbons above impact thresholds. For assessment of other mangrove habitats that occur within the EMBA, the deterministic analysis for the largest volume of oil ashore (from the 3,000 m^3 nearshore trunkline release) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~226 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~5 km, and ≥1,000 g/m^2 is ~2 km. Therefore, as the extent and duration of exposure to shorelines is expected to be limited the potential for environmental impacts would also be limited. Based on an assessment of the predicted magnitude and duration of shoreline oil, it is expected that only a small proportion of any mangrove and intertidal habitat would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause smothering was ranked as Minor (5).

Indirect impacts to commercial fisheries As identified in Section 4.4.1, several commercial fisheries have management areas and recent fishing effort recorded within the EMBA. Direct impacts commercially targeted fish species are expected to occur from in-water hydrocarbon exposures. Stochastic modelling showed that when dissolved and entrained oil was predicted to occur above the impact thresholds, it remained in the surface layers (<20 m water depth) only. Although exposures above impact thresholds have the potential to affect the recruitment of targeted commercial and recreational fish species, any acute impacts are expected to be limited, given this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time. On this basis recruitment of targeted species is not expected to be impacted significantly given the extent of exposure to concentrations above impact thresholds are expected to be limited due to rapid dilution and dispersion upon release. Spill events also have the potential to impact commercial fisheries through indirect impacts associated with tainting. Tainting is a change in the characteristic smell or flavour, and renders the catch unfit for human consumption or sale due to public perception. Tainting may not be a permanent condition but will persist if the organisms are continuously exposed; but when exposure is terminated, depuration will quickly occur (Ref. 143). Regardless of the small potential for tainting, customer perception that tainting has occurred may cause a larger impact then the direct impact itself. However, as this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time period, and the low persistence of the hydrocarbon in the environment, customer perceptions are not expected to be altered for a prolonged period. Modelling predicts that inshore exposure would be limited, whilst offshore exposures are expected to dilute and disperse over a longer period of time. In both instances, it is expected that any impacts from this type of event would likely be short term in duration. Therefore, CAPL assesses the consequence to commercial fisheries as localised and short term and it is ranked as Minor (5).
Reduction in amenity resulting in impacts to tourism and recreation Modelling predicts shoreline exposure ≥10 g/m^2 (visible impact threshold) has the potential to occur along parts of Ashburton, and several of the Pilbara inshore islands. The deterministic analysis for the largest volume of oil ashore (from the 3,000 m^3 nearshore trunkline release) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~225 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~5 km. Therefore, as the extent and duration of exposure to shorelines is expected to be limited the potential for environmental impacts would also be limited. Shoreline loading can impact the visual amenity of coastal areas and limit beach access for users, impacting tourism and recreation activities. Although there is public access for many of the Pilbara islands, access would only be restricted for a limited time given modelling indicates the spatial and temporal extent of exposure s not expected to be prolonged. However, given the short-term and localized disturbance to marine tourism and recreation activities, CAPL has ranked the consequence as Minor (5).
ALARP decision context justification
The operation of subsea production systems offshore is a well-practised nationally and internationally activity. The control measures to manage the risk associated with a major defect event are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. Specifically, CAPL has worked in the region for over 10 years, and has a demonstrated understanding of industry requirements and their operational implementation in these areas. During stakeholder consultation, no objections or claims were raised regarding major defect events arising from the activity. The risks associated with a major defect event are considered lower-order risks in accordance with Table 5-3. As such, CAPL would apply ALARP Decision Context A for this aspect.

Good practice control measures and source	
Control measure	**Source**
IM Plan	Inspections provide assurance that assets are in good condition and proactively identify maintenance or repair activities that may be required. The type and frequency of inspections of the subsea hydrocarbon system will be undertaken in accordance with the *Wheatstone Upstream Subsea System Inspection and Monitoring Plan* (Ref. 21) and *Wheatstone Upstream Trunkline System Inspection and Monitoring Plan* (Ref. 22). The IM Plan also requires that hydrocarbon system process monitoring (pressure, temperature and flow rates), fluid composition monitoring, and corrosion monitoring are undertaken. Inspection and monitoring results are assessed against acceptance criteria to allow early identification and management of potential anomalies through engineering assessment, maintenance, and repairs to ensure the integrity of the hydrocarbon system and prevent a loss of containment. Inspections are tracked via the Computerised Maintenance Management System (CMMS).
Source control	Source control is part of the first actions taken to minimise the volume of hydrocarbon released and therefore reduce potential impacts and risks to the environment. CAPL has developed Emergence Operating Procedures (EOPs) (Ref. 75) that provides guidance to operations personnel to detect, isolate and stabilise non-routine events such as trunkline/flowline loss of containment scenarios.
Well handover	Should a loss of well integrity event occur for Wheatstone or Iago production wells, CAPL would implement the NOPSEMA-accepted WOMP. This would require a well handover between Wheatstone Operations and ABU Wells work group in accordance with Section 3.2.1.1.1. Once the well is handed over to the ABU Wells work group, all well integrity remedial activities will be conducted in accordance with the NOSEPMA-accepted *Wheatstone Project: Producing Phase Well Operations Management Plan* (Ref. 8). Should a loss of well integrity event occur for JDP wells, CAPL would implement safety shutdown devices, and handover the well to Woodside (as per operational contractual arrangements; Section 2.3.3). Once the well is handed over to Woodside, all well integrity remedial activities will be conducted by Woodside.
OPEP	Under the OPGGS(E)R, NOPSEMA require that the petroleum activity have an accepted OPEP in place before commencing the activity. If a major defect occurs, the OPEP will be implemented. CAPL has developed an NOPSEMA-accepted OPEP (Ref. 2) to support all spill response activities across all its assets.
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	Analysis of the 2001 PARLOC database (Ref. 144) was used to evaluate the likelihood of a loss of containment from an individual offshore pipeline, which was determined to be equivalent to 0.189% per year (Ref. 145). This frequency was used as a guide to inform the likelihood of consequence. Because of the low probability of a major defect event, the likelihood of the event coinciding with the breeding or migration period of particular values and sensitivities, and the control measures in place, the likelihood of the worst-case environmental consequence occurring as described above was assessed as Remote (5).
Risk level	Very low (9)

Determination of acceptability	
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements relevant for this aspect include: • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 97) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 96) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • *Recovery Plan for Marine Turtles in Australia* (Ref. 93) • North-west Marine Parks Network Management Plan (Ref. 146).
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • IM Plans (Ref. 21; Ref. 22) • OPEP (Ref. 2) • OSMP (Ref. 3).
External context	During stakeholder consultation, no objections or claims were raised regarding major defect events arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, given that chemical discharge and/or pollution (of which an oil spill is a component) is listed as a threat to protected matters under documents made or implemented

	under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. The *Recovery Plan for Marine Turtles in Australia* (Ref. 93) specifies the following relevant action areas and action: • minimise chemical and terrestrial discharge • ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', e.g. nesting habitat, seagrass meadows or coral reefs. CAPL addresses spill response and monitoring within their OPEP (Ref. 2) and OSMP (Ref. 3). No other specific relevant actions were identified within other documents implemented under the EPBC Act. Therefore, CAPL has defined an acceptable level of impact as minimising the risk of impacts to the environment from spills from major defect events.

Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No unplanned release of hydrocarbons / hazardous materials to the environment during petroleum activities	**IM Plan** Inspection and maintenance will include, but not be limited to, visual or acoustic survey of the trunkline, in accordance with the IM Plan	CMMS records confirm a visual or acoustic survey of the subsea pipeline was undertaken in accordance with the IM Plan
	IM Plan Monitoring of hydrocarbon system pressure, temperature, flow rates and fluid composition against acceptable criteria and limits will be aligned with the IM Plan	Records confirm monitoring of hydrocarbon system pressure, temperature, flow rates and fluid composition against acceptable criteria and limits are aligned with the IM Plan
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	**Source control** The isolation steps of the source control / isolation procedures implemented within 30 minutes if a spill is detected from the hydrocarbon system	Records demonstrate relevant isolation components of the source control procedures are implemented if a spill is detected from the hydrocarbon system
	Well handover In the event of a Wheatstone or Iago well integrity failure event, well custodianship is handed over from CAPL's Wheatstone Operations to the ABU Wells work group for management and subsequent remediation	Completed well handover certification confirms that the well has transferred into the custodianship of the ABU Wells work group
	Well handover In the event of a JDP well integrity failure event, well custodianship is handed over from CAPL's Wheatstone Operations to Woodside for	Completed well handover certification confirms that the well has transferred into the custodianship of Woodside

	management and subsequent remediation	
	OPEP In the event of a spill occurring, the OPEP will be implemented	Records confirm the OPEP has been implemented
	OSMP In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

7.2 Unplanned release—vessel collision event

7.2.1 Credible scenario

A vessel collision event within the OA is considered a credible (but unlikely) unplanned event. A major marine spill because of vessel collision is only likely to occur under exceptional circumstances (e.g., loss of DP, navigational error, inclement weather conditions). Given the location, water depths, and lack of submerged features within most of the OA, grounding is not considered credible, and is not considered further.

Based upon the types of vessels typically used for IMR activities (with the exception of major repairs), size of largest fuel tanks and fuel type to be utilised for the activities in this EP, CAPL was able to identify the typical credible worst-case scenario (as per AMSA guidelines; Ref. 147) as being a surface release of ~325 m^3 of MDO resulting from a vessel collision event. However, in the event that major repairs are undertaken, larger vessels would be required. Typical fuel tank sizes associated with construction or heavy lift vessels are expected to be in the order of ~1,000 m^3. Therefore, as a conservative approach to risk assessment for activities covered under this EP, these higher volumes have been used in the following analyses.

7.2.2 Spill Modelling

CAPL commissioned RPS to conduct spill modelling to inform the risk assessment associated with a vessel collision event (Ref. 148).

The release location selected for use, while outside the OA for this EP, is considered an appropriate and conservative approach to inform the risk assessment given that the modelled release location is closer to sensitive shorelines.

A three-dimensional oil spill model (SIMAP) was used to simulate the drift, spread, weathering and fate of the spilled oil (Ref. 148). Modelling was conducted using a stochastic approach, where multiple simulations (using the same spill parameters) were conducted, but under varying meteorological and oceanographic conditions.

Table 7-7 summarises the model settings; Table 7-8 summarises the hydrocarbon properties for MDO; and and Table 7-4 and Table 7-5 (in Section 7.1) describe the modelled environmental exposure and impact thresholds respectively

Table 7-7: Vessel collision spill scenario model settings

Parameter	Details
Release location	~17 km south of OA (field), and within the Montebello Marine Park
Latitude	20°09'22" S
Longitude	115°24'11" E
Water depth	~50–60 m
Oil type	MDO
Simulation spill type	Surface
Simulation spill volume	1,063 m^3 (based on the largest single tank)
Simulation spill duration	24 hours
Total simulation duration	50 days
Number of randomly selected spill simulation start times	100 per season (300 total)
Seasons modelled	Summer (December to February) Transitional (March, October, November) Winter (April to September)

Table 7-8: Physical properties and boiling point ranges for MDO

Characteristic	Value			
Density	829.1 kg/m3 (at 25 °C)			
Dynamic viscosity	4 cP			
Pour point	-14 °C			
API gravity	37.6 API			
Classification	Group II, light persistent oil			
Boiling point	Volatile <180 °C	Semi-volatile 180–265 °C	Low volatility 265–380 °C	Residual >380 °C
	6.0%	34.6%	54.4%	5.0%

7.2.2.1 Weathering and fate

MDO is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3, an API of 37.6, and a low pour point (−14 °C) (Table 7-6). The low viscosity (4 cP) indicates that this oil will spread quickly when released and will form a thin film on the sea surface, increasing the evaporation rate.

Generally, about 6.0% of the MDO mass should evaporate within the first 12 hours (boiling point <180 °C); a further 34.6% should evaporate within the first 24 hours (boiling point 180°C–265 °C); and an additional 54.4% should evaporate over several days (boiling point 265°C–380 °C). Approximately 5% (by mass) of MDO will not evaporate at atmospheric temperatures. These compounds will persist in the environment.

While MDO will typically remain on the water surface (where it is subject to evaporation), it is noted that some of the heavy components have a strong tendency to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves but can re-float to the surface if these energies abate (Ref. 148).

7.2.2.2 Modelling outputs

Stochastic modelling outputs from RPS (Ref. 148) are summarised in Table 7-9 having regard to the particular values and sensitivities identified in Section 4.

For the 1,063 m^3 MDO release south of the OA:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~64 km south-southwest (transitional), and ~38 km south-southwest (summer) for the ≥10 g/m^2 impact threshold.
- The probability of contact to any shoreline at ≥10 g/m^2 was 7% in summer, 1% in winter, and no contact predicted in transitional months. The minimum time before shoreline contact was ~3 days and the maximum volume of oil ashore was 24.4 m^3. The maximum length of shoreline exposed at ≥10 g/m^2 was ~27 km, and at ≥100 g/m^2 was ~10 km. No shoreline accumulation ≥1,000 g/m^2 was predicted to occur during any season.
- No dissolved oil at ≥50 ppb impact thresholds was predicted to occur during any season.
- Entrained oil at ≥100 ppb impact thresholds was predicted to occur. However, entrained oil was predicted to remain in the surface layers, with no exposure at depths >10 m below the surface predicted to occur during any season.

Table 7-9: Vessel collision spill modelling EMBA receptor exposure summary

Sensitivity	Name	Surface^		In-water (dissolved)^	In-water (entrained)^	Shoreline^	
		≥1 g/m²	≥10 g/m²	≥50 ppb	≥100 ppb	≥10 g/m²	≥100 g/m²
		(probability of exposure, minimum time to exposure)		(probability of exposure)	(probability of exposure)	(probability of exposure, minimum time to exposure, mean length of shoreline)	
AMP	Gascoyne	—	—	—	1–4%	—	—
	Montebello	100%, ~1 hour	100%, ~1 hour	—	89–97%	—	—
	Ningaloo	—	—	—	0–1%	—	—
KEF	Ancient coastline at 125 m depth contour	0–6%, ~0.75 days	—	—	19–30%	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	—	—	—	1–4%	—	—
	Commonwealth waters adjacent to Ningaloo Reef	—	—	—	0–1%	—	—
	Continental slope demersal fish communities	0–1%, ~2.7 days	—	—	9–27%	—	—
	Exmouth Plateau	—	—	—	0–2%	—	—
	Glomar Shoals	—	—	—	0–2%	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast *(inferred from Cape Range IBRA, and Exmouth shoreline)*	—	—	—	0–2%	0–2%, ~14.4 days, ~3 km	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	—	—	—	1–2%	—	—

^ *Ranges in values shown are due to the different results between seasons.*

7.2.3 Risk assessment

Source			
Activities identified as having the potential to result in a vessel collision event are: • vessels and IMR operations within the OA. A vessel collision event may occur as a result of a loss of DP, navigational error or floundering due to weather.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	-	The potential environmental impacts associated with hydrocarbon exposures from a vessel collision event are:	
		• marine pollution resulting in sublethal or lethal effects to marine fauna	5
		• smothering of subtidal and intertidal habitats	5
		• indirect impacts to commercial fisheries	5
		• reduction in amenity resulting in impacts to tourism and recreation.	5

Consequence evaluation

Marine pollution resulting in sublethal or lethal effects to marine fauna

Marine mammals

Marine mammals may be exposed to hydrocarbons from an oil spill at the water surface or within the water column. Marine mammals can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 124; Ref. 125).

Direct contact with hydrocarbons may result in skin and eye irritation, burns to mucous membranes of eyes and mouth, and increased susceptibility to infection (Ref. 126). However, direct contact with surface oil is considered to have little deleterious effect on whales, possibly due to the skin's effectiveness as a barrier. Furthermore, effect of oil on cetacean skin is probably minor and temporary (Ref. 126). French-McCay (Ref. 127) identifies that a ≥10 g/m^2 oil thickness threshold has the potential to impart a lethal dose to the species; however, also estimates a probability of 0.1% mortality to cetaceans if they encounter these thresholds based on the proportion of the time spent at surface.

The physical impacts from ingested hydrocarbons with subsequent lethal or sublethal impacts are applicable; however, the susceptibility of cetaceans varies with feeding habits. Baleen whales are not particularly susceptible to ingestion of oil in the water column as they feed by skimming the surface (i.e., they are more susceptible to surface slicks). Toothed whales and dolphins may be susceptible to ingestion of dissolved and entrained oil as they gulp feed at depth. As highly mobile species, in general it is very unlikely that these animals will be constantly exposed to concentrations of hydrocarbons in the water column for continuous durations (e.g., >48–96 hours) that would lead to chronic effects.

Studies have shown little impact on Bottlenose Dolphins after hydraulic and mineral oil immersion and ingestion, although there was evidence of temporary skin damage in dolphins and a Sperm Whale from contact with various oil products including crude oil (Ref. 126; Ref. 128).

Marine mammals are vulnerable if they inhale volatiles when they surface within a hydrocarbon slick. For the short period that they persist, vapours from the spill are a significant risk to mammal health, with the potential to damage mucous membranes of the airways and the eyes, which will reduce the health and potential survivability of an animal. Inhaled volatile hydrocarbons are transferred rapidly to the bloodstream and may also accumulate in tissues (Ref. 126).

Stochastic modelling was used to identify BIAs for marine mammals that may be exposed to hydrocarbon concentrations greater than impact thresholds within the EMBA. These were:

- Humpback Whale (migration, resting)
- Pygmy Blue Whale (distribution, migration, foraging)
- Dugongs (breeding, calving, foraging, nursing).

As these species are considered most sensitive to surface exposures, deterministic analyses were utilised to understand the potential extent and duration of exposure.

The deterministic model for the worst-case trajectory for Montebello Islands indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 18 hours after the spill commenced. This deterministic scenario is considered most relevant for offshore waters, and subsequent impacts to offshore BIA's in those regions. Using the Pygmy Blue Whale migration BIA as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA.

The deterministic model for the worst-case trajectory for Ningaloo World Heritage area indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <2 days following the spill event, with a maximum area of coverage of ~32 km^2 occurring 18 hours after the spill commenced. This deterministic scenario is considered most relevant for nearshore waters around Ningaloo and Exmouth Gulf, and subsequent impacts to nearshore BIA's in those regions. Using the Dugong breeding BIA as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. As the extent and duration of exposure to nearshore environments is expected to be limited the potential for environmental impacts would also be limited. However, it is acknowledged that behaviours in nearshore waters are likely to result in increased sensitivity to hydrocarbon exposures as species are less likely to be transient.

Based on an assessment of the predicted magnitude and duration of surface oil, and entrained oil, it is expected that only a small proportion of any marine mammal population would be exposed above the defined impact exposure thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.

Reptiles

Marine reptiles may be exposed to hydrocarbons from an oil spill at the water surface or on the shoreline. Marine reptiles can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 129).

Marine turtles are vulnerable to the effects of oil at all life stages: eggs, hatchlings, juveniles, and adults. Several aspects of turtle biology and behaviour place them at risk, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations (Ref. 130). Oil effects on turtles can include impacts to the skin, blood, digestive, and immune systems, and increased mortality due to oiling.

Shoreline hydrocarbons can impact turtles coming ashore at nesting beaches. Eggs may also be exposed during incubation, potentially resulting in increased egg mortality and detrimental effects on hatchlings. Hatchlings may be particularly vulnerable to toxicity and smothering as they emerge from the nests and make their way over the intertidal area to the water (Ref. 129).

BIAs for the Flatback Turtle, Loggerhead Turtle, Green Turtle, and Hawksbill Turtle may be exposed to hydrocarbon concentrations greater than the impact thresholds. The behaviours associated with these BIAs include aggregation, basking, foraging, internesting, mating, and nesting.

Montebello Islands was the only area predicted to be exposed to shoreline hydrocarbons accumulation of ≥100 g/m^2. These islands are identified as habitat critical to the survival of Flatback, Green and Hawksbill turtles (Table 4-4). As such nesting adult turtles and hatchlings may be exposed as they traverse the intertidal area, resulting in potential smothering and acute impacts to some hatchlings during that nesting season.

The deterministic model for the worst-case trajectory for Montebello Islands indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 18 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as ~24 m^3, and the maximum length of shoreline exposed to ≥100 g/m^2 was ~10 km occurring ~4 days after the spill commenced. Using the Flatback Turtle internesting and nesting BIAs around Montebello Islands as an example, modelling indicates that the extent of surface and shoreline exposures was predicted to be limited to <1% of the entire BIA, or <1% of the coastline. This information indicates that if a vessel spill event occurred during the nesting season, it is unlikely to impact entire local nesting populations.

Based on an assessment of the predicted magnitude and duration of surface and shoreline oil, it is expected that only a small proportion of any marine reptile population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.

Fishes, including sharks and rays

Fish, including sharks and rays, may be exposed to hydrocarbons from an oil spill within the water column. Most fish do not break the sea surface, and therefore the risk from surface oil is not relevant; however, some shark species (including Whale Sharks) feed in surface waters, so there is also the potential for surface hydrocarbons to be ingested.

Potential effects include damage to the liver and lining of the stomach and intestine, and toxic effects on embryos (Ref. 131). Fish are most vulnerable to oil during embryonic, larval and juvenile life stages. However, very few studies have demonstrated increased mortality of fish as a result of oil spills (Ref. 132; Ref. 133; Ref. 134).

Demersal fish are not expected to be impacted given the presence of entrained oil ≥100 ppb is predicted in the surface layers (<10 m water depth) only.

Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons are typically insufficient to cause harm (Ref. 135). Pelagic species are also generally highly mobile and as such are not likely to suffer extended exposure (e.g., >48–96 hours) at concentrations that would lead to chronic effects due to their patterns of movement. Near the sea surface, fish can detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Ref. 136). Fish that have been exposed to dissolved hydrocarbons can eliminate the toxicants once placed in clean water; hence, individuals exposed to a spill are likely to recover (Ref. 137). Marine fauna with gill-based respiratory systems, including Whale Sharks, are expected to have higher sensitivity to exposures of entrained oil.

BIAs for fishes including sharks and rays that may be exposed to hydrocarbon concentrations greater than impact thresholds include:

- Whale Shark (foraging).

As these species are considered most sensitive to surface exposures, deterministic analyses were utilised to understand the potential extent and duration of exposure.

The deterministic model for the worst-case trajectory for Montebello Islands indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 18 hours after the spill commenced. This deterministic scenario is considered most relevant for offshore waters, and subsequent impacts to offshore BIA's in those regions. Using the Whale Shark foraging BIA, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA.

Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any fish population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.

Seabirds and shorebirds

Birds that rest at the water's surface (e.g., shearwaters) or surface-plunging birds (e.g., terns, boobies) are particularly vulnerable to surface hydrocarbons (Ref. 138; Ref. 130). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 139). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 139).

Breeding BIAs for the Fairy Tern, Lesser Crested Tern, Roseate Tern, and Wedge-tailed Shearwater may be exposed to hydrocarbon concentrations greater than impact thresholds.

Montebello Islands was the only area predicted to be exposed to shoreline hydrocarbons accumulation of ≥100 g/m^2.

The deterministic model for the worst-case trajectory for Montebello Islands indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 18 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as ~24 m^3, and the maximum length of shoreline exposed to ≥100 g/m^2 was ~10 km occurring ~4 days after the spill commenced. Using the Wedge-tailed Shearwater breeding BIA around Montebello Islands as an example, modelling indicates that the extent of surface and shoreline exposures was predicted to be limited to <1% of the entire BIA, or <1% of the coastline. This information indicates that if a vessel spill event occurred during breeding season, it is unlikely to impact entire local nesting populations.

Based on an assessment of the predicted magnitude and duration of surface and shoreline oil, it is expected that only a small proportion of any seabird population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.

Smothering of subtidal and intertidal habitats

Coral, seagrass and macroalgae

The effects of physical contact on subtidal habitats are similar, and studies have shown that it can cause sublethal stress and reduced growth rates in seagrass (Ref. 149; Ref. 150), act as a barrier to diffusion of CO_2 across cell walls in macroalgae (Ref. 151), and a decline in metabolic rate and partial mortality in corals (Ref. 152; Ref. 153) and impair respiration and photosynthesis by symbiotic zooxanthellae (Ref. 154; Ref. 155). The recovery of benthic habitats can be slow, with studies following the Deepwater Horizon incident showing long-term non-acute effects of the spill on coral colonies seven years after the event (Ref. 156).

Stochastic modelling predicted coral reefs associated with the following key values or sensitivities within the EMBA (Table 4-11) have the potential to be exposed to hydrocarbon concentrations above impact thresholds:

- Ningaloo Coast (World Heritage Property, National Heritage Place).

Coral, seagrass, and macroalgae habitats are also known to occur around the Barrow and Montebello islands, and to a smaller extent around some of the other Pilbara inshore islands.

Stochastic modelling showed that in-water (entrained) hydrocarbons were predicted to remain within the surface layers only. Therefore, exposure to coral reefs in deeper waters are not predicted to occur. However, smothering of benthic habitat communities may occur if a surface slick occurs in the intertidal area.

The deterministic model for the worst-case trajectory for Montebello Islands indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 18 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as ~24 m^3, and the maximum length of shoreline exposed to ≥100 g/m^2 was ~10 km occurring ~4 days after the spill commenced.

The deterministic model for the worst-case trajectory for Ningaloo World Heritage area indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <2 days following the spill event, with a maximum area of coverage of ~32 km^2 occurring 18 hours after the spill commenced.

These deterministic scenarios are considered most relevant for nearshore waters and subsequent impacts to nearshore corals. Therefore, as the extent and duration of exposure to nearshore environments is expected to be limited the potential for environmental impacts would also be limited.

Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any coral habitat would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause smothering was ranked as Minor (5).

Mangroves and intertidal mudflats

Shoreline hydrocarbons can have smothering and toxic effects on mangroves and intertidal mudflats. Acute and chronic impacts to the health of mangrove communities can occur via pneumatophore smothering and exposure to the toxic volatile fraction of the hydrocarbons (Ref. 142). Intertidal mudflats, which are typically sheltered and have a large surface area for oil absorption, can trap oil, potentially causing toxicity impacts to infauna. Intertidal mudflats are very sensitive to oil pollution because the oil enters lower layers of the mudflats where a lack of oxygen prevents the oil from decomposing (Ref. 142).

Stochastic modelling predicted shoreline accumulation above the ≥100 g/m^2 impact threshold may occur at Montebello Islands during summer; but no accumulation ≥1,000 g/m^2 was predicted to occur. This higher threshold is typically associated with impacts to coastal vegetation communities (Table 7-5), and therefore, shoreline exposure to mangroves and intertidal mudflats is not discussed further.

Indirect impacts to commercial fisheries As identified in Section 4.4.1, several commercial fisheries have management areas and recent fishing effort recorded within the EMBA. Direct impacts commercially targeted fish species are expected to occur from in-water exposures. Stochastic modelling showed that there no dissolved oil above impact thresholds (≥50 ppb) was predicted to occur during any season. Entrained oil above impact thresholds (≥100 ppb) was predicted to occur; however, was predicted to remain in the surface layers, with no exposure at depths >10 m below the surface predicted to occur during any season. Although exposures above impact thresholds have the potential to affect the recruitment of targeted commercial and recreational fish species, any acute impacts are expected to be limited, given this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time. On this basis recruitment of targeted species is not expected to be impacted significantly given the extent of exposure to concentrations above impact thresholds are expected to be limited due to rapid dilution and dispersion upon release. Spill events also have the potential to impact commercial fisheries through indirect impacts associated with tainting. Tainting is a change in the characteristic smell or flavour, and renders the catch unfit for human consumption or sale due to public perception. Tainting may not be a permanent condition but will persist if the organisms are continuously exposed; but when exposure is terminated, depuration will quickly occur (Ref. 143). Regardless of the small potential for tainting, customer perception that tainting has occurred may cause a larger impact then the direct impact itself. However, as this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time period, and the low persistence of the hydrocarbon in the environment, customer perceptions are not expected to be altered for a prolonged period. Modelling predicts that inshore exposure would be limited, whilst offshore exposures are expected to dilute and disperse over a longer period of time. In both instances, it is expected that any impacts from this type of event would likely be short term in duration. Therefore, CAPL assesses the consequence to commercial fisheries as localised and short term and it is ranked as Minor (5).
Reduction in amenity resulting in impacts to tourism and recreation Modelling predicts shoreline exposure ≥10 g/m^2 (visible impact threshold) from a vessel spill event during summer has the potential to occur predominantly along Montebello and Barrow Islands, with smaller/patchier occurrences along some of the other Pilbara inshore islands and North West Cape coast, depending on the environmental conditions at the time of the event. Only a small area of Montebello Island was predicted to be exposed during winter, and no shoreline contact was predicted to occur during transitional) seasons. The deterministic model for the worst-case trajectory for Montebello Islands indicates that the maximum length of shoreline oil above the visible impact threshold (≥10 g/m^2) at any given time was ~23 km, and the maximum volume of oil ashore was ~24 m^3. Shoreline loading can impact the visual amenity of coastal areas and limit beach access for users, impacting tourism and recreation activities. However, given the short-term and localized disturbance to marine tourism and recreation activities, CAPL has ranked the consequence as Minor (5).
ALARP decision context justification
Support vessels commonly operate near each other during offshore surveys, and these activities are well-practised nationally and internationally. The control measures to manage the risk associated with vessel collisions are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. Specifically, CAPL has worked in the region for over 10 years, and has a demonstrated understanding of industry requirements and their operational implementation in these areas. During stakeholder consultation, no objections or claims were raised regarding vessel collision scenarios arising from the activity. The risks associated with a vessel collision are considered lower-order risks in accordance with Table 5-3. As such, CAPL would apply ALARP Decision Context A for this aspect.

Good practice control measures and source	
Control measure	**Source**
Marine Safety Reliability and Efficiency (MSRE) process	CAPL's *ABU MSRE Corporate OE Process* (Ref. 52) ensures that various legislative requirements are met. These include: • crew meet the minimum standards for safely operating a vessel, including watchkeeping requirements • navigation, radar equipment, and lighting meets industry standards. These requirements will ensure that direct vessel radio contact is available to other marine users operating in this area to enable ease of communication in highlighting risks and nearby exclusion zones.
Maritime safety information	Maritime safety information, such as AUSCOAST navigational warnings, are issued by the Joint Rescue Coordination Centre (JRCC) Australia, part of AMSA. Under the *Navigation Act 2012*, the AHO is also responsible for maintaining and disseminating navigational charts and publications, including providing safety-critical information to mariners (including any change to prohibited/restricted areas, obstructions to surface navigation, etc.) via the Notice to Mariners system. Notice to Mariners can be permanent or temporary notifications. Where required for an IMR activities, AUSCOAST and/or Notice to Mariners will be issued; thus enabling other marine users to also safely plan their activities.
SOPEP / Shipboard Marine Pollution Emergency Plan	MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil) requires that each vessel has an approved SOPEP in place. To prepare for a spill event, the SOPEP details: • response equipment available to control a spill event • review cycle to ensure that the SOPEP is kept up to date • testing requirements, including the frequency and nature of these tests. In the event of a spill, the SOPEP details: • reporting requirements and a list of authorities to be contacted • activities to be undertaken to control the discharge of oil procedures for coordinating with local officials.
OPEP	Under the OPGG(E)R, NOPSEMA require that the petroleum activity have an accepted OPEP in place before commencing the activity. If a vessel collision occurs, the OPEP will be implemented. CAPL has developed an NOPSEMA-accepted OPEP (Ref. 2) to support all spill response activities across all its assets.
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	Based on industry data, vessel collisions are considered rare, with only 3% of all marine incidents that occurred in Australian waters between 2005 and 2012 associated with a vessel collision event. As most vessel collisions involve the LOC of a forward tank, which are generally double-lined and smaller than other tanks, the loss of the maximum credible volumes used in this scenario is unlikely. Considering the inherent low likelihood of a collision occurring, the safeguards in place, and enactment of the OPEP, the potential likelihood of causing the consequences described in this section is Remote (5)
Risk level	Very Low (9)
Acceptability summary	
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements relevant for this aspect include: • Commonwealth *Navigation Act 2012* • Marine Order 91, Marine Pollution Prevention – oil • Marine Order 30, Prevention of collisions • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 98) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 97) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 96) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 95) • *Recovery Plan for Marine Turtles in Australia* (Ref. 93) • North-west Marine Parks Network Management Plan (Ref. 146).
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 52) • OPEP (Ref. 2) • OSMP (Ref. 3).
External context	During stakeholder consultation, no objections or claims were raised regarding a vessel collision event arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, given that chemical discharge and/or pollution (of which an oil spill is a component) is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. The *Recovery Plan for Marine Turtles in Australia* (Ref. 93) specifies the following relevant action areas and action: • minimise chemical and terrestrial discharge • ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', e.g. nesting habitat, seagrass meadows or coral reefs.

	No other specific relevant actions were identified within other documents implemented under the EPBC Act. CAPL addresses spill response and monitoring within their OPEP (Ref. 2) and OSMP (Ref. 3). Therefore, CAPL has defined an acceptable level of impact as minimising the risk of impacts to the environment from spills from vessel operations.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No unplanned release of hydrocarbons / hazardous materials to the environment during petroleum activities	**MSRE process** Vessels will meet the crew competency, navigation equipment, and radar requirements of the MSRE process	Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the MSRE process
	Maritime safety information Where required, Notice to Mariners and/or AUSCOAST warnings are issued prior to commencing offshore IMR work	Record of lodgement of notification to relevant agency
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	**SOPEP** Marine vessels >400 T will carry on board a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL 73/78 Annex I – Prevention of Oil Pollution	OVIS report / ABU Marine OE Inspection Checklist confirms an approved SOPEP is on board marine vessels >400 T
		Inspection records (or similar) show drills conducted in accordance with SOPEP
	SOPEP In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP (or equivalent).	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill.
	OPEP In the event of a spill occurring, the OPEP will be implemented	Records confirm the OPEP has been implemented
	OSMP In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

7.3 Spill response

7.3.1 Response option selection

7.3.1.1 Strategic NEBA

CAPL has developed a series of Strategic Net Environmental Benefit Analysis (NEBAs) (Ref. 157) using generalised scenarios that reflect the spill risks associated with all CAPL offshore WA operations. Hydrocarbons associated with spill events from all CAPL operations were grouped into oil types as defined by the International Tanker Owners Pollution Federation Ltd (ITOPF) classification system:

- Group 1 – including Iago, Wheatstone, and Jansz condensate; Wheatstone trunkline fluids; and Wheatstone flowline fluids

- Group 2 – including MDO, Gorgon condensate, Barrow Island crude, and Gorgon/Jansz mixed trunkline fluids
- Group 3 / 4 – including HFO and intermediate fuel oil (IFO) (depending on blend).

These NEBAs were developed as a pre-spill planning tool for all CAPL EPs, to facilitate response option selection and support the development of the overall response strategies by identifying and comparing the potential effectiveness and impacts of oil spill response options (Ref. 158). After considering the benefits and drawbacks of each response option on the ecological, social, and economic receptors within the EMBA, the response options that were determined to minimise the impacts to the environment and people were pre-selected.

7.3.1.2 Protection prioritisation process

CAPL has developed a Protection Prioritisation Process (PPP) (Ref. 159) to support decision making in the event of a significant spill event. The information within the PPP document is used to identify priorities for protection within the activity specific spill scenario(s) EMBA, such as that described in Section 4. The identification of priorities for protection assists in the identification of resources to be assessed within the strategic and operational NEBAs, as described above. The NEBA considers the protection priority values, the EMBA, and the various control measures, including their feasibility, likely success, environmental benefits, level of effectiveness and performance of response tactics. The output of the NEBA and the protection priorities identified will then guide the strategic direction of the response through informing decisions made around tactical planning and response option selection.

The PPP (Ref. 159) ranks receptors (natural or anthropogenic value or resource that is potentially sensitivity to marine oil pollution) using a 5 level scale (from Very Low (1) to Very High (5)) based on a number of factors, including their sensitivity and vulnerability to oil, their conservation status and the biological and socioeconomic importance of the receptor. The CAPL PPP (Ref. 159) aligns with WA Department of Transport (DoT) PPP (Ref. 160) and utilises the same shoreline cells to illustrate broad scale identification of sensitive areas.

Areas with high value receptors and at greatest risk of contact with oil (as indicated by stochastic modelling) are assigned a high protection priority and designated as priority planning areas. The process for identifying these areas (described in the PPP document [Ref. 159]) considers all High (4) and Very High (5) ranked shoreline cells where contact above the moderate exposure threshold (from stochastic modelling across all seasons) is predicted within 4 days (96 hours). As described in the PPP (Ref. 159), the 4-day contact timeframe is based on the expected time it would take CAPL to develop and implement a Tactical Response Guide (TRG) for an area predicted to be impacted. For contact outside this timeframe, it expected that CAPL will have reasonable time to develop and implement a TRG prior to oil contacting the resource.

High and Very High value areas (DoT shoreline cells) identified for contact within this timeframe have been identified in Table 7-10 and Table 7-11 for the major defect and vessel collision events respectively. These priority planning areas, and the specific receptors identified within them, are considered to ensure that tactical planning and response option selection are appropriate.

Table 7-10: Priority panning areas for major defect spill scenario

Potential area of impact	Distance from source of spill	Shoreline values	Planned response tactics
DoT Shoreline Cell # 115 (Ashburton, Ashburton Island, Tortoise Island, Locker Island)	<2km	Turtles – BIAs including nesting Seabirds – BIAs including breeding Mangrove communities Coral and reef communities State and Commonwealth Managed Fisheries	Monitor, Evaluation and Surveillance Shoreline Protection and Deflection Shoreline Clean-up Oiled Wildlife Response
DoT Shoreline Cell # 326 (Serrurier Island, Flat Island, Table Island, Round Island)	20km	Turtles – BIAs including nesting Seabirds – BIAs including breeding Coral and reef communities State and Commonwealth Managed Fisheries	Monitor, Evaluation and Surveillance Shoreline Protection and Deflection Shoreline Clean-up Oiled Wildlife Response
DoT Shoreline Cell # 325 (Thevenard Island)	13km	Turtles – BIAs including nesting Seabirds – BIAs including breeding Coral and reef communities State and Commonwealth Managed Fisheries Tourism	Monitor, Evaluation and Surveillance Shoreline Protection and Deflection Shoreline Clean-up Oiled Wildlife Response

Table 7-11: Priority planning areas for vessel collision event spill scenario

Potential area of impact	Distance from source of spill	Shoreline values	Planned response tactics
DoT Shoreline Cell # 318 (Montebello Islands)	30 km	Turtles – BIAs including nesting Seabirds – BIAs including breeding Mangroves Coral and reef communities Australian Marine Park	Monitor, Evaluation and Surveillance Shoreline Clean-up Oiled Wildlife Response

7.3.2 Activity-specific response option selection

To select the appropriate response options for this EP, hydrocarbons applicable to the worst credible scenarios specific to this activity are:

- Group 1 – Wheatstone trunkline fluids
- Group 2 – MDO.

The outcomes of the Strategic NEBA are outlined in Table 6-1 of the OPEP (Ref. 2). Taking into account the priority planning areas identified in Table 7-10 and Table 7-11, the outcomes of the Strategic NEBA determined that the recommended response options proposed to be used for the spill scenarios associated with this EP include:

- Monitoring, Evaluation, and Surveillance (MES)

- Shoreline Protection and Deflection (SPD)
- Shoreline Clean-up (SHC).

These response options are carried out alongside Oiled Wildlife and Waste Management response tactics. CAPL does not consider Oiled Wildlife and Waste Management as separate response options as they are implemented as support tactics for all spill events in a manner that is commensurate to the level of impact and risk of that event.

7.3.3 CAPL existing spill response capability assessment

Based on the spill response arrangements that CAPL has in place across the business, the capability of these arrangements was determined. This process involved:

- identifying CAPL's existing response arrangements and the equipment and personnel available to CAPL under these arrangements
- defining the response package for each response option, and identifying the critical components for each response package (i.e. equipment or personnel that are limited in number and cannot be purchased or accessed readily)
- determining the number of critical components available to CAPL under existing arrangements
- Identify the number of response packages available to CAPL under existing arrangements
- defining the volume of hydrocarbons that could be recovered or treated per response package.

The outcome of this evaluation is included as Appendix C of the OPEP (Ref. 2).

7.3.3.1 CAPL project-specific capability requirement assessment

To understand the spill response capability required for this activity, CAPL assessed the worst-case credible spill event and used modelling to understand the number of packages per response technique that may be required to respond to that event. The steps involved in this assessment were:

1. Review the Strategic NEBA (Ref. 157) and priority planning areas to understand the planned response to an event.
2. Predict the average surface hydrocarbon volume per day; and average volume of hydrocarbon accumulated onshore per shoreline per day (if relevant) to calculate the number of response packages required per response strategy.
3. Review the number of response packages available to determine if the capability exists.

7.3.3.2 CAPL planned response major defect

In accordance with the Strategic NEBA (Ref. 157), the response strategies proposed to be used for this spill scenario and response package calculations are described below. Offshore CAR would not be effective because of the hydrocarbon properties (Group 1).

Implement MES response

A MES response will commence for a subsea release as soon as the spill is identified. This may range from very simplistic visual observation only, through to more involved monitoring and evaluating tactics. Appendix C of the OPEP (Ref. 2) has documented the arrangements that CAPL have in place to implement all the required MES tactics; therefore, this technique is not discussed further.

Implement an SPD response

Deterministic analysis for the largest volume of oil ashore indicates that 225.7 m^3 may wash ashore between day 1 and day 2 after release. The volume of oil ashore was used to support the planned response requirements—the volume of hydrocarbons that would need to be treated by an SPD response is directly correlated to the volume of oil that may wash ashore.

Based on Appendix C of the OPEP (Ref. 2), each protection team is expected to recover 15.6 m^3 of hydrocarbon per day. On the assumption that 225.7 m^3 washes ashore on the second day, CAPL would need up to 8 SPD packages available per day to implement the SPD response. Confirmation that CAPL has the arrangements in place to implement the required number of packages is provided in Table 7-12.

Despite confirmation of capability arrangements in place, it is unlikely an effective SPD response for all islands within these Priority Planning areas would be feasible given the time to shoreline contact. For example, modelling suggests that Ashburton Island would be impacted within one hour from release. It is plausible that shoreline contact on this island may occur before the Wheatstone EMT has been stood up. Rather, areas / islands that are further away from the release site (for example Serrurier and Thevenard Island) would be prioritised for a SPD response given there may be sufficient time to mobilise resources before shoreline contact occurs.

Implement an SHC response

For a spill event such as this (a non-continuous release), deterministic analysis indicates shoreline accumulation (if it occurs) occurs rapidly. CAPL will implement strategies to protect prioritised values and sensitivities; however, the focus would be on SHC operations.

Deterministic analysis for the largest volume of oil ashore indicates that 225.7 m^3 may wash ashore within ~2 days after release; and the maximum length of actionable shoreline oil was predicted to be ~3 km within ~1.875 days.

Based on Appendix C of the OPEP (Ref. 2), each SHC team is expected to recover 1.6 m^3 of hydrocarbon per day. If ten clean-up teams are mobilised on day 2 and used each day, all hydrocarbons can be recovered within 15 days. If required, these efforts could be ramped up as directed and informed by MES activities.

Table 7-12: Major defect response package deployment timeline

Response Technique	Days Following Event							Weeks Following Event				
	1	2	3	4	5	6	7	2	3	4	5	6
No. packages – planned MES	1	1	1	1	1	1	1	1	1	0	0	0
Does CAPL have the required capability?	Y	Y	Y	Y	Y	Y	Y	Y	Y			

Response Technique	Days Following Event							Weeks Following Event				
	1	2	3	4	5	6	7	2	3	4	5	6
No. packages – planned SPD	8	8	0	0	0	0	0	0	0	0	0	0
Does CAPL have the required capability?	Y	Y										
No. packages – planned SHC	0	10	10	10	10	10	10	10	10	0	0	0
Does CAPL have the required capability?		Y	Y	Y	Y	Y	Y	Y	Y			

7.3.3.3 CAPL planned response vessel collision

In accordance with the Strategic NEBA (Ref. 157), the response strategies proposed to be used for this spill scenario and response package calculations are described below. Offshore CAR would not be effective because of the hydrocarbon properties (Group 2).

Implement MES response

A MES response will commence for a subsea release as soon as the spill is identified. This may range from very simplistic visual observation only, through to more involved monitoring and evaluating tactics. Appendix C of the OPEP (Ref. 2) has documented the arrangements that CAPL have in place to implement all the required MES tactics; therefore, this technique is not discussed further.

Implement SPD response

Deterministic analysis for the largest volume of oil ashore indicates that ~24.4 m^3 may wash ashore within ~3 days after release. The volume of oil ashore was used to support the planned response requirements—the volume of hydrocarbons that would need to be treated by an SPD response is directly correlated to the volume of oil that may wash ashore.

Based on Appendix C of the OPEP (Ref. 2), each protection team is expected to recover 15.6 m^3 of hydrocarbon per day. On the assumption that 24.4 m^3 washes ashore on the third day, CAPL would need up to two SPD packages available on day two to implement the SPD response. Confirmation that CAPL has the arrangements in place to implement the required number of packages is provided in Table 7-13.

Implement SHC response

For a spill event such as this (a non-continuous release), deterministic analysis indicates shoreline accumulation (if it occurs) occurs rapidly. CAPL will implement strategies to protect prioritised values and sensitivities; however, the focus may be on SHC operations if time restricts the ability to conduct SPD activities.

Deterministic analysis for the largest volume of oil ashore indicates that 24.4 m^3 may wash ashore within ~3 days after release; and the maximum length of actionable shoreline oil was predicted to be ~10 km within ~4 days This scenario predicted exposure to the western coastlines of Montebello Island.

The Montebello Islands consists of a series of relatively flat limestone islands and sandy beaches and lagoons, easily accessed by boat (dependent on weather and sea conditions). On this basis, response planning indicates it would be feasible to conduct SHC activities.

Based on Appendix C of the OPEP (Ref. 2), each SHC team is expected to recover 1.6 m^3 of hydrocarbon per day. If 5 clean-up teams are mobilised on day 3 and used each day, all hydrocarbons can be recovered 5 days from the start of the spill (3 days of SHC response). If required, these efforts could be ramped up as directed and informed by MES activities.

Table 7-13: Vessel collision response package deployment timeline

Response technique	Days following event							Weeks following event				
	1	2	3	4	5	6	7	2	3	4	5	6
No. packages – planned MES	1	1	1	1	1	1	1	1	0	0	0	0
Does CAPL have the required capability?	Y	Y	Y	Y	Y	Y	Y	Y				
No. packages – planned SPD	0	2	2	0	0	0	0	0	0	0	0	0
Does CAPL have the required capability?		Y	Y									
No. packages – planned SHC	0	0	5	5	5	0	0	0	0	0	0	0
Does CAPL have the required capability?			Y	Y	Y							

7.3.4 Spill response environmental risk assessment

7.3.4.1 Ground disturbance—shoreline spill response

Conducting SPD or SHC involves moving personnel and equipment, which triggers the environmental aspect of ground disturbance.

SPD aims to decrease the overall effect of oil on shorelines before they are impacted and uses booms and sorbents placed adjacent to sensitive shoreline habitats to deflect or capture surface oil.

The objective of SHC is to apply techniques that are appropriate to the shoreline type to remove as much oil as possible. Various techniques may be used alone or in combination to clean oiled shorelines, including shoreline assessment, natural recovery, sorbents, sediment reworking, manual and mechanical removal, and washing, flooding, and flushing.

Source			
In the event of a worst-case spill event (major defect event releasing Wheatstone trunkline condensate, or vessel collision event releasing MDO), implementing SPD and SHC techniques involves people and equipment, which may disturb shoreline habitat.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Conducting SPD and SHC, including moving personnel and equipment, has the potential to damage terrestrial habitats (including nests), with	5

		subsequent impacts to fauna such as turtles and birds.	

Consequence evaluation

Potential impacts of SPD and SHC vary, depending on the method used and the shoreline habitat. General impacts include physical disturbance from using personnel, vehicles, and equipment.

Particular values and sensitivities in the area that may be affected by the spill include sensitive shoreline habitats (such as mangroves) and nesting / foraging habitat for fauna species such as turtles and birds.

The impacts associated with undertaking SHC may be more than if the hydrocarbon product was left in place and remediated through natural processes. Leaving the product in place is a common response option if continual human and vessel/vehicle traffic has the potential to generate greater impacts than the product itself. This technique has been implemented internationally, including for the Montara spill (where persistent components of the product were left to naturally break down in dense coastal mangroves) and the Macondo spill (where marshes and wetlands that had been impacted by weathered product were allowed to recover naturally). If a smaller extent of shoreline is impacted, the impacts from an SHC response activity may be lessened and more localised.

Potential impacts associated with using vehicles, personnel, and equipment during SHC (and/or SPD) can include disturbing wildlife feeding or breeding (including damage to nests) and damaging dune structures, vegetation, or intertidal habitats. These shoreline activities have the potential to result in short-term and localised damage to or alteration of habitats and ecological communities and therefore the consequence is ranked as Minor (5).

ALARP decision context justification

The risks associated with shoreline oil spill response techniques are well understood, with the techniques having been applied successfully for a number of large spill events. Although there is a good understanding of these response techniques, there is uncertainty regarding the specific location at which this may be undertaken, and the level of response that may be required in these areas. Spill modelling was used to inform the extent of such a spill, and thus provide a sound basis for response planning (including shoreline response) to such an incident.

Control measures to manage the risks associated with shoreline spill response techniques are well defined with most being linked to detailed monitoring plans that feed into tactical planning requirements and NEBAs.

During stakeholder consultation, no objections or claims were raised regarding spill response activities.

The risks arising from implementing shoreline response techniques in the event of a spill are extremely low, and CAPL consider these to be lower-order risks in accordance with Table 5-3. As such, CAPL considers ALARP Decision Context A should be applied for this aspect.

Good practice control measures and source

Control measure	Source
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets. Specifically, Operational Study 6 – Rapid Seabird and Shorebird Assessment and Operational Study 7 – Rapid Marine Megafauna Assessment provide information on the presence of wildlife with regards to predicted trajectory to understand the level of oiled wildlife response (OWR) required.

Likelihood and risk level summary

Likelihood	Depending on the clean-up technique and habitat, potential consequences of shoreline cleaning are remote (Note: Mechanical methods are generally

	expected to have greater consequences than manual cleaning). With the control measures in place, CAPL assessed the likelihood of the consequence described above as Remote (5).	
Risk level	Very low (9)	
Acceptability summary		
Principles of ESD	The potential impact associated with this aspect is considered to have the potential to result in minor, localised, incidental damage to, or alteration of, habitats and ecological communities; however, this is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No legislation and other requirements relevant to this aspect were identified.	
Internal context	This CAPL environmental performance standard / procedure was considered relevant for this aspect: • OSMP (Ref. 3).	
External context	During stakeholder consultation, no objections or claims were raised regarding spill response activities.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Reduce the risk of impacts to the environment during event response	**OSMP** In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

7.3.4.2 Physical presence—oiled wildlife response

Oiled wildlife response (OWR) activities are aimed at treating fauna that have encountered, or are likely to encounter, spilt hydrocarbons. OWR generates the environmental aspect of physical presence/interaction with fauna, through handling, treating, rehabilitating, and releasing fauna.

Source			
In the event of a worst-case spill event (major defect event releasing Wheatstone trunkline condensate, or vessel collision event releasing MDO), the handling and treating marine fauna (through an OWR) will result in personnel interacting with marine fauna.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Conducting OWR has the potential to cause further harm to oiled fauna due to hazing, barriers, deterrents, and cleaning activities, and has the potential to cause injury/death.	5

Consequence evaluation	
Particular environmental values that may be affected by OWR activities include marine fauna such as turtles and birds. Due to the intensive nature of OWR activities and the fragile nature of many shore and wading birds, OWR activities can have high bird mortality rates. Physical exclusion and hazing operations can result in entanglement and stress-related impacts to marine birds. Cleaning of oiled wildlife may result in skin irritations, impacts to the hydrophobic properties of bird plumage, and stress-induced physiological effects. Spill modelling indicates that areas along the coast frequented by fauna, such as the Montebello Islands, are areas where OWR is most likely to be undertaken. If a spill coincided with turtle nesting/hatchling or bird nesting periods, a large number of animals may be treated using OWR. Impacts from hazing and deterrents are anticipated to be localised to the area of potential spill impact and limited to the spill period. Even if OWR was undertaken during nesting periods, only a small proportion of the nesting population would be involved as the species potentially involved nest widely elsewhere. The potential consequences associated with an OWR are localised and short term and are ranked as Minor (5).	
ALARP decision context justification	
The risks associated with OWR are well understood, with the technique having been applied successfully for a number of large spill events. Although there is a good understanding of the response technique, there is uncertainty regarding the specific location at which this may be undertaken, the number of animals that may be impacted, and thus the level of response that may be required. Spill modelling was used to inform the extent of such a spill, and thus provide a sound basis for response planning to such an incident. Control measures to manage the risks associated with OWR are well defined with most being linked to detailed monitoring plans that feed into tactical planning requirements and NEBAs. During stakeholder consultation, no objections or claims were raised regarding OWR activities. The risks arising from implementing OWR in the event of a spill are extremely low, and CAPL consider these to be lower-order risks in accordance with Table 5-3. As such, CAPL considers ALARP Decision Context A should be applied for this aspect.	
Good practice control measures and source	
Control measure	**Source**
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets. Specifically, Operational Study 6 – Rapid Seabird and Shorebird Assessment and Operational Study 7 – Rapid Marine Megafauna Assessment provide information on the presence of wildlife with regards to predicted trajectory to understand the level of OWR required.
Likelihood and risk level summary	
Likelihood	Where there is the possibility for surface oil to impact wildlife, the risks associated with OWR are lower than those associated with inaction. With the control measures in place, the likelihood of the described consequences occurring from OWR activities was determined to be Remote (5).
Risk level	Very low (9)

Acceptability summary		
Principles of ESD	The potential impact associated with this aspect is considered as having the potential to result in a localised incidental impact and thus is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No legislation and other requirements considered relevant to this aspect were identified.	
Internal context	The CAPL environmental performance standard / procedure considered relevant for this aspect is: • OSMP (Ref. 3).	
External context	During stakeholder consultation, no objections or claims were raised regarding spill response activities.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Reduce the risk of impacts to the environment during event response	**OSMP** In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

8 implementation strategy

This implementation strategy identifies the systems, practices, and procedures used to ensure the environmental impacts and risks of the petroleum activities are continuously reduced to ALARP and the environmental performance outcomes and standards detailed in Sections 6 and 7 are achieved.

8.1 Operational Excellence Management System

CAPL's operations are managed in accordance with Chevron Corporation's OEMS, which is a comprehensive management framework that supports the corporate commitment to protect the safety and health of people and the environment. The OEMS aligns with ISO 14001:2015 *Environmental management systems - Requirements with guidance for use* (Ref. 50) and meets the requirements of the OPGGS(E)R.

OE systematically manages workforce safety and health, process safety, reliability, and integrity, environment, efficiency, security, and stakeholders to meet the OE objectives and ensure safe operations of CAPL facilities and projects. The OEMS comprises the following key components (Figure 8-1):

- **leadership and OE culture**—through the OEMS, CAPL leaders engage employees and contractors to build and sustain the OE culture and deliver OE performance
- **management system cycle** (MSC)—by applying the MSC, CAPL leaders make risk-based and data-driven decisions, prioritise activities, and direct improvements
- **focus areas and OE expectations** (including common expectations)—focus areas are categories of OE risks and include workforce safety and health, process safety reliability and integrity, environment, efficiency, security, and stakeholder engagement; OE expectations guide the design, management, and assurance of the presence and effectiveness of safeguards.

The OEMS outlines the process for identifying, establishing, and maintaining safeguards and to provide assurance that they are in place, functioning as intended, and are in accordance with legal and OE requirements. The risk management process (Figure 8-1) assesses and identifies safeguards, which are the hardware and human actions designed to directly prevent or mitigate an incident or impact associated with the project, personnel, and the environment. The assurance process (Figure 8-1) provides the verification and validation that the safeguards are in place and functioning as intended.

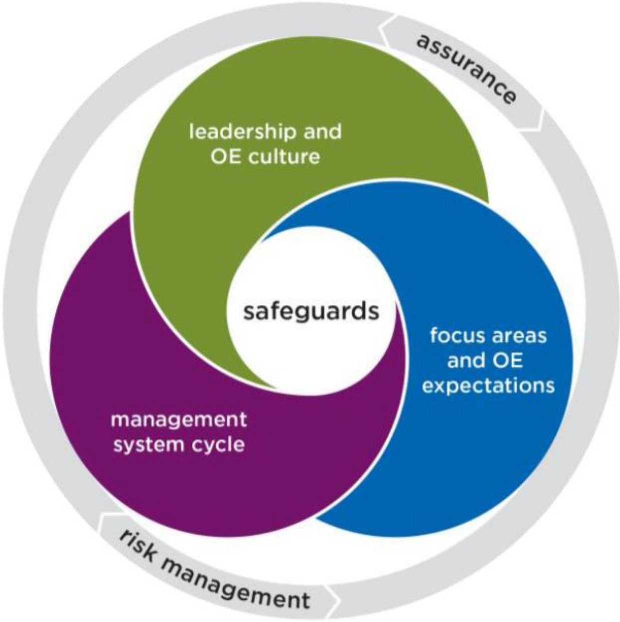


Figure 8-1: Overview of Chevron Corporation's OEMS

8.2 Leadership and OE culture

CAPL leaders demonstrate and are accountable for the consistent and rigorous application of the OEMS to drive performance and manage risks. The actions and visibility of leaders reinforce CAPL's commitment to place the highest priority on the safety and health of its workforce, and on the protection of communities, the environment, and its assets.

8.2.1 Roles and accountability

CAPL leaders have the overall accountability for the implementation of the OEMS.

8.2.1.1 Chain of command (petroleum activity)

A chain of command for implementing the petroleum activity is outlined in Figure 8-2.

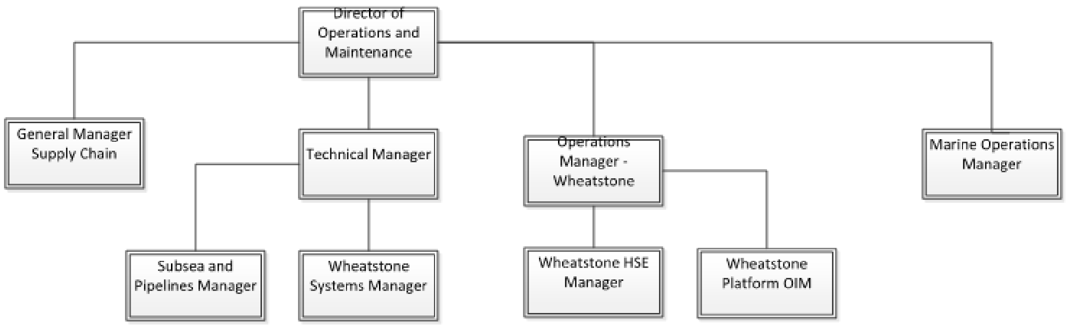


Figure 8-2: Chain of command—petroleum activities

8.2.1.2 Roles and responsibilities (petroleum activity)

The roles and responsibilities of key CAPL and contractor personnel for implementing task-specific control measures are detailed in Sections 6 and 7, and are summarised in Table 8-1.

Table 8-1: Key roles and responsibilities—petroleum activities

Role	Responsibilities
CAPL personnel	
Operations Manager - Wheatstone	• Overall responsibility for implementing, managing, and reviewing this EP
Wheatstone Platform Offshore Installation Manager (OIM) Wheatstone HSE Manager	Ensure that: • all personnel are made aware of their requirements under this EP • all personnel have the relevant training and competency as described in Section 8.2.1.3 • impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Sections 6 and 7 • monitoring and reporting is undertaken in accordance with Section 8.4 • all changes to this EP are subject to a Management of Change assessment as described in Section 8.3.2.2 • compliance with this EP is verified in accordance with Section 8.3.6 • this EP is reviewed in accordance with Section 8.5.
Subsea and Pipelines Manager	• Ensure that inspection and monitoring of the hydrocarbon system is undertaken in accordance with the IM Plan (Ref. 21; Ref. 22)
General Manager Supply Chain	• Ensure that all third-party vessels or contractors are aware of any requirements within this EP
Contractor personnel	
Vessel Master	Ensure that: • impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Sections 6 and 7 • all incidents are reported to CAPL • all emissions and discharges are monitored and recorded in accordance with Sections 6 and 7.

8.2.1.3 Training and competency (petroleum activity)

In accordance with Regulation 14(5) of the OPGGS(E)R and Regulation 15(5) of the PP(E)R, each employee responsible for implementing task-specific control measures during operational activities must be aware of their specific responsibilities as detailed in this EP. People who hold responsibilities relating to implementing this EP are hired by CAPL on the basis of their particular qualifications, experience, and competency.

All external contractor personnel involved with activities within scope of this EP will hold qualifications or training certification relevant to their role, which will be confirmed through the contractor selection process, audits and review processes.

Personnel with specific responsibilities under this EP (refer to Section 8.2.1.2) were included during the internal review of this EP and are made aware of their role-specific responsibilities under this EP.

All personnel (including contractors) are required to attend inductions and/or training that are relevant to their role (Table 8-2).

Table 8-2: Training and competency—petroleum activities

Type	Required personnel	Scope
Induction	All relevant personnel	Before commencing operations, all personnel, including subcontractors, must attend an induction that includes an overview of the requirements of this EP. This induction fosters environmental stewardship amongst all personnel and ensures that they are aware of the control measures implemented to minimise the potential impact on the environment. The induction includes: • awareness of Chevron Corporation's Operational Excellence Policy 530 (appendix a) • an overview of environmental sensitivities, and key impacts and risks from the petroleum activity • cetacean interaction requirements under Part 8 of the EPBC Regulations 2000 • fauna interaction requirements under Biodiversity Conservation Regulations 2018 • good waste management and hazardous materials housekeeping requirements • incident reporting requirements • incident response arrangements.
PW laboratory sampling training	All laboratory personnel	Laboratory personnel taking samples and analysing samples will be competent in ABU – 1645 Produced Water Treatment System – Fundamental Review and CAPL Laboratory Manual standards.
MSRE	All vessel personnel	Vessel personnel meet minimum MSRE competency requirements.
Platform operations	All relevant platform personnel	Competency requirements for the following operational roles as described in the Competency Management System (CMS): • Platform crane operators • CRT • Seawater system operators • Drainage system operators • Platform flare system operators • Platform turbine operators • Platform compressor operators

8.3 Focus areas and OE expectations

The OE expectations are organised into six focus areas (Figure 8-3). The OE expectations provide guidance to design, operate, maintain, improve, and assure the presence and effectiveness of safeguards. Common expectations also apply and support the OE expectations and focus areas Figure 8-3.

Figure 8-3: Focus areas and common expectations

The focus areas and common expectations relevant to this EP, and their key processes that demonstrate how CAPL is effective in reducing environmental impacts and risks to ALARP and an acceptable level, are listed in Table 8-3. Each of these focus areas and common expectations are described in further detail in the following subsections.

Table 8-3: Relevant focus areas and common expectations

Focus area or common expectation	Key processes
Focus area	
Workplace safety and health	• *Managing Safe Work (MSW): ABU Standardised OE Process* (Ref. 51) • *Marine Safety Reliability and Efficiency: ABU Standardised OE Process* (Ref. 52) • *ABU Hazardous Materials Management Procedure: ABU Standardised OE Procedure* (Ref. 54)
Process safety, reliability and integrity	• OE Information Management: ABU Standardised OE Process (Ref. 55) • *Management of Change for Facilities and Operations: ABU Standardised OE Process* (Ref. 56) • *ABU Surface Equipment Reliability and Integrity Process (SERIP) Base Business: Standardised OE Process (Ref. 57)*
Environment	• *Environmental Stewardship: ABU Standardised OE Process (Ref. 58)* • *Quarantine Procedure Marine Vessels. ABU Standardised OE Process (Ref. 59)*
Stakeholders	• *Stakeholder Engagement and Issues Management: ABU Standardised OE Process* (Ref. 60)
Common expectation	
Risk management	• *ABU OE Risk Management Process* (Ref. 45)
Assurance	• *OE Assurance Corporate Process* (Ref. 61) • *OE Corporate Standard Incident Investigation* (Ref. 64) • *OE Data Reporting Standard (Ref. 291)*
Incident investigation and reporting	• *Incident Investigation and Reporting (II&R) Execution Manual* (Ref. 65)
Emergency management	• *Emergency Management OE Process* (Ref. 66)

Focus area or common expectation	Key processes
	• OPEP (Ref. 2) • *Operational and Scientific Monitoring Plan* (OSMP) (Ref. 3)

8.3.1 Workforce safety and health

8.3.1.1 Managing safe work

The MSW expectation is to assess workplace safety and health hazards and manage the risks associated with the execution and control of work performed by CAPL employees, their delegates, contractors, and subcontractors. The MSW system (Ref. 51) is implemented to ensure safe work practices are made available to the workforce. Standards and procedures relating to MSW relevant to this EP include the permit to work (PTW) system. The PTW system, which includes simultaneous operations (SIMOPS) and hazard analysis, is a way to identify, communicate, mitigate, and control hazards associated with work that have the potential to adversely affect HSE. As the potential consequence associated with each task increases, so does the level of controls and approval that are required.

8.3.1.2 Marine

The Marine Safety Reliability and Efficiency (MSRE) process (Ref. 52) identifies the requirements and activities necessary to deliver safe, reliable, and efficient third-party marine operations. This process describes key roles and responsibilities for managing marine safety and establishes measurement and verification activities designed to promote a process of continual improvement.

The MSRE process applies to all marine vessels, emergency response, and all other (non-bulk petroleum) vessels chartered, owned, or operated by CAPL. The process also applies to vessels contracted by an affiliate or contractor that provide marine support or marine services to CAPL.

Vessels are assured and endorsed for their intended work scope by the MSRE Process Authority (or delegate). Contractors and subcontractors are required to meet all requirements in the Corporate Marine Standard (Ref. 53), including the MSRE Marine Contractor HES (MarCHES) qualification and performance monitoring. Contractors and subcontractors are also required to meet any in-force global MSRE marine notices, which must be complied with until they are revoked or added to the CAPL Marine Standard.

The key elements of the MSRE process that apply to the activities outlined in this EP are:

- vessel inspections—vessels used by CAPL or its affiliates must undergo a vessel audit/inspection process before deployment to ensure that the vessels and the staffing levels meet safety requirements and are fit-for-purpose; inspections also ensure emergency procedures (such as SOPEP/SMPEP) are available and that the required standards are met for navigation equipment, lighting, waste systems, and other marine safety protocols including Marine Order 30 (Prevention of Collisions)
- competency management—vessels used by CAPL must be operated by competent personnel who meet applicable international and local regulations

- cargo handling—cargo transport and handling operations on marine vessels must comply with handling procedures and align to standard marine industry practices
- complicated and/or heavy lifts—all lifting and installing of heavy equipment near offshore infrastructure must meet the detailed requirements
- hose management—operations involving the transfer of bulk liquids using loading hoses must align to standard industry practice and safety of the environment
- vessel communication—vessels must have in place communications procedures for operations close to installations, or other mobile units to ensure that safe positioning and communications are maintained at all times.

Vessels provide an activity-specific operational guideline (ASOG), based on their use and specification, which must be accepted by CAPL.

8.3.1.3 Hazardous materials

CAPL's *Hazardous Materials Management Procedure* (Ref. 54) outlines the process for HSE assessment and approval of hazardous materials. Hazardous materials include those classified as 'hazardous substances or 'dangerous goods'.

The *Hazardous Materials Management Procedure* is designed to:

- assess hazardous materials requested for procurement for their HSE risks
- ensure that appropriate controls are identified for using procured hazardous materials and that these controls are communicated to the requestors of the materials and end users at locations within CAPL's operations
- ensure no product includes CAPL-prohibited ingredients
- ensure substitutes were considered if a product contains CAPL-restricted ingredients.

As part of the hazardous materials selection process, hazardous materials that will be discharged to the environment will undergo a detailed environmental assessment. This environmental assessment is guided by the methodology and classification system used by the Offshore Chemical Notification Scheme (OCNS) and Chemical Hazard Assessment and Risk Management (CHARM). Hazardous materials not listed on OCNS or CHARM, are still subject to the environmental assessment described below.

The environmental assessment includes an evaluation of the potential environmental risks that could be associated with the chemical, and considers the relevant dosage, quantity and frequency of the chemical discharge, the location and nature of the receiving environment, and the assessment criteria described in Table 8-4.

The chemical selection process ensures impacts and risks associated with chemical discharge are reduced to levels that are ALARP and acceptable, while meeting operational performance requirements.

Table 8-4: Chemical risk assessment criteria

Assessment criteria	Selection rationale
Potential for acute and/or chronic toxicity to aquatic life	The toxicity of a chemical is the fundamental consideration within this assessment. This reflects the UK OCNS system which ranks chemicals based on their toxicity, and then adjusts rankings depending on biodegradation and bioaccumulation properties. The scale for toxicity is based on the toxicity rating classification system used by DMIRS, from Hinwood et al. (Ref. 71).
Persistence or biodegradability	Biodegradation rate provides an indication of the potential persistence of the chemical within the environment, and therefore the potential duration of exposure for environmental sensitivities. The scale for biodegradation is based on adjustment criteria used by Centre for Environment, Fisheries and Aquaculture Science (CEFAS) to finalise chemical hazard assessment scores under the OCNS system.
Bioaccumulation or bio-concentration	Indicates the potential for the chemical (or components of the chemical) to accumulate within biological matrices and food chains. Chemicals which may not be toxic and are introduced to the environment in low concentrations can concentrate within biological matrices to the point where they become toxic and may have either acute or chronic effects. The scale for bioaccumulation is based on adjustment criteria used by CEFAS to finalise chemical hazard assessment scores under the OCNS system.

8.3.2 Process safety, reliability and integrity

8.3.2.1 OE information management

Under the OEMS, records (including compliance records to demonstrate environmental performance and compliance with commitments in this EP) will be retained in accordance with Regulation 27 of the OPGGS(E)R and Regulation 31 of the PP(E)R.

The OE information management process (Ref. 55) explains how critical information related to HSE, reliability, efficiency, and process safety is to be identified, developed, assessed, and maintained so that the workforce has access to, and is using, the most current information. This document describes key roles, responsibilities, and competencies associated with the process, and includes measurement and verification activities.

Vessel contractors will maintain records as above and are required to make these available upon request.

8.3.2.2 Management of change

Management of Change (MoC) expectations are to manage proposed changes to design, equipment, operations and products before they are implemented. In conjunction with the *ABU OE Risk Management Process* (Section 8.3.5), the *Management of Change for Facilities and Operations* process (Ref. 56) is followed to document and assess the impact of changes to activities described in this EP. 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 EP. If these changes do not trigger relevant petroleum regulations, as detailed below, this EP will be revised, and changes recorded in the EP without resubmission.

In accordance with Regulation 17 of the OPGGS(E)R, and Regulation 18 of the PP(E)R, this EP must be resubmitted to NOPSEMA or DMIRS under the relevant jurisdiction in the following circumstances:

- before commencing a new activity, or any significantly modification or new stage of the activity, not provided for in this EP
- if a change in the titleholder results in a change in the manner in which the impacts and risks of the activity are managed
- as soon as practicable after the occurrence of any significant new environmental impact or risk, or significant increase in an existing environmental impact or risk, that is not provided for in this EP
- as soon as practicable after the occurrence of a series of new environmental impacts or risks, or a series of increases in existing environmental impacts or risks, occur which, taken together, amount to the occurrence of a significant new environmental impact or risk, or a significant increase in an existing environmental impact or risk, not provided for in this EP.

8.3.2.3 Computerised maintenance management system

The computerised maintenance management system (CMMS) supports asset integrity management and reliability management through a rigorous, detailed register of inspection and maintenance tasks and data records, including maintenance planning and scheduling. Each item (down to component level) is assessed, has a criticality assigned based on importance, performance standards (including those based on manufacturers' specifications or similar), and a start date and frequency for inspections and maintenance. Items of high criticality are to be completed on time, or adequately managed under the deviation process.

8.3.2.4 Laboratory information management system

The laboratory information management system (LIMS) provides for the planning, collection, analysis, recording, and reporting of platform samples to ensure product quality, plant reliability, and to support real-time monitoring. Requirements and schedules are developed within the LIMS, and non-compliance alerts are reported internally. Generally, the platform PW laboratory results and other relevant water sampling results are managed through the LIMS.

8.3.2.5 Production information management system

The production information management system (PIMS) accurately records information relating to production, metering, discharges, and hydrocarbon processing on the platform.

8.3.2.6 Competency Management System

All operations personnel have a competency profile allocated to their position that details training and competence requirements to undertake their duties. CAPL uses a competency management system (CMS) to track and manage competencies and required training for the operations workforce to ensure minimum levels are met and that personnel are trained and competent to undertake their duties.

8.3.2.7 Produced water operating manual

As mentioned in the platform PW risk assessment (Section 6.2.6), a documented response procedure is to be implemented if PW TPH concentrations trend off-specification. This topsides response is described in the platform *Produced Water Treatment System Operating Manual* (Ref. 72) and *Produced Water High Oil in Water Content Procedure* (Ref. 73), and operators follow a tiered response that aims to keep the PW TPH results below 30 mg/L as far as practicable.

8.3.2.8 Emergency operating procedures

Emergency operating procedures (EOPs) provide clear instructions on how operations personnel should respond to emergency scenarios. EOPs provide guidelines for safe hazard mitigation in the event of an emergency and include instructions on critical steps required to safely secure a process unit during specific emergency situations. EOPs provide guidance to platform CCR personnel to detect, isolate, and stabilise non-routine events including platform and hydrocarbon system loss of containment events (Ref. 75).

8.3.3 Environment

8.3.3.1 Environmental stewardship

The environmental stewardship process (Ref. 58) is designed to identify, assess, and manage potentially significant environmental impacts in a consistent manner and continually improve environmental performance. The objectives of the process are to:

- provide a consistent approach to environmental stewardship
- reduce the potential for environmental impacts
- support continual improvement in environmental performance throughout the lifecycle of Chevron's assets.

8.3.3.2 Quarantine

The *Quarantine Procedure Marine Vessels* (Ref. 59) provides information about quarantine compliance to CAPL, contractors, and others associated with marine vessels.

The purpose of this procedure in relation to the offshore title areas is to prevent offshore facilities and activities associated with CAPL title areas becoming staging areas for the introduction of marine pests into Australian waters and ports.

This procedure also outlines the requirements for vessels operating in title areas and details the premobilisation requirements and ongoing management of vessels operating in title areas.

8.3.4 Stakeholders

Stakeholder engagement expectations are to manage social, political, and reputational risks to CAPL (and Chevron), address potential business impacts, and generate business value by:

- identifying, assessing, and prioritising issues
- building and maintaining relationships with external stakeholders, including governments and the communities where CAPL operates

- developing and executing issue management and stakeholder engagement plans, tracking engagements and issues, and validating the effectiveness of plans.

The *Stakeholder Engagement and Issues Management Process* (Ref. 60) details an integrated approach for engaging stakeholders and managing external stakeholder issues. This process describes key roles and responsibilities for stakeholder engagement, establishes measurement and verification activities designed to monitor the effectiveness of the stakeholder engagement process and to promote continual improvement.

Section 2.6 describes the process undertaken for appropriate consultation with relevant authorities and relevant interested persons or organisations. CAPL will continue to engage with relevant stakeholders as described in Section 2.6.5.

8.3.5 Risk management

The risk management process (Ref. 45) assesses and identifies safeguards, which are the hardware and human actions designed to directly prevent or mitigate an incident or event and is designed to be consistent with the environmental risk management requirements of ISO 14001 *Environmental Management System* (Ref. 50) and ISO 31000:2018 *Risk management – Principles and guidelines* (Ref. 46).

This risk management process is summarised in Section 5 of this EP. Additional risk assessments must be undertaken if the MoC process (Section 8.3.2.2) is triggered. Risk assessments are undertaken in accordance with this process.

The *ABU OE Risk Management Process* (Ref. 45) and the *Management of Change for Facilities and Operations* process (Ref. 56) are the key systems CAPL use to ensure, that in accordance with Regulation 14(3)(a) of the OPGGS(E)R and Regulation 15(3)(a) of the PP(E)R, the impacts and risks of the petroleum activity continue to be identified and reduced to ALARP.

8.3.6 Assurance

Within the OEMS, assurance is a common expectation that supports the OE objective of each focus area. The *ABU OE Assurance Process* (Ref. 61) enables CAPL to deliver assurance that safeguards are established and functioning; it details:

- a framework for managing safeguards and verification activities that assure that CAPL complies with applicable legal and OEMS requirements
- a process to identify and resolve potential noncompliance
- the minimum qualifications and organisational capability to execute this process.

The *ABU OE Assurance Plan* (Ref. 62) is a multi-year plan that documents the CAPL ABU integrated assurance system and associated assurance activities (Figure 8-4). The *ABU OE Assurance Plan* is reviewed and approved annually and includes:

- a list of OE assurance priorities based on risk
- a schedule of assurance activities to evaluate safeguards and verifications (e.g., safeguard assurance workshops, audits, and assurance programs)

- reference to asset assurance plans that outline asset specific assurance activities and risk-based frequency (i.e., field inspection programs, audits, compliance reviews, performance reviews).

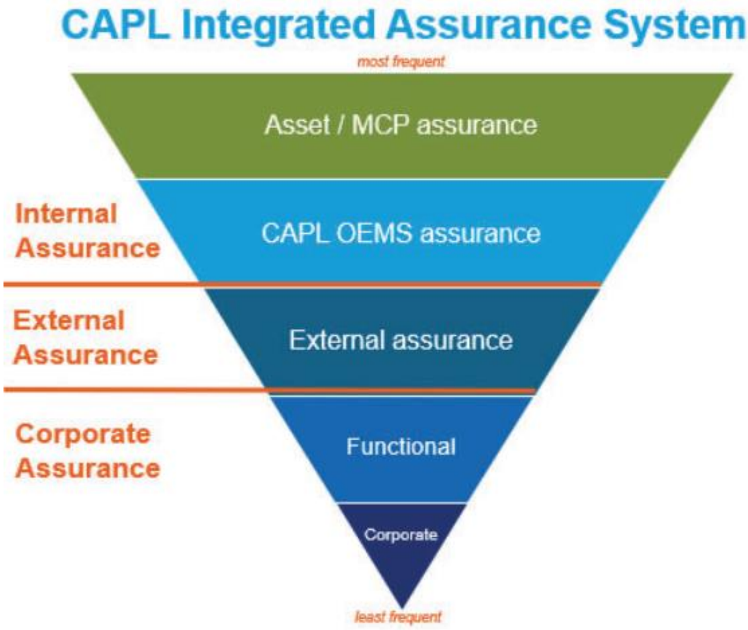


Figure 8-4: ABU integrated assurance system

To support the implementation of the *ABU OE Assurance Process* (Ref. 61), CAPL have developed an ABU integrated assurance system (Figure 8-4), which integrates and leverages assurance activities across the various levels of CAPL business through to the corporate level—to provide confidence that safeguards are in place and functioning as intended. This integrated assurance system includes:

- asset / facility / function assurance: ongoing, routine, planned verifications of safeguards specific for the asset / facility (e.g., HSE inspections, audits, asset integrity inspections, preventive maintenance, emergency drills and exercises, compliance reviews, performance reviews)
- ABU OEMS assurance: implemented through the established system-based assurances within the OEMS and ABU OE processes (e.g., assessments, reviews, audits, inspections, workshops, engagements) that support the CAPL assets and major capital project assurance plans and identify and respond to the systemic deterioration of safeguards and progress areas for improvement
- external assurance: assurance activities undertaken by third-party entities (e.g., regulatory inspections, joint venture partner reviews)
- corporate and functional assurance: assurance activities of CAPL functional groups (e.g., drilling and completions, HSE, FE) and OEMS focus areas to address OEMS requirements, safeguards and areas for improvement.

The *Wheatstone Asset Assurance Schedule* (Ref. 63) documents the specific assurance activities for this EP and is reviewed annually, however it may be updated as required throughout the year based on asset / facility operational risk. Assurance activities are scheduled on a risk-based approach and conducted to verify the effectiveness of safeguards and verifications and the extent to which requirements are met by CAPL.

Assurance activities focus on in-field activities and administrative processes, depending on the activities being undertaken and assurance priorities (these priorities are based on risk) and provide sufficient demonstration that Environmental Performance Objectives and Environmental Performance Standards have been met and the activity implemented in accordance with this Implementation Strategy. A record of all assurance activities undertaken, and the outcomes, are maintained and actions are tracked until closure.

Field inspections are scheduled based on a risk-based assessment and conducted as documented in the asset assurance plan and may range from monthly, quarterly or six monthly depending on the risk assessment.

Field inspections undertaken by the asset / facility are scheduled based on a risk-based assessment and conducted as documented in the *Wheatstone Asset Assurance Schedule* (Ref. 63). These are planned and may range from monthly, quarterly, six monthly or annual depending on the risk assessment and the type of assurance activity. Some inspections may be in response to a specific event such as cyclone or rainfall event. For example, a dangerous goods warehouse inspection may be assured monthly and a vegetation clearing permit audit may be assured quarterly.

Note that hydrocarbon system integrity inspections (as described in Section 3.4) also have a role in verifying environmental performance. The type and frequency of these inspections is documented in the *Wheatstone Upstream Subsea System Inspection and Monitoring Plan* (Ref. 21) and *Wheatstone Upstream Trunkline System Inspection and Monitoring Plan* (Ref. 22).

Environmental Performance Standards in the EP undergo an annual compliance review and evidence is gathered for each Environmental Performance Standard to support the annual environmental report. Assurance related to the Wheatstone Project start-up and operations activities described in this EP will be summarised in the annual report submitted to NOPSEMA (Section 8.4.3).

8.3.6.1 Managing instances of potential non-compliance

The reporting, investigation, and tracking of non-conformances are managed via Chevron's OE Corporate Standard Incident Investigation (Ref. 64) and OE Data Reporting Standard (Ref. 291). These processes apply to instances where the requirements of this EP have not been met. This process is used if audit findings identify that activities in the scope of this EP are not being implemented in accordance with the risk and impact control measures identified in Sections 6 and 7.

Audit findings and corrective actions are recorded and tracked in a CAPL compliance assurance database for timely closure of actions. Audit findings that identify a breach of an environmental performance outcome or environmental performance standard will be reported in accordance with Section 8.4.2.

Any suggested changes to activities or control measures arising from audit findings or instances of potential noncompliance will be subject to a MoC process in accordance with Section 8.3.2.2.

8.3.7 Incident investigation and reporting

Incident investigation and reporting (IIR) expectations are to identify, report, record and investigate incidents, analyse trends, correct deficiencies, and share and adopt relevant lessons learned.

The *Incident Investigation and Reporting (II&R) Execution Manual* (Ref. 65) defines the requirements to report, classify, record, and investigate incidents and near misses, including but not limited to injury, occupational illness, environmental impact, reliability, business disruption, and community concern.

The IIR process includes these requirements:

- training for employees and contractors to recognise and report events
- internal and external notification of events
- investigating incidents at the probable level of consequence, with the rigor of investigation based upon learning opportunity and incident severity
- allocating an incident management sponsor for selected investigations
- sharing alerts, lessons learned, and bulletins
- tracking recommended actions to closure
- analysing event trends.

Events that meet the required criteria are recorded in the CAPL incident management system (IMS). The system holds records of the associated investigation results. The lessons learned from selected investigations are shared to reduce the likelihood of future comparable events.

Specific incident reporting requirements for this EP are detailed in Section 8.4.2.

8.3.8 Emergency management

8.3.8.1 Emergency management arrangements

The emergency management arrangements outline a systematic approach for preventing, planning, responding to, and recovering from emergency events and are intended to provide a standardised corporate management and response structure that details emergency management documentation, Emergency Response Organisation (ERO), facilities and equipment, and training and exercises.

The ERO provides a standardised management and response structure for any emergency. Personnel filling roles within this structure may include full-time professionals, but most will be part-time volunteers drawn from across the workforce.

The system used to organise CAPL's emergency management teams (EMTs) is based on the Incident Command System and provides a standardised approach to the coordination of an emergency response across all hazards, including oil spill response. This program is compatible with the Australasian Inter-service Incident Management System (AIIMS), and the *National Plan for Maritime Environmental Emergencies* (National Plan; Ref. 67) and is consistent with the core aspects presented in the International Maritime Organisation (IMO) equivalent courses.

The ERO comprises the groups listed in Table 8-5; this table also describes the major functions of teams during an emergency.

Figure 8-5 to Figure 8-7 outline the organisational chart of the On-site Response Teams (ORTs) and EMTs. The Crisis Management Teams (CMTs), which focus on the business implications of incidents and events, are further described in the *ABU Crisis Management Plan* (Ref. 68).

As the incident escalates and the workload of each function increases, it may be necessary to delegate specific roles to additional people within each section. These roles may lead a team of people to fulfil the tasks under their control.

To establish emergency response arrangements that can be scaled up or down depending on the nature of the incident by integrating with other local, regional, national, and industry plans and resources, CAPL has adopted a tiered approach in its response system. This tiered-response model scales the number of resources mobilised for a response, and the emergency team activated, according to the severity of the incident. This approach is consistent with the *International Convention on Oil Pollution Preparedness, Response and Cooperation 1990*. The response tiers and resources that may be mobilised for an oil spill incident within CAPL are further described within the OPEP (Ref. 2).

Table 8-5: CAPL emergency management teams

Team	Description
Tier 1 (CAPL)	
On-site Response Teams (ORTs)	Trained responders at the installation who are responsible for on-scene tactical response operations during an incident. ORTs are led by an On-scene Commander (OC) who has incident control during smaller Level 1A incidents, which do not require further escalation to an incident management team. If the IEMT is activated, the OC will come under the direction of the Operations Section Chief (OSC).
Installation Emergency Management Team (IEMT)	The IEMT is led by an Incident Commander (IC) and operates out of an on-site emergency command centre. The IEMT may be activated to take control of Level 1B incidents and coordinate local resources and ORTs.
Perth Emergency Management Team (PEMT)	The PEMT is led by an IC and operates out of a Perth-based emergency command centre. The PEMT may be activated in a support role to assist IEMTs with the emergency response to major incidents that require coordination of further resources, personnel, and support. If required, incident control may also be transferred from the installation to the PEMT to manage the ongoing response (proactive phase) for long-duration, complex incidents such as a major oil spill. The PEMT stands up at the direction of the PEMT IC for Level 2 and 3 incidents.
CAPL Crisis Management Team (CMT)	Comprises senior CAPL executives and ensures emergency response and crisis management operations are carried out consistent with The Chevron Way, Chevron Corporation policies, and the tenets of OE. The CMT stands up at the direction of the CAPL Crisis Manager for Level 3 incidents.
Tier 2 (Regional Response)	
Chevron Corporation's Asia–Pacific Regional Response Team	An enterprise-level team able to support CAPL during the initial response (reactive phase) to a significant incident and help manage the transition to the ongoing response (proactive phase).
Tier 3 (Global Response)	
Chevron Corporation's Functional Response Teams	Enterprise-level teams with specific technical expertise in selected command staff positions and unit positions in the Planning, Logistics, and Finance sections. Team members are trained to support the management of global- and regional-level (Tier 2 and 3) incidents but are available to support any response.

Team	Description
Chevron Corporation's Worldwide Emergency Response Team	An enterprise-level team of Chevron Corporation's most highly trained and experienced personnel capable of filling IMS command and general staff roles of a response organisation, including Deputy IC. Team members are trained to support the management of global-level (Tier 3) incidents but are available to support any response.
Chevron Corporation's Advisory and Resource Team	An enterprise-level initial assessment and support team available to advise during the initial stages of a significant event, assess incident potential, and help the local response team marshal additional resources.

8.3.8.2 Emergency management process

The *Emergency Management OE Process* (Ref. 66) is CAPL's system for emergency management. The process ensures CAPL is prepared to respond immediately and effectively to all emergencies involving contractor- or CAPL-owned or -operated assets as defined in their scope of work.

The emergency management process (Ref. 66) comprises nine key elements.

- emergency scenarios, including worst case, have been identified; these scenarios are based on the findings from risk assessments of significant safety, health and environmental hazards and other sources (e.g., historical incidents)
- emergency response plans are developed and maintained to address emergency scenarios
- a reliability program is in place for inspection, testing and preventative maintenance of critical emergency response equipment and systems supporting emergency response plans
- an incident management system (IMS) is in place capable of immediately and effectively managing all emergencies
- a training and exercise program, including minimum training and exercise requirements, has been developed to establish and maintain emergency response capability
- crisis management plans have been developed to address a potential crisis or significant event
- business continuity plans have been developed in conformance with the Business Continuity Planning Corporate OE Process (Ref. 69).

The OPEP (Ref. 2) acts as an operational document to ensure an appropriate response to the emergency events described in this EP. Smaller spills will be monitored, evaluated, and cleaned up as part of routine duties, where relevant and appropriate to the nature and scale of the spill, and will not require activation of the ORT or OPEP. Several emergency management subprocesses are outlined below that are integral to emergency preparedness and management.

8.3.8.3 Chain of command (emergency response)

A well-delineated EMT chain of command has been established for emergency response (Figure 8-5 to Figure 8-7). As incidents grow in size or complexity, command may transfer several times. Within the response structure, command may transfer between On-scene Commanders (OC) at the tactical level. For a major incident, incident command may transfer to a designated Control Agency or to the Perth EMT, if required.

Although the identity of those filling command positions may change over the course of the incident, the continuity of responsibility and accountability will be maintained. Typically, specialists for particular response options will fulfil Task Leader positions in the ORT where they will be expected to oversee a team or particular response operations.

Throughout an incident, a formal handover will be conducted whenever any command or control position is transferred from one person to another.

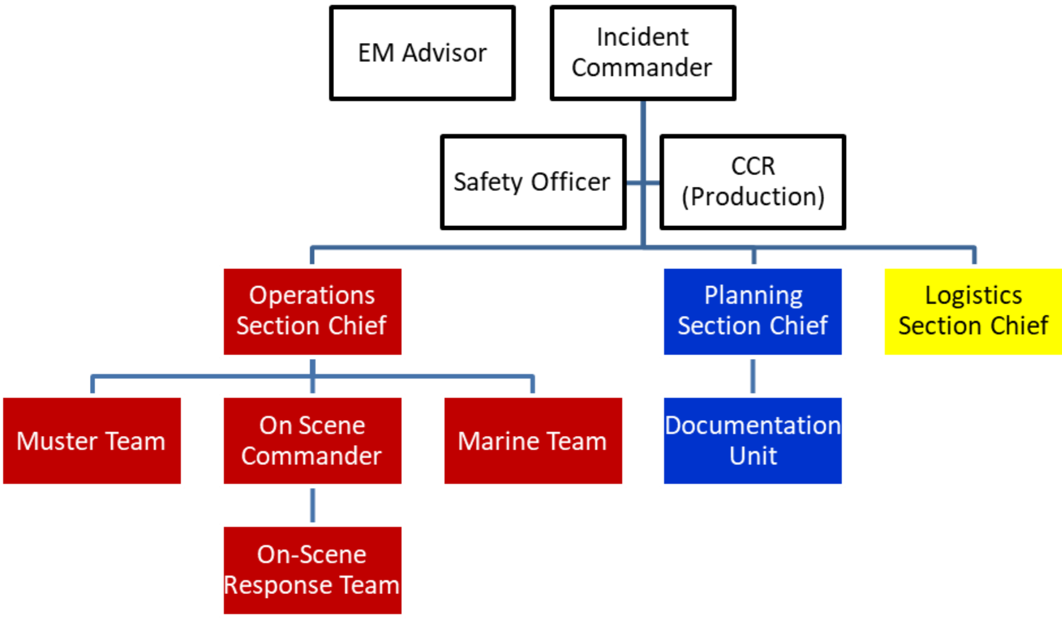


Figure 8-5: Basic installation EMT organisation chart

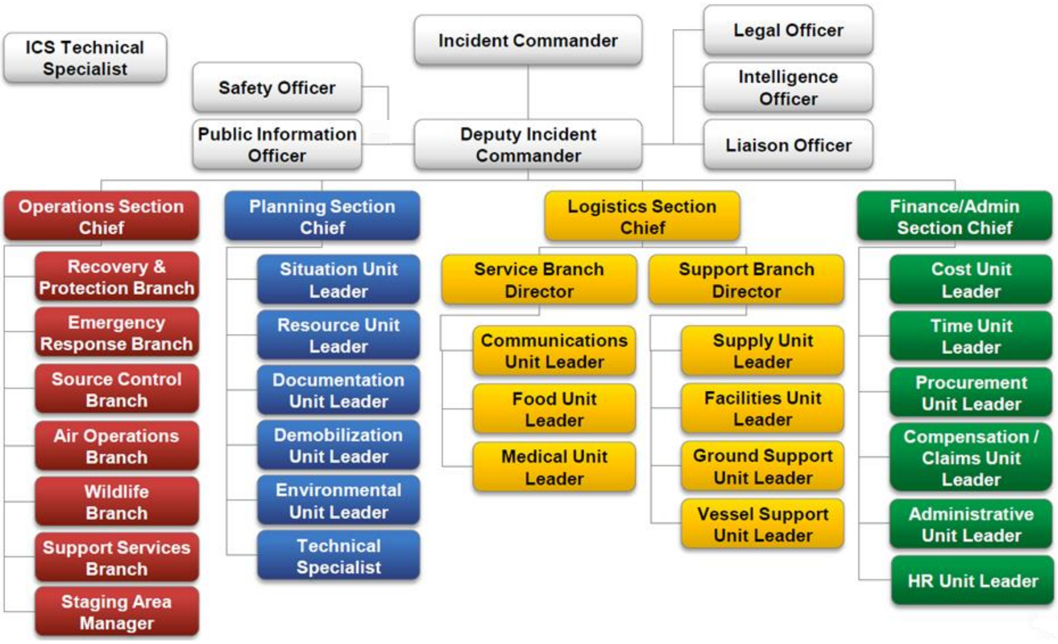


Figure 8-6: Expanded EMT organisation chart

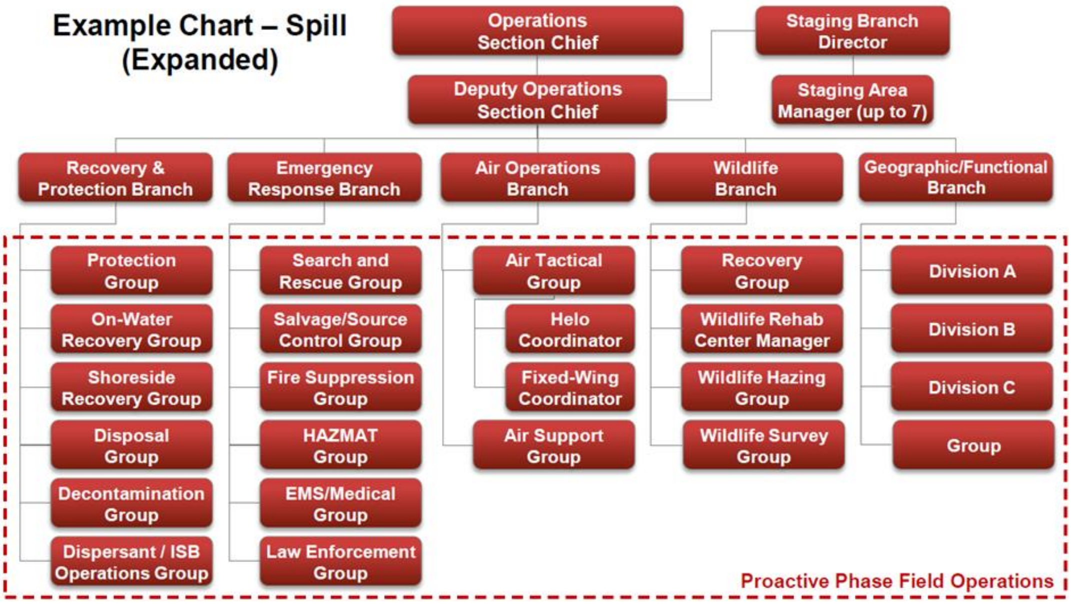


Figure 8-7: Example expanded operations section organisation chart

8.3.8.4 Roles and responsibilities (emergency response)

Table 8-6 provides additional information about the structure of these teams and the key individual roles and responsibilities during emergency response.

Table 8-6: Key roles and responsibilities—emergency response

Role	Responsibilities
On-Site Response Team	
On-Scene Commander (OC)	• Safely and effectively organises and manages the ORT response operations

Role	Responsibilities
(Vessel Master)	• Keeps the EMT informed regarding the nature and status of the incident and on-site tactical response operations
Site Safety Officer	• Ensures that appropriate actions are taken to protect the safety and health of ORT response personnel
Task Leader	• Safely carries out their assignment consistent with directions received from the OC, branch director, division, or group supervisor
Emergency Management Team	
Incident Commander (IC)	• Manages the overall emergency response operations and ensures that they are carried out safely, effectively, and efficiently • Establishes direct line of communications with the OC • Mobilises the EMT and assigns additional support from other response teams (as appropriate to the incident) for Level 2 and 3 incidents that require support beyond the ORT
Operations Section Chief (OSC)	• Provides strategic direction and support to the OC and muster and/or shelter area managers • Receives information regarding the nature and status of the ORT and provides support for mustering and/or shelter-in-place operations • Disseminates information to the IC and other members of the EMT
Planning Section Chief	• Focuses on the incident's potential using the compilation and display of information regarding the nature and status of an incident and emergency response operations • Assists the IC in defining strategic objectives • Assists the IC in providing information to the Level 3 EMT • Compiles and retains documentation
Logistics Section Chief	• Obtains personnel, equipment, materials, and supplies needed to mount and sustain emergency response operations • Provides services necessary to ensure that emergency response operations are carried out safely and efficiently

8.3.8.5 Training and competency (emergency response)

Competencies and training requirements for the EMT, ORT, and other personnel during implementation of the OPEP (Ref. 2) are outlined in Table 8-7. Competency and training records for personnel, including contractors and subcontractors, are maintained.

Table 8-7: Competency and training requirements—emergency response

Role	Summary	Training Standard
Note: Personnel with no specialist emergency response duties should undergo training in line with their responsibilities as indicated below for 'All personnel'.		
All personnel	• Provide basic first response to an incident, including, but not limited to: conducting a quick assessment; making safe; notifying anyone else in danger; and raising the alarm • Complete basic procedures in response to an alarm and evacuate to a muster point (as necessary) • Frequency: every 3 years if not involved in response or drills/exercises	
In addition to the above, personnel responsible for roles with specialist oil spill response duties should undergo further training and practice in line with the responsibilities set out below. Training is provided to maintain the capability to respond to all hazards in line with the Incident Command System implemented by CAPL.		

Role	Summary	Training Standard
Emergency Management Teams (EMTs)		
PEMT Incident Commander	• Selected Perth based personnel, would typically with a manager or senior manager role within CAPL • Competencies: overall management of emergency response operations and ensure operations are performed safely, effectively, and efficiently. Commands the EMT • Frequency: once a year (maintenance of competencies may be through response or training/drills/exercises)	• ICS-100 Introduction to the Incident Command System • ICS-200 Basic Incident Command System training • ICS-220 Initial Response Team • ICS-300 Intermediate Incident Command System Training (PEMT members only) • Oil Spill Awareness Training
PEMT Command and General Staff	• Selected Perth based personnel, typically a manager, or personnel with skills and knowledge appropriate to the function • Competencies: provides strategic direction, internal planning, logistics, and operational support. Operates from the emergency command centre and supports the IC who is responsible for the overall control of the incident • Frequency: once a year (maintenance of competencies may be through response or training/drills/exercises)	• ICS-100 Introduction to the Incident Command System • ICS-200 Basic Incident Command System training • ICS-220 Initial Response Team • ICS-300 Intermediate Incident Command System Training (PEMT members only) • Oil Spill Awareness Training

8.3.8.6 Oil spill exercise schedule

The CAPL *Oil Spill Response Multi-Year Exercise and Drill Schedule* (Ref. 70) describes the schedule of training and exercise required for all emergency events. The training and exercise program incorporates CAPL's oil spill exercise schedule for oil spill training, drills, and exercises. As CAPL'S response arrangements are common among its assets, and resource capabilities are shared, the testing and exercise schedule has been developed to test the various response options. The focus changes for each exercise to ensure any unique aspects of that location (e.g., resources at risk, first-strike equipment) are tested.

The objective is to test and maintain the capability to respond to emergency events. The exercises aim to test:

- notification, activation, and mobilisation of the ORT and EMT
- efficiency and effectiveness of equipment deployment
- efficiency and effectiveness of communication systems.

The testing schedule is a live document that is subject to change. The multi-year exercise schedule (Ref. 70) outlines the proposed testing arrangements to be completed, including the exercise types (Table 8-8) and proposed level of response to be tested (Table 8-9) that may be used to meet the defined objectives. A minimum of one test for each level will be conducted each year.

Table 8-8: Exercise types

Type	Details
Notification exercise	• Tests the procedures to notify and activate the EMTs, support organisations, and regulators
Tabletop exercise	• Normally involves interactive discussions of a simulated scenario amongst members of an EMT; personnel or equipment are not mobilised
Drill	• Conducts field activities such as equipment deployment, shoreline assessment, monitoring etc.
Functional exercise	• Activates at least one EMT to establish command, control, and coordination of a serious emergency event • Often more complex as it simulates several different aspects of an oil spill incident and may involve third parties.

Table 8-9: Exercise levels

Level	Details
Level 1 – ORT	• May be held in conjunction with a Level 2 EMT exercise • Designed to evaluate the ability of ORTs to implement CAPL's Emergency Management System as it applies to ORTs • ORTs are encouraged to conduct as many exercises as they want each year that do not include the ERT or a Level 2 EMT
Level 2 – EMT	• Exercises may include the participation of an ORT and may be held in conjunction with a Level 3 EMT exercise • Usual duration – one to two hours • Designed to evaluate a Level 2 EMT's ability to notify and activate team members, set up a Level 2 EMT emergency command centre, and implement CAPL's Emergency Management System as it applies to Level 2 EMTs
Level 3 – EMT	• Each exercise may include the participation of a Level 2 EMT and/or ORT • Usual duration – three to six hours • Designed to evaluate the EMT's ability to notify and activate team members, transfer command to a Level 3 EMT Emergency Command Centre and implement CAPL's Emergency Management System as it applies to incident escalation

The training and exercise program outlines the process for evaluating training, drills, and exercises against defined objectives, and incorporating lessons learned. An after-action report is generated for all Level 2 (and above) exercises, which is used during spill exercises to assess the effectiveness of the exercise against its objectives and to record recommendations. Relevant actions are then assigned to the responsible party where they are tracked to completion using internal processes. Exercise planners will be required to refer to previous recommendations for continual review and improvement.

Response arrangements as detailed in the OPEP (Ref. 2) must be tested:

- when they are introduced

- when they are significantly amended
- not later than 12 months after the most recent test
- if a new location for the activity is added to this EP after the response arrangements have been tested, and before the next test is conducted: test the response arrangements in relation to the new location as soon as practicable after it is added to this EP.

8.3.8.7 Onshore oil spill contingency plan

For onshore spills, because the trunkline is buried or below ground for most of the terrestrial route, response activities will be limited, and undertaken in accordance with the *Wheatstone Downstream Emergency Response Plan* (Ref. 81).

This section has been developed to demonstrate compliance with Regulation 15(8) of the PPER.

Preparations to be made for the possibility of an oil spill

CAPL has made the necessary preparations to respond in the event of an oil spill. This has been done through:

- development and documentation of a clear emergency management process (Section 8.3.8.2)
- development of a clear chain of command and emergency management team structure (Section 8.3.8.3)
- delineation of roles and responsibilities in the event of an emergency (Section 8.3.8.4)
- training key personnel identified in emergency response roles (Section 8.3.8.5)
- maintain an oil spill response exercise schedule to ensure response arrangements are understood, and any gaps clearly identified (Section 8.3.8.6).

Emergency response arrangements to be implemented if an oil spill occurs

In the event of an emergency, the arrangements detailed in Section 8.3.8.1 will be implemented. Specifically, the first-strike response tasks described in Table 8-10 will be implemented for an onshore pipeline (PL 99) spill.

Table 8-10: Initial (first-strike) response actions checklist for onshore pipeline (PL 99) release

Responsibility	Task	Consideration	Complete
Observer – first person at scene	Ensure their own safety and the safety of those nearby before taking any actions		☐
	Raise the alarm (radio, tetra, etc.) and provide specific details about the incident		☐

Responsibility	Task	Consideration	Complete
	If qualified and if it is safe to do so, attempt to control the source of the spill	Steps may include: • single-point control (righting overturned container, patching hole in ruptured container, move to secondary bunding, etc.) • transfer equipment control (shut down pumps, close valves, isolate source, etc.)	☐
	Remain in a safe location at the site of the incident and provide updates on the incident until relieved by the On-Scene Commander (OC)		☐
Supervisor	Ensure their own safety and the safety of those nearby before taking any actions		☐
	Take immediate actions to control the source of the spill	Take appropriate steps as described in the relevant Emergency Response Plan (ERP)/Procedure to stop, minimise, or control the escape of oil into the environment.	☐
	In all instances (where possible), notify the relevant Security Operations Centre (SOC) and the Central Control Room (CCR) **Barrow Island SOC: (08) 9184 3581** **Wheatstone SOC: (08) 9184 7444**		☐
	Identify as much information as possible about the spill incident, including but not limited to: • any injuries, other hazards • location and coordinates, if known • oil type • source of oil • volume of spill • spill rate (if applicable) • if controlled or continuing to spill • weather, tide, and current details • any nearby habitat/shoreline type, proximity to inland waterways, etc.	Information to help identify the oil type includes: • signs on nearby tanks or pipelines from which the substance could have originated • labelling on packaging • visible sheen on water surface • Safety Data Sheets	☐

Responsibility	Task	Consideration	Complete
	• apparent trajectory of the spill		
	For all spills from PL 99 verbally notify DMIRS **as soon as practicable**, to inform them of the incident		☐
SOC and the CCR Supervisor	Capture key details relating to the incident from the reporting party	Confirm the incident report (via fixed systems, closed-circuit television [CCTV], on-scene witness)	☐
	Activate, via the automated alert system, the ORT, and/or the relevant EMTs		☐
	If required, initiate emergency shutdown and depressurise or isolate (process, power, water, etc)	Initiate remotely activated systems (if required)	☐
On-Scene Commander (OC)	Confirm the nature and location of incident with the SOC or CCR		☐
	Establish the Command Post (CP) upwind of the incident and establish site control by securing the perimeter where practicable	Conduct risk assessment; assess the nature of the emergency, and safe approach routes to determine the potential CP location	☐
	Communicate directly with Emergency Response Team (ERT) members upon deployment to the incident scene and confirm resource/equipment requirements		☐

Recovery arrangements to be implemented if an oil spill occurs

In the event of an onshore pipeline release, CAPL will control the source in accordance with the following steps:

- shut in the field, process equipment, and/or isolation valves to stop the leak
- allow pipeline to depressurise.

In the event of an onshore pipeline release, CAPL will contain and recover the hydrocarbons where practicable in accordance with the following steps:

- spread absorbent material on affected ground surface
- remove (excavate) and replace absorbent product as required until evidence of hydrocarbon draw ceases
- remove contaminated product to a lined/bunded disposal holding area (to be designated in the event of a spill)
- excavate hydrocarbon contaminated soils
- remove contaminated soils to the designated disposal holding area

- sample contaminated soils against solid waste to landfill guidelines to determine method of disposal
- sample soil underneath and around contaminated site to determine if all contamination has been removed.

Once the emergency response has been terminated, further sampling and monitoring may be required. The longer-term monitoring and remediation of the site may come under the *Contaminated Sites Act 2003* and Contaminated Sites Regulations 2006, administered by WA Department of Water and Environmental Regulation (DWER).

Current oil spill trajectory modelling that applies to the pipeline activity

As detailed in Section 6.1.4 the onshore credible spill scenario associated with this EP is a trunkline loss of containment (onshore). CAPL calculated the potential worst case release volume based on flow and pressure at the onshore location, and the time taken to isolate the inventory. The release was determined to be ~100 m^3. As the trunkline is buried, any spill event will result in the contamination of soil around the pipeline below the ground. Consequently, manual excavation will be required to repair the source and recover hydrocarbon contaminated material following depressurisation.

8.4 Environmental monitoring and reporting

8.4.1 Environmental monitoring

Emissions and discharges to the environment from the petroleum activities will be monitored, as defined in the performance standards and measurement criteria (Sections 6 and 7).

Regulation 14(7) of OPGGS(E)R and Regulation 15(7) of the PP(E)R requires that the implementation strategy provides for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges such that this record can be used to assess whether the environmental performance outcomes and standards in the EP are being met.

CAPL and vessel contractors will monitor and record emissions and discharges as detailed in Sections 6 and 7 to ensure that that this record can be used to assess whether the environmental performance outcomes and standards in this EP are being met.

If an emergency condition resulting in a Level 2 or 3 spill event occurs, CAPL will implement the OSMP (Ref. 3), which is identified as a control measure in Section 7.1, 7.2, and 7.3.4. The OSMP describes a program of monitoring, and is the principal tool for determining the extent, severity, and persistence of environmental impacts from an emergency condition and the emergency response activities to be undertaken by CAPL.

8.4.1.1 Platform wastewater discharges monitoring framework

The following sections describe the monitoring framework for platform discharges in Commonwealth waters during normal operations.

Considering the nature and scale of the platform discharges, and the potential risks and impacts (described in Sections 6.2.6 and 6.2.7), the PW discharge is the focus of the Waste Water Discharges Monitoring Framework; however, potential constituents from other discharges are also included, where relevant.

The framework ensures the nature, extent, and potential effect of the PW and other discharges are assessed, and helps determine changes to water quality, sediment quality and benthic habitats in relation to applied environmental quality criteria (EQC).

The framework comprises several monitoring program components (Table 8-11). Figure 8-8 outlines the overall monitoring framework, the relationships between the various elements and the activities that trigger changes.

Table 8-11: Platform wastewater discharges monitoring framework—monitoring programs

Monitoring program	Frequency
Routine topsides monitoring	• Continuous, daily, weekly, quarterly, annual (refer to Table 8-12) • Additional monitoring as a result of trigger actions
Field sampling (water quality, sediment & benthic habitats)	• 5 yearly • Additional field sampling as a result of trigger actions or water quality and/or sediment assessments
Model verification	• Model verification as a result of a trigger actions • Validation during operational field sampling campaigns
WET testing (or equivalent)	• Quarterly surrogate test (indicatively 2-species) (minimum annual) • 3 yearly multi (indicatively 8) species test • Additional WET testing as a result of trigger actions, chemical changes or significant PW composition changes

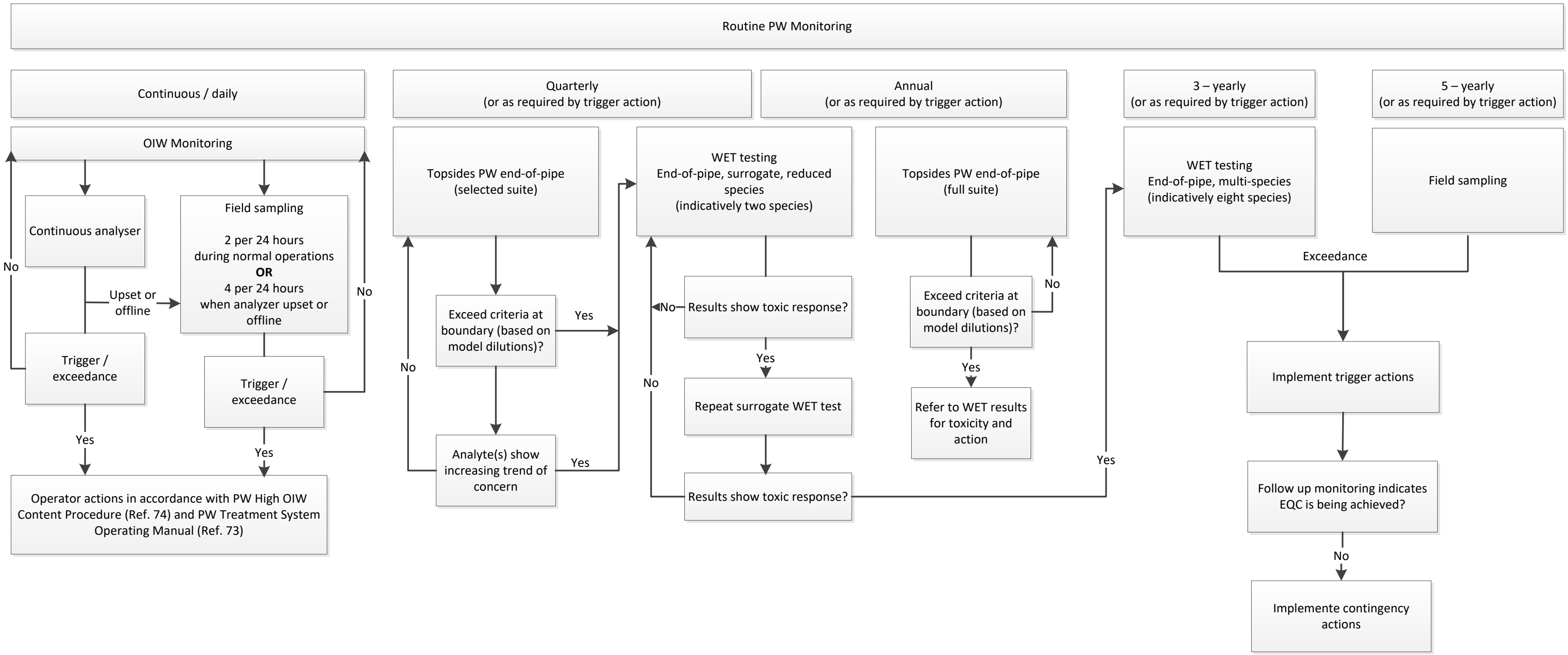


Figure 8-8: Platform wastewater discharges monitoring framework

8.4.1.1.1 Topsides monitoring

The objective of the topsides monitoring program is:

- to use data collected from topsides PW and CW discharges, combined with modelling, to assess whether ANZG Guidelines or equivalent (e.g. developed EGC) are likely to be exceeded beyond the discharge zone boundary and for how long this has or will continue to occur (duration).

The main components of topsides monitoring are listed in Table 8-12; full details are included in the Waste Water Discharges Management Plan (Ref. 307).

Table 8-12: Platform wastewater discharges—topsides monitoring

Aspect	Parameters	Frequency
Produced water	Discharge volume (online flow meter)	Normally continuous
	TPH (platform laboratory analysis, typically using a Horiba or similar)	Normally twice every 24 hours, more frequently as required*
	Full Suite Characterisation (samples collected on platform and analysed on Platform or at an onshore laboratory) for selected analytes that may be present in PW: • Metals (total and dissolved) • Process Chemical markers (when discharging) • Selected PAH (including naphthalene), organic acids, glycols (including MEG and TEG), phenols. • Physical and chemical parameters	Annual
	Selected Suite Selected analytes will be analysed quarterly. Analytes targeted are those regularly present and informative towards PW toxicity. Analytes are subject to review and update as per Section 8.4.1.1.8: • Metals (total). • BTEX • Phenols	Quarterly*
Cooling Water	Hypochlorite concentration	Quarterly
	Temperature	Quarterly
	Discharge volume	Normally continuous
Platform Drainage	TPH (platform laboratory analysis, typically using a Horiba or similar)	Weekly when discharging
Sewage	Calculated volume and percentage of macerated compared to un-macerated sewage discharged to the marine environment	Monthly

** Refer to Section 8.4.1.1.8 for alterations to monitoring of analytes*

8.4.1.1.2 Field sampling

Monitoring of water quality, sediment and benthic habitats was undertaken prior to start-up (‘baseline’) and will occur every five years. More frequent field sampling may also be implemented as a result of trigger exceedances.

Baseline survey

Sampling of water quality, sediments, and benthic habitats was undertaken prior to commencement of start-up (but after installation and dewatering activities) to establish baseline levels of constituents and conditions for future comparisons during Operations. Although the term baseline has been used for the pre-operational sampling, it should be noted that previous construction activities have already occurred at the site. Therefore the baseline is not reflective of a longer term ecological baseline (prior to any works), but is reflective of a ‘before’ discharge sampling.

Operational survey

Operational field sampling will be optimised and altered using data collected during baseline sampling as well as collected during operational topsides monitoring. Field sampling programs will be refined and optimised to monitor potential long-term and cumulative impacts as well as providing ground-truthing as to the reliability of the discharge model to predict plume locations.

Data on benthic habitats, water quality and sediment quality will be collected from up to 12 sites located within the predicted discharge zone boundary, and from up to 36 control sites located outside of the predicted discharge zone boundary. Site selection and parameters measured will be tailored for each of the monitoring scopes of water quality, sediments, and benthic habitats.

Water quality

The objectives of the water quality monitoring program include:

- use baseline and reference site data to assess the impact of PW and CW discharges on the receiving environment
- where topside monitoring indicates EQC are likely to be exceeded beyond the discharge zone boundary and exceedances are likely to continue and are not easily mitigated, field samples will be collected using an appropriately scaled sampling program based on the nature, extent, magnitude and duration of exceedances to verify the spatial extent and severity (magnitude) of the water quality exceedances and verify the accuracy of modelling.

Water quality sampling surrounding the platform will be undertaken to allow for the detection of potential impacts associated with discharges to the marine environment. Samples will be collected at sites outside and within impacted areas along transects that follow the dominant currents. Sites deemed outside will be approximately two to five kilometres away from the platform to ensure the waters are not influenced by the discharge. Sites within the discharge zone boundary will be sampled to allow the extent of any potential impacts to be quantified during operation of the platform.

Sites on the discharge zone boundary will also be sampled to compare with model predictions. The design will include up to 12 replicate sites within the discharge zone and up to 36 sites in the control zone, with replicate samples collected from each site near the surface and bottom of water column. The design will allow for a comparison of potentially impacted areas against unimpacted areas, which are subject to natural variation.

During operations, in situ water quality monitoring will be done in the direction of the prevailing current at increasing distance from the platform, to examine dilution of PW out to, on, and beyond the 850 m boundary. Reference sites for water quality will be collected up-current of the platform, data from which will represent background water quality. Sampling will be done over consecutive days (minimum of 5 days) and on different tidal cycles during the day. During each sampling event the prevailing current direction will be identified adjacent to the outfall, and information on sampling the co-ordinates, depth, time and date of each sample will be recorded. Data collected over the sampling period will be compared with ANZG guidelines (Ref. 11) and any developed EQC, using summary statistics (average, median).

Water samples collected during field surveys will be undertaken in accordance with ANZG guidelines (Ref. 11), but having regard for the logistical and environmental constraints that exist given the isolated nature of the Platform (e.g. constraints on holding times).

Sediment composition

The objectives of the sediment monitoring program include:

- use baseline and reference site data to assess the impact of discharges on the receiving environment;
- quantify changes to sediment quality conditions that may be caused by discharges from the Wheatstone Platform;
- verify sediment composition where routine topside monitoring indicates ANZG guidelines (Ref. 11) are likely to be exceeded beyond the discharge zone and exceedances are likely to continue.

Based on reservoir analyses, forecast PW flow rates, and the level of constituents, preliminary calculations predict very low build-up rates, making the risk of sediment contamination low (Ref. 171).

In situ sampling of sediments surrounding the platform will follow a similar design as described for *Water Quality* (above) and will be undertaken 5-yearly (or on trigger). Where topside monitoring indicates ANZG guidelines (Ref. 11) are likely to be exceeded beyond the discharge zone, exceedances are likely to continue and are not easily mitigated, field samples will be collected to verify the spatial extent and severity (magnitude) of exceedances and the accuracy of modelling. These surveys will be appropriately scaled based on the nature, extent, magnitude and duration of exceedances.

More than 90% of the cover of the platform site and its immediate vicinity comprises hard rock with a thin veneer of sand, and a rock blanket is directly below the discharge caisson. Therefore, traditional grab techniques are difficult and unreliable. Sampling methods will be investigated to achieve opportunistic sampling of sediment patches. Survey will include up to 12 replicate sites within the discharge zones and up to 36 sites in the control zone, with replicate samples collected from each site.

Sediment samples collected during field surveys will be undertaken in accordance with ANZG guidelines (Ref. 11), but having regard for the logistical and environmental constraints that exist given the isolated nature of the Platform (e.g. constraints on holding times).

Benthic habitats

The objectives of the benthic habitats monitoring program include:

- to verify benthic habitat condition where field sampling indicates that ANZG guidelines (Ref. 214) for water and/ or sediment have been exceeded beyond the mixing zone(s) and exceedances are likely to continue;

- to quantify natural changes to sessile benthic habitats through time (every five years) to assist in inferring the cause of changes detected when benthic habitat surveys are triggered in response to an exceedance of water quality guidelines, described in (ii) above or to examine any potential chronic or cumulative impacts.

Benthic habitat surveys occurred prior to discharge of PW and CW (baseline); and will occur within the first five years of operations and thereafter every five years. This is based on the modelled predictions that seafloor fauna are likely to be exposed only to very dilute levels of contaminants given the water depth at the platform and that the discharge plume will be positively buoyant. However, in the event that field sampling of water and/ or sediment indicates that ANZG guidelines (Ref. 214) have been exceeded, then benthic habitats will be surveyed using an appropriately scaled sampling program based on the nature, extent, magnitude and duration of exceedances.

Benthic habitats surveys surrounding the platform will follow a similar BACI designed as described for Water Quality (above). Surveys will characterise the spatial extent, distribution, benthic cover and/or abundance and community composition (at a suitable taxonomic resolution to differentiate communities) of benthic habitats. Receptors to be assessed in benthic habitat surveys will include sponges and gorgonians. These taxa were identified as the dominant sessile benthic biota in the ridgeline habitat (Section 4.3.5), they create habitat for other species and are potentially at greatest risk from contaminant exposure due to their sessile (fixed) nature. Photosynthetic taxa, such as algae, seagrasses and hermatypic corals appeared to be largely absent at locations surveyed.

Surveys will use a ROV (or similar), to capture footage of benthic habitats, which can be used to quantitatively assess habitat and biota types. Typically, surveys will use five replicate 50 m transects at each site representing control and potentially impacted areas.

Power to detect change above natural variation is predominantly related to the effect size we wish to detect, the natural variability in the parameter to be measured and the level of replication in the sampling design. Baseline sampling was undertaken to understand the spatial distribution, cover and/or abundance of benthic biota surrounding the Wheatstone Platform. Following this initial survey, natural variability was examined for key parameters.

For major taxonomic groups of sessile biota (i.e. sponges and gorgonians) the sampling design employed will aim to achieve detection of a 20% change in benthic cover and/or abundance, above natural variation, with a high level of statistical power (power >0.8). A change of 20% in benthic cover and/or abundance was chosen since sessile benthic communities surrounding the platform appear to be relatively sparse (Section 4.3.5) and detection of any smaller change in cover and/or abundance (e.g. 10%) is likely to result in a logistically unfeasible level of replication to achieve a high level of power. However, whilst every effort will be made to achieve a high level of power to detect a 20% change in key taxonomic groups, where certain groups are very low in cover and/or abundance (e.g. <5%) and/or are highly variable in space and time, it may not be possible to achieve such power. In this instance, the design will still aim to detect a 20% change, however, the power to detect such a change may be less than 0.8. Where power to detect changes is less than 0.8, then a gradient approach and or multiple lines of evidence will be used to compliment formal statistical tests, and used in the assessment of possible impacts, such that the ability to describe changes in the environment is not impeded by low power.

Although fish have been identified as potentially at risk, they are not proposed to be monitored as part of the initial and ongoing, routine monitoring programs because they are inherently variable in abundance due to both natural factors (e.g. currents, tidal cycle, time of day), artefacts of sampling method (e.g. avoidance or attraction behaviour towards ROVs and lights) and physical presence of the platform (avoidance or attraction behaviour), making detection of change and inference of the cause of change difficult, even with a large sampling effort.

However, if results of sediment monitoring, water quality monitoring (including quarterly topside monitoring) or WET testing, describe changes that may have deleterious effects on fishes and related species (i.e. crustaceans) beyond the discharge zone boundary, then monitoring of fish will be implemented during operations. The monitoring would focus on demersal fish that may be exposed to chronic/long-term impacts, and not pelagic fish that are generally more transient in nature and thereby less likely to receive chronic exposure. Transient, pelagic fish also pose problems for detecting and inferring change due to high spatial and temporal variability. Due to the limitation of baseline data, monitoring would use an Impact versus Reference, Gradient and/or Lines of Evidence approach as described in the OSMP, Scientific Guidance Notes (SCI7a – Fish and Aquaculture Impact Study).

8.4.1.1.3 Model verification

Model verification was undertaken in 2018 for PW (Section 6.2.6) and CW (Section 6.2.7). In both cases in-field verification using dye release, drone and an ROV (mounted fluorometer and physical samples) showed modelling to conservatively underpredict actual in-field dilutions. For cooling water, modelling drastically underestimates nearfield mixing because of the presence of entrained air and for produced water modelling underestimates appear to be due to platform-induced turbulence (local flow concentration through the platform and associated turbulence around the base, legs and structural cross-members) which induces additional mixing in the platform lee (Ref. 217). This confirms that end-of-pipe monitoring combined with modelling provides a conservative estimate of the extent of the mixing zones for PW and CW discharges in order to be meet the EPO.

Collection of water quality data during 5-yearly field sampling (as per Table 8-11) will be used to validate that topside monitoring combined with modelling provides a reliable prediction of the extent of the mixing zones for PW and CW discharges. Further model verification may be undertaken as a trigger action should discharge conditions be significantly different from those modelled.

8.4.1.1.4 PW whole effluent toxicity testing

WET testing has been undertaken post start-up on a quarterly basis (>3 years). WET testing employed a combination of monthly proxy testing, 8-species and 3-species tests and has provided a basis for establishing a robust operational WET testing approach (Ref. 255). Surrogate WET tests (indicatively 2-species) will occur quarterly (and not less than annually refer Section 8.4.1.1.8), with multi-species (indicatively 8-species) to occur at least every three years, or as required based on trigger actions and response.

As shown in Figure 8-8, if the results of a surrogate WET test indicate a toxic response at the discharge zone boundary, the surrogate WET test will be repeated within a reasonable time (having regard for logistics and weather). If the repeat test also indicates a toxic response at the discharge zone boundary, a multi species toxicity test (indicatively 8 species) will be implemented at the next monitoring event. A toxic response at the discharge zone boundary from the multi species toxicity test will trigger the trigger / contingency action process. If the initial or repeat surrogate WET test show no toxic response at the discharge zone boundary, routine testing will resume.

At any stage, WET testing may be instigated sooner as a result of trigger actions or if a change in production chemicals introduces new constituents of concern and/ or disclosure from the chemical supplier is insufficient to confirm that the topsides monitoring suite is sufficient to monitor a new production chemical.

WET testing of PW collected from the topsides will be undertaken in accordance with ANZG guidelines (Ref. 11) but having regard for the logistical and environmental constraints that exist given the isolated nature of the Platform (e.g., constraints on holding times). Samples will be collected, stored, and transported according to the relevant parts of AS/NZS 5667.1:1998, and all tests will be conducted by laboratories using National Association of Testing Authorities (NATA) accredited methods where possible.

Outcomes from WET testing will feed into the review process to help define triggers that are appropriate for the sensitivity of local organisms. The tests will enable the discharge criteria to be validated or amended if required, based on actual and relevant toxicity results, as well as provide additional information to assess trigger/contingency plans.

8.4.1.1.5 Review process

Oil in water / TPH monitoring review

As described in Section 6.2.6, TPH is sampled and analysed offshore by the platform laboratory and trended by an analyser. Operations are managed to achieve the performance standard of daily average 30 mg/L TPH during normal operations:

- laboratory samples are assessed to track performance against Performance Standards, and initiate appropriate management response to manage and mitigate as required
- analyser outputs are trended to evaluate process conditions, and help operators manage water quality in accordance with environmental objectives.

Topsides monitoring, WET testing, and field sampling review

As described in Section 6.2.6, the predicted movement and fate of the PW plume and associated constituents around the platform have been modelled and a discharge zone boundary has been determined (850 m from the platform), at which constituent concentrations are expected to be at or below defined ANZG trigger levels (Ref. 11). Data from topsides monitoring and field monitoring will be reviewed once data is received, including:

- topside comparison against ANZG and other EQC forecast at the discharge zone boundary (i.e., [discharge value / dilution] < EQC).
- field monitoring comparison against ANZG and other EQC, baseline and modelling.

If concentrations of constituents of concern exceed the EQC triggers at the discharge zone boundary, the risks and impacts will be further quantified and the trigger/ contingency action process implemented (refer Sections 8.4.1.1.6 and 8.4.1.1.7).

Results of surrogate WET tests will be reviewed once data is received. If the results indicate a toxic response, the surrogate WET test will be repeated within a reasonable time (having regard for logistics and weather). If the repeat test also indicates a toxic response, a multi species toxicity test (indicatively eight species) will be implemented at the next monitoring event. A toxic response from the multi species toxicity test will trigger the trigger/ contingency action process. If the initial or the repeat surrogate WET test show no toxic response, routine testing will resume.

Annual summary

On an annual basis, data will be collated and compared to identify longer term trends and improve understanding of platform discharges. Where potential future exceedances of a Performance Standard are identified, trigger actions in addition to those already implemented over the course of the year will be implemented.

8.4.1.1.6 Trigger actions

WET testing and trigger values in the ANZG guidelines (Ref. 11) are concentrations that, if exceeded, could indicate potential adverse environmental impacts, and so 'trigger' a management response, e.g. further investigation and possible topsides actions.

Depending on the nature and scale of the exceedance, a number of trigger actions will be considered by environmental personnel, operators, and laboratory staff. These include action to:

- confirm the exceedance and likely environmental impact, and
- investigate the cause of the exceedance.

The results of the above will determine the necessary corrective actions.

Actions to confirm the exceedance include:

- check analyser reading against laboratory samples
- resampling topside discharges
- undertaking modified or additional topside monitoring (e.g. additional numbers of samples, extending the suite of analyses, reviewing sampling points)

To confirm if adverse environmental impacts have occurred, actions to be considered include:

- re-assessing background water quality, sediment composition, and/or habitat surveys to better inform modelled predictions
- extra WET testing to predict impacts of altered PW composition
- extending or adding receptor monitoring programs (e.g. infauna analyses or increasing the frequency or extent of monitoring).

Actions to investigate the cause of the exceedance include:

- assessing conditions that may have changed during that sampling period, which may have influenced the nature and scale of constituent concentrations (e.g. well clean-ups, flow rate changes, chemical changes)

- verify that equipment is being operated and maintained as per basis of design and specification
- operating practices are being followed (such as *PW Treatment System Operating Manual* (Ref. 72) and *PW High OIW Content Procedure* (Ref. 73)), and the controls are effective)
- reviewing chemical usage such as chemical types, dosing specifications versus sample concentrations, and pump calibrations.

Corrective action to address any findings will be taken as soon as practicable. Corrective actions can include:

- amendment to chemicals and/or dosing concentrations (see hazardous materials selection process, summarised in Section 8.3.1.3)
- changes to operational procedures
- maintenance and changes to maintenance schedules
- training.

Follow up monitoring (i.e. resampling) will be undertaken to confirm the effectiveness of implemented changes and that EQCs are being achieved.

If the Trigger Actions listed above still do not correct the trends, concentrations of contaminants of concern or WET testing continues to indicate an exceedance at the discharge boundary, then contingency actions will be triggered (Section 8.4.1.1.7).

8.4.1.1.7 Contingency actions

Contingency actions may include:

- additional tertiary treatment systems (e.g. a third filter bed, more frequent filter change-outs, change in type of filter media, change in treatment system) should TPH in the discharge continue to exceed forecasts and/or design specifications
- diffuser addition or caisson modification to change the dispersion characteristics, should hydrocarbons or metals concentrations exceed expected levels, flow rates change, or properties of the discharge exceed forecast physical characteristics e.g. density or temperature
- addition of removal beds or filtration for mercury or organics should mercury or organics content continue to exceed forecast concentrations
- design modifications to secondary treatment equipment or the process (e.g. use of supplemental packaged equipment, directing more PW through the tertiary treatment system, improved IGF, hydrocyclone technology), should the performance of the topsides water treatment facilities not meet design specifications, and/or improved technology is available.

Implementing any contingency actions will require detailed methodical planning, preparation, and documentation to ensure the effectiveness of the actions and to ensure that risks and impacts are ALARP. Being a new facility with no operating history, the investigation of platform modifications is highly dependent on the nature and scale of the exceedance and the practicality of the proposed modification. Therefore all proposed contingency action design changes will be assessed with respect to the nature and extent of the exceedance, the potential environmental impacts and risks associated with the exceedance, the technical performance of the current systems, the technical performance of additional control measures such as design modifications, and considering the principles of ALARP. The process will typically require input from various subject matter experts, such as operations personnel, process engineers, HSE personnel, and Management.

8.4.1.1.8 Changes to the monitoring framework

Changes to the monitoring framework may be initiated for a number of reasons, these include:

- In line with the *ABU Hazardous Materials Management Procedure: ABU Standardised OE Procedure* (Ref. 54), planned changes to production chemicals (either change of chemical or increased dosing rates) will be assessed and, if required, the topsides analysis suite will be reviewed to confirm (e.g. through consultation with the chemical supplier) that it is sufficient to monitor for the chemical (i.e. considering composition of production chemical).
- The selected topsides analytical suite may be reviewed and the frequency of monitoring specific analytes updated if PW composition changes or specific analytes become more (or less) applicable. The selected suite will be tailored to those analytes that are regularly identified and are providing the most informative data and may include markers or proxy tests such as microtox. The full suite (as shown in Table 8-12) will continue to be analysed at least annually.
- Surrogate WET will be undertaken quarterly to further validate the surrogate testing method as part of the WET testing program. In time, surrogate testing frequency may be reduced based on an evaluation of ecotoxicity data and trends, quarterly topsides analytical results, platform / discharge operational status, and in line with the principles of the adaptive management framework. Surrogate WET will remain at least annual (or on trigger) with multi-species WET at least 3-yearly (or on trigger).
- CAPL will continue to work with subject matter experts (such as CSIRO) to refine the ecotoxicity testing program and advances in testing may be integrated into future methodology.
- The frequency of laboratory samples (i.e., normally twice daily) may be reviewed and amended if at least six months' of data demonstrates the analyser is effective in managing discharge performance to meet water quality objectives. The frequency of laboratory samples will not be reduced to less than weekly.
- Research and development is being undertaken to support continuous improvement in environmental management approaches, including collaboration with university and industry bodies - with new technologies for topsides, analytical and field measurements in development. Should projects currently in early stages of the technology development lifecycle progress to implementation stage, and be shown to pose advantages (i.e. equivalent or better management outcomes) to current monitoring methods, approaches may be amended to reflect these advances. Refer to Section 8.4.1.3 for more information.

8.4.1.1.9 Well clean-up activities

This section describes the monitoring framework for platform discharges in Commonwealth waters during well clean-up campaigns. The framework ensures that adequate sampling to protect the environment, confirm discharges are in-line with those anticipated and inform future decisions is conducted for each specific campaign event.

During the planning phase of a well clean-up campaign a review of reservoir characteristics, proposed clean-up strategy, potential additional treatment options and chemicals, will be conducted to inform the topsides sampling program.

The main components of topsides monitoring program for well clean-ups are listed in Table 8-12; full details are included in the Waste Water Discharges Management Plan (Ref. 307).

Table 8-13: Well clean-up—topsides monitoring

Parameters	Frequency
Discharge volume	Normally continuous
TPH (platform laboratory analysis, typically using a Horiba or similar)	Normally four times every 24 hours, more frequently as required
Characterisation (samples collected on platform and analysed on Platform or at an onshore laboratory) for selected analytes as defined in the planning review (may include but not limited to): • metals (total and dissolved) • process Chemical markers • glycols (including MEG and TEG) • physical and chemical parameters.	Per campaign

Oil in water / TPH monitoring review

As described in Section 6.2.6, TPH is sampled and analysed offshore by the platform laboratory and trended by an analyser. Well clean-up campaigns are managed to achieve the performance standard of daily average 100 mg/L TPH and 30 mg/L monthly average:

- laboratory samples are assessed to track performance against Performance Standards, and initiate appropriate management response to manage and mitigate as required

Topsides monitoring review

As described in Section 6.2.6, a discharge zone boundary has been determined (850 m from the platform), at which constituent concentrations are expected to be at or below defined ANZG trigger levels (Ref. 11). Data from topsides monitoring will be reviewed once data is received, including:

- topside comparison against ANZG and other EQC forecast at the discharge zone boundary (i.e., [discharge value / dilution] < EQC).

If concentrations of constituents of concern exceed the EQC triggers at the discharge zone boundary, the risks and impacts will be further quantified, and the trigger/contingency action process implemented. Relevant data will also inform future well clean-up campaigns.

Trigger actions and contingency actions are described in Sections 8.4.1.1.6 and 8.4.1.1.7 respectively. Depending on the timing in receiving results, nature and scale of the exceedance, a number of trigger actions and corrective actions will be considered by environmental personnel, operators, and laboratory staff.

8.4.1.2 Platform air emissions monitoring program

Table 8-14 lists the main components of the platform air emissions monitoring program.

Emissions monitoring for key point source emissions located on the platform is undertaken through metered systems, employing integrated instrumentation such as gas chromatographs and flowmeters to measure and report data to the production allocation (energy components) system via PIMS. Data is reconciled in this system of record, with assurances and quality checks at daily, monthly, and annual intervals by the integrated production management (IPM) team. Quality assured production data is accessed by the HSE function for use in NGER, NPI, and Chevron Corporate reporting where further quality checks and assurance is performed in accordance with reporting obligations. This data along with other non-production records pertinent to emissions management, such as diesel consumption, vessel usage, and other inputs for calculated parameters (such as those required to calculate fugitive emissions from plant, equipment and produced water) are compiled, tracked and trended.

Further details of the platform emissions monitoring are included in the Wheatstone Platform EMMP (Ref. 82), which accounts for all emissions sources from the platform.

Table 8-14: Platform air emissions monitoring program

Monitoring program	Frequency	Description	Review
Greenhouse Emissions (e.g., from flaring, fuel gas and diesel combustion and fugitive emissions)	Ongoing	Recording and reporting of emissions as required by the *National Greenhouse and Energy Reporting Act 2007*	Tracking of compliance against limits established in line with the *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015*
Criteria Pollutant Emissions (e.g., from flaring, fuel gas and diesel combustion and fugitive emissions)	Ongoing	Recording and reporting of emissions as required by the National Pollutant Inventory.	Annual review of criteria pollutants against NEPM standards.
Emissions and Energy Management Plan (EEMP)	Ongoing	Continuous monitoring and recording of emissions from key production sources.	Regular monitoring of performance against emissions performance standard.

State monitoring

Monitoring of emissions and discharges will include those listed in Table 8-15 to provide information for the quarterly report (Table 8-17). The data will be derived from estimations, typically based on the duration of the activity/release/discharge (e.g., using information such as fuel usage) and considering standard industry practices and other available data where relevant. Given the nature and scale of the petroleum activities, and the negligible and intermittent emissions and discharges associated with the activities, monitoring is not continuous, and is conducted on an as-needs basis to ensure data is available for the quarterly discharges report. Generally, equipment is not used to monitor these emissions and discharges.

Table 8-15: Monitoring requirements in State waters and/or onshore

Activity	Aspect	Parameter
IMR vessels in State waters	Planned discharges from vessels performing petroleum activities	Volumes of sewage and oily bilge water
	Air emissions from vessels performing petroleum activities	Volumes of air emissions
Field support activities in PL99 – vehicle usage	Air emissions from vehicles performing petroleum activities in PL99	Volumes of air emissions
IMR activities in PL99 – pigging	Air emissions from the onshore pig receiver	Volumes of air emissions
Field support and IMR activities	Waste generated from IMR activities	Volumes of waste
Field support and IMR activities	Spills in State waters and onshore in PL99	Volumes spilt

8.4.1.3 Alternative measurement approaches

Research and development is being undertaken to support continuous improvement in environmental management approaches, including collaboration with university and industry bodies - with new technologies for topsides, analytical and field measurements in development. Should projects currently in early stages of the technology development lifecycle progress to implementation stage, and be shown to pose advantages (i.e., equivalent or better management outcomes) to current monitoring methods, approaches may be amended to reflect these advances.

Current R&D includes projects which may improve sample gathering, analytical processing or in-field measurements. For example, remote sensing, autonomous vehicles and improved ecotoxicological testing.

Updates to management approaches from advances in technology will be subject to MOC in accordance with Section 8.3.2.2, and involve consultation with NOPSEMA as appropriate.

8.4.2 Incident reporting

Environmental incidents will be reported by CAPL in accordance with Table 8-16.

Table 8-16: Incident reporting

<table>
<tr><th colspan="2">Recordable Incident reporting – Regulation 26B of OPGGS(E)R and Regulation 30 of PP(E)R</th></tr>
<tr><td colspan="2">Legislative definition of 'recordable incident':
'Recordable incident, for an activity, means a breach of an environmental performance objective or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident'
Recordable incidents are breaches of the environmental performance outcomes and standards described in Section 5.7.</td></tr>
<tr><td>Reporting requirements</td><td>Report to / Timing</td></tr>
<tr><td>Written notification to NOPSEMA by the 15th of each month</td><td>Submit written report to NOPSEMA by the 15th of each month</td></tr>
</table>

As a minimum, the written incident report must describe: • the incidents and all material facts and circumstances concerning the incidents • any actions taken to avoid or mitigate any adverse environmental impacts • any corrective actions already taken, or that may be taken, to prevent a repeat of similar incidents. If no recordable incidents occur during the reporting month, a 'nil report' will be submitted.	Submit written report to DMIRS by the 15th of each month

Reportable Incident reporting – Regulations 26, 26A, and 26AA of OPGGS(E)R and Regulations 28, and 29 of PP(E)R

Legislative definition of 'reportable incident':

'Reportable incident, for an activity means an incident relating to an activity that has caused, or has the potential to cause an adverse environmental impact; and under the environmental risk assessment process the environmental impact is categorised as moderate or more serious than moderate.'

Therefore, reportable incidents under this EP are those events (not planned activities) that have a moderate or greater consequence (or risk) level. In accordance with this definition, the reportable incidents identified under this EP are:

- introduction of an IMP (Section 6.4.8)
- vessel collision emergency condition (Section 7.1)
- major defect emergency condition (Section 7.2).

Reporting requirements	Report to
Verbal or written notification must be undertaken within two hours of the incident or as soon as practicable. This information is required: • the incident and all material facts and circumstances known at the time • any actions taken to avoid or mitigate any adverse environmental impacts.	Report verbally to NOPSEMA within two hours or as soon as practicable and provide written record of notification by email. Phone: (08) 6461 7090 Email: submissions@nopsema.gov.au
	Report verbally or in writing to DMIRS within two hours or as soon as practicable. Phone: (08) 9222 3727 Email: petroleum.environment@dmirs.wa.gov.au
Verbal notifications must be followed by a written report as soon as practicable, and not later than three days following the incident. At a minimum, the written incident report will include: • the incident and all material facts and circumstances • actions taken to avoid or mitigate any adverse environmental impacts • any corrective actions already taken, or that may be taken, to prevent a recurrence. If the initial notification of the reportable incident was verbal, this information must be included in the written report.	Written report to be provided to: • NOPSEMA: submissions@nopsema.gov.au • National Offshore Petroleum Titles Authority: info@nopta.gov.au • WA DMIRS: petroleum.environment@dmirs.wa.gov.au

Additional Reporting Requirements	
Reporting requirements	**Report to**
An oil/gas pollution incident that occurs within a marine park or is likely to impact on a marine park. The notification should include: • titleholder details • time and location of the incident (including name of marine park likely to be affected) • proposed response arrangements as per the OPEP (e.g. dispersant, containment, etc.) • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator.	DNP (24-hour) Marine Compliance Duty Officer Phone: 0419 293 465.
Death or injury to individual(s) from an EPBC Act Listed Species as a result of the petroleum activities	Report injury to or mortality of EPBC Act Listed Threatened or Migratory species within seven business days of observation to DAWE or equivalent: • Phone: +61 2 6274 1111 • Email: EPBC.Permits@environment.gov.au
Vessel collision with marine mammals (whales)	Reported as soon as practicable. https://data.marinemammals.gov.au/report/shipstrike
Presence of any suspected IMP or disease within 24 hours	DPIRD: • Email: biosecurity@fish.wa.gov.au • Phone: FishWatch 24-hour hotline: 1800 815 507

8.4.3 Routine environmental reporting

Regulation 26C of the OPGGS(E)R and Regulation 16 of the PP(E)R requires environmental performance reporting for the activity described in this EP, as summarised in Table 8-17.

Table 8-17: Routine external reporting requirements

Reporting requirement	Description	Reporting to	Timing
Environmental performance reporting (annual)	A report detailing environmental performance of the activity detailed in this EP	NOPSEMA submissions@nopsema.gov.au Phone: +61 8 6461 7090	Annually from commencement of activities
	A report detailing environmental performance of the activity detailed in this EP as per the requirements of the *Guidelines for Preparing Petroleum Annual*	DMIRS Petroleum.environment@dmirs.wa.gov.au	Annually from commencement of activities

Reporting requirement	Description	Reporting to	Timing
	Environmental Reports (Ref. 290)		
Emissions and discharge report	An emissions and discharges report will be submitted that summarises estimated emissions and discharges	DMIRS Petroleum.environment@dmirs.wa.gov.au	Quarterly (within 15 days after the end of the reporting period)
Notification of start of activity	CAPL must complete Form FM1405 and submit to NOPSEMA 10 days before activity commencement	NOPSEMA submissions@nopsema.gov.au or: https://securefile.nopsema.gov.au/filedrop/submissions	Once prior to activity commencement
	CAPL must notify WA DMIRS prior to commencement	DMIRS Petroleum.environment@dmirs.wa.gov.au	Once prior to activity commencement
End of EP notification	CAPL must complete Form FM1405 and submit to NOPSEMA within 10 days of activity completion	NOPSEMA submissions@nopsema.gov.au or: https://securefile.nopsema.gov.au/filedrop/submissions	Once following completion of activity
	CAPL must notify WA DMIRS within one week of the completion of the activity	DMIRS Petroleum.environment@dmirs.wa.gov.au	Once following completion of activity

8.5 Environment Plan review

CAPL will submit a proposed revision of this EP to NOPSEMA and/or DMIRS at least 14 days before the end of the five-year period since the EP was last accepted by the relevant regulator. An OPEP revision will be submitted for approval to DMIRS no later than 14 days prior to 2.5 years since the EP was last approved.

An additional review of the EP and/or OPEP will be undertaken following:

- an emergency event
- the identification of additional response strategies to emergency events
- the identification of deficiencies within the EP or OPEP following the review of emergency response exercises or other activities.

CAPL is committed to continual improvement and adaptive management processes, and in recognition of the changing regulatory and scientific information related to GHG and carbon management, will annually review Australian regulatory and/or relevant international guidelines or standards, including:

- the periodic release of the Chevron Corporate's *Climate Change Resilience* report which considers corporate climate risk management with regard to established, contemporary climate science and/or carbon management guidance from intergovernmental bodies (e.g., UN IPCC, IEA)

- the release of new/revised policies or guidance from the Australian government
- the release of new/revised applicable guidelines or standards from international bodies (e.g., IMO) that have been adopted by the relevant authority (e.g., AMSA)
- the release of revised GHGMP for the Wheatstone LNG Plant
- the outcomes of CAPL emission reduction reviews and Chevron Corporate governance processes specific to the Wheatstone Project.

Where these annual reviews result in the identification of additional and/or revised control measures to ensure environmental impacts and risks are managed to ALARP, a review of this EP will be undertaken.

Additional revisions and/or resubmission of this EP to NOPSEMA, in accordance with Regulation 17 of the OPGGS(E)R or Regulation 18 of the PSLER and PPER, will be undertaken in accordance with the OEMS, and particularly the MoC process (Section 8.3.2.2).

9 acronyms and abbreviations

Table 9-1 defines the acronyms and abbreviations used in this document.

Table 9-1: Acronyms and abbreviations

Acronym/ Abbreviation	Definition
ABU	Australasian Business Unit
ACN	Australian Company Number
AHO	Australian Hydrographic Office
AIIMS	Australasian Inter-service Incident Management System
AIS	Automated Identification System
ALARP	As low as reasonably practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
ANSIA	Ashburton North Strategic Industrial Area
ANZG	Australian and New Zealand Governments
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
AS/NZS	Australian Standard/New Zealand Standard
AR6	Sixth Assessment Report (AR6) of the United Nations Intergovernmental Panel on Climate Change (IPCC)
ASOG	Activity-specific operational guideline
ASV	Accommodation support vessel
BACI	Before-After-Control-Impact
BIA	Biologically important areas
BTAC	Buurabalayji Thalanyji Aboriginal Corporation
BTEX	Benzene, toluene, ethyl benzene, and xylene compounds
CAMBA	China–Australia Migratory Bird Agreement
CAPL	Chevron Australia Pty Ltd
CCR	Central Control Room
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CHARM	Chemical Hazard and Risk Management
CMMS	Computerised Maintenance Management System
CMS	Competency Management System
CMT	Crisis Management Team
COVID	Coronavirus disease
CO	Carbon monoxide
cP	Centipoise
CP	Cathodic Protection
CRT	Control Room Technician

Acronym/ Abbreviation	Definition
CW	Cooling Water
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DMIRS	Western Australian Department of Mines, Industry Regulation and Safety
DMP	Western Australian Department of Mines and Petroleum (now DMIRS)
DNP	Director of National Parks
DP	Dynamic positioning
DoT	Western Australian Department of Transport
DotE	Commonwealth Department of the Environment (now DAWE)
DP	Dynamic positioning
DPIRD	Western Australian Department of Primary Industries and Regional Development
DWER	Western Australian Department of Water and Environmental Regulation
EEA	Environmental exposure area
EEMP	Emissions and Energy Management Plan
EIS/ERMP	Environmental Impact Statement / Environmental Review and Management Programme
EMBA	Environment that may be affected
EMT	Emergency Management Team
EOFL	End of facility life
EOP	Emergency Operating Procedure
EP	Environment Plan
EP Act	Western Australian *Environmental Protection Act 1986*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPO	Environmental Performance Outcome
EPRS	Emergency pipeline repair system
EQC	Environmental quality criteria
ERO	Emergency Response Organisation
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESD	Ecologically sustainable development
FBR	Full bore rupture
FE	Facilities engineering
FEED	Front end engineering and design
FOSA	Field Operating Services Agreement
GHG	Greenhouse gas
GHGMP	Greenhouse Gas Management Plan

Acronym/ Abbreviation	Definition
HFO	Heavy fuel oil
HIRA	Hazard Identification and Risk Assessment
HP	High pressure
HSE	Health, safety, and environment
IAPP	International Air Pollution Prevention
IBRA	Interim Biogeographic Regionalisation for Australia
IC	Incident Commander
ICS	Incident Command System
IEE	International Energy Efficiency
IEMT	Installation Emergency Management Team
IFO	Intermediate fuel oil
IGF	Induced Gas Flotation
IIR	Incident investigation and reporting
IM	Inspection and monitoring
IMM	Inspection, monitoring, and maintenance
IMO	International Maritime Organization
IMP	Introduced Marine Pest
IMR	Inspection, maintenance, and repair
IMS	Incident Management System
IP	Intelligent Pigging
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated production management
ISO	International Organization for Standardization
ITOPF	International Tanker Owners Pollution Federation
JAMBA	Japan–Australia Migratory Bird Agreement
JDP	Julimar Development Project
JRCC	Joint Rescue Coordination Centre
KEF	Key environmental feature
LAT	Lowest Astronomical Tide
LC_{50}	Concentration or dose found to be lethal in 50% of a group of test species
LIMS	Laboratory Information Management System
LNG	Liquefied Natural Gas
LOC	Loss of containment
LP	Low pressure
MARPOL	International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. Also known as MARPOL 73/78.
MARS	Maritime Arrivals Reporting System

Acronym/ Abbreviation	Definition
MBES	multibeam echo sounders
MDO	Marine diesel oil
MEG	Monoethylene glycol
MES	Monitor, Evaluation, and Surveillance
MGO	Marine gas oil
MHF	Major Hazard Facility
MODU	Mobile offshore drilling unit
MS	Ministerial Statement
MSRE	Marine safety, reliability, and efficiency
MSW	Manage Safe Work
N/A	Not applicable
NATA	National Association of Testing Authorities
NDC	Nationally determined contribution
NEBA	Net Environmental Benefit Analysis
NEPM	National Environmental Protection Measures
NEPM AAQ	National Environmental Protection Measure for Ambient Air Quality
NGER Act	Commonwealth *National Greenhouse and Energy Reporting Act 2007*
NMFS	United States National Marine Fisheries Service
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NO_2	nitrogen dioxide
NWS	North West Shelf
O_3	Ozone
OA	Operational area
OC	On-Scene Commander
OCNS	Offshore Chemical Notification Scheme
OE	Operational Excellence
OEMS	Operational Excellence Management System
OGCI	Oil and Gas Climate Initiative
OGUK	Oil and Gas UK
OIM	Offshore Installation Manager
OIW	Oil in water
OPEP	Oil Pollution Emergency Plan
OPGGS Act	Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPGGS(E)R	Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
ORT	On-site Response Team
OSC	Operations Section Chief

Acronym/ Abbreviation	Definition
OSMP	Operational and Scientific Monitoring Plan
OSPAR	Oslo and Paris Conventions for the Protection of the Marine Environment of the North-East Atlantic, 'OSPAR Convention'.
OWR	Oiled Wildlife Response
PAH	Polycyclic Aromatic Hydrocarbons
PARLOC	Pipeline and Riser Loss of Containment
PASS	Potential acid sulphate soils
PCPT	piezo cone penetration test
PEMT	Perth Emergency Management Team
PFA	Pipeline flange adaptor
PGPA	Policy, Government and Public Affairs
PIMS	Production Information Management System
PLONOR	Poses Little or No Risk (to the Environment)
POB	People on Board
PP Act	Western Australian *Petroleum Pipelines Act 1969*
PPER	Western Australian Petroleum Pipelines (Environment) Regulations 2012
PPP	Protection Prioritisation Process
PSL Act	Western Australian *Petroleum (Submerged Lands) Act 1982*
PSLER	Western Australian Petroleum (Submerged Lands) (Environment) Regulations 2012
PTS	Pipeline termination structure
PTS	Permanent threshold shift
PTW	Permit to Work
PW	Produced Water
RBI	Risk-based Inspection
RESDV	Riser Emergency Shutdown Valve
RO	Reverse osmosis
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
ROV	Remotely operated vehicle
RWT	Rhodamine WT
SDG	Sustainable Development Goal
SCSSV	Surface control subsurface safety valve
SEEMP	Ship Energy Efficiency Management Plan
SEL	Sound Exposure Levels
SERIP	Surface Equipment Reliability and Integrity Process
SHC	Shoreline clean-up
SIMOPS	Simultaneous operations
SO_2	Sulfur dioxide

Acronym/ Abbreviation	Definition
SO_x	Sulphur oxides
SOPEP	Shipboard Oil Pollution Emergency Plan
SPD	Shoreline protection and deflection
SPL	Sound pressure level
SSIV	Subsea isolation valve
SSS	Side-scan sonar
TAPL	Texaco Australia Pty Ltd
TEC	Threatened ecological communities
TEG	Tri-ethylene glycol
The Project	Wheatstone Liquefied Natural Gas Project
TPH	Total Petroleum Hydrocarbons
TRG	Tactical Response Guides
TTS	Temporary threshold Shift
UNFCCC	United Nations Framework Convention on Climate Change
UT	Ultrasonic Testing
VOC	Volatile organic compounds
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council's
WET	Whole effluent toxicity
WOMP	Well Operations Management Plan
WQ	Water Quality
YACMAC	Yaburara and Coastal Mardudhunera Aboriginal Corporation

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appendix a operational excellence—policy 530

policy 530

operational excellence: achieving world-class performance

It is the policy of Chevron Corporation to protect the safety and health of people and the environment, and to conduct our operations reliably and efficiently. The Operational Excellence Management System (OEMS) is the way Chevron systematically manages workforce safety and health, process safety, reliability and integrity, environment, efficiency, security, and stakeholder engagement and issues. OEMS puts into action our Chevron Way value of Protecting People and the Environment, which places the highest priority on the safety and health of our workforce and the protection of communities, the environment and our assets. Compliance with the law is a foundation for the OEMS.

Our OEMS is a risk-based system used to understand and mitigate risks and maintain and assure safeguards. OEMS consists of three parts:

leadership and OE culture

Leadership is the largest single factor for success in OE. Leaders are accountable not only for achieving results, but achieving them in the right way. Leaders must demonstrate consistent and rigorous application of OE to drive performance and meet OE objectives.

focus areas and OE expectations

Chevron manages risks to our employees, contractors, the communities where we operate, the environment and our assets through focus areas and OE expectations that guide the design, management and assurance of safeguards.

management system cycle

Chevron takes a systematic approach to set and align objectives; identify, prioritize and close gaps; strengthen safeguards and improve OE results.

We will assess and take steps to manage OE risks within the following framework of focus areas and OE expectations:

Workforce Safety and Health: We provide a safe and healthy workplace for our employees and contractors. Our highest priorities are to eliminate fatalities and prevent serious injuries and illnesses.

Process Safety, Reliability and Integrity: We manage the integrity of operating systems through design principles and engineering and operating practices to prevent and mitigate process safety incidents. We execute reliability programs so that equipment, components and systems perform their required functions across the full asset lifecycle.

Environment: We protect the environment through responsible design, development, operations and asset retirement.

Efficiency: We use energy and resources efficiently to continually improve and drive value.

Security: We protect personnel, facilities, information, systems, business operations and our reputation. We proactively identify security risks, develop personnel and sustainable programs to mitigate those risks, and continually evaluate the effectiveness of these efforts.

Stakeholders: We engage stakeholders to foster trust, build relationships, and promote two-way dialogue to manage potential impacts and create business opportunities. We work with our stakeholders in a socially responsible and ethical manner, consistent with our respect for human rights, to create a safer, more inclusive business environment. We also work with our partners to responsibly manage Chevron's non-operated joint venture partnerships and third-party aviation and marine activities.

There are specific OE expectations which need to be met under each focus area. Additional expectations apply to all focus areas and address legal, regulatory and OE compliance; risk management; assurance; competency; learning; human performance; technology; product stewardship; contractor OE management; incident investigation and reporting; and emergency management.

Through disciplined application of the OEMS, we integrate OE processes, standards, procedures and behaviours into our daily operations. While leaders are responsible for managing the OEMS and enabling OE performance, every individual in Chevron's workforce is accountable for complying with the principles of 'Do it safely or not at all' and 'There is always time to do it right'.

Line management has the primary responsibility for complying with this policy and applicable legal requirements within their respective functions and authority limits. Line management will communicate this policy to their respective employees and will establish policies, processes, programs and standards consistent with expectations of the OEMS.

Employees are responsible for understanding the risks that they manage and the safeguards that need to be in place to mitigate those risks. Employees are responsible for taking action consistent with all Company policies, and laws applicable to their assigned duties and responsibilities. Accordingly, employees who are unsure of the legal or regulatory implications of their actions are responsible for seeking management or supervisory guidance.

M Hatfield

Mark Hatfield
Managing Director, Australasia Business Unit

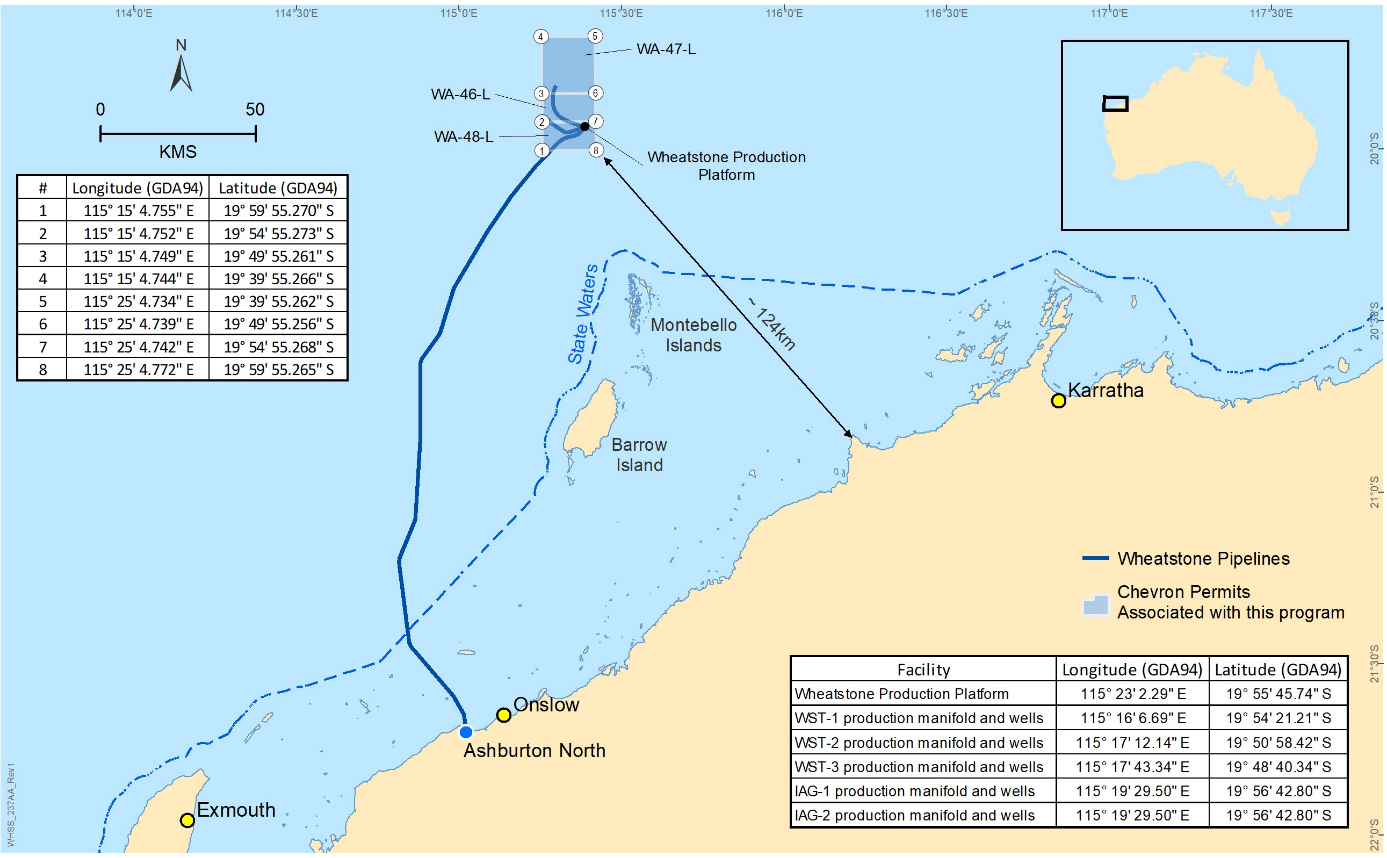
the human energy company™

appendix b stakeholder engagement—fact sheets

wheatstone project start-up and operations

environment plan stakeholder consultation

May 2021



#	Longitude (GDA94)	Latitude (GDA94)
1	115° 15' 4.755" E	19° 59' 55.270" S
2	115° 15' 4.752" E	19° 54' 55.273" S
3	115° 15' 4.749" E	19° 49' 55.261" S
4	115° 15' 4.744" E	19° 39' 55.266" S
5	115° 25' 4.734" E	19° 39' 55.262" S
6	115° 25' 4.739" E	19° 49' 55.256" S
7	115° 25' 4.742" E	19° 54' 55.268" S
8	115° 25' 4.772" E	19° 59' 55.265" S

Facility	Longitude (GDA94)	Latitude (GDA94)
Wheatstone Production Platform	115° 23' 2.29" E	19° 55' 45.74" S
WST-1 production manifold and wells	115° 16' 6.69" E	19° 54' 21.21" S
WST-2 production manifold and wells	115° 17' 12.14" E	19° 50' 58.42" S
WST-3 production manifold and wells	115° 17' 43.34" E	19° 48' 40.34" S
IAG-1 production manifold and wells	115° 19' 29.50" E	19° 56' 42.80" S
IAG-2 production manifold and wells	115° 19' 29.50" E	19° 56' 42.80" S

overview

The Chevron Australia-operated Wheatstone Project produces, processes and transports gas and condensate (hydrocarbons) from the Wheatstone and Iago offshore fields to domestic and international markets.

These fields are located within production licenses WA-46-L, WA-47-L and WA-48-L.

Chevron Australia also processes third-party hydrocarbons from the Julimar-Brunello offshore gas field.

Hydrocarbons from the offshore subsea wells is transported by a flowline system to the Wheatstone Platform for processing and is then routed through a subsea trunkline to the onshore gas plant at Ashburton North, approximately 12 kilometres south west of Onslow, Western Australia (Figure 1).

Processed liquefied natural gas (LNG) and condensate are then exported from Ashburton North via cargo vessels, while domestic gas is supplied via a tie-in to the Dampier-to-Bunbury Natural Gas Pipeline.

Supply vessels support the Platform and transfer miscellaneous items including chemicals, diesel and water to service the platform via cranes and bunker hoses.

This factsheet is for the purpose of stakeholder consultation for a required 5-year revision and resubmission of the original *Wheatstone Start-up and Operations Environment Plan,* approved by NOPSEMA and DMIRS in 2016.

location and water depths

The subsea gathering system delivers hydrocarbons from the wells through the flowlines to the platform. Ocean depths in the hydrocarbon gathering area range from approximately 70 to 280 metres.

The platform is located at Latitude: 19° 55’ 45.78” S; Longitude: 115° 23’ 02.22” E, in approximately 70 metres water depth and includes a four-legged steel gravity structure which supports the topsides.

The platform comprises hydrocarbon processing systems, power generation systems, flare structure, seawater system, wastewater treatment systems, living quarters and other systems and utilities. The normal operational crew on the platform is 55 and may occasionally reach up to 104. The platform is well-lit, meeting safety and navigational requirements.

The carbon steel trunkline (44 inches in diameter, approximately 225 kilometres in length) carries dry gas and condensate from the platform to the onshore facility. The trunkline is located predominately in Commonwealth Waters and follows the 110 metres water depth contour for much of its length, crossing into State Waters before passing under the WA shoreline through a tunnel, travelling a further one kilometre underground then emerging above ground and into the onshore gas plant.

Table 1: Key infrastructure locations and water depths, as marked on nautical maps.

Infrastructure	Latitude South	Longitude East	Depth (m)
Wheatstone Production Platform	19° 55' 45.74"	115° 23' 2.29"	70
WST-1 production manifold and wells	19° 54' 21.21"	115° 16' 6.69"	183
WST-2 production manifold and wells	19° 50' 58.42"	115° 17' 12.14"	204
WST-3 production manifold and wells	19° 48' 40.34"	115° 17' 43.34"	228
IAG-1 production manifold and wells	19° 56' 42.80"	115° 19' 29.50"	118
IAG-2 production manifold and wells	19° 55' 0.34"	115° 20' 40.18"	116

exclusion zones

Currently a number of exclusion zones are in place for the Wheatstone Project. A 500 m petroleum safety zone is in place around the infrastructure in table above.

No new exclusion or petroleum safety zones (PSZs) are proposed over Chevron Australia’s wells or infrastructure.

As part of its consultation in 2020, Woodside Energy Limited confirmed, like the existing Brunello production wells and crossover manifold (which deliver hydrocarbons to the Chevron-operated Wheatstone Platform), the Julimar production wells and crossover manifold will also have 250m PSZs in place.

environment plan approvals

In 2016, the original *Wheatstone Start-up and Operations Environment Plan* was approved by NOPSEMA and DMIRS.

In accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and Petroleum Pipelines (environment) Regulations 2021, an Environment Plan is subject to a five-yearly review and resubmission to NOPSEMA and DMIRS.

Consequently, the *Wheatstone Start-up and Operations Environment Plan* is being updated to reflect contemporary regulatory guidance, along with any learnings and risk reduction controls gained during the previous five years of operation.

The Environment Plan describes the environment in which the petroleum activity takes place, an assessment of the impacts and risks arising from the activity, and the identification of control measures to manage the potential impacts and risks to levels that are acceptable and as low as reasonably practicable.

The Environment Plan is also required to outline how Chevron Australia has engaged with key relevant stakeholders, whose interests, functions and activities may be affected.

implications for stakeholders

The potential impacts and risks to the environment and, along with a list of the control measures currently being implemented are summarised in Table 2.

Further details will be provided in the Environment Plan and will incorporate feedback received from stakeholders during this consultation process.

table 2: summary of relevant aspects and proposed controls

Aspect	Proposed Control
Physical Presence	• Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information. • Vessels will meet the crew competency, navigation equipment, and radar requirements as per the Chevron Australia's Marine, Safety Reliability and Efficiency process. • Vessels will implement caution and no approach zones in accordance with Australian National Guidelines for Whale and Dolphin Watching 2017. • Platform radar, navigational lighting and audio navigational equipment is maintained in accordance with manufacturers' specifications as detailed in the Computerised Maintenance Management System (CMMS). Implementation of a Conservation Significant Marine Fauna Interaction Management Plan.
Planned Discharges	**Vessels** • Oily bilge water is stored / retained on board for controlled disposal or discharged in accordance with MARPOL 73/78, Annex I • Offshore discharge of sewage from vessels in accordance with MARPOL Annex IV • Food waste discharged in accordance with MARPOL, Annex V, or taken to shore for disposal • Chevron Australia's Marine, Safety Reliability and Efficiency process for vessel inspections implemented. **Platform** • Production chemicals subject to Chevron Australia's chemical selection process – ABU Hazardous Material Approval Procedure • Platform Wastewater Discharges Monitoring Program is implemented • Produced water treatment system is operational and maintained in accordance with manufacturers' specifications as detailed in the CMMS. • Total Petroleum Hydrocarbon (TPH) analysis completed on a routine basis. • Produced Water Operating Manual tiered response and Produced Water - High Oil in Water Procedure are implemented • Sewage treatment plant and food waste macerator are operated and maintained • An oil-water treatment system is operated and maintained on the Platform

	• The seawater system (continuous dosing) meets residual chlorine discharge limits and ongoing monitoring is performed.
Air Emissions	**Vessels** • Vessels will hold a valid International Air Pollution Prevention certificate and a current international energy efficiency certificate. • All vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan as per MARPOL 73/78 Annex VI. • Chevron Australia's Marine, Safety Reliability and Efficiency process for vessel inspections implemented. **Platform** • Energy efficient design features (including the waste heat recovery units, high integrity valves and flanges, seawater lift pump configuration, aero derivative turbines, variable compression modes, condensate export pumps with variable speed drive) are installed and tested • Computerised maintenance management system utilised for the Platform • Platform air emissions monitoring program implemented • Flare monitoring and minimisation program implemented.
Introduced Marine Pests	• Chevron Australia's Quarantine Procedure – Marine Vessels is implemented • Maritime Arrivals Reporting System - Vessels coming from overseas will have Commonwealth Department of Agriculture, Water and the Environment clearance • In accordance with Australian Ballast Water Requirements, vessels coming from overseas will not discharge high-risk ballast water inside Australia's territorial sea (the area within 12 nautical miles of the Australian coastal baseline) • Marine vessels are to maintain an up-to-date international antifouling coating certification • Biofouling management plan, record book and risk assessment implemented.
Weeds	• License area is inspected for the presence of declared or new weed species.
Vessel Spills	• Chevron Australia's Marine, Safety Reliability and Efficiency process • Operational and scientific monitoring undertaken in accordance with the Operational and Scientific Monitoring Plan • Spill response implemented in accordance with the response arrangements and strategies detailed in the Oil Pollution Emergency Plan.
Infrastructure Spills	• Chevron Australia's Marine, Safety Reliability and Efficiency process • Chevron Australia-endorsed third-party handover processes • Hydrocarbon system commissioned and tested according to industry standards (completed in the construction and commissioning phase) • A Flow Management Tool will be in place, functional, and maintained to identify potential leaks along the main production flowlines • Inspection Maintenance and Repair program implemented • Monitoring of hydrocarbon system process, fluid composition and corrosion • Operational and scientific monitoring undertaken in accordance with the Operational and Scientific Monitoring Plan • Source control procedures developed and (the isolation steps) implemented • Spill response implemented in accordance with the response arrangements and strategies detailed in the Oil Pollution Emergency Plan.
Waste	**Vessels** • Garbage managed in accordance with MARPOL 73/78, Annex V. **Platform** • Hazardous wastes are stored in designated areas with secondary containment for hazardous liquid wastes • Lidded bins are provided • Platform waste storage areas are inspected and maintained • Training and competency of crane operator • Waste Management Plan is implemented.

providing feedback

Feedback from the interested and relevant stakeholders on potential or perceived impacts associated with Chevron Australia’s ongoing Wheatstone Project operations will be carefully considered and assessed.

Please note that stakeholder feedback and Chevron Australia’s response will be included in the EP.

NOTE: If feedback is identified as sensitive by a stakeholder, Chevron Australia will make this known to NOPSEMA in order for the information to remain confidential.

Feedback can be directed to:

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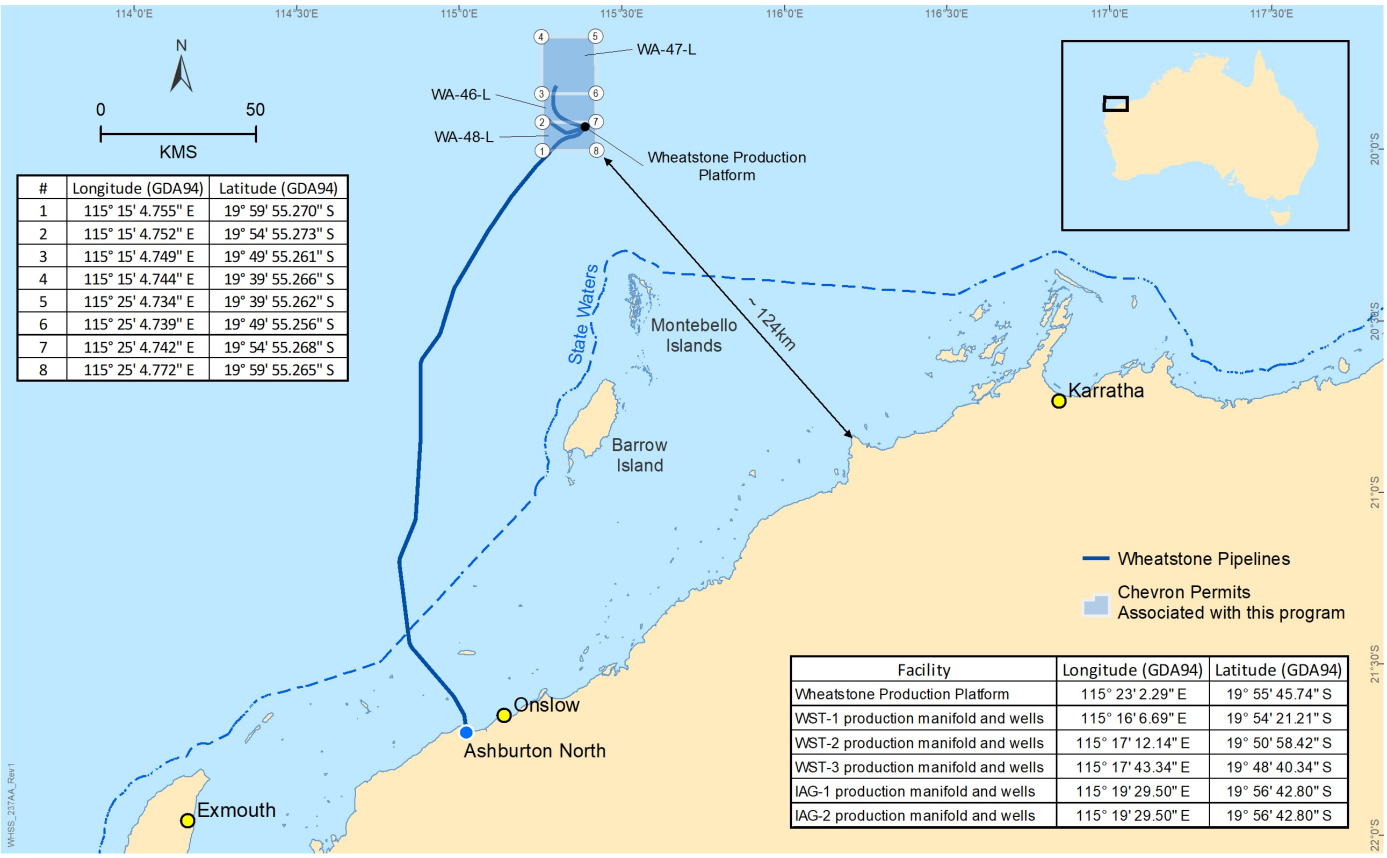
Partnerships Advisor
abuenvplaninfo@chevron.com
(08) 9216 4000

wheatstone project start-up and operations

environment plan commercial fishing consultation

May 2021



#	Longitude (GDA94)	Latitude (GDA94)
1	115° 15' 4.755" E	19° 59' 55.270" S
2	115° 15' 4.752" E	19° 54' 55.273" S
3	115° 15' 4.749" E	19° 49' 55.261" S
4	115° 15' 4.744" E	19° 39' 55.266" S
5	115° 25' 4.734" E	19° 39' 55.262" S
6	115° 25' 4.739" E	19° 49' 55.256" S
7	115° 25' 4.742" E	19° 54' 55.268" S
8	115° 25' 4.772" E	19° 59' 55.265" S

Facility	Longitude (GDA94)	Latitude (GDA94)
Wheatstone Production Platform	115° 23' 2.29" E	19° 55' 45.74" S
WST-1 production manifold and wells	115° 16' 6.69" E	19° 54' 21.21" S
WST-2 production manifold and wells	115° 17' 12.14" E	19° 50' 58.42" S
WST-3 production manifold and wells	115° 17' 43.34" E	19° 48' 40.34" S
IAG-1 production manifold and wells	115° 19' 29.50" E	19° 56' 42.80" S
IAG-2 production manifold and wells	115° 19' 29.50" E	19° 56' 42.80" S

overview

The Chevron Australia-operated Wheatstone Project produces, processes and transports gas and condensate (hydrocarbons) from the Wheatstone and Iago offshore fields to domestic and international markets.

These fields are located within production licenses WA-46-L, WA-47-L and WA-48-L.

Chevron Australia also processes third-party hydrocarbons from the Julimar-Brunello offshore gas field.

Hydrocarbons from the offshore subsea wells is transported by a flowline system to the Wheatstone Platform for processing and is then routed through a subsea trunkline to the onshore gas plant at Ashburton North, approximately 12 kilometres south west of Onslow, Western Australia (Figure 1).

Processed liquefied natural gas (LNG) and condensate are then exported from Ashburton North via cargo vessels, while domestic gas is supplied via a tie-in to the Dampier-to-Bunbury Natural Gas Pipeline.

Supply vessels support the Platform and transfer miscellaneous items including chemicals, diesel and water to service the platform via cranes and bunker hoses.

This factsheet is for the purpose of stakeholder consultation for a required 5-year revision and resubmission of the original *Wheatstone Start-up and Operations Environment Plan,* approved by NOPSEMA and DMIRS in 2016.

location and water depths

The subsea gathering system delivers hydrocarbons from the wells through the flowlines to the platform. Ocean depths in the hydrocarbon gathering area range from approximately 70 to 280 metres.

The platform is located at Latitude: 19° 55’ 45.78” S; Longitude: 115° 23’ 02.22” E, in approximately 70 metres water depth and includes a four-legged steel gravity structure which supports the topsides.

The platform comprises hydrocarbon processing systems, power generation systems, flare structure, seawater system, wastewater treatment systems, living quarters and other systems and utilities. The normal operational crew on the platform is 55 and may occasionally reach up to 104. The platform is well-lit, meeting safety and navigational requirements.

The carbon steel trunkline (44 inches in diameter, approximately 225 kilometres in length) carries dry gas and condensate from the platform to the onshore facility. The trunkline is located predominately in Commonwealth Waters and follows the 110 metres water depth contour for much of its length, crossing into State Waters before passing under the WA shoreline through a tunnel, travelling a further one kilometre underground then emerging above ground and into the onshore gas plant.

Table 1: Key infrastructure locations and water depths, as marked on nautical maps.

Infrastructure	Latitude South	Longitude East	Depth (m)
Wheatstone Production Platform	19° 55' 45.74"	115° 23' 2.29"	70
WST-1 production manifold and wells	19° 54' 21.21"	115° 16' 6.69"	183
WST-2 production manifold and wells	19° 50' 58.42"	115° 17' 12.14"	204
WST-3 production manifold and wells	19° 48' 40.34"	115° 17' 43.34"	228
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The Environment Plan describes the environment in which the petroleum activity takes place, an assessment of the impacts and risks arising from the activity, and the identification of control measures to manage the potential impacts and risks to levels that are acceptable and as low as reasonably practicable.

The Environment Plan is also required to outline how Chevron Australia has engaged with the commercial fishing sector as key relevant stakeholders, whose interests, functions and activities may be affected. The Environment Plan must include how commercial fisher feedback has been considered and addressed.

commercial fishing

Chevron Australia recognises the commercial fishing sector is an important and relevant stakeholder group whose members may have interests, functions, and activities that could be affected by this ongoing activity.

Chevron Australia is committed to engaging and working proactively with the commercial fishing sector, with information included in this fact sheet developed with advice from the Western Australia Fishing Industry Council.

On-the-water communications and cooperation between Chevron staff, contractors and sub-

contractors and the commercial fishing sector is a Chevron Australia priority.

Chevron staff, contractors and sub-contractors will be made aware of the potential to engage with active commercial fishers, and where possible, support vessels will steer clear of commercial fishing activities and fish aggregations in the vicinity of active commercial fishing vessels.

Support vessel personnel will be prohibited from any recreational fishing activities.

implications for stakeholders

The potential impacts and risks to the environment and the commercial fishing sector, along with a list of the control measures currently being implemented are summarised in Table 2.

Further details will be provided in the Environment Plan and will incorporate feedback received from commercial fishers during this consultation process.

table 2: summary of relevant aspects and proposed controls

Aspect	Proposed Control
Physical Presence	• Relevant commercial fishers will be advised of the commencement of key phases of activities and any relevant exclusion zone information. • Vessels will meet the crew competency, navigation equipment, and radar requirements as per the Chevron Australia's Marine, Safety Reliability and Efficiency process. • Vessels will implement caution and no approach zones in accordance with Australian National Guidelines for Whale and Dolphin Watching 2017. • Platform radar, navigational lighting and audio navigational equipment is maintained in accordance with manufacturers' specifications as detailed in the Computerised Maintenance Management System (CMMS). Implementation of a Conservation Significant Marine Fauna Interaction Management Plan.
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Feedback from the commercial fishing sector and other interested and relevant stakeholders on potential or perceived impacts associated with Chevron Australia's ongoing Wheatstone Project operations will be carefully considered and assessed.

Please note that stakeholder feedback and Chevron Australia's response will be included in the EP.

NOTE: If feedback is identified as sensitive by a stakeholder, Chevron Australia will make this known to NOPSEMA in order for the information to remain confidential.

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appendix c subsea inventory

The following table provides the status of subsea infrastructure associated with the Wheatstone Project (current as of April 2022).

Item	Petroleum title	Status	IM Plan	EP reference
Wells				
WST-1A	WA-46-L	Operational	In place	Section 3.2.1.1
WST-1C	WA-46-L	Operational	In place	Section 3.2.1.1
WST-1D	WA-46-L	Operational	In place	Section 3.2.1.1
WST-3A-ST1	WA-47-L	Operational	In place	Section 3.2.1.1
WST-3C	WA-47-L	Operational	In place	Section 3.2.1.1
WST-3D	WA-47-L	Operational	In place	Section 3.2.1.1
WST-3F	WA-47-L	Operational	In place	Section 3.2.1.1
IAG-1B-ST1	WA-48-L	Operational	In place	Section 3.2.1.1
IAG-1E	WA-48-L	Operational	In place	Section 3.2.1.1
Manifolds				
WST-1 manifold	WA-46-L	Operational	In place	Section 3.2.1.1
WST-3 manifold	WA-47-L	Operational	In place	Section 3.2.1.1
IAG-1 manifold	WA-48-L	Operational	In place	Section 3.2.1.1
Pipeline termination structures				
End of line PTS (3)	WA-46-L, WA-47-L, and WA-48-L	Operational	In place	Section 3.2.1.4
Midline PTS (3)	WA-46-L, WA-47-L, and WA-48-L	Operational	In place	Section 3.2.1.4
Production pipelines, flowlines, and support infrastructure				
44” trunkline (1)	WA-25-PL	Operational	In place	Section 3.2.1.5
24” production flowlines (2)	WA-46-L, WA-47-L, and WA-48-L	Operational	In place	Section 3.2.1.2
6” MEG pipelines (2)	WA-46-L, WA-47-L, and WA-48-L	Operational	In place	Section 3.2.1.2
14” utility pipelines (2)	WA-46-L, WA-47-L, and WA-48-L	Operational	In place	Section 3.2.1.2
Electrohydraulic/chemical umbilicals (3)	WA-46-L, WA-47-L, and WA-48-L	Operational	In place	Section 3.2.1.3
Platform				
Platform topside—cellar deck, intermediate deck, upper deck	WA-48-L, and WA-3-IL	Operational	In place	Section 3.3
Topside structure and equipment—helideck (1), crane (2)	WA-48-L, and WA-3-IL	Operational	In place	Section 3.3

Item	Petroleum title	Status	IM Plan	EP reference
Foundations and steel gravity structures (4)	WA-48-L, and WA-3-IL	Operational	In place	Section 3.3
Risers—trunkline riser (1), MEG riser (2), production flowline riser (2), utility flowline riser (2)	WA-48-L, and WA-3-IL	Operational	In place	Section 3.3

appendix d description of the environment (CAPL planning area)

description of the environment

CAPL planning area

Document ID:	**ABU-COP-02890**
Revision ID:	**3.0**
Revision Date:	**23 July 2021**
Next Revision Due	**23 July 2022**
Information Sensitivity:	**Company Confidential**

description of the environment

CAPL planning area

Document information

Document Number	ABU-COP-02890	Revision	3.0
Document Owner	David Smith	Department Owner	HSE Regulatory Affairs Team Lead

Revision history

Rev No.	Description	Date	Prepared By	Approved By
1.0	Issued for use	01 May 2020	A Fertch	D Salins
2.0	Updated with Offshore Areas incorporated into Planning Area	11 September 2020	A Fertch	D Salins
3.0	Annual review	23 July 2021	M Carey	D Smith

Approvals

	Name	Signature	Date
Author:	Michelle Carey HSE Specialist		
Checked:	Duanne Salins Regulatory Approvals Advisor		
Approved:	David Smith HSE Regulatory Affairs Team Lead		

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figures

1 introduction

1.1 Purpose

This document describes the environment within Chevron Australia Pty Ltd's (CAPL's) Planning Area (PA) (Figure 1-1), which is the total area in which CAPL's activities may interact with the environment. This document applies to all CAPL operations and is to be used for each Environment Plan (EP) submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) after this document's initial acceptance.

Each EP will define an environment that may be affected (EMBA) by its specific petroleum activity. The EMBA for each activity will most likely be based on conservative stochastic spill modelling thresholds; based on the knowledge gained from previous stochastic modelling from CAPL's activities, all EMBAs are expected to fall within this PA. If an EMBA from an individual EP extends outside the PA, this document will be revised, and the PA extended to incorporate that EMBA.

1.2 Regulatory context

The Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 detail the information that must be included in an EP. Specifically:

Regulation 13(2) states that the environment plan must:

> *(a) describe the existing environment that may be affected by the activity; and*
>
> *(b) include details of the particular relevant values and sensitivities (if any) of that environment.*

Regulation 4 defines the environment as:

> *(a) ecosystems and their constituent parts, including people and communities; and*
>
> *(b) natural and physical resources; and*
>
> *(c) the qualities and characteristics of locations, places and areas; and*
>
> *(d) the heritage value of places;*
>
> *and includes*
>
> *(e) the social, economic and cultural features of the matters mentioned in paragraphs (a), (b), (c) and (d).*

Regulation 13(3) further provides that, without limiting paragraph (2)(b) of Regulation 13(2), particular relevant values and sensitivities may include any of these:

> (a) the world heritage values of a declared World Heritage property within the meaning *of the EPBC Act;*
>
> *(b) the national heritage values of a National Heritage place within the meaning of that Act;*
>
> *(c) the ecological character of a declared Ramsar wetland within the meaning of that Act;*

(d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act;

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

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

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

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

Specific to the description of the environment, NOPSEMA's *Environment Plan Content Requirement* guidance (Ref. 1) states:

The level of detail within the plan should be appropriately scaled to the nature of the impacts and risks to the particular values and sensitivities. For example, the environment that may be affected by planned operations will need to be described in a greater level of detail than areas exposed to low levels of hydrocarbon in the unlikely event of a worst-case hydrocarbon release.

Consequently, CAPL has taken the approach that this document provides information suitable for summarising the particular values and sensitivities in order to inform the impact and risk evaluation for CAPL operations. However, if additional information is available for specific locations (typically an operational area for a specific activity) and if this information can be used to further influence or inform the impact and risk assessment, this additional information will be included in the 'Description of the Environment' section of the individual EP.

1.3 Review and revision

The information provided in this document is derived from various referenced desktop sources. As a minimum, this document will be reviewed annually to include any relevant changes to source documents, which may include State (Western Australian [WA])/Commonwealth Management Plans, Recovery Plans, Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) status, or new published research.

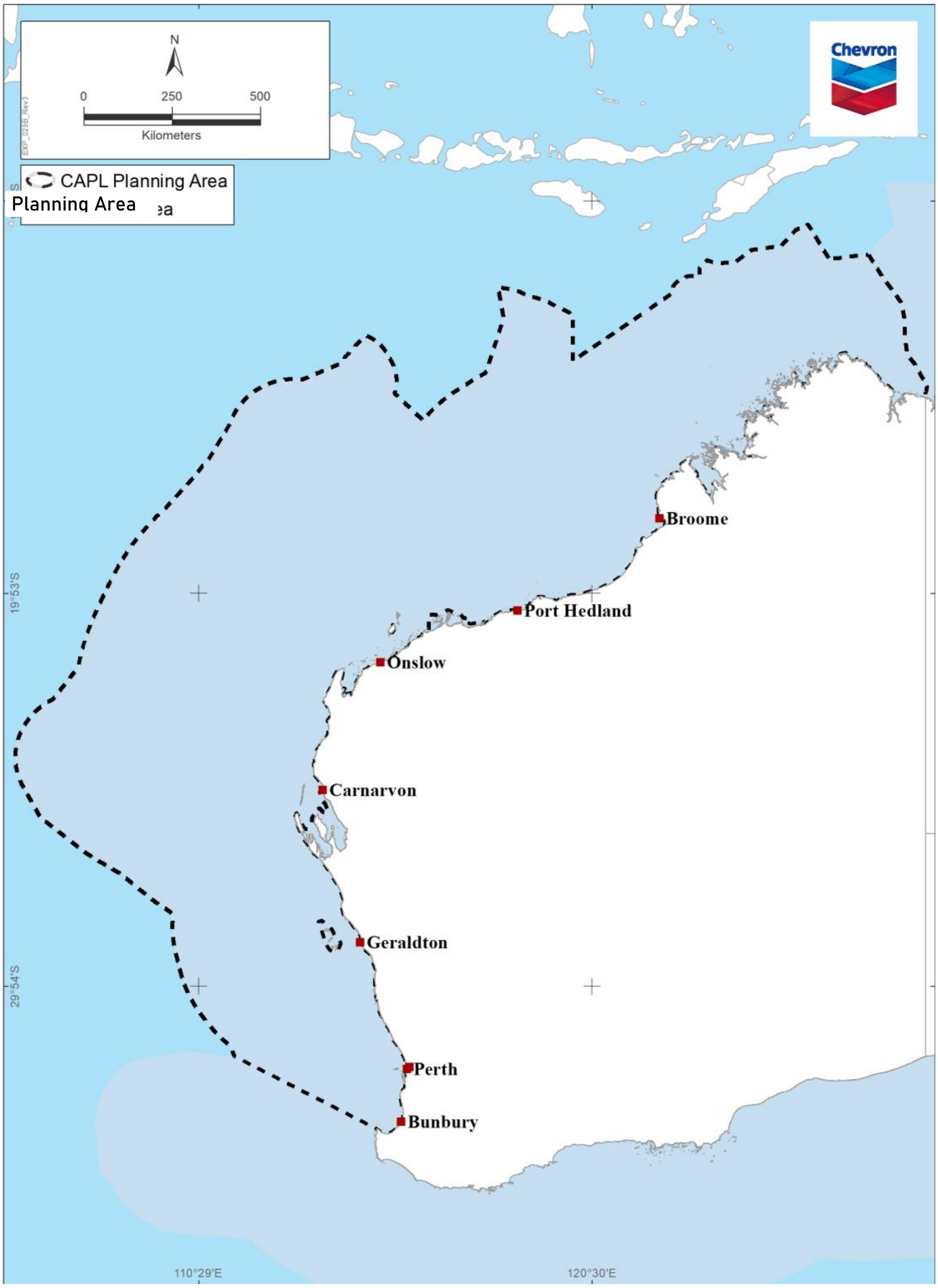


Figure 1-1: CAPL's planning area

2 matters of national environmental significance

2.1 World Heritage properties

Properties nominated for World Heritage listing are inscribed on the list only after they have been carefully assessed as representing the best examples of the world's cultural and natural heritage. At the time of writing this document, Australia has 20 properties on the World Heritage List (Ref. 2; Ref. 3).

The list of Australia's World Heritage areas (Ref. 2) and a protected matters search (Ref. 4; appendix a) show that two World Heritage properties are within the PA. Table 2-1 summarises value of these World Heritage properties (Ref. 2).

Table 2-1: World Heritage properties

World Heritage property	Brief overview of values^
Shark Bay	On the Indian Ocean coast at the most westerly point of Australia, Shark Bay's waters, islands, and peninsulas covering a large area of ~2.2 million hectares (of which about 70% are marine waters) have a number of exceptional natural features, including one of the largest and most diverse seagrass beds in the world. However, it is for its stromatolites (colonies of microbial mats that form hard, dome-shaped deposits, which are said to be the oldest life forms on earth), that the property is most renowned. The property is also famous for its rich marine life including a large population of dugongs and provides a refuge for a number of other globally threatened species.
The Ningaloo Coast	The Ningaloo Coast is located on WA's remote coast along the East Indian Ocean. The property holds a high level of terrestrial species endemism and high marine species diversity and abundance. An estimated 300 to 500 Whale Sharks aggregate annually coinciding with mass coral spawning events and seasonal localised increases in productivity. The marine portion of the nomination contains a high diversity of habitats that includes lagoon, reef, open ocean, the continental slope, and the continental shelf. Intertidal systems such as rocky shores, sandy beaches, estuaries, and mangroves are also found within the property. The most dominant marine habitat is the Ningaloo reef, which sustains both tropical and temperate marine fauna and flora, including marine reptiles and mammals. The main terrestrial feature of the Ningaloo Coast is the extensive karst system and network of underground caves and water courses of the Cape Range. The karst system includes hundreds of separate features such as caves, dolines, and subterranean water bodies and supports a rich diversity of highly specialised subterranean species. Above ground, the Cape Range Peninsula belongs to an arid ecoregion recognised for its high levels of species richness and endemism, particularly for birds and reptiles.

^ Source: Ref. 2.

2.2 National Heritage places

The National Heritage List is Australia's list of natural, historic, and Indigenous places of outstanding significance to the nation. The National Heritage List spatial database (Ref. 5) describes the place name, class (Indigenous, natural, historic), and status.

A search of the National Heritage List spatial database (Ref. 5) and a protected matters search (Ref. 4; appendix a) revealed that several National Heritage places occur in the PA (Table 2-2). The information presented in Table 2-2 outlines the nominator's Summary Statement of Significance sourced from the Australian Heritage Database (Ref. 6).

Table 2-2: National Heritage places

National Heritage place	Class	Summary of significance^
Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos	Historic	Wrecked on 4 June 1629, the *Batavia* is the oldest of the known Verenigde Oost-Indische Compagnie wrecks on the WA coast. Because of its relatively undisturbed nature, the archaeological investigation of the wreck itself has revealed a range of objects of considerable historical value. The recovered sections of the hull of the *Batavia* have been reconstructed in the Western Australian Maritime Museum and provides information on 17th century Dutch ship building techniques, while the remains of the cargo carried by the vessel have provided economic, and social evidence of the operation of the Dutch port at Batavia (now Jakarta) in the early 17th century.
Dampier Archipelago (including Burrup Peninsula)	Indigenous	The Dampier Archipelago located about 1,550 km north of Perth. On the magnificent Dampier Archipelago in WA, where the striking red earth of the Burrup Peninsula meets the blue Indian Ocean, rock engravings thought to number in the millions and other significant sites are helping us learn more about our Indigenous heritage. Made up of islands, reefs, shoals, channels and straits, and covering a land area of around 400 km^2, the Burrup Peninsula is 27 km long and 4 km wide. Many important native plants, animals and habitats are found in the area. The Archipelago was formed 6-8,000 years ago when rising sea levels flooded what were once coastal plains. The underlying rocks are amongst the oldest on earth, formed in the Archaean period more than 2,400 million years ago. The Dampier Archipelago was included in the National Heritage List on 3 July 2007.
Dirk Hartog Landing Site 1616 – Cape Inscription Area	Historic	Cape Inscription is the site of the oldest known landings of Europeans on the WA coastline, and is associated with a series of landings and surveys by notable explorers over a 250-year period. The first known European landing on the west coast of Australia was by Dirk Hartog of the Dutch East India Company's ship the *Eendracht* at Cape Inscription on 25 October 1616. Hartog left a pewter plate, inscribed with a record of his visit and nailed to a post left standing upright in a rock cleft on top of the cliff. This plate is the oldest extant record of a European landing in Australia. Hartog's discovery had a major impact on world cartography. After leaving the island, he sailed northwards charting the coastline of WA to 22° south. As a result, a known part of the coastline of WA appeared on world maps for the first time, replacing the mythical southern continent of 'Terra Australis Incognita'.
HMAS Sydney II and *HSK Kormoran* Shipwreck Sites	Historic	The naval battle fought between the Australian warship *HMAS Sydney II* and the German commerce raider *HSK Kormoran* off the WA coast during World War II (November 1941) was a defining event in Australia's cultural history. *HMAS Sydney II* was Australia's most famous warship of the time and this battle has forever linked the stories of these warships to each other. The tragic loss of *HMAS Sydney II* and its entire crew of 645 following the battle with *HSK Kormoran* remains Australia's worst naval disaster.
Lesueur National Park*	Natural	The Lesueur National Park (inland from Green Head, WA) contains an exceptional concentration of plant species richness and endemism. It is estimated to contain >900 plant species, including nine plant taxa that are endemic to the National Park and 111 taxa that are endemic to the surrounding region. A further 81 plant taxa are at the northern or southern limit of their distribution, which is significant for the evolution of new species (Ref. 7).

National Heritage place	Class	Summary of significance^
		The Lesueur National Park is one of the most important places in Australia for demonstrating species richness and endemism within the Proteaceae plant family, including the genera of Banksia, *Hakea*, *Dryandra*, *Grevillea*, and *Isopogon* (Ref. 8). The Lesueur National Park contains outstanding species richness and endemism in several other plant families such as: the Fabaceae family, including the genera of *Gastrolobium* (poison pea), *Daviesia* (bitter pea) and *Jacksonia* (dogwood); the Myrtaceae family, including the genera of *Verticordia* (feather flower) and *Melaleuca* (paper bark); the Haemodoraceae family (bloodroots, conostyles and kangaroo paws); the Stylidiaceae family (triggerplants); and the Droseraceae family (sundews) (Ref. 8).
Shark Bay, Western Australia	Natural	Shark Bay is on the most western point of the Australian coast. The region is one of the few properties inscribed on the World Heritage List (see Table 2-1) for all four outstanding natural universal values: • as an outstanding example representing the major stages in the Earth's evolutionary history • as an outstanding example representing significant ongoing ecological and biological processes • as an example of superlative natural phenomena • containing important and significant habitats for in situ conservation of biological diversity. 25% of vascular plants (283 species) are at the limits of their range in Shark Bay. Many vegetation formations and plant species are found only in the interzone area. The area south of Freycinet Estuary contains the unique type of vegetation known as tree heath. There are also at least 51 species endemic to the region and others that are considered new to science. The Shark Bay region is an area of major zoological importance, primarily due to habitats on peninsulas and islands being isolated from the disturbance that has occurred elsewhere. Of the 26 species of endangered Australian mammals, five are found on Bernier and Dorre Islands. These are the Boodie or Burrowing Bettong, Rufous Hare Wallaby, Banded Hare Wallaby, the Shark Bay Mouse, and the Western Barred Bandicoot. The Shark Bay region has a rich avifauna with over 230 species, or 35%, of Australia's bird species having been recorded. A number of birds attain their northern limit here, such as the Regent Parrot, Western Yellow Robin, Blue-breasted Fairy-wren, and Striated Pardalote. The region is also noted for the diversity of its amphibians and reptiles, supporting nearly 100 species. Again, many species are at the northern or southern limit of their range. The area is also significant for the variety of burrowing species, such as the Sandhill Frog, which, apparently, needs no surface water. Shark Bay contains three endemic sand-swimming skinks, and 10 of the 30 dragon lizard species found in Australia. The 12 species of seagrass in Shark Bay make it one of the most diverse seagrass assemblages in the world. Seagrass covers >4,000 km^2 of the bay, with the 1,030 km^2 Wooramel Seagrass Bank being the largest structure of its type in the world. Seagrass has contributed significantly to the evolution of Shark Bay as it has modified the physical, chemical, and biological environment as well as the geology and has led to the development of major marine features, such as Faure Sill. The barrier banks associated with the growth of seagrass over the last 5,000 years has, with low rainfall, high evaporation, and low

National Heritage place	Class	Summary of significance^
		tidal flushing, produced the hypersaline Hamelin Pool and L'Haridon Bight. This hypersaline condition is conducive to the growth of cyanobacteria, which trap and bind sediment to produce various mats and structures including stromatolites. Stromatolites represent the oldest form of life on Earth. They are representative of life forms from ~3,500 million years ago. Hamelin Pool contains the most diverse and abundant examples of stromatolite forms in the world. Shark Bay is renowned for its marine fauna. For example, the Shark Bay population of about 10,000 Dugong is one of the largest in the world, and dolphins abound, particularly at Monkey Mia. Humpback Whales use Shark Bay as a staging post in their migration along the WA coast. This species was reduced by past exploitation from an estimated population of 20,000 on the west coast to 500–800 whales in 1962; the population is now estimated at 2,000–3,000. Green and Loggerhead Turtles are found in Shark Bay near their southern limits; they nest on Dirk Hartog Island and Peron Peninsula beaches. Dirk Hartog Island is the most important nesting site for Loggerhead Turtles in WA. Shark Bay is also an important nursery ground for larval stages of crustaceans, fishes, and medusae (jellyfish).
The Ningaloo Coast	Natural	The integration of the Ningaloo Reef and Exmouth Peninsula karst system as a cohesive limestone structure is at the heart of the natural heritage significance of the Ningaloo Coast. The modern Ningaloo Reef, Exmouth Peninsula karst, and the wave-cut terraces, limestone plains, Pleistocene reef sediments of Exmouth Peninsula, and associated marine, terrestrial, and subterranean ecosystems, including the Muiron Islands, demonstrate a geological, hydrological, and ecological unity, which harmonises the region's present ecosystem functions with its evolutionary history as a time-series of coral reefs and an evolving karst system. The history of coral reefs during the last 26 million years is chronicled in the limestone parapets and wave-cut terraces of Cape Range, which record previous high water levels. Demonstrating late Quaternary deformation at a passive continental margin, the uplifted Neogene wave-cut terraces and fossil reefs that fringe Exmouth Peninsula, and the submerged fossil reef terraces that form the substrate of the modern reef, in immediate juxtaposition with the undeformed modern Ningaloo Reef, contribute to an understanding of the mechanisms that led to the modern character of the west coast of Australia. Archaeological deposits in the rock shelters on Cape Range show Aboriginal people had a comprehensive and sophisticated knowledge of edible and non-edible marine resources between 35,000 and 17,000 years ago. The rock shelters of Exmouth Peninsula are outstanding because they provide the best evidence in Australia for the use of marine resources during the Pleistocene, including their uses as food and for personal adornment. The evidence for standardisation in size and manufacture of the shell beads found at Mandu Creek rock shelter, coupled with the fact they provide the earliest unequivocal evidence for the creation of personal ornaments in Australia, demonstrates a high degree of creative and technical achievement.
The West Kimberley	Natural	The National Heritage listing of the West Kimberley recognises the natural, historic, and Indigenous stories of the region that are of outstanding heritage value to the nation. These and other fascinating stories about the west Kimberley are woven together in

National Heritage place	Class	Summary of significance^
		the following description of the region and its history, including a remarkable account of Aboriginal occupation and custodianship over the course of more than 40,000 years. The Kimberley occupies more than 420,000 km^2 on the north-western margin of the Australian continent. Its rocky coastline edges the Indian Ocean, and off the coast lie thousands of islands, many fringed with coral. The Mitchell Plateau (Ngauwudu) rises to nearly 800 m above sea level at its centre, in places dropping into steep escarpments, and losing altitude as it approaches the sea. Further south, Yampi Peninsula lies in a transitional area between the high rainfall of tropical north Kimberley and the drier conditions characteristic of central WA. These different environments meet in a complex landscape of plains, dissected sandstone plateaus, and rugged mountains. The central Kimberley, which includes the periphery of north Kimberley plateau country and the King Leopold Ranges, is very rugged; the physical structures here were formed by significant geological events, which folded rocks intensely, many thousands of millions of years ago. That such evidence of a distant past can today be seen so clearly in the landscape is due to the region's remarkable geological stability. This stability has also allowed the much more recent appearance of extensive limestone ranges, built from the remains of an extraordinary reef complex which, more than 300 million years ago, rivalled the Great Barrier Reef in size. The ranges have since eroded to form complex networks of caves and tunnels. Dinosaur footprints and tracks are another remarkable remnant of past life in the Kimberley; they are exposed in many places in the Broome sandstone, along the western length of Dampier Peninsula. This coastline is subject to one of the highest tidal ranges in the world, and many of the fossil footprints can only be seen for short periods during very low tides. Inland of Dampier Peninsula, south of the broad floodplains of the Fitzroy River, the distinctive red of the pindan country opens onto a vast expanse of desert. Throughout the Kimberley, where water meets land—in estuaries, mangroves and mudflats, in moist vine thickets, along the banks of rivers and creeks, around waterholes or soaks—there is an abundance of plants and animals, some of which live only in the Kimberley, while others may have travelled from the far side of the world to nest or breed here.

^ Source: Ref. 6.
** Identified in the protected matters search (appendix a) but located inland and thus not expected to be exposed to CAPL's activities.*

2.3 Commonwealth Heritage places

The Commonwealth Heritage List is a list of Indigenous, historic, and natural heritage places owned or controlled by the Australian Government. The Commonwealth Heritage List (Ref. 9) describes the place name, class (Indigenous, natural, historic), and status.

A search of the Commonwealth Heritage List and a protected matters search (appendix a; Ref. 4) revealed that Commonwealth Heritage Places occur in the PA (Table 2-3). The information presented in this table outlines the Nominator's Summary Statement of Significance sourced from the Australian Heritage Database (Ref. 6).

Table 2-3: Commonwealth Heritage places

Commonwealth Heritage place	Class	Summary of significance^
Ashmore Reef National Nature Reserve (External territories list)	Natural	Ashmore Reef (which is an atoll that includes four low-lying uninhabited sand islands) has major significance as a staging point for wading birds migrating between Australia and the northern hemisphere, including 43 species listed on the China–Australia Migratory Bird Agreement (CAMBA) and/or the Japan–Australia Migratory Bird Agreement (JAMBA). The place provides habitat for three species of sea snake; *Aipysurus apraefrontalis*, *A. foliosquama*, and *A. fuscus* with very restricted distributions. *Aipysurus fuscus* is endemic to Ashmore Reef. Ashmore Reef supports extremely high concentrations of breeding seabirds, many of which are nomadic and typically breed on small isolated islands. Breeding colonies of 17 species of seabirds have been recorded. The islands are regarded as supporting some of the most important seabird rookeries on the Sahul Shelf, including large (1,000 to 50,000 breeding pairs) breeding colonies of Sooty Tern (*Sterna fuscata*), Crested Tern (*S. bergii*), Bridled Tern (*S. anaethetus*) and Common Noddy (*Anous stolidus*), and smaller breeding colonies of Little Egret (*Egretta alba*), Eastern Reef Egret (*E. sacra*), Black Noddy (*Anous minutus*), White-tailed Tropic Bird (*Phaethon lepturus*), and Red-tailed Tropic Bird (*P. rubricauda*). The place is also important for providing breeding habitat for Green (*Chelonia mydas*) and Hawksbill Turtles (*Eretmochelys imbricata*). Ashmore Reef exhibits a higher diversity of marine habitats compared with other North West Shelf reefs. The place supports an exceptionally diverse marine fauna, particularly corals (255 species in 56 genera) and molluscs (433 species), and is regarded as having the highest diversity of sea snakes (12 species) in the world. Other highly diverse fauna include birds (78 species), decapod crustaceans (99 species), echinoderms (178 species), and fish (569 species). Species of conservation significance recorded at Ashmore Reef include: the nationally endangered Little Tern (*Sterna albifrons*) and Loggerhead Turtle (*Caretta caretta*), and the nationally vulnerable Green Turtle (*Chelonia mydas*) and Hawksbill Turtle (*Eretmochelys imbricata*). The place also includes species not previously recorded or only rarely recorded in Australia including: three bird species(Brown Hawk Owl [*Ninox scutulata*], White-tailed Tropic Bird [*Phaethon lepturus*], and Black Noddy [*Anous minutus*]); five hermatypic coral species; and 13 fish species. Ashmore Reef is an important scientific reference area for migratory seabirds, sea snakes, and marine invertebrates. It has been the site of several major scientific expeditions and is the subject of ongoing scientific monitoring of biological diversity, fauna populations, and breeding activity. Ashmore Reef is the type locality for two species of sea snake—*Aipysurus apraefrontalis* and *A. foliosquama*. Ashmore Reef is significant for its history of human occupation and use. Although the reef may have been known to the Rottinese people (Rote is an island in modern-day Indonesia) for many centuries, the first description is probably that contained in Eredia (1600) if accepted, this may be the first description of Ashmore Reef, which is now part of Australia. Ashmore Reef is believed to have been visited by fisherman from Rote Island since the early 18th century, as well as by Makassans and Bajau (‘Sea Gypsies’) and people from the island of Seram. The Ashmore Reef islands were used both for fishing and as a staging point for voyages to the southern reefs off Australia’s coast. Occupation by these seafarers, particularly from the area east of Madura (Indonesia), on the islands

Commonwealth Heritage place	Class	Summary of significance^
		occurred intermittently during the 1930s. Visits recommenced in 1947 following World War II and have continued. The islands are also significant for phosphate mining, which lead to their annexation by Great Britain and ultimate transfer to the Australian Government in 1934. Physical evidence of these former occupations exists and would be particularly significant in archaeological terms. Such evidence may include original wells and grave sites and would include evidence of disturbance from early phosphate mining.
Cliff Point Historic Site (WA list)	Historic	The Cliff Point Historic Site, individually significant within the area of Garden Island, is important as it was the first site inhabited by Governor Stirling's party in 1829 when founding the colony of WA, and as WA's first official non-convict settlement. The site was initially occupied by Captain Charles Fremantle before the arrival of Captain Stirling. The party occupied the site for two months before a move was made to the Swan River settlement on the mainland. The Cliff Point Historic Site is important as the site of first settlement in WA and is highly valued by the community for its cultural associations. The Cliff Point Historic Site, also known as Sulphur Town, after *HMS Sulphur* was chosen in 1828 by Governor Stirling to transport settlers to the new colony and is important for its association with Governor Stirling and Captain Charles Fremantle.
Garden Island (WA list)	Natural	Garden Island was the first site occupied by Governor Stirling's party in 1829 when founding the colony of WA; it was also the site of the first official non-convict settlement in WA. The Cliff Point Historic Site on Garden Island, also known as Sulphur Town, was initially occupied by Captain Charles Fremantle before the arrival of Captain Stirling, and is listed separately in the Register (Reg. No. 10657). The party occupied the site for two months before they moved to the Swan River settlement on the mainland. Garden Island, and in particular the Cliff Point Historic Site, is highly valued for its cultural associations as the site of first settlement in WA and is important for its association with Governor Stirling and Captain Charles Fremantle. In 1911, the Commonwealth resumed Garden Island from WA for use as a naval base. The strategic role of Garden Island and Cockburn Sound, which was secured for coastal defence in World War II, is illustrated by defence installations including Challenger or J Gun Battery, and the Scriven, Beacon, and Collie Battery complexes, supported by a range of service structures. Challenger Battery is listed separately in the Register at Reg. No. 18968. The absence of feral predators means that Garden Island provides a significant refuge for animals vulnerable to predation on the mainland. Due to its isolation from the WA mainland, the island is relatively free of disturbance from humans or introduced animals. Species of particular interest include the Tammar Wallaby (*Macropus eugenii*), Carpet Python (*Morelia spilota*), and the Lined Skink (*Lerista lineata*). Populations of the 14 species of reptile and the Tammar Wallaby have been isolated from mainland populations for 6,000–7,000 years. In particular, the population of the Tammar Wallaby on Garden Island is morphologically distinct from all other populations. The vegetation on Garden Island differs in structure and composition from vegetation on nearby Rottnest Island and the adjacent mainland (e.g., eucalypts and banksia, which are common on the mainland, are absent from the island). Due to a low fire frequency, the vegetation on Garden Island is older and denser than that on the mainland. The northern end of the island supports

Commonwealth Heritage place	Class	Summary of significance^
		some of the oldest stands of the rare Rottnest Island Pine (*Callitris preissii*), with most trees dating from the 1920s. Other species that are now rare in the region include the Cheesewood (*Pittosporum phylliraeoides* var. *phylliraeoides*) and Rottnest Teatree (*Melaleuca lanceolata*). The parabolic sand dunes on the western side of Garden Island are among the best-preserved dunes of the Quindalup soil unit, which is widespread in coastal WA. It is likely that Indigenous values exist at this place. The Australian Heritage Commission (AHC) has not yet identified, documented, or assessed these values for National Estate significance.
HMAS Sydney II and *HSK Kormoran* Shipwreck Sites (External territories list)	Historic	The naval battle fought between the Australian warship *HMAS Sydney II* and the German commerce raider *HSK Kormoran* off the WA coast during World War II was a defining event in Australia's cultural history. *HMAS Sydney II* was Australia's most famous warship of the time and this battle has forever linked the stories of these warships to each other. The tragic loss of *HMAS Sydney II* and its entire crew of 645 following the battle with *HSK Kormoran*, remains Australia's worst naval disaster and sent shockwaves throughout the Australian community in November 1941. The battle between *HMAS Sydney II* and *HSK Kormoran* had far-reaching consequences for developing Australia's defences. The loss of *HMAS Sydney II* was the first and most significant in a succession of Australian naval losses that directly threatened the security of Australia and its surrounding seas, having occurred only 17 days before the Japanese launched their attacks in Southeast Asia and the Northern Pacific. The aftermath of the sinking of *HMAS Sydney II* and subsequent warship losses saw a major shift in Australian military and political doctrine away from defending Australia by defending the British Empire to that of direct defence of the Australian mainland and the development of a defence alliance with the United States. The discovery and inspection of *HMAS Sydney II* and *HSK Kormoran* in 2008 has enabled reconciliation of theory and known historical fact concerning the battle with the archaeological evidence present in the remains. This physical evidence was pivotal to the findings of the 2009 *HMAS Sydney II* Commission of Inquiry (Cole Inquiry), and allowed some circumstances of the loss of *HMAS Sydney II* to be better understood. It has also enabled the study of unique technological features that allowed *HSK Kormoran* to avoid identification as a warship when approaching *HMAS Sydney II* until reaching point blank range for the weapons of the time. The surprise achieved by using these technologies was a major factor in the destruction of *HMAS Sydney II*. During the relatively short but conspicuous career of *HMAS Sydney II*, it was commanded by two of the most highly regarded and respected officers serving in the Royal Australian Navy at that time (Captain J.A. Collins and Captain J. Burnett). Their association with *HMAS Sydney II* is significant in both their naval careers and of the ship itself. The 2008 discovery of *HMAS Sydney II* and *HSK Kormoran* has highlighted the ongoing importance of these shipwrecks and their stories to the wider Australian community. The stories of these two ships are not only valued by the family and friends of the servicemen who died but also by veterans, defence personnel, and the Australian community in general. The location, interpretation, and memorialisation of these shipwrecks also provides some closure for the families.
J Gun Battery	Historic	Garden Island is important as the first site occupied by Governor Stirling's party in 1829 when founding the colony of Western

Commonwealth Heritage place	Class	Summary of significance^
(WA list)		Australia and as the first official non-convict settlement in WA. The Cliff Point Historic Site, also known as Sulphur Town, was occupied in the first instance by Captain Charles Fremantle before the arrival of Captain Stirling, and is listed separately in the Register (Reg. No. 10657). The party occupied the site for two months before a move was made to the Swan River settlement on the mainland. Garden Island, and in particular the Cliff Point Historic Site, is highly valued by the community for its cultural associations as the site of first settlement in WA and is important for its association with Governor Stirling and Captain Charles Fremantle. Garden Island was selected as the base for a naval base in 1911 and resumed by the Commonwealth. The strategic role of the island and Cockburn Sound, secured for coastal defence in the Second World War 1939–1945, is illustrated by defences including Challenger or J Battery and the Scriven, Beacon, and Collie Battery complexes, supported by a range of service structures. Challenger battery is listed separately in the Register at Reg. No. 18968. The absence of feral predators means that Garden Island provides a significant refuge for animals vulnerable to predation on the mainland. Due to its isolation from the WA mainland, the island is relatively free of disturbance from humans or introduced animals. Species of particular interest include the Tammar Wallaby (*Macropus eugenii*), Carpet Python (*Morelia spilota*), and the Lined Skink (*Lerista lineata*). Populations of the 14 species of reptile and the Tammar Wallaby have been isolated from mainland populations for 6,000–7,000 years. In particular, the population of the Tammar Wallaby on Garden Island is morphologically distinct from all other populations. The vegetation on Garden Island differs in structure and composition from vegetation on nearby Rottnest Island and the adjacent mainland. For example, eucalypts and banksia, which are common on the mainland, are absent from the island. Due to a low fire frequency, the vegetation on Garden Island is older and denser than that on the mainland. The northern end of the island has some of the oldest stands of the rare Rottnest Island pine (*Callitris preissii*), with most trees dating from the 1920s. Other species that are now rare in the region include the Cheesewood (*Pittosporum phylliraeoides* var. *phylliraeoides*) and Rottnest Teatree (*Melaleuca lanceolata*). The parabolic sand dunes on the western side of the island are among the best-preserved dunes of the Quindalup soil unit, which is widespread in coastal WA. It is likely that Indigenous values exist at this place. The AHC has not yet identified, documented, or assessed these values for National Estate significance.
Lancelin Defence Training Area (WA list)	Natural	The Lancelin Defence Training Area (DTA) is at the northern end of the Swan Coastal Plain, an area of exceptionally diverse flora and fauna. Much of Lancelin is dominated by species-rich Banksia woodlands and Myrtaceous/Proteaceous heaths. The floristic mosaic of *Banksia attenuata – B. menziessi* low woodlands, wet heaths, and low-heath communities represent significant vegetation remnants that are poorly conserved and under-represented in the conservation reserve system. The Lancelin DTA contains wetlands that are important in the hydrogeological system of the region. The Namming freshwater wetland suite contains a high diversity of habitats, is an important breeding site for waterfowl, and acts as a drought refuge for both waterfowl and other fauna.

Commonwealth Heritage place	Class	Summary of significance^
		The Lancelin DTA is close to the boundary of two major zoogeographic regions, the semi-arid Eyrean zone, and the Bassean, or south-western zone of WA. This accounts in part for the high vertebrate fauna richness, particularly for reptiles and frogs, with eight frog species recorded in the large, seasonal Walyengarra Lake. Several species occur at the edge of their distribution range within the place. Reptile species that are at, or near, the southern limit of their distribution in the Lancelin DTA include the skink *Lerista planiventralis* and the snake *Simoselaps littoralis*. Many bird species are at or near their northern limit of distribution here, including the Southern Emu Wren (*Stipiturus malachurus*), and the Spotted Pardalote (*Pardalotus punctata*), while several are at their southern limits, including the Pied Butcherbird (*Cracticus nigrogularis*), and the Pied Honeyeater (*Certhionyx variegatus*). The vegetation community known as Tall Heath—comprising *Calothamnus quadrifidus*, *Dryandra sessilis*, and *Hakea trifurcata*—is near the southern limit of its distribution within the Lancelin DTA. Stands of Tuart (*Eucalyptus gomphocephala*) are significant as this area is close to this restricted species' northern limit. Several flora species found in the place are listed as poorly known or rare (Priority species) in WA, including species that are known from only a few populations that are under threat. The Lancelin DTA occurs within a narrow strip along the central and south WA coast where a number of reptile species have restricted distributions. Species with restricted distributions that occur here include the legless lizards *Aclys concinna*, *Pletholax gracilis*, and *Delma grayii* and the skinks *Ctenotus australis* and *Lerista praepedita.*
Learmonth Air Weapons Range Facility (WA list)	Natural	The geomorphology of Cape Range, of which the Learmonth Air Weapons Range (AWR) Facility is a part, is of considerable importance in documenting sea level and landform changes since the late Cenozoic Era (~1.8 million years ago). A series of emergent reef complexes, which represent several periods of coral reef development, are striking elements of the geomorphology of the western side of the Learmonth AWR Facility and Cape Range. The ages of these reef terraces are key to understanding of the timing of uplift events. The coastal plain of Cape Range contains a network of subterranean waterways, comprising caverns and fissures in the limestone beneath the coastal plain. Of these, Bundera Sinkhole, found within the Learmonth AWR Facility, is the only deep anchialine system known in Australia, and is the only continental anchialine system known in the southern hemisphere. Anchialine systems are cave systems with restricted exposure to open air, with subterranean connections to the sea, and showing marine and terrestrial influences. Anchialine systems are noted both for their relict fauna and their high species richness. The physicochemical environment in Bundera Sinkhole is very complex, and is associated with biogeochemical processes that are likely to be important for maintaining the unique community contained in this system. The cave fauna of Cape Range, including that within the Learmonth AWR Facility at Bundera Sinkhole, is of exceptional biogeographical importance. Much of the fauna developed a long time ago, with a number of species of the aquatic cave fauna (stygofauna) originating in the Tethys Sea ~170 million years ago. Bundera Sinkhole supports several species of aquatic stygofauna, many of which are endemic to the sinkhole or to Cape Range. Many of the stygofauna species have their closest known affinities

Commonwealth Heritage place	Class	Summary of significance^
		with the fauna of anchialine caves on either side of the North Atlantic. This narrow cave is also the only known southern hemisphere site for a crustacean from the class Remipedia (*Lasionectes exleyi*). *L. exleyi* is listed as endangered at both State and Commonwealth levels. This species is widely separated from related species found in the North Atlantic. Bundera Sinkhole is also the only known locality in the southern hemisphere for another crustacean species: *Danielopolina* sp. Nov. Several other crustacean species found in Bundera Sinkhole are likely to have originated from the Tethys Sea, including: *Stygiocaris lancifera* (the Lance-beaked Cave Shrimp); two copepods from the Calanoida order (*Bunderia* sp. and *Stygocyclopia* sp.); and another copepod, *Halicyclops spinifer*. Many of these species also have widely separated distributions (e.g. *Halicyclops* is confined in Australia to Cape Range, but is also found in Iran, Brazil, and India). The Lance-beaked Cave Shrimp is listed as rare or likely to become extinct at the State level. The gastropod *Iravadia* sp. is found in brackish water in Bundera Sinkhole, and represents the first marine/estuarine stygophile recorded from the region. A fish species, the Blind or Cave Gudgeon *Milyeringa veritas*, also occurs here—it is one of only two vertebrate species known in Australasia that is confined to caves. This species is listed as vulnerable at the national level. *Prionospio thalanji* sp. nov., a worm from the Spionidae family, has been described from Bundera Sinkhole. Other species from this genus are predominantly marine, and this is the first global record of a spionid occurring in a cave environment. The ecosystems represented in the caves of the Cape Range and subterranean waterways under the coastal plains of the peninsula, including in the Learmonth AWR Facility at Bundera Sinkhole, are rare in WA. Only a small number of cave ecosystems exist in WA, and Bundera Sinkhole, along with other caves at Cape Range, are the only example in Australia of an orogenic (formed during a mountain building phase) limestone from the Tertiary Period (between 65 million and 1.8 million years ago). Stygofauna throughout the world is of considerable scientific interest, yielding important information concerning the evolution of life on earth. The stygofauna at Cape Range, including species found within the Learmonth AWR Facility at Bundera Sinkhole, give insights into the origin of Australian fauna, changes in climate since the Miocene Epoch, and the biogeographical history of the continent Several species of vertebrate terrestrial fauna at Cape Range, including within the Learmonth AWR Facility, are of biogeographical importance because they form isolated populations, or populations at the limit of their range. The reptile fauna is of particular biogeographical significance, with a number of species or subspecies occurring here with highly restricted distributions. The Learmonth AWR Facility supports six southern reptile species that are at, or close to, their northern geographic limit: *Diplodactylus ornatus*, *Ctenotus fallens*, *Lerista lineopunctulata*, *L. praepedita*, *Morethia lineoocellata*, and *Vermicella littoralis*. All these species are found on the western coastal dunes, and are largely restricted to the coastal corridor. All are endemic to southern WA and restricted to sandy coastal habitats along the western coast. The Learmonth AWR Facility supports several plant species that are either endemic, or mainly limited to the Cape Range peninsula, with at least ten endemic flora species occurring here.

Commonwealth Heritage place	Class	Summary of significance^
Mermaid Reef – Rowley Shoals (WA list)	Natural	Mermaid Reef is characterised by environmental conditions that are rare for shelf-edge reefs and are known only in the Rowley Shoals in WA; these conditions include clear, deep oceanic water and large tidal ranges. Species of conservation significance recorded at the place include the nationally vulnerable Green Turtle (*Chelonia mydas*). The Rowley Shoals provide habitat for species not previously been recorded in WA, including 216 fish species, 39 mollusc species, and seven echinoderm species. The Rowley Shoals are regionally important for their fauna diversity, which includes: corals (184 species in 52 genera); molluscs (260 species); echinoderms (90 species); and fish (485 species). Mermaid Reef, together with Clerke and Imperieuse Reefs, has biogeographical significance due to the presence of species that are at, or close to, the limits of their geographic ranges, including fish known previously only from Indonesian waters (e.g. the apogonid *Cheilodipterus singapurensis*, the pomacentrid *Chrysiptera hemicyanea*, the blenniid *Escenius schroederi*, and several gobiids). The monotypic labrid *Conniella apterygia* is endemic to the region of Rowley Shoals and Seringapatam and Scott Reefs. Mermaid Reef is particularly significant as a stepping-stone in the spread of genetic material from the Indonesian archipelago to the reefs to the south. The Rowley Shoals are important for benchmark studies as they are one of the few places off the north-west coast of WA that have been the site of major biological collection trips by the WA Museum. The Rowley Shoals includes the type locality of several fish, including the genus and species of the wrasse *Conniella apterygia* and the serranid species *Pseudanthias sheni*. The place is one of the best morphological examples of shelf-edge reefs in Australian waters and is important for demonstrating their principal structural and developmental characteristics. A shipwreck off the western edge of Mermaid Reef is believed to be that of the British whaling vessel *Lively*, which was lost in the early 1800s.
Ningaloo Marine Area – Commonwealth Waters (WA list)	Natural	Whale Sharks (*Rhincodon typus*) congregate in the Ningaloo Marine Area after the mass coral spawning each autumn in the adjacent Ningaloo Reef (State waters). The place is an important feeding area for the Whale Shark and one of the few places in the world where they are known to congregate regularly in significant numbers. The place is part of the annual migration route for the endangered (Commonwealth) Humpback Whale. They migrate north to Kimberley (WA) breeding grounds in winter (June–August) and south to Antarctic feeding grounds in summer (August–November). Other Commonwealth listed threatened species found in the place are the endangered Blue Whale, Southern Right Whale (*Eubalaena australis*), Loggerhead Turtle, and Southern Giant Petrel (*Macronectes giganteus*); the vulnerable Fin Whale (*Balaenoptera physalis*), Sei Whale (*B. borealis*), Green Turtle, Hawksbill Turtle, Flatback Turtle, Soft-plumaged Petrel (*Pterodroma mollis*), Great White Shark (*Carcharodon carcharias*), and Grey Nurse Shark (*Carcharias taurus*). Other significant species include the Dugong, Spinner Dolphin (*Stenella longirostris*), Yellow-nosed Albatross (*Diomedea chlororhynchos*) and Osprey (*Pandion haliaetus*). Marine turtle density is exceptionally high in the place; Green Turtles are the most abundant, exceeding the highest densities recorded in the Great Barrier Reef Marine Park (Queensland). The place is on the migratory route of many trans-equatorial wader bird species, and provides valuable feeding grounds for many migratory seabirds, including 11 species protected under JAMBA and/or CAMBA including the Wedge-tailed Shearwater (*Puffinus pacificus*), Wilson's Storm Petrel (*Oceanites oceanicus*), Lesser

Commonwealth Heritage place	Class	Summary of significance^
		Frigatebird (*Fregata ariel*), Crested Tern (*Sterna bergii*), and White-winged Tern (*Chlidonias leucoptera*). The place is an important breeding area for billfish, and is one of the few areas in the world where aggregations of several species (Black Marlin, Blue Marlin, Striped Marlin, and sailfish) occur. The place is an important feeding area for manta rays in autumn and winter and significant for tuna migration and potentially important for juvenile Southern Bluefin Tuna (*Thunnus maccoyii*). The Ningaloo Marine Area provides opportunities for scientific research in many different fields related to aspects of the place's unique and interesting features. Past, current, and ongoing research is being undertaken by academic and research institutions, including: the Department of Biodiversity, Conservation and Attractions (WA), Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australian Institute of Marine Science (AIMS), Murdoch University (WA), University of WA, Edith Cowan University (WA), and James Cook University (Queensland). Areas of research include tourism, marine ecology, whales, marine turtles, Whale Sharks, fish, and oceanography. The Ningaloo Marine Area has many historic associations for European exploration and development of the North West Cape and northern WA, including pearling and whaling activities. To date eight shipwrecks dating from 1811 to 1923 have been discovered in the area. Other Indigenous and non-Indigenous cultural values of National Estate significance may exist in this place, but the AHC has not yet identified, documented, or assessed these values.
Scott Reef and Surrounds – Commonwealth Area (External territories list)	Natural	Scott Reef is a significant component of a disjointed chain of shelf-edge reefs separated from Indonesia by the Timor Trough. It is regionally significant both because of its high representation of species not found in coastal waters off WA and for the unusual nature of its fauna, which has affinities with the oceanic reef habitats of the Indo-West Pacific as well as the reefs of the Indonesian region. Scott Reef is important for its contribution to understanding long-term geomorphological and reef formation processes and past environments—its sedimentary sequence extends back to include sediments from the Triassic Period. The place has biogeographical significance due to the presence of species that are at, or close to, the limits of their geographic ranges, including fish known previously only from Indonesian waters (e.g. *Cheilodipterus singapurensis*, *Chrysoptera hemicyanea*, *Ecsenius schroederi*, and several gobiids). In addition, some coral species may be endemic to Scott Reef. The reef's isolation and large size may predispose it for the evolution of genetically distinct subspecies or endemic species. Several species are currently only known from Scott Reef, including 51 fish species, 14 mollusc species, six echinoderm species, and the seagrass *Thalassia hemprichii*. Scott Reef is of biogeographical significance due to its connectivity in terms of gene flow and coral spore movement to surrounding reefs such as Ashmore Reef and Rowley Shoals. Scott Reef has enormous habitat diversity and is considered a hot spot of fish diversity. Scott Reef is characterised by environmental conditions that are rare for shelf atolls; these conditions include clear, deep oceanic water and large tidal ranges. Scott Reef has nationally vulnerable Green Turtles (*Chelonia mydas*), which are genetically distinct from those on near-coastal sites in WA, from the Lacepede Islands to North West Cape. The sand cays of the place are important habitat for migrating animals in the largely landless expanse of the Timor Sea. They are an important staging area for birds, particularly

Commonwealth Heritage place	Class	Summary of significance^
		migrants to and from Australia. Seventeen of the 25 bird species identified on Scott Reef are on CAMBA and/or JAMBA lists. Scott and Seringapatam Reefs together are regionally important for the diversity of their fauna, which includes corals (224 species in 56 genera); molluscs (279 species); decapod crustacea (56 species); echinoderms (117 species); and fish (558 species). Scott Reef is important for scientific research and benchmark studies due to its great age, the exceptional documentation of its geophysical and physical environmental characteristics, and its use as a site of major biological collection trips and surveys by the WA Museum and AIMS.
Yampi Defence Area (WA list)	Natural	The Yampi Defence Area displays a complex mosaic of landforms in the transition from the sandstone plateaus of the north-west Kimberley, to the broad plains and pindan scrub of the south-west Kimberley. The occurrence of such diverse landscapes within a relatively limited area is unusual. The strong relationship that exists between past orogenic events and the diverse landscape pattern of ridges and valleys is emphasised in the shape of the Yampi Fold Belt, and distinguished by the pronounced ria embayments that characterise the coastline. Landforms originating from rocks within the Yampi Fold Belt and the terrain associated with the Late Devonian Lillybooraroo Conglomerate are of considerable scientific importance. The erosion of the Lillybooraroo Conglomerate, which covers the Yampi Fold Belt, has partially exposed a pre-Devonian land surface, the attributes of which have enormous potential to aid our understanding of long-term geomorphological processes and evolution. Suggestions that the Lillybooraroo Conglomerate remains an original valley fill deposit would attest to very low rates of erosion and long-term landscape stability, reinforcing the scientific importance of the place. The Yampi Defence Area, which is at the crossroads of the Dampierland, Central, and Northern Kimberley biogeographical regions, has a diverse range of ecosystems, displaying an unusual richness of faunal associations and vegetation communities, with >800 plant species (approximately one-third of the described Kimberley flora) being recorded. Previous surveys of the Dampier Peninsula and Walcott Inlet, and the Kimberley Rainforest Survey enable the changing floristic composition to be compared between adjacent areas. On the basis of species richness, indications are that the Yampi Defence Area supports >1,000 species, including undescribed, rare, and fire-sensitive species that are declining elsewhere in the Kimberley. Similarly, the known distributions of vertebrates from the Yampi Peninsula, and locations to the north and south, indicate that a far richer fauna is likely to occur in the place. Fire-protected sandstone communities, typified by healthy mixed-age stands of cypress pine (*Callitris intratropica*) once common throughout the Kimberley are now very rare in northern Australia, and the occurrence of such stands around Secure Bay are important reference sites for similar Kimberley plant communities that are subject to more frequent fire regimes. The extensive sandstone landforms support small isolated patches of rainforest (the south-west limit in the Kimberley of the distribution of rainforest over sandstone), creating important nodes of diversity and refugia that contain many regionally endemic plants, animals, and invertebrates. Granite landforms are of restricted distribution in the Kimberley and mostly occur in drier areas. The high concentration of granite outcrop sequences at Yampi occurs in a higher rainfall zone

Commonwealth Heritage place	Class	Summary of significance^
		resulting in formation of diverse and specialised vegetation communities. Aquatic plants inhabit the ephemeral pools that form in granite depressions, while rock-colonisers populate the granite fissures and scree slopes where run-off water is high. Six plant taxa occur within the place that are endemic to the Yampi Peninsula. Yampi Defence Area is the type locality for the insectivorous plant *Byblis filifolia*, first collected in 1838 during the voyage of *HMS Beagle*. The close juxtaposition of three botanical regions within the place is highlighted by the presence of numerous tropical plant species and several animal taxa that are at the southern edge of their distribution. Merging with these are many arid zone plants at the northern and western edge of their distribution, recognisable as the pindan grades into the taller woodland structure of the north-western Kimberley. The sandstone mesa south of Kimbolton is the southernmost locality for several plant taxa restricted to the fire-protected sandstone ranges of the Kimberley. The diversity of landforms in the place and the resultant high concentration of small refugial habitats support a regionally rich vertebrate fauna and represent the most southerly known extant population of the nationally vulnerable Golden-backed Tree-rat (*Mesembriomys macrurus*) and the most southerly record in the Kimberley of the Sugar Glider (*Petaurus breviceps*). The bird fauna is significant as it represents a suite of species that are at, or near, the southern edge of their range in the semi-humid zone of the Kimberley including the Green-winged Pigeon (*Chalcophaps indica*); the Torres Strait Pigeon (*Ducula bicolor*); and the Little Shrike-thrush (*Colluricincla megarhyncha parvula*). The place is also an important zone of overlap between many northern and southern species and subspecies. The vertebrate fauna shows its closest similarity to those recorded from the wetter areas of the west Kimberley that lie further to the north. The place supports several fauna and flora species that are listed as specially protected, threatened, or having priority status in WA, as well as four fauna species that are nationally vulnerable and one species that is nationally endangered. Other Indigenous and non-Indigenous cultural values of National Estate significance may exist in this place, but the AHC has not yet identified, documented, or assessed these values.

^ Source: Ref. 6.

2.4 Wetlands of international importance (listed under the Ramsar Convention)

At the time of writing this document, Australia has 66 Ramsar wetlands that cover >8.3 million ha. Ramsar wetlands are those that are representative, rare, or unique wetlands, or that are important for conserving biological diversity. These are included on the List of Wetlands of International Importance held under the Ramsar Convention (Ref. 10).

The Ramsar Wetlands of Australia spatial dataset (Ref. 11) shows the Ramsar wetlands within the PA (Table 2-4). The Ramsar Convention defines ecological character as the combination of the ecosystem components, processes, benefits and services that characterise the wetland at a given point in time (Ramsar Convention 2005a, Resolution IX.1 Annex A). A summary of the ecological character of the wetlands is described in Table 2-4.

Table 2-4: Ramsar wetlands

Summary of the ecological character of Ramsar wetlands
Ashmore Reef Commonwealth Marine Reserve
Ashmore Reef Commonwealth Marine Reserve is located in the Indian Ocean on the edge of Australia's North West Shelf, ~610 km north of Broome and ~840 km west of Darwin. The Reserve is in Australia's External Territory of Ashmore and Cartier Islands. It is the largest of only three emergent oceanic reefs present within the north-eastern Indian Ocean. The Reserve is comprised of numerous marine habitats and supports a regionally important and diverse range of species. The following summary of ecosystem components, processes and services has been extracted from Hale and Butcher (Ref. 12). **Ecosystem components and processes** • Climate: Arid tropical monsoonal climate. Located outside the main belt of tropical cyclones in the Timor Sea. • Geomorphic setting: Located in an area of high oil and gas reserves, with active hydrocarbon seeps. Geomorphic groups within the site include reef slope, reef crest, reef flat, back reef sands, lagoons and islands. • Tides and currents: Strong seasonal influences of the Indonesian Throughflow and Holloway currents. Internal waves are a feature of the region and Ashmore Reef may act to break these resulting in increased nutrients from the bottom waters. High energy environment with spring tides over 4.5 m and large flushing on tidal cycles. • Water quality: Seasonal variations in temperature and salinity in ocean and lagoon water. Water clarity, turbidity and other water quality parameters remain a knowledge gap. • Vegetation: Five species of seagrass recorded with *Thalassia hemprichii* dominant, comprising over 85% of total cover. Total cover of 470 ha, over 3,000 ha of macroalgae, mostly on reed slope and crest areas. Algae dominated by turf and coralline algae with fleshy macroalgae comprising typically less than 10% of total algae cover. • Marine invertebrates: Ashmore Reef has a diversity of marine invertebrates including hard and soft corals, molluscs, echinoderms and crustaceans. 275 species of hard coral, covering an area of around 700 ha. 39 taxa of soft coral, covering an area of around 300 ha. Total coral cover was low around the time of listing following the 1998 bleaching event but recovered in recent years to baseline levels. Over 600 species of mollusc, including two endemic species. Over 180 species of echinoderm, including 18 species of sea cucumber. Sea cucumber density is highly variable, but on average exceeds 30 per hectare. 99 species of decapod crustacean. • Fish: Over 750 species of fish, including five species of fish and three species of shark listed as threatened. Predominantly shallow water, benthic taxa that are common throughout the Indo-Pacific. Density of small reef fishes is around 20,000 to 40,000 per hectare. Low density of sharks (less than one per hectare). • Seasnakes: Prior to listing there was a high diversity and population, peaking in 1998 with an estimated total population of 40,000 snakes in the site. However, by time of listing in 2002 the site was on a trajectory of decline and diversity and abundance was low. • Turtles: Three species of marine turtle: Green (*Chelonia mydas*), Hawksbill (*Eretmochelyis imbricata*) and Loggerhead (*Caretta caretta*) all of which are listed threatened species. Green Turtles are the most abundant, with a total estimated population of around 10,000. Nesting by two species; Green Turtles and Hawksbill Turtles. • Seabirds and shorebirds: Ashmore Reef supports an abundance and diversity of wetland birds. 72 species of wetland dependent bird recorded within the Ramsar site. 47 species listed under international migratory agreements. Average of around 48,000 seabirds and shorebirds annually. Six species are regularly recorded in numbers greater >1% of the population. Nesting of 20 species, 14 of which regularly breed in the site. • Dugong: Small but significant population, that may breed within the site. Data deficient. **Ecosystem services** • Provisioning services–Freshwater: Indonesian fishers use the freshwater lens at West Island. • Cultural services–Recreation and tourism: Although remote and access is controlled, the site is important for passive recreation such as diving and bird watching.

Summary of the ecological character of Ramsar wetlands
• Cultural services–Cultural heritage and identity: Ashmore Reef has been regularly visited and fished by Indonesians since the early 18th century. West Island contains some archaeological artefacts and graves. • Cultural services–Scientific and educational: The reef has high value for scientific research because it currently received relatively low use and is ecologically unique within the bioregion. • Supporting services–Near-natural wetland types: Ashmore Reef supports a number of largely unmodified wetland types. • Supporting services–Biodiversity: Ashmore Reef is a hotspot of biodiversity within the Timor Province bioregion. Highest biodiversity of reef building corals (275 species from 56 genera). Highest diversity of soft corals (39 taxa). More than 600 species of mollusc. Over 180 species of echinoderm, including 13 species of sea cucumber. Nearly 100 species of decapod crustacean. Over 750 species of finfish. High diversity of seasnakes. • Supporting services–Physical habitat: The site supports large breeding colonies of seabirds. • Supporting services–Priority wetland species: The Ramsar site supports 47 species of shorebirds listed under international migratory bird treaties. • Supporting services–Threatened species: Ashmore Reef supports 62 species listed as threatened at the national and/or international level.
Becher Point Wetlands
The Becher Point Wetlands Ramsar site is a system of about 60 small wetlands located near Rockingham in southwest WA. Over the past 5,000 years Becher Point advanced seaward, or westwards, in response to falling sea levels, with the new terrestrial land forming a stable beachridge plain. As the beachridge plain grew westwards, new wetlands formed to the west of the older wetlands. The older wetlands evolved from simple groundwater systems to more complex wetland systems with different hydrological and ecological character. The Becher Point Wetlands Ramsar site covers the younger wetlands in this progression, with the newest wetlands being <1,000 years old and the oldest ~3,000 years old. The wetlands support sedgelands, herblands, grasslands, open-shrublands, and low open-forests. The sedgelands that occur within the linear wetland depressions of the Ramsar site are a nationally listed threatened ecological community (TEC). At least four species of amphibians and 21 species of reptiles have been recorded on the site. The site also supports the Southern Brown Bandicoot. The site is gazetted as a reserve for conservation of flora and fauna. The site, which includes the Port Kennedy Scientific Park, is used for research, education, and recreation. A formal ecological character description report is currently not available for the Becher Point Wetlands.
Eighty-mile Beach
The Eighty-mile Beach Ramsar site comprises two separate areas: ~220 km of beach and associated intertidal mudflats from Cape Missiessy to Cape Keraudren, and the Mandora Salt Marsh ~40 km to the east. The beach is characterised by extensive (1–4 km wide) intertidal mudflats comprised of fine silt and clay, bounded to the east by a narrow strip of coarse quartz sand and then coastal dunes. The beach is a relatively linear stretch with a few tidal creeks with small extents of the grey mangrove (*Avicennia marina*). Mandora Salt Marsh comprises of a series of floodplain depressions within a linear dune system. The site contains two large seasonal depressional wetlands (Lake Walyarta and East Lake) and a series of small permanent mound springs. The following summary of ecosystem components, processes and services has been extracted from Hale and Butcher (Ref. 13). **Ecosystem components and processes** • Climate: Semi-arid monsoonal with a prolonged dry period. >80% of rainfall in the wet season (December to March). High inter-annual variability. High occurrence of tropical cyclones. • The Beach:

Summary of the ecological character of Ramsar wetlands
– Geomorphology: Extensive intertidal mudflats comprised of fine-grained sediments. Site is backed by steep dunes comprised of calcareous sand. – Hydrology: Macro-tidal regime. No significant surface water inflows. Groundwater interactions unknown (knowledge gap). – Primary production and nutrient cycling: Data deficient, but organic material deposited from ocean currents driving the system through bacterial or microphytobenthos driven primary production. – Invertebrates: Large numbers and diversity of invertebrates within the intertidal mudflat areas. – Fish: Data deficient, but anecdotal evidence of marine fish (including sharks and rays) using inundated mudflats. – Waterbirds: Significant site for stop-over and feeding by migratory shorebirds. Regularly supports >200,000 shorebirds during summer and >20,000 during winter. High diversity with 97 species of waterbird recorded from the beach. Regularly supports >1% of the flyway population of 20 species. – Marine turtles: Significant breeding site for the Flatback Turtle. • Mandora Salt Marsh: – Geomorphology: Wetland formation dominated by alluvial processes. Wetlands were once a part of an ancient estuary. Freshwater springs have been dated at 7,000 years old. – Hydrology: Lake Walyarta, East Lake and the surrounding intermittently inundated paperbark thickets are inundated by rainfall and local runoff. Extensive inundation occurs following large cyclonic events. Salt Creek and the mound springs are groundwater fed systems through the Broome Sandstone aquifer. – Water quality: Most wetlands are alkaline reflecting the influence of soils and groundwater. Salinity is variable, mound springs are fresh, Salt Creek hyper-saline and Lake Walyarta variable with inundation. Nutrient concentrations in groundwater and groundwater fed systems are high. – Primary production and nutrient cycling: Data deficient. However, evidence of boom-and-bust cycle at Lake Walyarta with seasonal inundation. – Vegetation: Inland mangroves (*Avicennia marina*) lining Salt Creek are one of only two occurrences of inland mangroves in Australia. Paperbark thickets dominated by the saltwater paperbark (*Melaleuca alsophila*) extend across the site on clay soils which retain moisture longer than the surrounding landscape. Samphire (*Tecticornia* spp.) occurs around the margins of the large lakes. Freshwater aquatic vegetation occurs at Lake Walyarta when inundated and at the mound spring sites year round. – Invertebrates: Data limited, but potentially unique species – Waterbirds: Significant site for waterbirds and waterbird breeding, particularly during extensive inundation events. 66 waterbirds recorded. Supports >1% of the population of at least two species. Breeding recorded for at least 24 species. **Ecosystem benefits and services** • Provisioning service–Freshwater: The freshwater springs at Mandora Salt Marsh provide drinking water for livestock. • Provisioning service–Genetic resources: Plausible, but as yet no documented uses. • Regulating service– Climate regulation: Plausible, but data deficient. • Regulating service–Biological control of pests: Evidence that many of the shorebirds feed on the adjacent pastoral land and that the incidence of 2.88 million oriental pratincole coincided with locusts in almost plague proportions, upon which the birds fed. • Cultural Services–Recreation and tourism: The beach portion of the site is important for recreational fishing, tourism, bird watching and shell collecting. • Cultural Services–Spiritual and inspirational: Spiritually significant for the Karajarri and Nyangumarta and contain a number of specific culturally significant sites. Site has inspirational, aesthetic and existence values at regional, state and national levels. • Cultural Services–Scientific and educational: Mandora Salt Marsh and Eighty-mile Beach have been the site of a number of significant scientific investigations. In addition, Eighty-mile

Summary of the ecological character of Ramsar wetlands
Beach is a significant site for migratory shorebird monitoring and is currently part of the Shorebirds 2020 program. • Supporting services: As evidenced by the listing of the Eighty-mile Beach Ramsar site as a wetland of international importance. The system provides a wide range of biodiversity related ecological services critical for the ecological character of the site including: – contains exceptionally large examples of wetland types and includes rare wetland types of special scientific interest – supports significant numbers of migratory shorebirds – supports waterbird breeding – supports marine turtles.
Ord River Floodplain
The Ord River Floodplain Ramsar site is located in the northeast of WA, ~8 km east of the town of Wyndham within the Victoria-Bonaparte bioregion. The site covers over 140,000 hectares and lies within the Shire of Wyndham–East Kimberley. The Ord River Floodplain site contains a wide range of wetland types and includes inland and marine components. The Ramsar site comprises: Parry Lagoons, Ord Estuary, and False Mouths of the Ord. The following summary of ecosystem components, processes and services has been extracted from Hale (Ref. 14). **Ecosystem components and processes** • Climate: semi-arid monsoonal; 80% of rainfall in the wet season (December to February); on average evaporation exceeds rainfall in 11 of 12 months • Geomorphology: estuarine reaches of river; tidal flat creek system (False Mouths of Ord); seasonally inundated floodplain with permanent waterholes (Parry Lagoons). • Hydrology: macro-tidal influence; modified flows from dams upstream; low flow during dry season; higher flows in wet season; overbank flows from the Ord River to Parry Lagoons now low frequency; Parry Creek major source of water for Parry Lagoons (and floodplains) • Water Quality: estuary is highly turbid; potentially high nutrient levels from upstream agriculture; estuary is a net exporter of nutrients; salinity in estuary varies seasonally (30–35 ppt in dry season; < 4 ppt in wet); Parry Lagoons predominantly fresh; levels of agrichemicals above ANZECC guidelines detected • Phytoplankton: estuary dominated by diatoms; plankton is predominantly epibenthic • Vegetation: extensive mangroves in intertidal areas – 15 species; saltmarsh at higher elevations; Parry Lagoons characterised by extensive sedge / grass lands (intermittent inundation); aquatic vegetation in permanent waterholes; wooded swamp surrounding • Invertebrates: commercially significant taxa include mud crabs and white banana prawns; data deficient for other communities and populations • Fish: > 50 species (estuarine, marine and freshwater); migratory route for ~17 species; supports threatened taxa listed under the EPBC Act (Freshwater Sawfish, Green Sawfish and Northern River Shark) • Birds: Regularly supports >20,000 waterbirds; breeding recorded for 16 species; regularly supports >1 % of the population of Plumed Whistling Duck and Little Curlew; supports the EPBC listed species the Australian Painted Snipe • Crocodiles: supports Saltwater and Freshwater Crocodiles **Ecosystem services** • Provisioning service–Wetland products: commercial fisheries for a number of species of fish, as well as prawns and crabs; genetic resources - plausible, but as yet no documented uses • Regulating services–Erosion control: mangroves • Regulating services–Climate regulation: plausible, but data deficient • Regulating services–Biological control of pests: support of predators of agricultural pests • Cultural services–Recreation and tourism: site is important for recreational fishing; tourism; bird watching and crocodile watching • Cultural services–Spiritual and inspirational: spiritually significant for the Miriuwung, Gajerrong and contain a number of specific culturally significant sites; site has inspirational,

Summary of the ecological character of Ramsar wetlands
aesthetic and existence values at regional, state and national levels; the site contains a number of non-indigenous historical sites • Cultural services–Scientific and educational: focus of scientific research (e.g. CSIRO investigation) • Supporting services: as evidenced by the listing of the Ord River Floodplain site as a wetland of international importance; the system provides a wide range of biodiversity related ecological services critical for the ecological character of the site including: – supporting diverse habitat types – supporting critical life stages – supporting threatened species – supporting waterbird populations – supporting fish populations.
Peel-Yalgorup System
The Peel-Yalgorup wetland system, in south-western Australia, is located ~80 km south of Perth within the Swan Coastal Plain bioregion. The 26,000 ha site includes shallow estuarine waters, saline, brackish and freshwater wetlands of the Peel Inlet, Harvey Estuary, several lake systems including Lake McLarty and Lake Mealup and the Yalgorup National Park. The following summary of ecosystem components, processes and services has been extracted from Hale and Butcher (Ref. 15). **Ecosystem components and processes** • Peel-Harvey Estuary – Geomorphology: Shallow bar-built estuary. Narrow connection to the Indian Ocean (Mandurah Channel). Organic sediments (black ooze). – Hydrology: Highly seasonal freshwater inflows from direct precipitation and rivers. Limited tidal exchange with the Indian Ocean. Limited groundwater inflows. – Water Quality: High concentrations of nutrients (eutrophic) from catchment. Seasonal variability in salinity. Stratification and deoxygenation of bottom waters. – Acid Sulfide Soils: Monosulphidic black ooze. Exposed via dredging. – Phytoplankton: Winter diatom blooms. Spring Nodularia blooms in the Harvey Estuary. – Benthic Plants: Excessive growth of green macroalgae (Cladophora and/or Chaetomorpha) in the Peel Inlet. Smothering of seagrass. – Littoral Vegetation: Samphire communities around the shorelines. Paperbark communities in the Harvey River delta. – Invertebrates: Commercially significant taxa include blue swimmer crabs and western king prawns. Diverse communities in the estuary and the intertidal zones – Fish: Estuarine and marine species. Migratory route for some species. – Birds: High diversity and abundance of waterbirds. Regularly supports >20,000 waterbirds (maximum recorded 150,000 individuals). Breeding recorded for 12 species. Regularly supports >1% of the population of 11 species. • Yalgorup Lakes – Geomorphology: Shallow depressional wetlands. No defined surface water inflow or outflow channels. – Hydrology: Highly seasonal freshwater in-flows predominantly from groundwater. No surface water outflows. – Water quality: Brackish to hypersaline conditions. Seasonal salinity cycles. Low nutrient concentrations. Some lakes exhibit stratification. Highly alkaline (calcium and bicarbonate). – Benthic microbial community: Thrombolites in Lake Clifton. Cyanobacterial algal mats across the sediment surface in some lakes. – Flora: Small buffer zones. Some areas of paperbark communities. – Fauna: Significant site for waterbirds. Large numbers of Shelduck and Black Swans annually. 1% of population of Banded Stilt, Red-necked Stint, Hooded Plover, Shelduck and Musk Duck. Breeding of eight species.

Summary of the ecological character of Ramsar wetlands
• Lakes McLarty and Mealup – Geomorphology: Shallow depressional wetlands. No defined surface water inflow or outflow channels. – Hydrology: Highly seasonal freshwater inflows predominantly from groundwater. No natural surface water outflows (although there are drains present). – Water quality: Fresh to brackish conditions. Alkaline. – Flora: Typha across parts of each lake. Sedges on the margins. Paperbark community at higher elevations. – Fauna: Important habitat for freshwater invertebrates. Provides habitat for a large diversity and number of waterbirds. Breeding recorded for 12 species of waterbird. **Ecosystem services** • Provisioning services–Wetland products: Commercial fisheries for a number of species of fish, as well as prawns and crabs. • Regulating services–Pollution control and detoxification: Peel Inlet and Harvey Estuary act as sinks for nutrients from the catchment and a mechanism for discharges to the sea. • Regulating services–Climate regulation: Data deficient – plausible but not documented. Regulating service–Flood control: Site acts as a receiver for drainage water from the surrounding floodplain. • Cultural services–Recreation and tourism: The Peel Inlet and Harvey Estuary are important recreational fisheries. Passive recreational activities such as bird watching occur both in the estuarine and wetland areas within the site. The Peel Inlet and Harvey Estuary are important for water based recreational activities and water sports such as boating. • Cultural services–Spiritual and inspirational: Wetlands and estuarine areas are spiritually significant for the Nyoongar and contain a number of specific culturally significant sites. The site has inspirational, aesthetic and existence values at regional, state and national levels. • Cultural services–Scientific and educational: The Peel Inlet and Harvey Estuary are the sites for long-term monitoring dating back several decades. Lake Clifton represents one of very few places at which thrombolites can be studied. • Supporting services–Biodiversity: As evidence by the listing of the Peel-Yalgorup site as a wetland of international importance. The system provides a wide range of biodiversity values including: – supporting a wide range of ecological communities – supporting a number of regionally, nationally and internationally threatened species – supporting a high diversity of species (flora and fauna) – supporting a bio-regionally unique community (thrombolites). • Supporting services–Nutrient cycling: The Peel-Yalgorup system plays a large role in the recycling and discharge of nutrients from the surrounding catchment. Carbon sequestration – data deficient but plausible.
Roebuck Bay
The Roebuck Bay Ramsar site comprises 34,119 ha, mostly occupied by intertidal mudflats. Waters more than 6 m deep at low tide are excluded from the site, which stretches from Campsite (a location on the northern shore of Roebuck Bay) east of the town of Broome, to south of Sandy Point. The soft bottom intertidal mudflats of the northern and eastern shores of Roebuck Bay, and high tide roosts at Bush and Sandy Points are the most biologically significant parts of the site, which was listed for several reasons including, most notably, outstanding shorebird values. The following summary of ecosystem components, processes and services has been extracted from Bennelongia (Ref. 16). **Ecosystem components and processes** • Climate: The climate of the Broome region is semi-arid, monsoonal with a distinct wet (October to February) and dry season (March to September). Cyclonic flooding during the summer wet season results in periodic inundation of Roebuck Plains and drainage of freshwater off the Plains and through the mangroves. • Ocean currents: The Indonesian Flowthrough flows westwards from the Pacific to the Indian Ocean. This in turn provides a mass of warm water to the Leeuwin current off Western Australia as it sweeps south along the west coast and east along the south coast.

Summary of the ecological character of Ramsar wetlands
• Tidal variation: Tides in the vicinity of Broome have a very large range (9.5 m), thus exchange through the Bay is high, tidal velocities are relatively high and large mudflats have developed. • Geomorphology: A megascale irregular curved embayment that contains a wide expanse of intertidal mud and sand flats indented by microscale linear tidal creeks. • Sediment structure: Three main sediment provinces have been identified: northern sands province, eastern silt and clay province and southern sands province. • Hydrology: The Broome Sandstone contains the most utilised (Broome water supply) and hence most threatened groundwater resource in the Canning Basin. The Broome Sandstone is generally an unconfined aquifer recharged by direct infiltration from rainfall. The Broome sandstone will be discharging groundwater to the surface or subsurface at the margins of the Roebuck plains and tidal creek systems. There will also be deep submarine groundwater discharge occurring at or below the low tide mark and within Roebuck deeps. The Broome Sandstone will be discharging groundwater to the coupled Roebuck Bay/Roebuck Plains system from all landward directions. This may create freshwater dependant ecological niches which could be threatened by regional water use or pollution. Roebuck Plains produces large amounts of sheetwash into the bay after large cyclonic events or prolonged wet season rains. This will be an important vector for nutrients, organic carbon and freshwater into the bay. • Water quality: Water quality appears poor, with TP levels, although there is limited information available from similar marine systems for comparison. Consideration has been given to the impact of urban run-off into the marine ecosystem. Agricultural activities may influence water quality from rangeland run-off during flood events. • Littoral vegetation: Along the sea edge there are mangrove communities. Mangrove detritus is a major source of energy for animals in the mangal and, perhaps, some mudflat species. Behind the mangal is an extensive plain of saline grassland that rises to the pindan plains typical of the western desert. Samphire occurs in the wetter zones. On beach dunes spinifex dominates. • Plankton and diatoms: Stable isotopes of carbon and nitrogen have shown that plankton and diatoms are a major source of energy for shellfish in the Bay. • Benthic invertebrates: Roebuck Bay has one of the most diverse arrays of benthic invertebrate infauna for any intertidal ecosystem. Species numbers are dominated by polychaetes. There is a rich assemblage of bivalves that provide an important source of accessible food for shorebirds. The average density of macrobenthic fauna is around 1287 animals per square metre. • Birds: The bay provides important food resources and refuge for migrating arctic shorebirds. A total of 43 species of waterbirds are recorded for the Bay including 22 species listed in migratory bird agreements. • Fish: The mudflats and mangrove creeks are nurseries for at least 4 fish species, for commercial prawn species and for mudcrabs • Marine fauna: Dugongs have been regular and important inhabitants of Roebuck Bay. Earlier records show evidence of Dugongs feeding on extensive seagrass beds in 1986. Loggerhead Turtles and Green Turtles regularly use the Ramsar site as a seasonal feeding area and as a transit area on migration. Flatback Turtles regularly nest in small numbers around Cape Villaret during the summer months.
Ecosystem services
• Provisioning services–Wetland products: Commercial and recreational fisheries for a number of species of fish, prawns and crabs. Aboriginal people continue to make extensive use of the Bay's natural resources. • Regulating Services–Pollution control and detoxification: No data • Regulating Services–Climate regulation: No data • Cultural service–Recreation and tourism: Major tourism and bird-watching venue. Broome is an important destination for national and international tourism. Active recreational fishing and crabbing activities, boating, hovercraft. • Cultural services–Spiritual and inspirational: Site has inspirational and aesthetic values that are both regional and nationally recognised through travel to Broome. Roebuck Bay is spiritually significant to Aboriginal people belonging to the Yawuru and Jukun groups and contains a number of specific culturally significant sites.

Summary of the ecological character of Ramsar wetlands
• Cultural services–Scientific and educational: Many scientific research programs, especially on shorebirds and mudflat invertebrates, have been based at Roebuck Bay. they have often involved Broome Bird Observatory, near Fall Point. • Supporting Services–Biodiversity: Key location in global flyway for migratory waders. Nursery values for prawns and fish. Seagrass beds for Dugong.

2.5 Listed threatened and migratory species

The Species of National Environmental Significance (SNES) database (Ref. 17) stores maps and point distribution information about species related to the EPBC Act.

The Biologically Important Areas (BIAs) of Regionally Significant Marine Species database (Ref. 18) uses the marine bioregional planning program to identify, describe, and map BIAs for protected species under the EPBC Act. BIAs spatially and temporally define areas where protected species display biologically important behaviours (including breeding, foraging, resting, or migration).

The following information was generated from the Biologically Important Areas of Regionally Significant Marine Species database (Ref. 18), the Species of National Environmental Significance (Public Grids) database (Ref. 17), and a protected matters search (appendix a; Ref. 4).

2.5.1 Marine mammals

Table 2-5 lists the threatened and/or migratory marine mammals that may be present within the PA (Ref. 17; Ref. 4; appendix a).

Table 2-6 lists the individual BIAs for marine mammals and their known seasonal presence within the PA (Ref. 18); these are shown in Figure 2-1.

A review of the Conservation Advices and/or Recovery Plans identified key threats associated with threatened and/or migratory marine mammals that may be present within the PA. These threats and relevant management advice are listed in Table 2-7.

Table 2-5: Threatened and/or migratory marine mammals

Common name	Scientific name	Threatened status	Migratory
Antarctic Minke Whale, Dark-shoulder Minke Whale	*Balaenoptera bonaerensis*		Migratory
Sei Whale	*Balaenoptera borealis*	Vulnerable	Migratory
Bryde’s Whale	*Balaenoptera edeni*		Migratory
Blue Whale	*Balaenoptera musculus*	Endangered	Migratory
Fin Whale	*Balaenoptera physalus*	Vulnerable	Migratory
Pygmy Right Whale	*Caperea marginata*		Migratory
Dugong	*Dugong dugon*		Migratory
Southern Right Whale	*Eubalaena australis*	Endangered	Migratory
Dusky Dolphin	*Lagenorhynchus obscurus*		Migratory
Humpback Whale	*Megaptera novaeangliae*	Vulnerable	Migratory

Common name	Scientific name	Threatened status	Migratory
Australian Sea-lion, Australian Sea Lion	*Neophoca cinerea*	Vulnerable	
Australian Snubfin Dolphin	*Orcaella heinsohni*		Migratory
Killer Whale, Orca	*Orcinus orca*		Migratory
Sperm Whale	*Physeter macrocephalus*		Migratory
Indo-Pacific Humpback Dolphin	*Sousa chinensis*		Migratory
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	*Tursiops aduncus* (Arafura/Timor Sea populations)		Migratory

Table 2-6: BIAs for regionally significant marine mammals

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Australian Snubfin Dolphin	Breeding	Year-round	Known to occur
	Calving	Year-round	Known to occur
	Foraging	Year-round	Known to occur
	Foraging (high density prey)	Year-round	Known to occur
	Foraging likely	Year-round	Known to occur
	Resting	Year-round	Known to occur
Indo-Pacific Humpback Dolphin	Breeding	Year-round	Known to occur
	Breeding	Year-round	Likely to occur
	Calving	Year-round	Known to occur
	Calving	Year-round	Likely to occur
	Foraging	Year-round	Known to occur
	Foraging	Year-round	Likely to occur
	Foraging (high density prey)	Year-round	Known to occur
	Foraging (high density prey)	Year-round	Likely to occur
	Significant habitat	Year-round	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Significant habitat – unknown behaviour	Year-round	Likely to occur
Indo-Pacific/Spotted Bottlenose Dolphin	Breeding	Not possible to determine yet	Known to occur
	Calving	Not possible to determine yet	Known to occur
	Foraging	Not possible to determine yet	Known to occur
	Foraging likely	Not possible to determine yet	Known to occur
	Migration likely	Not possible to determine yet	Known to occur
Dugong	Breeding	April/May	Known to occur
	Breeding	Year-round	Known to occur
	Calving	April/May	Known to occur
	Calving	Year-round	Known to occur
	Foraging	April/May	Known to occur
	Foraging	May–September	Known to occur
	Foraging	Year-round	Likely to occur
	Foraging (high density seagrass beds)	April/May	Known to occur
	Foraging (high density seagrass beds)	Year-round	Known to occur
	Migration likely	Year-round	Known to occur
	Nursing	April/May	Known to occur
	Nursing	Year-round	Known to occur
Australian Sea Lion	Foraging (male)	Year-round	Likely to occur
	Foraging (male and female)	Year-round	Known to occur
Blue and Pygmy Blue Whale	Foraging (abundant food source)	Arrive as early as November, with number of animals steadily increasing to peak in March–May. After May the number of whales drops, by late June most animals have	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
		left, although a few acoustic detections are made into July (Ref. 19)	
	Foraging (high-density)	Arrive early as Nov with number of animals increasing to peak in March–May. After May the number of whales drops, late June most animals left, a few acoustic detections are made into July (Ref. 19). Satellite tracking data indicates use mid-March-late April,	Known to occur
	Foraging (on migration)	Arrive early as Nov with number of animals increasing to peak in March–May. After May the number of whales drops, late June most animals left, a few acoustic detections are made into July (Ref. 19). Satellite tracking data indicates use mid-March-late April.	Known to occur
Humpback Whale	Calving	Winter	Known to occur
	Migration	Northern migration, late July to September	Known to occur
	Migration	Winter	Known to occur
	Migration (north)	Northern migration, late July to September	Known to occur
	Migration (north and south)	Northern migration, late July to September	Known to occur
	Migration (north and south)	Northern peak July and southward peak October – November (Ref. 19)	Known to occur
	Migration (north and south)	Southbound peak late Sept to mid-Oct. Northward peak mid-June to mid-July	Known to occur
	Migration (south)	Southbound peak late Sept to mid-Oct	Known to occur
	Nursing	Winter	Known to occur
	Resting	Winter	Known to occur
Pygmy Blue Whale	Distribution		Known to occur
	Foraging		Known to occur
	Foraging area (annual high use area)		Known to occur
	Known foraging area		Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Migration	Northern migration (enter Perth canyon January to May; pass Exmouth April to August; continue north to Indonesia). Southern migration (follow WA coastline from October to late December)	Known to occur
		Most use between October and December, peaking in November	Known to occur
Southern Right Whale	Calving buffer	Late autumn, winter, and spring	Known to occur
	Seasonal calving habitat	Late autumn, winter, and spring	Known to occur
Sperm Whale	Foraging (abundant food source)	Summer	Known to occur

Table 2-7: Summary of relevant conservation plans—marine mammals

Species	Relevant Plan / Advice	Key threats / Relevant management advice
Humpback Whale	Conservation Advice for the Humpback Whale 2015–2020 (Ref. 20)	Assessing and addressing anthropogenic noise; shipping, industrial, and seismic surveys • All seismic surveys must be undertaken consistently with the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales. Should a survey be undertaken in or near a calving, resting, foraging area, or a confined migratory pathway then Part B. Additional Management Procedures must also be applied. • For actions involving acoustic impacts (example pile driving, explosives) on Humpback Whale calving, resting, feeding areas, or confined migratory pathways site-specific acoustic modelling should be undertaken (including cumulative noise impacts). • Should acoustic impacts on humpback calving, resting, foraging areas, or confined migratory pathways be identified a noise management plan should be developed. This can include: – the use of shutdown and caution zones – pre- and post-activity observations – the use of marine mammal observers and/or Passive Acoustic Monitoring – Implementation of an adaptive management program following verification of the noise levels produced from the action (i.e. if the noise levels created exceed original expectations). Minimising vessel collisions • Maximise the likelihood that all vessel strike incidents are reported in the national ship strike database. All cetaceans are protected in Commonwealth waters and, the EPBC Act requires that all collisions with whales in Commonwealth waters are reported. Vessel collisions can be submitted to the National Ship Strike Database at https://data.marinemammals.gov.au/report/shipstrike

Species	Relevant Plan / Advice	Key threats / Relevant management advice
		• Ensure the risk of vessel strike on Humpback Whales is considered when assessing actions that increase vessel traffic in areas where Humpback Whales occur and, if required appropriate mitigation measures are implemented to reduce the risk of vessel strike. • Enhance education programs to inform vessel operators of best practice behaviours and regulations for interacting with Humpback Whales.
Blue Whale	Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 21)	Key threats include: • whaling • climate variability and change • noise interference • habitat modification • vessel disturbance • overharvesting of prey. No relevant management advice has been identified.
Sei Whale	Conservation Advice *Balaenoptera borealis* Sei Whale (Ref. 22)	Assessing and addressing anthropogenic noise: • Once the spatial and temporal distribution (including biologically important areas) of Sei Whales is further defined an assessment of the impacts of increasing anthropogenic noise (including from seismic surveys, port expansion, and coastal development) should be undertaken on this species. Minimising vessel collisions: • Ensure all vessel strike incidents are reported in the national vessel strike database (https://data.marinemammals.gov.au/report/shipstrike).
Fin Whale	Conservation Advice *Balaenoptera physalus* Fin Whale (Ref. 23)	Assessing and addressing anthropogenic noise: • Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined an assessment of the impacts of increasing anthropogenic noise (including from seismic surveys, port expansion, and coastal development) should be undertaken on this species. Minimising vessel collisions: • Ensure all vessel strike incidents are reported in the national vessel strike database
Southern Right Whale	Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011–2021 (Ref. 24)	Key threats include: • entanglement • vessel disturbance • whaling • climate variability and change • noise interference • habitat modification. No relevant management advice has been identified.
Australian Sea Lion	Recovery Plan for the Australian Sea Lion	Key threats include: • interactions with the commercial gillnet fishing sector • mortality due to interactions with the rock lobster industry

Species	Relevant Plan / Advice	Key threats / Relevant management advice
	(*Neophoca cinerea*) (Ref. 25)	• deaths caused by fisheries-related marine debris. Other factors that may be contributing to the lack of recovery include: • habitat degradation and interactions with aquaculture operations • human disturbance to colonies • deliberate killings • disease • pollution and oil spills • prey depletion • climate change. No relevant management advice has been identified.

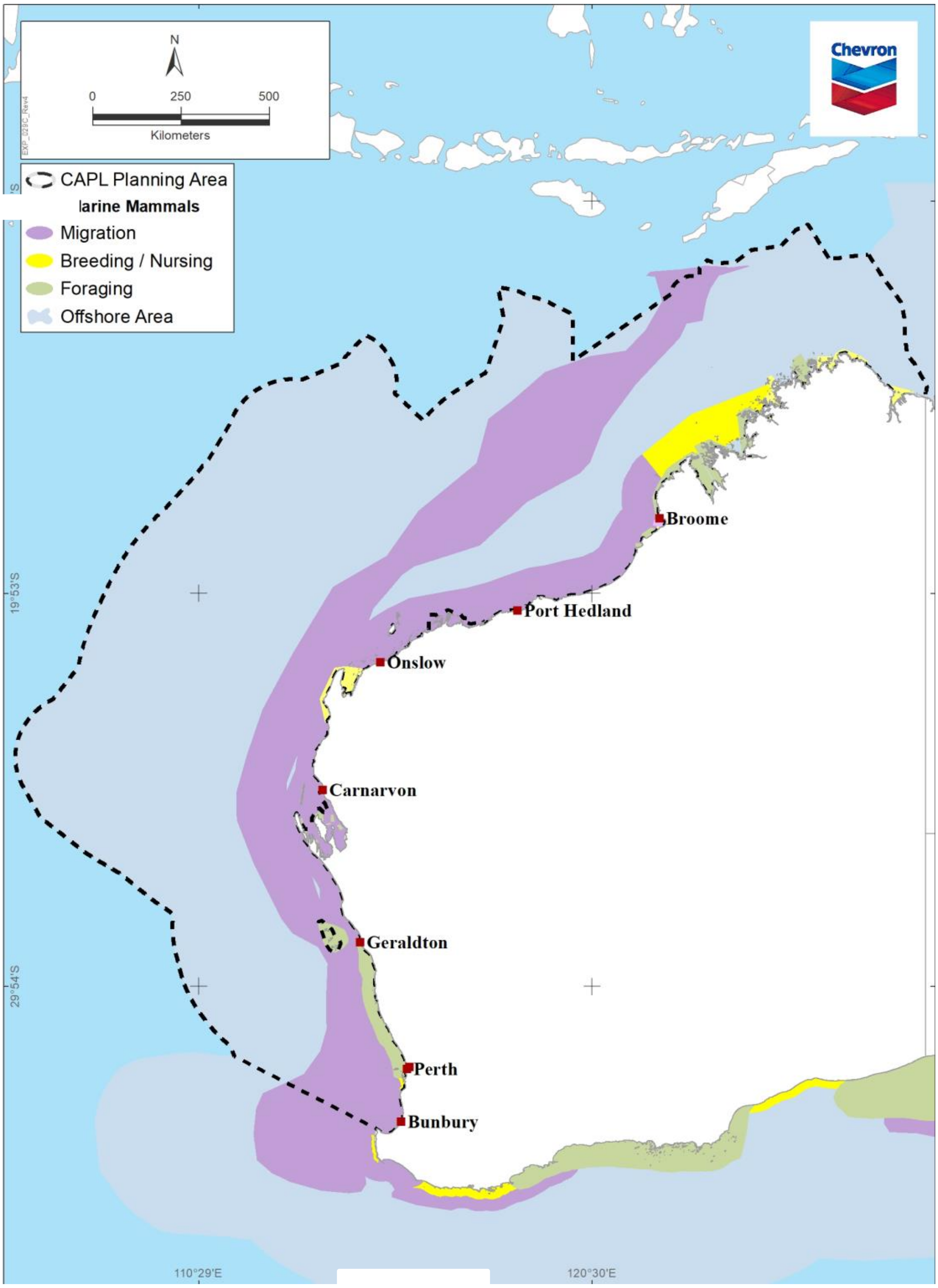


Figure 2-1: BIAs associated with marine mammals

2.5.2 Reptiles

Table 2-8 lists the threatened and/or migratory marine reptile species that may be present within the PA (Ref. 17; Ref. 4; appendix a).

Table 2-9 lists critical nesting habitats within the PA; these are shown on Figure 2-2 (Ref. 26).

Table 2-10 lists the BIAs for marine reptiles and their known seasonal presence within the PA; these are also shown on Figure 2-2 (Ref. 18).

A review of the Conservation Advices and Recovery Plans identified key threats associated with threatened and/or migratory marine reptiles that may be present within the PA. These threats and relevant management advice are listed in Table 2-11.

In addition to the threatened and/or migratory marine reptile species identified in the tables below, an additional 26 listed marine reptile species (all sea snakes except the Freshwater Crocodile [*Crocodylus johnstoni*]) were identified as having the potential to occur within the PA (Ref. 4). Cogger (Ref. 27; Ref. 28) notes that most sea snakes have shallow benthic feeding patterns and are rarely observed in water >30 m deep, indicating that these species are likely to be present in shallow waters.

Table 2-8: Threatened and/or migratory marine reptiles

Common name	Scientific name	Threatened status	Migratory
Short-nosed Seasnake	*Aipysurus apraefrontalis*	Critically Endangered	
Leaf-scaled Seasnake	*Aipysurus foliosquama*	Critically Endangered	
Loggerhead Turtle	*Caretta*	Endangered	Migratory
Green Turtle	*Chelonia mydas*	Vulnerable	Migratory
Salt-water Crocodile, Estuarine Crocodile	*Crocodylus porosus*		Migratory
Leatherback Turtle, Leathery Turtle, Luth	*Dermochelys coriacea*	Endangered	Migratory
Hawksbill Turtle	*Eretmochelys imbricata*	Vulnerable	Migratory
Olive Ridley Turtle, Pacific Ridley Turtle	*Lepidochelys olivacea*	Endangered	Migratory
Flatback Turtle	*Natator depressus*	Vulnerable	Migratory

Table 2-9: Critical habitat for marine turtles

Common name	Location	Seasonal presence	Occurrence descriptor
Loggerhead Turtle	Exmouth Gulf and Ningaloo Coast. 20 km internesting buffer	Nov–May	Known to occur
	Gnaraloo Bay and beaches. 20 km internesting buffer	Nov–May	Known to occur
	Shark Bay, all coastal and island beaches out to the northern tip of Dirk Hartog Island. 20 km internesting buffer	Nov–May	Known to occur
Green Turtle	Mainland east of Mary Island to mainland adjacent to Murrara Island including all offshore islands. 20 km internesting buffer	Nov–Mar	Known to occur
	Ashmore Reef and Cartier Reef. 20 km internesting buffer	Dec–Jan	Known to occur
	Browse Island. 20 km internesting buffer	Nov–Mar	Known to occur
	Scott Reef. 20 km internesting buffer	Nov–Mar	Known to occur
	Adele Island, Lacepede Islands	Nov–Mar	Known to occur

Common name	Location	Seasonal presence	Occurrence descriptor
	Dampier Archipelago. 20 km internesting buffer	Nov–Mar	Known to occur
	Barrow Island, Montebello Islands, Serrurier Island, and Thevenard Island. 20 km internesting buffer	Nov–Mar	Known to occur
	Exmouth Gulf and Ningaloo Coast. 20 km internesting buffer	Nov–Mar	Known to occur
Hawksbill Turtle	Dampier Archipelago, including Delambre Island and Rosemary Island. 20 km internesting buffer	Oct–Feb	Known to occur
	Cape Preston to mouth of Exmouth Gulf including Montebello Islands and Lowendal Islands. 20 km internesting buffer	Oct–Feb	Known to occur
Olive Ridley Turtle	Cape Leveque. 20 km internesting buffer	May–Jul	Known to occur
	Prior Point and Llanggi. 20 km internesting buffer	May–Jul	Known to occur
	Darcy Island. 20 km internesting buffer	May–Jul	Known to occur
	Vulcan Island. 20 km internesting buffer	May–Jul	Known to occur
Flatback Turtle	Cape Domett and Lacrosse Island in the Cambridge Gulf. 60 km internesting buffer	Aug–Sep	Known to occur
	Lacepede Islands. 60 km internesting buffer	Oct–Mar	Known to occur
	Eco Beach – coastal beach near Broome. 60 km internesting buffer	July	Known to occur
	Eighty Mile Beach – coastal beach. 60 km internesting buffer	July	Known to occur
	Cemetery Beach, Port Hedland. 60 km internesting buffer	Oct–Mar	Known to occur
	Mundabullangana Beach. 60 km internesting buffer	Oct–Mar	Known to occur
	Dampier Archipelago, including Delambre Island and Hauy Island. 60 km internesting buffer	Oct–Mar	Known to occur
	Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island. 60 km internesting buffer	Oct–Mar	Known to occur

Table 2-10: BIAs for regionally significant marine reptiles

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Flatback Turtle	Aggregation		Known to occur
	Foraging	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Foraging	January – Flatbacks, Greens	Known to occur
	Foraging	Observations during July, no evidence of turtle activity Oct–Nov for Solitary, Steamboat,	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
		Carey, Preston Islands, and Cape Preston	
	Foraging	Year-round	Known to occur
	Internesting		Known to occur
	Internesting buffer	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Internesting buffer	January – Flatbacks, Greens	Known to occur
	Internesting buffer	Summer	Known to occur
	Internesting buffer	Summer (nesting /internesting), year-round	Known to occur
	Mating	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Migrating Corridor	Summer (nesting/interesting) year-round	Known to occur
	Nesting	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Nesting	January – Flatbacks, Greens	Known to occur
	Nesting	Short summer nesting season, predominantly Nov–Mar with peak in January	Known to occur
	Nesting	Summer	Known to occur
Green Turtle	Aggregation	Early summer	Known to occur
	Aggregation		Known to occur
	Basking	Summer	Known to occur
	Foraging	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Foraging	January – Flatbacks, Greens	Known to occur
	Foraging	March–May	Likely to occur
	Foraging	Observations during July, no evidence of turtle activity Oct–Nov for Solitary, Steamboat, Carey, Preston Islands, and Cape Preston	Known to occur
	Foraging	Summer	Known to occur
	Foraging	Summer / possibly year-round	Known to occur
	Foraging	Year-round	Known to occur
	Foraging	Year-round	Likely to occur
	Foraging		Known to occur
	Internesting	Dec–Feb	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Internesting	Peak season Dec–Jan	Known to occur
	Internesting	Summer	Known to occur
	Internesting	Year-round	Likely to occur
	Internesting		Known to occur
	Internesting buffer	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Internesting buffer	January – Flatbacks, Greens	Known to occur
	Internesting buffer	Peak season Dec–Jan	Known to occur
	Internesting buffer	Summer	Known to occur
	Internesting buffer	Summer (nesting /internesting) year-round	Known to occur
	Internesting buffer	Year-round	Known to occur
	Internesting buffer	Year-round	Likely to occur
	Internesting buffer		Known to occur
	Mating	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Mating	Summer	Known to occur
	Mating	Year-round	Likely to occur
	Mating		Known to occur
	Migrating Corridor	Summer (nesting/interesting) year-round	Known to occur
	Nesting	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Nesting	January – Flatbacks, Greens	Known to occur
	Nesting	Peak season Dec–Jan	Known to occur
	Nesting	Summer	Known to occur
	Nesting	Year-round	Known to occur
	Nesting	Year-round	Likely to occur
	Nesting		Known to occur
Hawksbill Turtle	Foraging	Aggregation inside of NW Is. Early in summer	Known to occur
	Foraging	Observations during July no evidence of turtle activity Oct–Nov for Solitary, Steamboat, Carey, Preston Islands, and Cape Preston	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Foraging	Year-round	Known to occur
	Foraging	Year-round	Likely to occur
	Internesting	Spring and early summer, peak nesting October	Known to occur
	Internesting buffer	Spring and early summer, peak nesting October	Known to occur
	Internesting buffer	Peak nesting in spring and early summer	Known to occur
	Internesting buffer		Known to occur
	Internesting buffer	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Internesting buffer	Year-round	Known to occur
	Internesting buffer	Year-round	Likely to occur
	Internesting buffer	Peak season Dec–Jan	Likely to occur
	Internesting buffer	Peak nesting in spring and early summer	Likely to occur
	Mating	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Mating	Spring and early summer, peak nesting October	Known to occur
	Mating	Year-round	Known to occur
	Nesting	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Nesting	Peak nesting in spring and early summer	Known to occur
	Nesting	Peak season Dec–Jan	Known to occur
	Nesting	Spring and early summer, peak nesting October	Known to occur
	Nesting	Year-round	Known to occur
	Nesting	Year-round	Likely to occur
	Nesting		Known to occur
Loggerhead Turtle	Foraging	Year-round	Known to occur
	Foraging		Known to occur
	Internesting	Dec–Mar	Known to occur
	Internesting buffer	Dec–Mar	Known to occur
	Internesting buffer	Peak season monitored	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Internesting buffer		Known to occur
	Nesting	Dec–Mar	Known to occur
	Nesting	Peak season monitored	Known to occur
	Nesting		Known to occur
Olive Ridley Turtle	Foraging		Known to occur

Table 2-11: Summary of relevant conservation plans—marine reptiles

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Caretta caretta (Loggerhead Turtle) *Chelonia mydas* (Green Turtle) *Dermochelys coriacea* (Leatherback Turtle, Leathery Turtle, Luth) *Eretmochelys imbricata* (Hawksbill Turtle) *Natator depressus* (Flatback Turtle)	Recovery Plan for Marine Turtles in Australia (Ref. 29)	Key threats include: • climate change and variability • marine debris • chemical and terrestrial discharge • international take • terrestrial predation • fisheries bycatch • light pollution • habitat modification • Indigenous take • vessel disturbance • noise interference • recreational activities • diseases and pathogens. Details regarding relevant threats: • A3: Reduce the impacts from marine debris • A4: Minimise chemical and terrestrial discharge: – Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', e.g. nesting habitat, seagrass meadows, or coral reefs – Quantify the impacts of decreased water quality on stock viability – Quantify the accumulation and effects of anthropogenic toxins in marine turtles, their foraging habitats, and subsequent stock viability. • A8: Minimise light pollution: – Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats – Develop and implement best practice light management guidelines for existing and future developments

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		adjacent to marine turtle nesting beaches – Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.
Dermochelys coriacea (Leatherback Turtle, Leathery Turtle, Luth)	Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (Ref. 30)	Key threats include: • incidental capture in commercial fisheries • harvest of eggs and meat • ingestion of marine debris • vessel disturbance / boat strike • predation on eggs by wild dogs (*Canis familiaris*), pigs (*Sus scrofa*) and monitor lizards (*Varanus salvator*) • degradation of foraging areas • changes to breeding sites. No relevant management advice has been identified.
Aipysurus apraefrontalis (Short-nosed Sea Snake)	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (Ref. 31)	Key threats include: • changes to the inner region of Ashmore Reef (sand encroachment) that has caused coral outcrops that previously supported high densities of sea snakes to be filled in with sand • increases in water temperatures observed in Ashmore and surrounding reefs associated with El Niño events, which may have impacted the species directly or indirectly by contributing to further habitat degradation • oil and gas exploration, including seismic surveys and exploration drilling • incidental catch and death in commercial prawn trawling fisheries. Unsustainable and illegal fishing practices are recognised as the most significant direct and indirect threat to natural processes and biological diversity in the Ashmore Reef region. No relevant management advice has been identified.
Aipysurus foliosquama (Leaf-scaled Sea Snake)	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (Ref. 32)	Key threats include: • changes to the inner region of Ashmore Reef (sand encroachment) – coral outcrops that previously supported high densities of sea snakes are now filled with sand • increases in water temperatures observed in Ashmore and surrounding reefs associated with El Niño events, which may have impacted the species directly or indirectly by contributing to further habitat degradation • oil and gas exploration, including seismic surveys and exploration drilling • incidental catch and death in commercial prawn trawling fisheries. Unsustainable and illegal fishing practices are recognised as

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		the most significant direct and indirect threat to natural processes and biological diversity in the Ashmore Reef region. No relevant management advice has been identified.

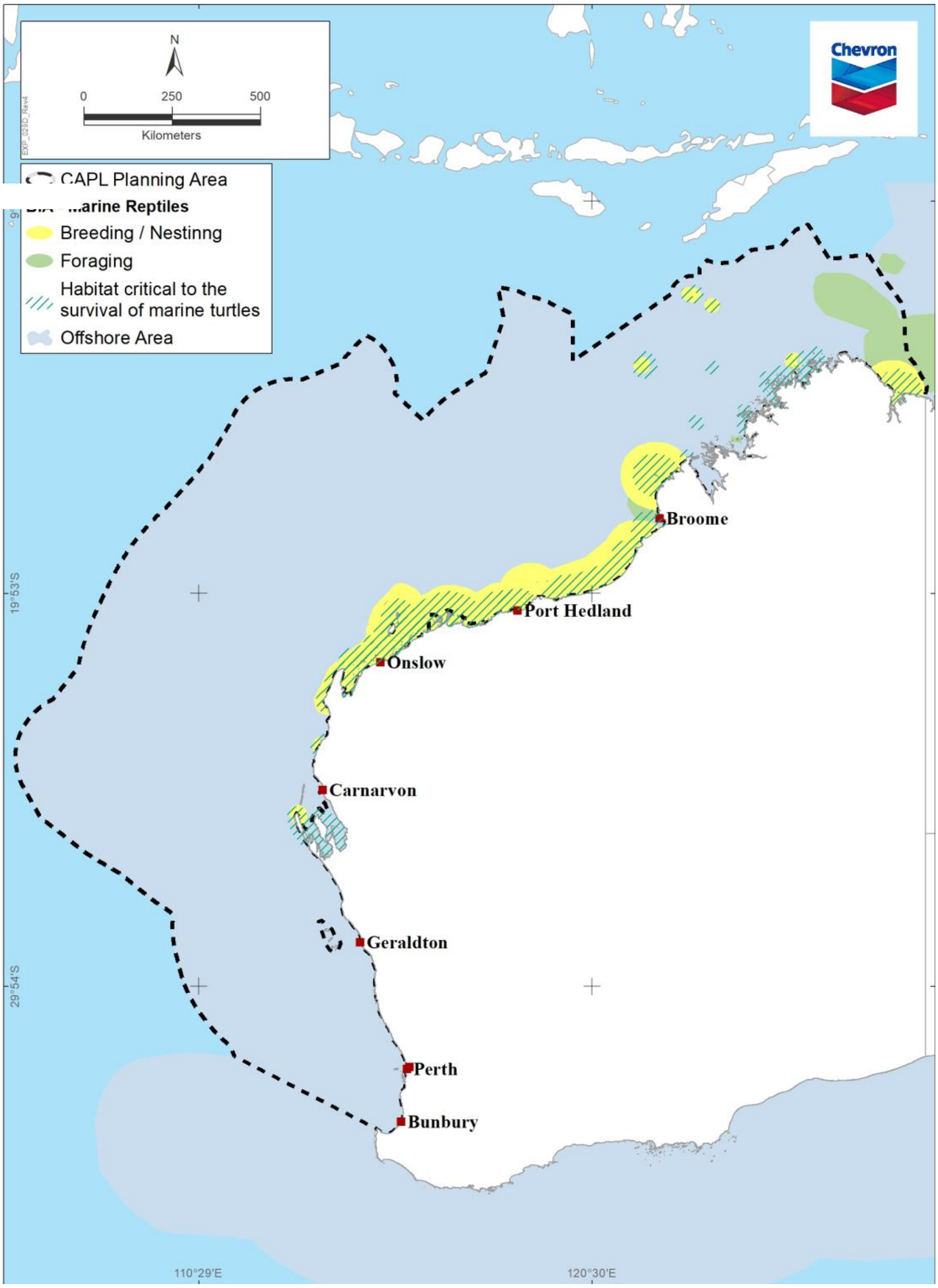


Figure 2-2: BIAs associated with marine reptiles

2.5.3 Fishes, including sharks and rays

Table 2-12 lists the threatened and/or migratory fishes (including sharks and rays) that may be present within the PA (Ref. 17; Ref. 4; appendix a).

Table 2-13 lists the BIAs for fishes (including sharks and rays) and their known seasonal presence within the PA (Ref. 18); these are shown in Figure 2-3.

Within the PA, 61 solenostomid and syngnathid species that are listed marine species have been identified as having the potential to occur (appendix a; Ref. 4).

Almost all syngnathids live in nearshore and inner shelf habitats, usually in shallow coastal waters, among seagrasses, mangroves, coral reefs, macroalgae-dominated reefs, and sand or rubble habitats (Ref. 33; Ref. 34; Ref. 35; Ref. 36). Although two species have been identified in the North-west Marine Region in deeper waters (Winged Seahorse [*Hippocampus alatus*] and Western Pipehorse [*Solegnathus* sp. 2]; Ref. 37), these species were not identified by the SNES search of the PA (Ref. 17).

A review of the Conservation Advices and Recovery Plans identified key threats associated with threatened and/or migratory fishes (including sharks and rays) that may be present within the PA. These threats and relevant management advice are included in Table 2-14.

Table 2-12: Threatened and migratory fishes, including sharks and rays

Common name	Scientific name	Threatened status	Migratory
Narrow Sawfish, Knifetooth Sawfish	*Anoxypristis cuspidata*		Migratory
Grey Nurse Shark (west coast population)	*Carcharias taurus* (west coast population)	Vulnerable	
Oceanic Whitetip Shark	*Carcharhinus longimanus*		Migratory
White Shark, Great White Shark	*Carcharodon carcharias*	Vulnerable	Migratory
Northern River Shark, New Guinea River Shark#	*Glyphis garricki*	Endangered	
Speartooth Shark#	*Glyphis glyphis*	Critically Endangered	
Shortfin Mako, Mako Shark	*Isurus oxyrinchus*		Migratory
Longfin Mako	*Isurus paucus*		Migratory
Porbeagle, Mackerel Shark	*Lamna nasus*		Migratory
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray	*Manta alfredi*		Migratory
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	*Manta birostris*		Migratory
Blind Gudgeon*	*Milyeringa veritas*	Vulnerable	
Balston's Pygmy Perch^	*Nannatherina balstoni*	Vulnerable	
Blind Cave Eel*	*Ophisternon candidum*	Vulnerable	

Common name	Scientific name	Threatened status	Migratory
Dwarf Sawfish, Queensland Sawfish	*Pristis clavata*	Vulnerable	Migratory
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish#	*Pristis pristis*	Vulnerable	Migratory
Green Sawfish, Dindagubba, Narrowsnout Sawfish	*Pristis zijsron*	Vulnerable	Migratory
Whale Shark	*Rhincodon typus*	Vulnerable	Migratory
** Subterranean fauna species identified in the Protected Matters Search Report (appendix a; Ref. 4) but not expected to be exposed to CAPL's activities.* *# Species mainly located inland (freshwater and estuarine habitats) identified in the Protected Matters Search Report but with the potential to be present offshore (neritic and intertidal zones) and exposed to CAPL's activities.* *^ Freshwater species located inland identified in the Protected Matters Search Report but not expected to be exposed to CAPL's activities.*			

Table 2-13: BIAs for regionally significant fishes, including sharks and rays

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Dwarf Sawfish	Foraging	All seasons	Known to occur
	Foraging	Use in dry season to early wet (Dec)	Known to occur
	Foraging		Known to occur
	Juvenile	All seasons	Known to occur
	Nursing	All seasons	Known to occur
	Nursing	Use in dry season to early wet (Dec)	Known to occur
	Nursing		Known to occur
	Pupping	All seasons	Known to occur
	Pupping		Known to occur
Freshwater Sawfish	Foraging	All seasons	Known to occur
	Foraging	Pupping occurs from Jan–May	Known to occur
	Foraging	Pupping occurs from Jan–May, more prevalent during the late wet season when mature animals have more water to manoeuvre in	Known to occur
	Juvenile	Pupping occurs from Jan–May	Known to occur
	Nursing	All seasons	Known to occur
	Nursing	All seasons	Likely to occur
	Pupping	Pupping occurs from Jan–May	Known to occur
	Pupping	Pupping occurs from Jan–May	Likely to occur
	Pupping	Pupping occurs from Jan–May, more prevalent during the late wet season when mature animals	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
		have more water to manoeuvre in	
Green Sawfish	Foraging		Known to occur
	Nursing		Known to occur
	Pupping		Known to occur
Whale Shark	Foraging	Spring	Known to occur
	Foraging (high density prey)	Apr–Jun, autumn	Known to occur
	Foraging		Known to occur

Table 2-14: Summary of relevant conservation plans—fishes, including sharks and rays

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Pristis zijsron (Green Sawfish, Dindagubba, Narrowsnout Sawfish) *Pristis clavata* (Dwarf Sawfish) *Glyphis garricki* (Northern River Shark) *Glyphis* (Speartooth Shark)	Sawfish and River Sharks Multispecies Recovery Plan (Ref. 38)	Key threats include: • fishing activities including: being caught as bycatch in the commercial and recreational sectors; through Indigenous fishing; and illegal, unreported, and unregulated fishing • habitat degradation and modification. Other potential threats to the species include the collection of animals for display in public aquaria and marine debris. No relevant management advice has been identified.
	Approved Conservation Advice for Green Sawfish (Ref. 39)	The main potential threats to Green Sawfish include: • incidental capture as bycatch and by-product in gillnet and trawl fisheries • illegal capture for fins and rostra • habitat degradation through coastal development. No relevant management advice has been identified.
	Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (Ref. 40)	The main identified threats to Dwarf Sawfish include: • incidental capture as bycatch in commercial and recreational net fishing • illegal, unreported, and unregulated fishing. No relevant management advice has been identified.
	Approved Conservation Advice for *Glyphis garricki* (Northern River Shark) (Ref. 41)	The main identified threats to Northern River Sharks include: • commercial, recreational, and Indigenous fishing activities • IUU fishing • habitat degradation and modification.

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		No relevant management advice has been identified.
	Approved Conservation Advice for *Glyphis* (Speartooth Shark) (Ref. 42)	The main identified threats to Speartooth Sharks include: • commercial, recreational, and Indigenous fishing activities • IUU fishing • habitat degradation and modification. No relevant management advice has been identified.
Rhincodon typus (Whale Shark)	Conservation Advice for the Whale Shark 2015–2020 (Ref. 43)	The most significant threat to Whale Sharks is intentional and unintentional mortality from fishing outside Australian waters. In Australian waters, threats to the recovery of the species include boat strike from large vessels and habitat disruption from mineral exploration, production, and transportation. Other less-important threats include disturbance from domestic tourism operations, marine debris, and climate change. Limited subsistence hunting of Whale Sharks still occurs in some parts of the world. Ecotourism in these regions could provide an alternative income, which would give these communities the means to stop hunting and a reason to conserve the species. No relevant management advice has been identified.
Carcharias taurus (west coast population) (Grey Nurse Shark [west coast population])	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (Ref. 44)	Key threats include: • commercial fishing • recreational fishing • shark finning • shark control activities • ecotourism • aquarium trade.
Carcharodon Carcharias (Great White Shark)	Recovery Plan for the White Shark (*Carcharodon Carcharias*) (Ref. 45)	Key threats include: • mortality related to being caught accidentally (bycatch) or illegally (targeted) by commercial and recreational fisheries, including issues of post release mortality • mortality related to shark control activities such as beach meshing or drum lining (east coast population). Other potential threats to the species include the impacts of illegal trade in White Shark products; ecosystem effects as a result of habitat modification and climate change (including changes in sea temperature, ocean currents, and acidification); and ecotourism, including cage diving. No relevant management advice has been identified.

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Milyeringa veritas (Blind Gudgeon)	Approved Conservation Advice for *Milyeringa veritas* (Blind Gudgeon) (Ref. 46)	The main identified threats to the Blind Gudgeon include: • sedimentation from mining and construction • canal development • water abstraction • point source pollution from sewage • landfill • dumping and mining • diffuse pollution from urban development and petroleum infrastructure. No relevant management advice has been identified.
Nannatherina balstoni (Balston's Pygmy Perch)	Approved Conservation Advice for *Nannatherina balstoni* (Balston's Pygmy Perch) (Ref. 47)	The main identified threat to the Balston's Pygmy Perch is habitat alteration and the introduction of exotic fish species. Habitat alteration is likely to occur through any alterations to inflow and increased salinisation, siltation, and eutrophication that occur through changes to flow regimes (regulation and abstraction), road maintenance, mineral sand exploration and mining, groundwater extraction, and agricultural and forestry practices in the uppermost catchment. No relevant management advice has been identified.

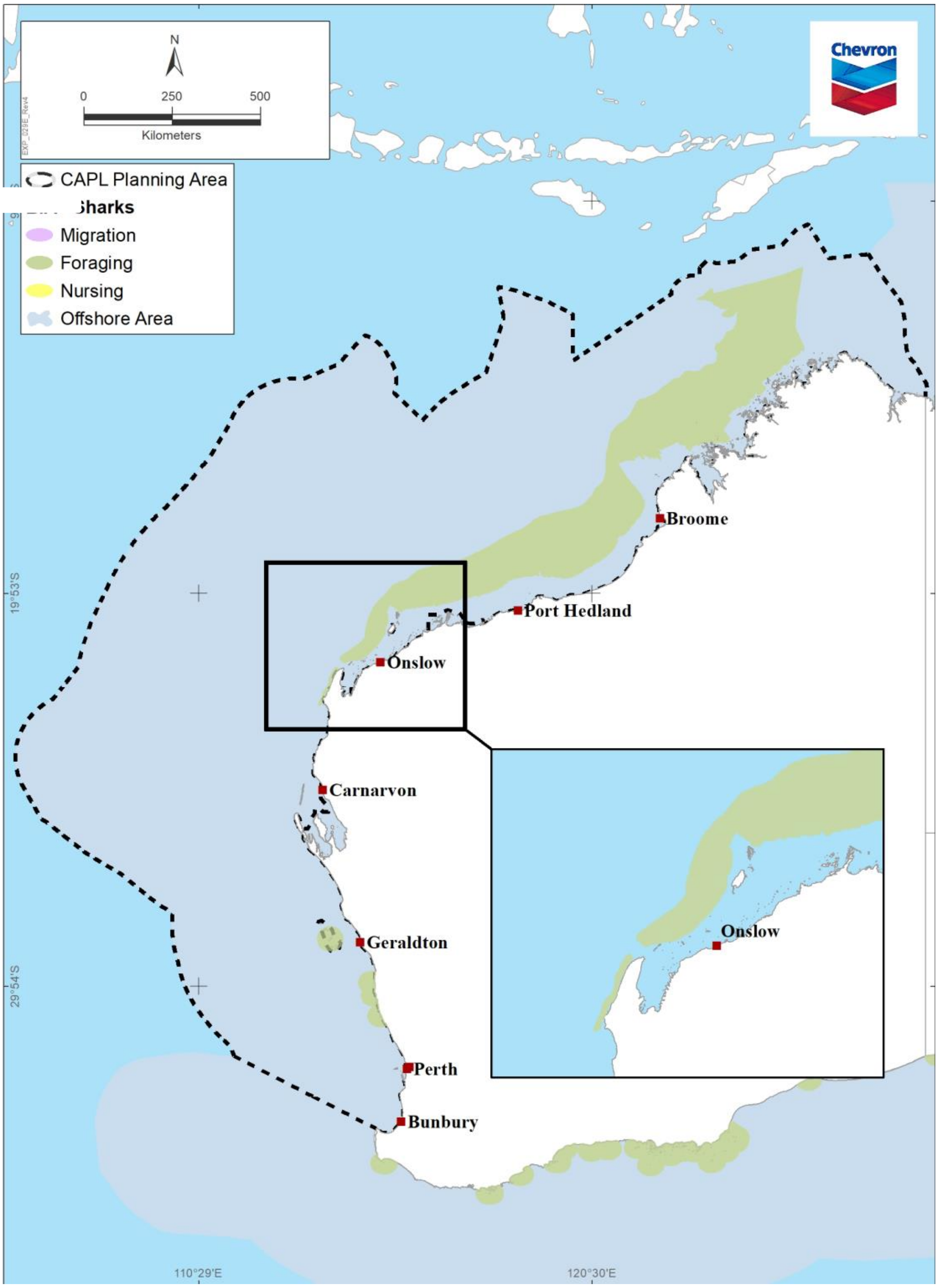


Figure 2-3: BIAs associated with fishes, including sharks and rays

2.5.4 Seabirds and shorebirds

Table 2-15 lists the threatened and/or migratory seabirds and shorebirds that may be present within the PA (Ref. 17; Ref. 4; appendix a).

Table 2-16 lists the BIAs for seabirds and shorebirds and their known seasonal presence within the PA (Ref. 18); these are shown in Figure 2-4.

A review of Conservation Advices and Recovery Plans identified key threats associated with threatened and/or migratory seabirds and shorebirds that may be present within the PA. These threats and relevant management advice are included in Table 2-17.

Table 2-15: Threatened and/or migratory seabirds and shorebirds

Common name	Scientific name	Threatened status	Migratory
Oriental Reed-warbler*	*Acrocephalus orientalis*		Migratory
Common Sandpiper*	*Actitis hypoleucos*		Migratory
Common Noddy	*Anous stolidus*		Migratory
Australian Lesser Noddy	*Anous tenuirostris melanops*	Vulnerable	
Fork-tailed Swift	*Apus pacificus*		Migratory
Flesh-footed Shearwater, Fleshy-footed Shearwater	*Ardenna carneipes*		Migratory
Wedge-tailed Shearwater	*Ardenna pacifica*		Migratory
Ruddy Turnstone*	*Arenaria interpres*		Migratory
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	
Sharp-tailed Sandpiper*	*Calidris acuminata*		Migratory
Sanderling*	*Calidris alba*		Migratory
Red Knot, Knot*	*Calidris canutus*	Endangered	Migratory
Curlew Sandpiper*	*Calidris ferruginea*	Critically Endangered	Migratory
Pectoral Sandpiper*	*Calidris melanotos*		Migratory
Red-necked Stint*	*Calidris ruficollis*		Migratory
Long-toed Stint*	*Calidris subminuta*		Migratory
Great Knot*	*Calidris tenuirostris*	Critically Endangered	Migratory
Streaked Shearwater	*Calonectris leucomelas*		Migratory
Forest Red-tailed Black-Cockatoo, Karrak	*Calyptorhynchus banksii naso*	Vulnerable	
Baudin's Cockatoo, Long-billed Black-Cockatoo	*Calyptorhynchus baudinii*	Vulnerable	
Carnaby's Cockatoo, Short-billed Black-Cockatoo	*Calyptorhynchus latirostris*	Endangered	
Red-rumped Swallow#	*Cecropis daurica*		Migratory
Double-banded Plover*	*Charadrius bicinctus*		Migratory
Greater Sand Plover, Large Sand Plover	*Charadrius leschenaultii*	Vulnerable	Migratory

Common name	Scientific name	Threatened status	Migratory
Lesser Sand Plover, Mongolian Plover	*Charadrius mongolus*	Endangered	Migratory
Oriental Plover, Oriental Dotterel*	*Charadrius veredus*		Migratory
Oriental Cuckoo, Horsfield’s Cuckoo	*Cuculus optatus*		Migratory
Amsterdam Albatross	*Diomedea amsterdamensis*	Endangered	Migratory
Tristan Albatross	*Diomedea dabbenena*	Endangered	
Southern Royal Albatross	*Diomedea epomophora*	Vulnerable	Migratory
Wandering Albatross	*Diomedea exulans*	Vulnerable	Migratory
Northern Royal Albatross	*Diomedea sanfordi*	Endangered	
Red Goshawk	*Erythrotriorchis radiatus*	Vulnerable	
Gouldian Finch	*Erythrura gouldiae*	Endangered	
Crested Shrike-tit (northern), Northern Shrike-tit	*Falcunculus frontatus whitei*	Vulnerable	
Lesser Frigatebird, Least Frigatebird	*Fregata ariel*		Migratory
Great Frigatebird, Greater Frigatebird	*Fregata minor*		Migratory
Swinhoe’s Snipe*	*Gallinago megala*		Migratory
Pin-tailed Snipe*	*Gallinago stenura*		Migratory
Partridge Pigeon (western)	*Geophaps smithii blaauwi*	Vulnerable	
Oriental Pratincole*	*Glareola maldivarum*		Migratory
Blue Petrel	*Halobaena caerulea*	Vulnerable	
Barn Swallow#	*Hirundo rustica*		Migratory
Caspian Tern	*Hydroprogne caspia*		Migratory
Malleefowl	*Leipoa ocellata*	Vulnerable	
Broad-billed Sandpiper*	*Limicola falcinellus*		Migratory
Asian Dowitcher*	*Limnodromus semipalmatus*		Migratory
Bar-tailed Godwit*	*Limosa lapponica*		Migratory
Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit*	*Limosa lapponica baueri*	Vulnerable	Migratory
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri)	*Limosa lapponica menzbieri*	Critically Endangered	Migratory
Black-tailed Godwit*	*Limosa limosa*		

Common name	Scientific name	Threatened status	Migratory
Southern Giant-Petrel, Southern Giant Petrel	*Macronectes giganteus*	Endangered	Migratory
Northern Giant Petrel	*Macronectes halli*	Vulnerable	Migratory
White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren	*Malurus leucopterus edouardi*	Vulnerable	
White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren	*Malurus leucopterus*	Vulnerable	
Grey Wagtail[#]	*Motacilla cinerea*		Migratory
Yellow Wagtail[#]	*Motacilla flava*		Migratory
Eastern Curlew, Far Eastern Curlew*	*Numenius madagascariensis*	Critically Endangered	Migratory
Little Curlew, Little Whimbrel*	*Numenius minutus*		Migratory
Whimbrel*	*Numenius phaeopus*		Migratory
Bridled Tern	*Onychoprion anaethetus*		Migratory
Fairy Prion (southern)	*Pachyptila turtur subantarctica*	Vulnerable	
Osprey*	*Pandion haliaetus*		Migratory
Abbott's Booby	*Papasula abbotti*	Endangered	
Night Parrot	*Pezoporus occidentalis*	Endangered	
White-tailed Tropicbird	*Phaethon lepturus*		Migratory
Red-tailed Tropicbird	*Phaethon rubricauda*		Migratory
Red-necked Phalarope*	*Phalaropus lobatus*		Migratory
Ruff (Reeve) *	*Philomachus pugnax*		Migratory
Sooty Albatross	*Phoebetria fusca*	Vulnerable	Migratory
Pacific Golden Plover*	*Pluvialis fulva*		Migratory
Grey Plover*	*Pluvialis squatarola*		Migratory
Princess Parrot, Alexandra's Parrot	*Polytelis alexandrae*	Vulnerable	
Soft-plumaged Petrel	*Pterodroma mollis*	Vulnerable	
Rufous Fantail#	*Rhipidura rufifrons*		Migratory
Australian Painted Snipe	*Rostratula australis*	Endangered	
Roseate Tern	*Sterna dougallii*		Migratory
Little Tern	*Sternula albifrons*		Migratory
Australian Fairy Tern	*Sternula nereis*	Vulnerable	

Common name	Scientific name	Threatened status	Migratory
Masked Booby	*Sula dactylatra*		Migratory
Brown Booby	*Sula leucogaster*		Migratory
Red-footed Booby	*Sula sula*		Migratory
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Vulnerable	
Tasmanian Shy Albatross	*Thalassarche cauta*		Migratory
Shy Albatross, Tasmanian Shy Albatross	*Thalassarche cauta*	Vulnerable	
White-capped Albatross	*Thalassarche cauta steadi*	Vulnerable	
Campbell Albatross, Campbell Black-browed Albatross	*Thalassarche impavida*	Vulnerable	
Black-browed Albatross	*Thalassarche melanophris*	Vulnerable	Migratory
Crested Tern*	*Thalasseus bergii*		Migratory
Grey-tailed Tattler*	*Tringa brevipes*		Migratory
Wood Sandpiper*	*Tringa glareola*		Migratory
Common Greenshank, Greenshank*	*Tringa nebularia*		Migratory
Marsh Sandpiper, Little Greenshank*	*Tringa stagnatilis*		Migratory
Common Redshank, Redshank*	*Tringa totanus*		Migratory
Painted Button-quail (Houtman Abrolhos)	*Turnix varius scintillans*	Vulnerable	
Masked Owl (northern)	*Tyto novaehollandiae kimberli*	Vulnerable	
Terek Sandpiper*	*Xenus cinereus*		Migratory
** Migratory Wetland Species* *# Migratory Terrestrial Species (unlikely to be encountered in the PA)*			

Table 2-16: BIAs for regionally significant seabirds and shorebirds

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Australian Lesser Noddy	Foraging (provisioning young)	Year-round	Known to occur
Bridled Tern	Foraging (in high numbers)	Almost entirely a breeding visitor, arriving late September or October and leaving between late February and early May	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Brown Booby	Breeding	Breeding Feb–Oct (but mainly in autumn)	Known to occur
Caspian Tern	Foraging (provisioning young)		Known to occur
Common Noddy	Foraging	Breeding visitor in Abrolhos (mid-August to late April) and further north (May to at least November)	Known to occur
	Foraging (provisioning young)	Breeding visitor in Abrolhos (mid-August to late April) and further north (May to at least November)	Known to occur
Fairy Tern	Breeding	Breeding from July to late September; birds from South-West Marine Region (SWMR) dispersing northwards in winter	Known to occur
	Foraging (in high numbers)	Year-round, but southern birds disperse north in winter	Known to occur
Flesh-footed Shearwater	Aggregation	Late April to late June and late August to early November	Known to occur
Greater Frigatebird	Breeding	Breeding in May–June and August	Known to occur
Great-winged Petrel (macroptera race)	Foraging (provisioning young)	Late January to early December	Known to occur
Lesser Crested Tern	Breeding	Breeding Mar–Jun	Known to occur
Lesser Frigatebird	Breeding	Breeding Mar–Sep	Known to occur
Little Penguin	Foraging (provisioning young)		Known to occur
Little Shearwater	Foraging (in high numbers)	Early January to early December, mainly April to November	Known to occur
Little Tern	Breeding	Breeding recorded in June, July, and October	Known to occur
	Resting	Breeding recorded in June, July, and October	Known to occur
Pacific Gull	Foraging (in high numbers)		Former Range
	Foraging (in high numbers)		Known to occur
Red-footed Booby	Breeding	Breeding in May-June	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Roseate Tern	Breeding	Breeding from mid-March to July; Also birds from SWMR dispersing north in winter	Known to occur
	Foraging	Winter	Known to occur
	Foraging (provisioning young)	Winter	Known to occur
	Resting	Breeding from mid-March to July; birds from SWMR dispersing north in winter	Known to occur
Soft-plumaged Petrel	Foraging (in high numbers)	Mainly March to late September	Known to occur
Sooty Tern	Foraging	Late Aug to early May	Known to occur
Wedge-tailed Shearwater	Breeding	Breeding visitor arriving in mid-August and leaving in April in Pilbara and mid-May in Shark Bay	Known to occur
	Foraging (in high numbers)	Mid-August–May	Known to occur
White-faced Storm Petrel	Foraging (in high numbers)		Known to occur
White-tailed Tropicbird	Breeding	Breeding recorded in May and October	Known to occur

Table 2-17: Summary of relevant conservation plans—seabirds and shorebirds

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Anous tenuirostris melanops (Australian Lesser Noddy)	Conservation Advice for *Anous tenuirostris melanops* Australian Lesser Noddy (Ref. 48)	The main potential threat to breeding colonies is catastrophic destruction of habitat by cyclones. Other threats include: • pollution • oil spills • over-fishing.
Calyptorhynchus banksii naso (Forest Red-tailed Black-Cockatoo) *Calyptorhynchus baudinii* (Baudin's Cockatoo, Long-billed Black-Cockatoo)	Forest Black-Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii*) and Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan (Ref. 49)	Key threats are: • killing by illegal shooting • feral honeybees • habitat loss • nest hollow shortage • nest hollow competition.
	Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black-Cockatoo) (Ref. 50)	The main identified threats to the Forest Red-tailed Black-Cockatoo are: • illegal shooting • habitat loss

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		• nest hollow shortage and competition from other species • injury or death from *Apis mellifera* (European Honey Bees).
	Conservation Advice *Calyptorhynchus baudinii* Baudin's Cockatoo (Ref. 51)	Key threats include: • habitat loss, disturbance, and modifications • fire • invasive species • competition with native species • illegal killing • phytopathogens and pests • climate change.
Calyptorhynchus latirostris (Carnaby's Cockatoo)	Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (Ref. 52)	Key threats include: • loss of breeding habitat • loss of non-breeding foraging and night roosting habitat • tree health • mining and extraction activities • illegal shooting • illegal taking • climate change • collisions with motor vehicles • disease.
Leipoa ocellate (Malleefowl)	National Recovery Plan for Malleefowl *Leipoa ocellate* (Ref. 53)	Key threats include: • clearing • habitat fragmentation and isolation • grazing • predation • fire (wildfire and intentional burns) • disease, inbreeding, and chemical exposure • climate change.
Macronectes giganteus (Southern Giant Petrel) *Macronectes halli* (Northern Giant Petrel) *Thalassarche carteri* (Indian Yellow-nosed Albatross) *Thalassarche cauta* (Tasmanian Shy Albatross) *Thalassarche cauta* (Shy Albatross)	National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016 (Ref. 54)	Key threats include: • incidental catch resulting from fishing operations • competition with fisheries for marine resources • dependence on discards • marine pollution • climate change • intentional shooting/killing • feral pest species • human disturbance at the nest • parasites and diseases

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Thalassarche cauta steadi (White-capped Albatross) *Thalassarche impavida* (Campbell Albatross, Campbell Black-browed Albatross) Thalassarche melanophris (Black-browed Albatross)		• loss of nesting habitat • competition for nest space • climate change.
Malurus leucopterus edouardi (White-winged Fairy-wren (Barrow Island)	Approved Conservation Advice for *Malurus leucopterus edouardi* (White-winged Fairy-wren [Barrow Island]) (Ref. 55)	The main potential threats to the White-winged Fairy-wren (Barrow Island) include: • introduction of non-endemic fauna, flora, or pathogens • inappropriate fire regime • vegetation clearing • destruction of birds • degradation of habitat by fire and development.
Malurus leucopterus (White-winged Fairy-wren (Dirk Hartog Island))	Approved Conservation Advice for *Malurus leucopterus* (White-winged Fairy-wren (Dirk Hartog Island)) (Ref. 56)	The main identified threats to the White-winged Fairy-wren (Dirk Hartog Island) are: • fire, which can kill birds and/or destroy habitat • degradation through grazing and trampling of habitat by feral goats (*Capra hircus*) • predation by feral cats (*Felis catus*) and house mice (*Mus* sp.)
Pachyptila turtur subantarctica (Fairy Prion (southern))	Conservation Advice *Pachyptila turtur subantarctica* Fairy Prion (southern) (Ref. 57)	Key threats include: • habitat loss, disturbance, and modification • predation.
Papasula abbotti (Abbott's Booby)	Conservation Advice *Papasula abbotti* Abbott's Booby (Ref. 58)	The Abbott's booby breeds only on Christmas Island. The principal reason for the decline of Abbott's Booby is thought to be the clearance of about a third of the former nesting rainforest habitat.
Pezoporus occidentalis (Night Parrot)	Conservation Advice *Pezoporus occidentalis* Night Parrot (Ref. 59)	There are no known threats to this species.
Polytelis alexandrae (Princess Parrot)	Conservation Advice *Polytelis alexandrae* Princess Parrot (Ref. 60)	Potential threats include: • increased intensity of bushfires • habitat degradation from introduced weeds and herbivores

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		• predation by introduced predators • competition with other bird species • disease • illegal collection.
Pterodroma mollis (Soft-plumaged Petrel)	Conservation Advice *Pterodroma Mollis* Soft-plumaged Petrel (Ref. 61)	Key threats include: • accidental introduction of predators to island populations.
Rostratula australis (Australian Painted Snipe)	Approved Conservation Advice for *Rostratula australis* (Australian Painted Snipe) (Ref. 62)	Key threats include: • habitat loss, disturbance, and modification • invasive weeds • trampling, browsing, or grazing • animal predation or competition • fire.
Sternula nereis (Australian Fairy Tern)	Approved Conservation Advice for *Sternula nereis* (Fairy Tern) (Ref. 63)	Key threats include: • predation by introduced animals • disturbance by humans and direct destruction of nests • increasing salinity in waters adjacent to colonies • irregular water management (flooding nests etc.) • weed encroachment • oil spills.
Turnix varius scintillans (Painted Button-quail (Houtman Abrolhos))	Approved Conservation Advice for *Turnix varia scintillans* (Painted Button-quail (Houtman Abrolhos)) (Ref. 64)	Key threats include: • inappropriate fire regimes • competition for food with, or predation of eggs by, the introduced House Mouse (*Mus musculus*) • introduction of non-endemic fauna, flora or pathogens • grazing and trampling of habitat.
Tyto novaehollandiae kimberli (Masked Owl (northern))	Conservation Advice *Tyto novaehollandiae kimberli* Masked Owl (northern) (Ref. 65)	Potential threats include: • decline in food availability • more intense, frequent, and extensive fires, which may also reduce the availability of large trees and hollows • competition for tree hollows • reduction in suitable habitat.

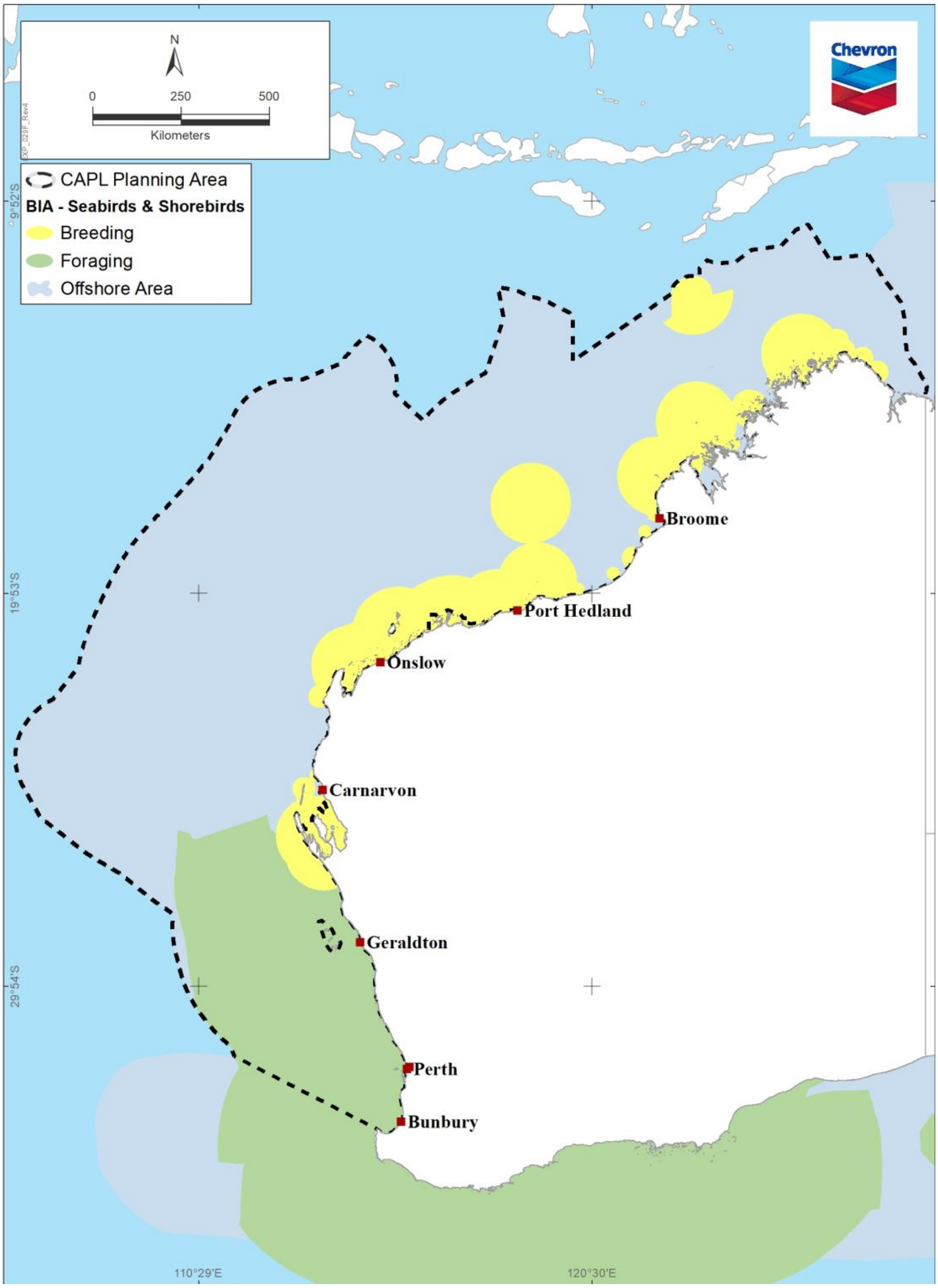


Figure 2-4: BIAs associated with seabirds and shorebirds

2.6 Listed threatened ecological communities

In Australia, three categories exist for listing threatened ecological communities (TECs) under the EPBC Act: critically endangered, endangered, and vulnerable.

In WA, TECs are present in the southwest and in the north around Broome. Table 2-18 summarises these communities (Ref. 66; Ref. 4; appendix a).

Table 2-18: Threated ecological communities

TEC	Summary of significance
Banksia Woodlands of the Swan Coastal Plain ecological community*	The ecological community is a woodland associated with the Swan Coastal Plain of southwest WA. A key diagnostic feature is a prominent tree layer of banksia, with scattered eucalypts and other tree species often present among or emerging above the banksia canopy. The understorey is a species-rich mix of sclerophyllous shrubs, graminoids, and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range. (Ref. 67)
Monsoon Vine Thickets on the coastal sand dunes of Dampier Peninsula	The Monsoon Vine Thickets on the coastal sand dunes of Dampier Peninsula ecological community represents certain occurrences of Monsoon Vine thickets in the south-west Kimberley region of WA (within the Dampierland bioregion). The ecological community is predominantly restricted to the coastlines of the Dampier Peninsula from Broome in the south to One Arm Point in the north and on the north-eastern coast of the Peninsula from One Arm Point to Goodenough Bay. The coastal dune environment, being largely of sand, has minimal soil development and is susceptible to erosion from various sources including rising tides, strong winds, and cyclonic activity. Tides of the Dampier Peninsula range up to 11 m and are a major factor affecting the coastal environment where the ecological community occurs. (Ref. 68)
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	The Rockingham-Becher Plain has been formed through the accumulation of Holocene sediments and contains a continuous depositional history from 7000 BP to present. Wetlands occur within the swales where the water table is close to or at the ground surface in the wetter months of the year. The most typical form is that of the Becher Suite, which is made up of over 250 very small to small sumplands and damplands, many of which contain occurrences of this community. The present known distribution of the sedgelands in Holocene dune swale community as is ~193 ha and is almost entirely located within linear wetland depressions (swales) occurring between parallel sand ridges of the Rockingham-Becher Plain. Additional occurrences include a small area at Yanchep and a small area at Dalyellup. Holocene dunes with wetlands around Preston Beach, south of Lancelin, and at Cheynes Beach may also contain occurrences of this community. (Ref. 69)
Subtropical and Temperate Coastal Saltmarsh	The Subtropical and Temperate Coastal Saltmarsh ecological community occurs within a relatively narrow margin of the Australian coastline, within the subtropical and temperate climatic zones south of the South-east Queensland IBRA bioregion boundary at 23° 37′ latitude along the east coast and south of (and including) Shark Bay at 26° on the west coast. Coastal saltmarsh occurring on islands within the geographic range is also included within the ecological community. The Coastal Saltmarsh ecological community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, sedges, rushes, and shrubs. Succulent herbs, shrubs, and grasses generally dominate, and vegetation is generally <0.5 m high (with the exception of some reeds and sedges). (Ref. 70)
Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)*	The Lake Clifton thrombolite community is restricted to Lake Clifton, which occurs within the South West Natural Resource Management Region. This ecological community is situated in the Swan Coastal Plain IBRA Bioregion of WA. Lake Clifton is situated within the Yalgorup National Park and is the northernmost lake in the Peel-Yalgorup Lakes System. The main known occurrence of the ecological community is a stretch, ~15 km long and up to 15 m wide, along the north-eastern shoreline of Lake Clifton. There are other small clusters of thrombolites within the lake, also at the northern end. This structure is the largest known example of a living, non-marine microbialite reef in the southern hemisphere. (Ref. 71)

TEC	Summary of significance
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community*	The ecological community occurs as woodlands or forests or other structural forms where the primary defining feature is the presence of *Eucalyptus gomphocephala* (Tuart) trees in the uppermost canopy layer. The ecological community includes the assemblage of plants, animals, and other organisms that occur in association with Tuart. The ecological community has a discontinuous distribution in the west of the Swan Coastal Plain, of southwest WA. The Tuart woodlands and forests occur on the Swan Coastal Plain in WA, from Jurien, ~200 km north of Perth, to the Sabina River, near Busselton, 225 km south of Perth. The ecological community occurs mainly on the Spearwood and Quindalup dune systems, which are underlain by Tamala Limestone. (Ref. 72)

** Identified in the protected matters search (appendix a) but located inland and thus not expected to be exposed to CAPL's activities.*

2.7 Commonwealth marine areas

The Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone (EEZ) and/or over the continental shelf of Australia, which is not State or Territory waters.

The Commonwealth marine area stretches from three to 200 nautical miles from the coast. Marine protected areas are marine areas that are recognised to have high conservation value (Ref. 73).

2.7.1 Australian Marine Parks

Australian Marine Parks (AMPs), proclaimed under the EPBC Act in 2007 and 2013, are located in Commonwealth waters that start at the outer edge of state and territory waters, generally three nautical miles (~5.5 km) from the shore, and extend to the outer boundary of Australia's EEZ, 200 nautical miles (~370 km) from the shore (Ref. 75).

Table 2-19, Table 2-20, and Table 2-21 summarise the north-west, south-west, and north AMPs present within the PA, including their zones, areas, and International Union for Conservation of Nature (IUCN) categories (Ref. 74; Ref. 4; appendix a).

Table 2-19: Summary of AMPs (North-west Marine Parks)

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
Argo–Rowley Terrace	National Park Zone (II) 36 050 km² Multiple Use Zone (VI) 108 812 km² Special Purpose Zone (Trawl) (VI) 1141 km²	The Argo–Rowley Terrace Marine Park is ~270 km north-west of Broome, WA, and extends to the limit of Australia's EEZ. The Marine Park is adjacent to the Mermaid Reef Marine Park and the WA Rowley Shoals Marine Park. The Marine Park covers an area of 146 003 km² and has	The Marine Park includes examples of ecosystems representative of: • Northwest Transition—an area of shelf break, continental slope, and the majority of the Argo Abyssal Plain. Key topographic features include Mermaid, Clerke, and Imperieuse reefs, which collectively are a biodiversity hotspot • Timor Province—an area dominated by warm, nutrient-poor waters. Canyons are an important feature in this area of the Marine Park and are generally associated with high productivity and aggregations of marine life.

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		water depths between 220 m and 6000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Argo–Rowley Terrace Marine Park on 9 October 2017.	Key ecological features of the Marine Park are: • Canyons linking the Argo Abyssal Plain with the Scott Plateau—an area likely to result in upwelling of nutrient-rich water and aggregations of marine life • Mermaid Reef and Commonwealth waters surrounding Rowley Shoals—an area of enhanced productivity and high species richness, thought to be facilitated by internal wave action generated by internal tides. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include resting and breeding habitat for seabirds and a migratory pathway for the Pygmy Blue Whale.
Ashmore Reef	Sanctuary Zone (Ia) 550 km² Recreational Use Zone (IV) 34 km²	The Ashmore Reef Marine Park is ~630 km north of Broome and 110 km south of the Indonesian island of Roti. The Marine Park is in Australia's External Territory of Ashmore and Cartier Islands and is within an area subject to a Memorandum of Understanding (MoU) between Indonesia and Australia, known as the MoU Box. The Marine Park covers an area of 583 km² and water depths from <15 m to 500 m. The Marine Park has three vegetated sand cays that are permanently above water: West, Middle, and East islands. The Marine Park was originally proclaimed under the Commonwealth *National Parks and Wildlife Conservation Act 1975* on 16 August 1983 as the Ashmore Reef National Nature	The Marine Park includes examples of ecosystems representative of the Timor Province—a bioregion with a depth range from ~200 m near the shelf break to 5920 m over the Argo Abyssal Plain. The reefs and islands of the bioregion are regarded as biodiversity hotspots. Ashmore Reef is an important feature of the bioregion. Endemism in demersal fish communities of the continental slope is high with two distinct communities identified: one on the upper slope, the other mid slope. Key ecological features of the Marine Park are: • Ashmore Reef and Cartier Island and surrounding Commonwealth waters—areas of enhanced productivity in an otherwise low-nutrient environment, of regional importance for feeding and breeding aggregations of birds and marine life • continental slope demersal fish communities—an area of high-diversity demersal fish assemblages. The marine environment of the Marine Park includes habitats associated with two extensive lagoons, sand flats, shifting sand cays, extensive reef flat, and large areas of seagrass. The reef ecosystems are comprised of hard and soft corals, gorgonians, sponges, and a range of encrusting organisms, with the highest number of coral species of any reef off the Western Australian coast. The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		Reserve, and proclaimed under the EPBC Act on 14 December 2013; it was renamed Ashmore Reef Marine Park on 9 October 2017.	Marine Park include breeding, foraging, and resting habitat for seabirds; resting and foraging habitat for migratory shorebirds; foraging, mating, nesting, and internesting habitat for marine turtles; foraging habitat for Dugong; and a migratory pathway for Pygmy Blue Whales. Ashmore Reef Ramsar site The Ashmore Reef Ramsar site includes the largest of the atolls in the region. West Island, Middle Island, and East Island represent the only vegetated islands in the region. Ashmore Reef Ramsar site supports internationally significant populations of seabirds and shorebirds, is important for turtles (Green, Hawksbill and Loggerhead) and Dugong, and has the highest diversity of hermatypic (reef-building) corals on the West Australian coast. It is known for its abundance and diversity of sea snakes. However, since 1998 populations of sea snakes at Ashmore Reef have been in decline.
Carnarvon Canyon	Habitat Protection Zone (IV) 6177 km²	The Carnarvon Canyon Marine Park is ~300 km north-west of Carnarvon. It covers an area of 6177 km² with a water depth range of 1500–6000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Carnarvon Canyon Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Central Western Transition — a bioregion characterised by large areas of continental slope; a range of topographic features such as terraces, rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species. It includes the Carnarvon Canyon, a single-channel canyon covering the entire depth range of the Marine Park. Ecosystems of the Marine Park are influenced by tropical and temperate currents, deep-water environments, and proximity to the continental slope and shelf. The soft-bottom environment at the base of the Carnarvon Canyon is likely to support species that are typical of the deep sea floor (e.g. holothurians, polychaetes, sea pens). The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. There is limited information about species' use of this Marine Park.
Cartier Island	Sanctuary Zone (Ia) 172 km²	The Cartier Island Marine Park is ~45 km south-east of Ashmore Reef Marine Park and 610 km north of Broome, WA. Both Marine Parks are located in Australia's External Territory of	The Marine Park includes examples of ecosystems representative of the Timor Province—a bioregion with a depth range from ~200 m near the shelf break to 5920 m over the Argo Abyssal Plain. The reefs and islands of the bioregion are regarded as biodiversity hotspots. Endemism of demersal fish communities of the continental slope is high with two distinct communities identified, one on the upper

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		Ashmore and Cartier Islands and are also within an area subject to a Memorandum of Understanding (MoU) between Indonesia and Australia, known as the MoU Box. The Marine Park covers an area of 172 km² with water depths from <15 m to 500 m. The Marine Park was originally proclaimed under the Commonwealth *National Parks and Wildlife Conservation Act 1975* on 21 June 2000 as the Cartier Island Marine Reserve, and proclaimed under the EPBC Act on 14 December 2013; it was renamed Cartier Island Marine Park on 9 October 2017.	slope, the other mid slope. Key ecological features represented in the Marine Park are: • Ashmore Reef and Cartier Island and surrounding Commonwealth waters—areas of enhanced productivity in an otherwise low-nutrient environment, of regional importance for feeding and breeding aggregations of birds and marine life • Continental slope demersal fish communities—an area of high diversity in demersal fish assemblages. The Marine Park includes an unvegetated sand island (Cartier Island); mature reef flat; a small, submerged pinnacle (Wave Governor Bank); and two shallow pools to the north-east of the island. It is also an area of high diversity and abundance of hard and soft corals, gorgonians (sea fans), sponges, and a range of encrusting organisms. The reef crests are generally algal dominated, while the reef flats feature ridges of coral rubble and large areas of seagrass. The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and foraging habitat for seabirds; internesting, nesting, and foraging habitat for marine turtles; and foraging habitat for Whale Sharks. The Marine Park is important for a range of other species and internationally significant for its abundance and diversity of sea snakes, some of which are listed species under the EPBC Act.
Dampier	National Park Zone (II) 73 km² Habitat Protection Zone (IV) 104 km² Multiple Use Zone (VI) 1074 km²	The Dampier Marine Park is ~10 km north-east of Cape Lambert and 40 km from Dampier extending westwards from the WA state water boundary. The Marine Park covers an area of 1252 km² and a water depth range between <15 m and 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Dampier Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. The Marine Park supports a range of species including those listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and foraging habitat for seabirds, internesting habitat for marine turtles, and a migratory pathway for Humpback Whales.

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
Eighty Mile Beach	Multiple Use Zone (VI) 10 785 km²	The Eighty Mile Beach Marine Park is located ~74 km north-east of Port Hedland, adjacent to the Western Australian Eighty Mile Beach Marine Park. The Marine Park covers an area of 10 785 km² and a water depth ranges between less than 15 m and 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Eighty Mile Beach Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding, foraging, and resting habitat for seabirds; internesting and nesting habitat for marine turtles; foraging, nursing, and pupping habitat for sawfish; and a migratory pathway for Humpback Whales.
Gascoyne	National Park Zone (II) 9132 km² Habitat Protection Zone (IV) 38 982 km² Multiple Use Zone (VI) 33 652 km²	The Gascoyne Marine Park is located ~20 km off the west coast of the Cape Range Peninsula, adjacent to the Ningaloo Reef Marine Park and the Western Australian Ningaloo Marine Park, and extends to the limit of Australia's EEZ. The Marine Park covers an area of 81 766 km² and water depths between 15 m and 6000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Gascoyne Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of: • Central Western Shelf Transition—continental shelf with water depths up to 100 m, and a significant transition zone between tropical and temperate species • Central Western Transition—characterised by large areas of continental slope; a range of topographic features such as terraces, rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species • Northwest Province—an area of continental slope comprising diverse and endemic fish communities. Key ecological features of the Marine Park are: • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula—an area resulting in upwelling of nutrient-rich water and aggregations of marine life • Commonwealth waters adjacent to Ningaloo Reef—an area where the Leeuwin and Ningaloo currents interact resulting in enhanced productivity and aggregations of marine life • Continental slope demersal fish communities—an area of high diversity of demersal fish assemblages on the continental slope

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
			• Exmouth Plateau—a regionally and nationally unique deep-sea plateau in tropical waters. Ecosystems represented in the Marine Park are influenced by the interaction of the Leeuwin Current, Leeuwin Undercurrent, and the Ningaloo Current. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds; internesting habitat for marine turtles; a migratory pathway for Humpback Whales; and foraging habitat and migratory pathway for Pygmy Blue Whales.
Kimberley	National Park Zone (II) 6392 km² Habitat Protection Zone (IV) 5665 km² Multiple Use Zone (VI) 62 411 km²	The Kimberley Marine Park is located ~100 km north of Broome, extending from the Western Australian state water boundary north from the Lacepede Islands to the Holothuria Banks offshore from Cape Bougainville. The Marine Park is adjacent to the Western Australian Lalang-garram/Camden Sound Marine Park and the North Kimberley Marine Park. The Marine Park covers an area of 74 469 km² and water depths from less than 15 m to 800 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Kimberley Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of: • Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and an ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. • Northwest Shelf Transition—straddles the North-west and North Marine Regions and in the Northwest includes shelf break, continental slope, and the majority of the Argo Abyssal Plain and is subject to a high incidence of cyclones. Benthic biological communities in the deeper parts of the bioregion have not been extensively studied, although high levels of species diversity and endemism occur among demersal fish communities on the continental slope. • Timor Province—water depths (of the bioregion) ranging from ~200 m near the shelf break to 5920 m over the Argo Abyssal Plain. The reefs and islands of the bioregion are regarded as biodiversity hotspots. Endemism in demersal fish communities of the continental slope is high; two distinct communities have been identified on the upper and mid slopes. Key ecological features of the Marine Park are: • the ancient coastline at the 125 m depth contour—where rocky escarpments are thought to provide

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
			biologically important habitats in areas otherwise dominated by soft sediments • the continental slope demersal fish communities—characterised by high diversity of demersal fish assemblages. The Marine Park supports a range of species, including protected species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and foraging habitat for seabirds; internesting and nesting habitat for marine turtles; breeding, calving, and foraging habitat for inshore dolphins; calving, migratory pathway, and nursing habitat for Humpback Whales; migratory pathway for Pygmy Blue Whales; foraging habitat for dugong; and foraging habitat for Whale Sharks.
Mermaid Reef	National Park Zone (II) 540 km²	The Mermaid Reef Marine Park is located ~280 km north-west of Broome, adjacent to the Argo–Rowley Terrace Marine Park and ~13 km from the Western Australian Rowley Shoals Marine Park. The Marine Park covers an area of 540 km² and water depths from less than 15 m to 500 m. The Marine Park was originally proclaimed under the Commonwealth *National Parks and Wildlife Conservation Act 1975* on 10 April 1991 as the Mermaid Reef Marine National Nature Reserve, and proclaimed under the EPBC Act on 14 December 2013 and renamed Mermaid Reef Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Transition—an area of shelf break, continental slope, and the majority of the Argo Abyssal Plain. Together with Clerke Reef and Imperieuse Reef, Mermaid Reef is a biodiversity hotspot and key topographic feature of the Argo Abyssal Plain. A key ecological feature of the Marine Park is the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals—an area of enhanced productivity and high species richness thought to be facilitated by internal wave action generated by internal tides in the lagoon. Ecosystems of the Marine Park are associated with emergent reef flat, deep reef flat, lagoon, and submerged sand habitats. The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds and a migratory pathway for the Pygmy Blue Whale.
Montebello	Multiple Use Zone (VI) 3413 km²	The Montebello Marine Park is located offshore of Barrow Island and 80 km west of Dampier extending from the Western	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		Australian state water boundary, and is adjacent to the Western Australian Barrow Island and Montebello Islands Marine Parks. The Marine Park covers an area of 3413 km² and water depths from <15 m to 150 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Montebello Marine Park on 9 October 2017.	coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. A key ecological feature of the Marine Park is the ancient coastline at the 125 m depth contour where rocky escarpments are thought to provide biologically important habitat in areas otherwise dominated by soft sediments. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds; internesting, foraging, mating, and nesting habitat for marine turtles; a migratory pathway for Humpback Whales; and foraging habitat for Whale Sharks.
Ningaloo	National Park Zone (II) 116 km² Recreational Use Zone (IV) 2319 km²	The Ningaloo Marine Park stretches ~300 km along the west coast of the Cape Range Peninsula, and is adjacent to the Western Australian Ningaloo Marine Park and Gascoyne Marine Park. The Marine Park covers an area of 2435 km² and a water depth range of 30 m to more than 500 m. The Marine Park was originally proclaimed under the *National Parks and Wildlife Conservation Act 1975* on 20 May 1987 as the Ningaloo Marine Park (Commonwealth Waters), and proclaimed under the EPBC Act on 14 December 2013 and renamed Ningaloo Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of: • Central Western Shelf Transition—continental shelf of water depths up to 100 m, and a significant transition zone between tropical and temperate species • Central Western Transition—characterised by large areas of continental slope; a range of topographic features such as terraces, rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species • Northwest Province—an area of continental slope comprising diverse and endemic fish communities • Northwest Shelf Province—a dynamic environment, influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. Key ecological features of the Marine Park are: • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula—an area resulting in upwelling of nutrient-rich water and aggregations of marine life • Commonwealth waters adjacent to Ningaloo Reef—an area where the Leeuwin and Ningaloo currents interact,

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
			resulting in enhanced productivity and aggregations of marine life • Continental slope demersal fish communities—an area of high diversity among demersal fish assemblages on the continental slope. Ecosystems represented in the Marine Park are influenced by interaction of the Leeuwin Current, Leeuwin Undercurrent, and the Ningaloo Current. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and or foraging habitat for seabirds; internesting habitat for marine turtles; a migratory pathway for Humpback Whales; foraging habitat and migratory pathway for Pygmy Blue Whales; breeding, calving, foraging, and nursing habitat for dugong; and foraging habitat for Whale Sharks.
Roebuck	Multiple Use Zone (VI) 304 km²	The Roebuck Marine Park is located ~12 km offshore of Broome, and is adjacent to the Western Australian Yawuru Nagulagun/Roebuck Bay Marine Park. The Marine Park covers an area of 304 km² and a water depth range of less than 15 m to 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Roebuck Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and resting habitat for seabirds; foraging and internesting habitat for marine turtles; a migratory pathway for Humpback Whales; and foraging habitat for dugong.
Shark Bay	Multiple Use Zone (VI) 7443 km²	The Shark Bay Marine Park is located ~60 km offshore of Carnarvon, adjacent to the Shark Bay World Heritage Property and National Heritage place. The Marine Park covers an area of 7443 km²,	The Marine Park includes examples of ecosystems representative of: • Central Western Shelf—a predominantly flat, sandy, and low-nutrient area, in water depths 50–100 m. The bioregion is a transitional zone between tropical and temperate species • Central Western Transition—characterised by large areas of continental slope; a range of topographic features such as terraces,

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		extending from the Western Australian state water boundary, and a water depth range between 15 m and 220 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Shark Bay Marine Park on 9 October 2017.	rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species. Ecosystems represented in the Marine Park are influenced by the Leeuwin, Ningaloo, and Capes currents. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds, internesting habitat for marine turtles, and a migratory pathway for Humpback Whales. The Marine Park and adjacent coastal areas are also important for Shallow-water Snapper.

^ Source: Ref. 75.

Table 2-20: Summary of AMPs (South-west Marine Parks)

AMP	Zones, IUCN categories and zone area	Description	Natural values^
Abrolhos	Habitat Protection Zone (IV) 23,239 km² Multiple Use Zone (VI) 56,545 km² National Park Zone (II) 2548 km² Special Purpose Zone (VI) 5729 km²	Abrolhos Marine Park is located adjacent to the Western Australian Houtman Abrolhos Islands, covering a large offshore area extending from the Western Australian state water boundary to the edge of Australia's exclusive economic zone. It is located ~27 km south-west of Geraldton and extends north to ~330 km west of Carnarvon. The northernmost part of the shelf component of the Marine Park, north of Kalbarri, is adjacent to the Shark Bay World Heritage Area. The Marine Park covers an area of 88,060 km² and a water depth range between less than 15 m and 6000 m.	The Marine Park includes examples of ecosystems representative of: • Central Western Province—characterised by a narrow continental slope incised by many submarine canyons and the most extensive area of continental rise in any of Australia's marine regions. A significant feature within the area are several eddies that form off the Leeuwin Current at predictable locations, including west of the Houtman Abrolhos Islands • Central Western Shelf Province—a predominantly flat, sandy, and low-nutrient area, in water depths between 50 and 100 m. Significant sea floor features of this area include a deep hole and associated area of banks and shoals offshore of Kalbarri. The area is a transitional zone between tropical and temperate species • Central Western Transition—a deep ocean area characterised by large areas of continental slope, a range of significant sea floor features including the Wallaby Saddle, seasonal and sporadic upwelling, and benthic slope communities comprising tropical and temperate species • South-west Shelf Transition—a narrow continental shelf that is noted for its

AMP	Zones, IUCN categories and zone area	Description	Natural values^
		The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Abrolhos Marine Park on 9 October 2017.	physical complexity. The Leeuwin Current has a significant influence on the biodiversity of this nearshore area as it pushes subtropical water southward along the area's western edge. The area contains a diversity of tropical and temperate marine life including a large number of endemic fauna species.
Geographe	National Park Zone (II) 15 km² Habitat Protection Zone (IV) 21 km² Multiple Use Zone (VI) 291 km² Special Purpose Zone (Mining Exclusion) (VI) 650 km²	The Geographe Marine Park is located in Geographe Bay, ~8 km west of Bunbury and 8 km north of Busselton, adjacent to the Western Australian Ngari Capes Marine Park. The Marine Park covers an area of 977 km², extending from the Western Australian state water boundary, and a water depth range between 15 m and 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Geographe Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the South-west Shelf Province—an area of diverse marine life, influenced by the warm waters of the Leeuwin Current. The bioregion includes globally important biodiversity hotspots, such as the waters off Geographe Bay. Key ecological features of the Marine Park are: • Commonwealth marine environment within and adjacent to Geographe Bay—the sheltered waters of Geographe Bay support extensive seagrass beds that in turn provide important nursery habitat for a range of marine species • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the food web on the inner shelf, particularly as juveniles. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds, a migratory pathway for Humpback and Pygmy Blue Whales, and a calving buffer area for Southern Right Whales.
Jurien	National Park Zone (II) 31 km² Special Purpose Zone (VI) 1820 km²	The Jurien Marine Park is located ~148 km north of Perth and 155 km south of Geraldton, adjacent to the Western Australian Jurien Bay Marine Park. The Marine Park covers an area of 1851 km² of continental shelf, extending from the Western Australian state water boundary, and a water depth	The Marine Park includes examples of ecosystems representative of: • South-west Shelf Transition—consists of a narrow continental shelf that is noted for its physical complexity. The Leeuwin Current has a significant influence on the biodiversity of this nearshore area as it pushes subtropical water southward along the bioregion's western edge. The area contains a diversity of tropical and temperate marine life including a large number of endemic fauna species. Key ecological features of the Marine Park are:

AMP	Zones, IUCN categories and zone area	Description	Natural values^
		range between 15 m and 220 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Jurien Marine Park on 9 October 2017.	• Ancient coastline between 90 m and 120 m depth—high benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment • Demersal slope and associated fish communities of the Central Western Province—an area that provides important habitat for demersal fish communities and is characterised by high species diversity and endemism • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the food web on the inner shelf, particularly as juveniles. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds, Australian Sea Lions, and White Sharks; and a migratory pathway for Humpback and Pygmy Blue Whales.
Perth Canyon	National Park Zone (II) 1241 km² Habitat Protection Zone (IV) 4352 km² Multiple Use Zone (VI) 1816 km²	The Perth Canyon Marine Park is located ~52 km west of Perth and ~19 km west of Rottnest Island. The Marine Park covers an area of 7409 km² and water depths range between 120 m and 5000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Perth Canyon Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of: • Central Western Province—characterised by a narrow continental slope incised by many submarine canyons, including Perth Canyon, and the most extensive area of continental rise in any of Australia's marine regions. A significant feature within the area are the several eddies that form off the Leeuwin Current at predictable locations, including the Perth Canyon • South-west Shelf Province—marine life in this area is diverse and influenced by the warm waters of the Leeuwin Current • South-west Transition—significant features of this area include the submarine canyons that incise the northern parts of the slope and the deep-water mixing that results from the dynamics of major ocean currents when these meet the sea floor, particularly in the Perth Canyon • South-west Shelf Transition—consists of a narrow continental shelf that is noted for its physical complexity. The Leeuwin Current has a significant influence on the biodiversity of this

AMP	Zones, IUCN categories and zone area	Description	Natural values^
			nearshore area as it pushes subtropical water southward along the area's western edge. The area contains a diversity of tropical and temperate marine life including a large number of endemic fauna species. Key ecological features of the Marine Park are: • Perth Canyon and adjacent shelf break, and other west coast canyons—unique sea floor features give rise to ecologically important events of localised productivity and aggregations of marine life. The Perth Canyon is prominent among these canyons because of its large size and ecological importance. The upwelling of deep ocean currents in the canyon creates a nutrient-rich cold-water habitat that attracts feeding aggregations of deep-diving mammals, such as Pygmy Blue Whales and large predatory fish that feed on aggregations of small fish, krill, and squid • Demersal slope and associated fish communities of the Central Western Province—an area that provides important habitat for demersal fish communities and is characterised by high species diversity and endemism • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the food web on the inner shelf, particularly as juveniles • Mesoscale eddies—important transporters of nutrients and plankton communities that form at predictable locations off the western and south-western shelf break. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds, Antarctic Blue, Pygmy Blue, and Sperm Whales; a migratory pathway for Humpback, Antarctic Blue, and Pygmy Blue Whales; and a calving buffer area for Southern Right Whales.
South-west Corner	National Park Zone	The South-west Corner Marine Park is located adjacent to	The Marine Park includes examples of ecosystems representative of:

AMP	Zones, IUCN categories and zone area	Description	Natural values^
	(II) 54 841 km² Habitat Protection Zone (IV) 95 088 km² Multiple Use Zone (VI) 106 602 km² Special Purpose Zone (Mining Exclusion) (VI) 9550 km² Special Purpose Zone (VI) 5753 km²	the Western Australian Ngari Capes Marine Park, covering an extensive offshore area that is closest to Western Australia state waters ~48 km west of Esperance, 73 km west of Albany, and 68 km west of Bunbury, and extends to the edge of Australia's exclusive economic zone. The Marine Park covers an area of 271 833 km² and a water depth range from <15 m to 6400 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed South-west Corner Marine Park on 9 October 2017.	• Southern Province—includes the deepest ocean areas of the Australian EEZ, reaching depths of ~5900 m, and is characterised by a long continental slope incised by numerous, well-developed submarine canyons, and the Diamantina Fracture Zone, a rugged area of deep sea floor comprising seamounts and many ridges and troughs • South-west Transition—the main features of this area are the Naturaliste Plateau, the deepest submarine plateau along Australia's continental margins. The Plateau supports rich and diverse biological communities. Deep-water mixing results from the dynamics of major ocean currents when these meet the sea floor South-west Shelf Province—marine life in this area is diverse and influenced by the warm waters of the Leeuwin Current. A small upwelling of nutrient-rich water off Cape Mentelle during summer increases productivity locally, attracting aggregations of marine life. Key ecological features of the Marine Park are: • Albany Canyon group and adjacent shelf break—a feature consisting of 32 canyons cut deeply into the steep continental slope. The canyons are believed to be associated with small periodic upwellings that enhance productivity and attract aggregations of marine life • Cape Mentelle upwelling—draws relatively nutrient-rich water from the base of the Leeuwin Current, up the continental slope, and onto the inner continental shelf, where it results in phytoplankton blooms at the surface • Diamantina Fracture Zone—a unique sea floor feature consisting of a rugged, deep-water environment of seamounts and many closely spaced troughs and ridges. The ridges and seamounts can affect water dynamics and flow, enhancing productivity, and may act as 'stepping stones' for species dispersal and migration across the region and the wider abyssal plain • Naturaliste Plateau—the combination of this unique sea floor feature's structural complexity, mixed water dynamics, and relative isolation indicate that it supports deep-water

AMP	Zones, IUCN categories and zone area	Description	Natural values^
			communities with high species diversity and endemism • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the food web on the inner shelf, particularly as juveniles • Ancient coastline between 90 m and 120 m depth—high benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds, Australian Sea Lions, White Sharks, and Sperm Whales; a migratory pathway for Antarctic Blue, Pygmy Blue, and Humpback Whales; and a calving buffer area for Southern Right Whales.
Two Rocks	National Park Zone (II) 15 km² Multiple Use Zone (VI) 867 km²	The Two Rocks Marine Park is located 25 km north-west of Perth, to the north-west of the Western Australian Marmion Marine Park. The Marine Park covers an area of 882 km², extending from the Western Australian state water boundary, and a water depth range from 15 m to 120 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Two Rocks Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the South-west Shelf Transition—an area of narrow continental shelf that is noted for its physical complexity. The Leeuwin Current has a significant influence on the biodiversity of this nearshore area as it pushes subtropical water southward along the area's western edge. The area contains a diversity of tropical and temperate marine life including a large number of endemic fauna species. The inshore lagoons are thought to be important areas for benthic productivity and recruitment for a range of marine species. Key ecological features of the Marine Park are: • Commonwealth marine environment within and adjacent to the west coast inshore lagoons—an area that is regionally important for enhanced benthic productivity, including macroalgae and seagrass communities, and breeding and nursery aggregations for many temperate and tropical marine species • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the

AMP	Zones, IUCN categories and zone area	Description	Natural values^
			food web on the inner shelf, particularly as juveniles • Ancient coastline between 90 m and 120 m depth—high benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds and Australian Sea Lions, a migratory pathway for Humpback and Pygmy Blue Whales, and a calving buffer area for Southern Right Whales.

^ Source: Ref. 76.

Table 2-21 Summary of AMPs (North Marine Parks)

AMP Name	Zones, IUCN categories and zone area	Description	Natural values^
Oceanic Shoals	National Park Zone (II) 406 km² Habitat Protection Zone (IV) 6929 km² Multiple Use Zone (VI) 39 964 km² Special Purpose Zone (Trawl) (VI) 24 444 km²	The Oceanic Shoals Marine Park is located west of the Tiwi Islands, ~155 km north-west of Darwin, Northern Territory and 305 km north of Wyndham, Western Australia. It extends to the limit of Australia's exclusive economic zone. The Marine Park covers an area of 71 743 km² and water depths from <15 m to 500 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Oceanic Shoals Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Transition— a dynamic environment influenced by strong tidal currents, upwellings of nutrient-rich waters, and a range of prominent sea floor features. The pinnacles, carbonate banks, and shoals are sites of enhanced biological productivity. Key ecological features of the Marine Park are: • Carbonate bank and terrace systems of the Van Diemen Rise—an area characterised by terraces, banks, channels, and valleys supporting sponges, soft coral, polychaetes, ascidians, turtles, snakes, and sharks • Carbonate bank and terrace system of the Sahul Shelf—an area characterised by terraces, banks, channels, and valleys, supporting sponges, soft corals, sessile filter feeders, polychaetes, and ascidians • Pinnacles of the Bonaparte Basin—an area that contains the largest concentration of pinnacles along the Australian margin, where local upwellings of nutrient-rich water attract aggregations of fish, seabirds, and turtles • Shelf break and slope of the Arafura Shelf—an area characterised by

AMP Name	Zones, IUCN categories and zone area	Description	Natural values^
			continental slope, patch reefs, and hard substrate pinnacles that support >280 demersal fish species. • The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging and internesting habitat for marine turtles.
Joseph Bonaparte Gulf	Multiple Use Zone (VI) 6346 km² Special Purpose Zone (VI) 2251 km²	The Joseph Bonaparte Gulf Marine Park is located ~15 km west of Wadeye, Northern Territory, and ~90 km north of Wyndham, Western Australia, in the Joseph Bonaparte Gulf. It is adjacent to the Western Australian North Kimberley Marine Park. The Marine Park covers an area of 8597 km² and water depth ranges between <15 m and 100 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Joseph Bonaparte Gulf Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Transition— a dynamic environment influenced by strong tidal currents, monsoonal winds, cyclones, and wind-generated waves. The large tidal ranges and wide intertidal zones near the Marine Park create a physically dynamic and turbid marine environment. The key ecological feature in the Marine Park is the carbonate bank and terrace system of the Sahul Shelf—characterised by terraces, banks, channels, and valleys supporting sponges, soft corals, sessile filter feeders, polychaetes, and ascidians. The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for marine turtles and the Australian Snubfin Dolphin.

^ Source: Ref. 77.

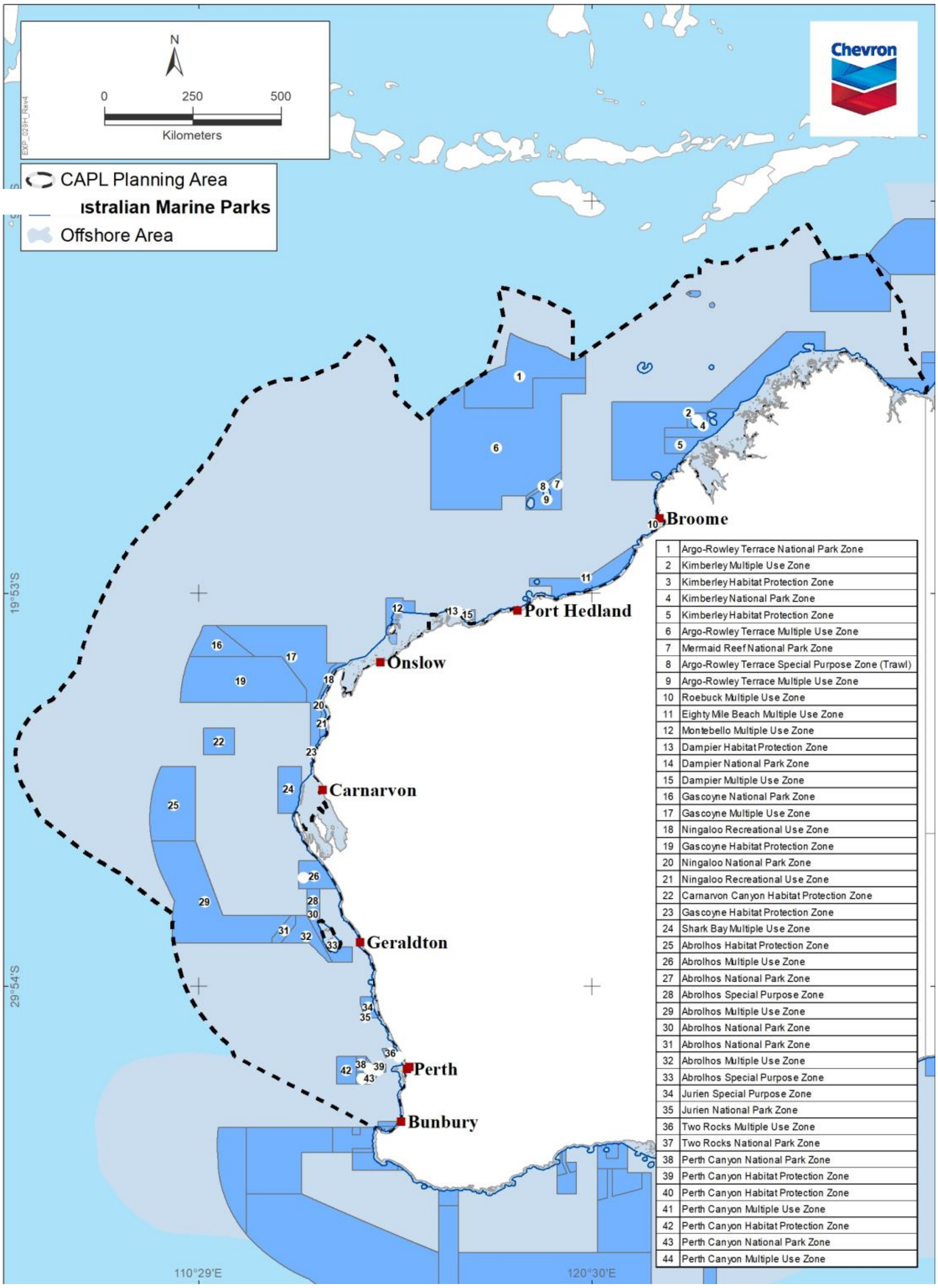


Figure 2-5: Australian Marine Parks

2.7.2 Key ecological features

Key ecological features (KEFs) are elements of the Commonwealth marine environment that are considered to be of regional importance for a region's biodiversity or its ecosystem function and integrity. KEFs meet one or more of these criteria (Ref. 78):

- a species, group of species, or a community with a regionally important ecological role (e.g., a predator, or prey that affects a large biomass or number of other marine species)
- a species, group of species, or a community that is nationally or regionally important for biodiversity
- an area or habitat that is nationally or regionally important for:
  - enhanced or high productivity (such as predictable upwellings—an upwelling occurs when cold nutrient-rich waters from the bottom of the ocean rise to the surface)
  - aggregations of marine life (such as feeding, resting, breeding or nursery areas)
  - biodiversity and endemism (species that only occur in a specific area)
- a unique sea floor feature, with known or presumed ecological properties of regional significance.

KEFs have been identified by the Australian Government on the basis of advice from scientists about the ecological processes and characteristics of the area (Ref. 78).

Table 2-22, Table 2-23, and Table 2-24 list the KEFs located within the PA (Ref. 78; Ref. 4; appendix a).

Table 2-22: Key ecological features of the North-west Marine Bioregion

KEF	Value	Description^
Ancient coastline at 125 m depth contour	Unique sea floor feature with ecological properties of regional significance	Parts of the ancient coastline, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments. The topographic complexity of these escarpments may also facilitate vertical mixing of the water column, providing relatively nutrient-rich local environments.
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	High productivity and aggregations of marine life	Ashmore Reef is the largest of only three emergent oceanic reefs present in the north-eastern Indian Ocean and is the only oceanic reef in the region with vegetated islands. Ashmore Reef and Cartier Island and the surrounding Commonwealth waters are regionally important for feeding and breeding aggregations of birds and other marine life; they are areas of enhanced primary productivity in an otherwise low-nutrient environment. Ashmore Reef supports the highest number of coral species of any reef off the west Australian coast.
Canyons linking the Argo Abyssal Plain with the Scott Plateau	High productivity and aggregations of marine life	The canyons linking the Argo Abyssal Plain and Scott Plateau are important features likely to be associated with aggregations of marine life.
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	Unique sea floor features with ecological properties of regional significance	The canyons are associated with upwelling as they channel deep water from the Cuvier Abyssal Plain up onto the slope. This nutrient-rich water interacts with the Leeuwin Current at the canyon heads. Aggregations of Whale Sharks, manta rays, sea snakes, sharks, large predatory fish, and seabirds are known to occur in this area.

KEF	Value	Description^
Carbonate bank and terrace system of the Sahul Shelf	Unique sea floor feature with ecological properties of regional significance	Little is known about the bank and terrace system of the Sahul Shelf, but it is regionally important because of its likely ecological role in enhancing biodiversity and local productivity relative to its surrounds. The banks are thought to support a high diversity of organisms (including reef fish, sponges, soft and hard corals, gorgonians, bryozoans, ascidians, and other sessile filter feeders). The banks are known to be foraging areas for Loggerhead, Olive Ridley, and Flatback Turtles. Cetaceans and Green and Freshwater Sawfish are likely to occur in the area.
Commonwealth waters adjacent to Ningaloo Reef	High productivity and aggregations of marine life	The Leeuwin and Ningaloo currents interact, leading to areas of enhanced productivity in the Commonwealth waters adjacent to Ningaloo Reef. Aggregations of Whale Sharks, manta rays, Humpback Whales, sea snakes, sharks, large predatory fish, and seabirds are known to occur in this area.
Continental Slope Demersal Fish Communities	High levels of endemism	The diversity of demersal fish assemblages on the continental slope in the Timor Province, the Northwest Transition, and the Northwest Province is high compared to elsewhere along the continental slope.
Exmouth Plateau	Unique sea floor feature with ecological properties of regional significance	The Exmouth Plateau is a regionally and nationally unique deep-sea plateau in tropical waters. The plateau is a very large topographic obstacle that may modify the flow of deep waters, generating internal tides and may contribute to upwelling of deeper water nutrients closer to the surface, thus serving an important ecological role.
Glomar Shoals	High productivity and aggregations of marine life	The Glomar Shoals are regionally important for their high biological diversity and high localised productivity. Biological data specific to Glomar Shoals is limited; however, the fish of Glomar Shoals are probably a subset of reef-dependent species and anecdotal and fishing industry evidence suggests they are particularly abundant.
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	High productivity and aggregations of marine life	The reefs of the Rowley Shoals (including Mermaid Reef) are areas of enhanced productivity and high species richness. Enhanced productivity that contributes to this species richness is thought to be facilitated by the breaking of internal waves in the waters surrounding the reefs, causing mixing and resuspension of nutrients from water depths of 500–700 m into the photic zone. The steep changes in slope around the reef also attract a range of migratory pelagic species such as dolphins, tuna, billfish, and sharks.
Pinnacles of the Bonaparte Basin	Unique sea floor feature with ecological properties of regional significance	As they provide areas of hard substrate in an otherwise relatively featureless environment, the pinnacles are likely to support a high number of species, although a better understanding of the species richness and diversity associated with these structures is required. Covering >520 km^2 within the Bonaparte Basin, this feature contains the largest concentration of pinnacles along the Australian margin. The pinnacles of the Bonaparte Basin are thought to be the eroded remnants of

KEF	Value	Description^
		underlying strata; it is likely that the vertical walls generate local upwelling of nutrient-rich water, leading to phytoplankton productivity that attracts aggregations of planktivorous and predatory fish, seabirds, and foraging turtles.
Seringapatam Reef and Commonwealth waters in the Scott Reef Complex	High productivity and aggregations of marine life	Seringapatam Reef and the Commonwealth waters in the Scott Reef complex are regionally important in supporting the diverse aggregations of marine life, high primary productivity, and high species richness associated with the reefs themselves. As two of the few offshore reefs in the north-west, they provide an important biophysical environment in the region.
Wallaby Saddle	High productivity and aggregations of marine life	The Wallaby Saddle may be an area of enhanced productivity. Historical whaling records provide evidence of Sperm Whale aggregations in the area of the Wallaby Saddle, possibly due to the enhanced productivity of the area and aggregations of baitfish.

^ Source: Ref. 79.

Table 2-23: Key ecological features of the North Marine Bioregion

KEF	Value	Description^
Carbonate bank and terrace system of the Van Diemen Rise	Unique sea floor feature with ecological properties of regional significance	The bank and terrace system of the Van Diemen Rise is part of the larger system associated with the Sahul Banks to the north and Londonderry Rise to the east; it is characterised by terrace, banks, channels, and valleys. The variability in water depth and substrate composition may contribute to the presence of unique ecosystems in the channels. Species present include sponges, soft corals, and other sessile filter feeders associated with hard substrate sediments of the deep channels; epifauna and infauna include polychaetes and ascidians. Olive Ridley Turtles, sea snakes, and sharks are also found associated with this feature.
Pinnacles of the Bonaparte Basin	Unique sea floor feature with ecological properties of regional significance	As they provide areas of hard substrate in an otherwise relatively featureless environment, the pinnacles are likely to support a high number of species, although a better understanding of the species richness and diversity associated with these structures is required. Covering >520 km^2 within the Bonaparte Basin, this feature contains the largest concentration of pinnacles along the Australian margin. The pinnacles of the Bonaparte Basin are thought to be the eroded remnants of underlying strata; it is likely that the vertical walls generate local upwelling of nutrient-rich water, leading to phytoplankton productivity that attracts aggregations of planktivorous and predatory fish, seabirds, and foraging turtles.

^ Source: Ref. 80.

Table 2-24: Key ecological features of the South-west Marine Bioregion

KEF	Value	Description^
Ancient coastline at 90–120 m depth	Relatively high productivity and aggregations of marine life, and high levels of biodiversity and endemism	Benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment, such as in the western Great Australian Bight, where the sea floor is dominated by sponge communities of significant biodiversity and structural complexity.
Cape Mentelle upwelling	High productivity and aggregations of marine life	The Cape Mentelle upwelling draws relatively nutrient-rich water from the base of the Leeuwin Current, up the continental slope, and onto the inner continental shelf, where it results in phytoplankton blooms at the surface. The phytoplankton blooms provide the basis for an extended food chain characterised by feeding aggregations of small pelagic fish, larger predatory fish, seabirds, dolphins, and sharks.
Commonwealth marine environment surrounding the Houtman Abrolhos Islands	High levels of biodiversity and endemism	The Houtman Abrolhos Islands and surrounding reefs support a unique mix of temperate and tropical species, resulting from the southward transport of species by the Leeuwin Current over thousands of years. The Houtman Abrolhos Islands are the largest seabird breeding station in the eastern Indian Ocean. They support more than one million pairs of breeding seabirds.
Commonwealth marine environment within and adjacent to Geographe Bay	High productivity and aggregations of marine life, and high levels of biodiversity and endemism	Geographe Bay is known for its extensive beds of tropical and temperate seagrass that support a diversity of species, many of them not found anywhere else. The bay provides important nursery habitat for many species. It is also an important migratory area for Humpback Whales.
Commonwealth marine environment within and adjacent to the west coast inshore lagoons	High productivity and aggregations of marine life	These lagoons are important for benthic productivity, including macroalgae and seagrass communities, and breeding and nursery aggregations for many temperate and tropical marine species. They are important areas for the recruitment of commercially and recreationally important fishery species. Extensive schools of migratory fish visit the area annually, including herring, garfish, tailor, and Australian Salmon.
Naturaliste Plateau	Unique sea floor feature with ecological properties of regional significance	The Naturaliste Plateau is Australia's deepest temperate marginal plateau. The combination of its structural complexity, mixed water dynamics, and relative isolation indicate that it supports deep-water communities with high species diversity and endemism.
Meso-scale eddies (several locations)	High productivity and aggregations of marine life	Driven by interactions between currents and bathymetry, persistent meso-scale eddies form in predictable locations within the meanders of the Leeuwin Current. They are important transporters of nutrients and plankton communities and are likely to attract a range of organisms from the higher trophic levels, such as marine mammals, seabirds, tuna and billfish. The eddies play a critical role in determining species distribution, as they influence the southerly range boundaries of tropical and subtropical species, the transport of

KEF	Value	Description^
		coastal phytoplankton communities offshore and recruitment to fisheries.
Perth Canyon and adjacent shelf break, and other west coast canyons	High biological productivity and aggregations of marine life, and unique sea floor features with ecological properties of regional significance	The Perth Canyon is the largest known undersea canyon in Australian waters. Deep ocean currents rise to the surface, creating a nutrient-rich cold-water habitat attracting feeding aggregations of deep-diving mammals, such as Pygmy Blue Whales and large predatory fish that feed on aggregations of small fish, krill, and squid.
Western demersal slope and associated fish communities	Species groups that are nationally or regionally important to biodiversity	The western demersal slope provides important habitat for demersal fish communities, with a high level of diversity and endemism. A diverse assemblage of demersal fish species below a depth of 400 m is dominated by relatively small benthic species such as grenadiers, dogfish, and cucumber fish. Unlike other slope fish communities in Australia, many of these species display unique physical adaptations to feed on the sea floor (such as a mouth position adapted to bottom feeding), and many do not appear to migrate vertically in their daily feeding habits.
Western Rock Lobster	A species that plays a regionally important ecological role	This species is the dominant large benthic invertebrate in the region. The lobster plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western rock lobsters are an important part of the food web on the inner shelf, particularly as juveniles.

^ *Source: Ref. 81.*

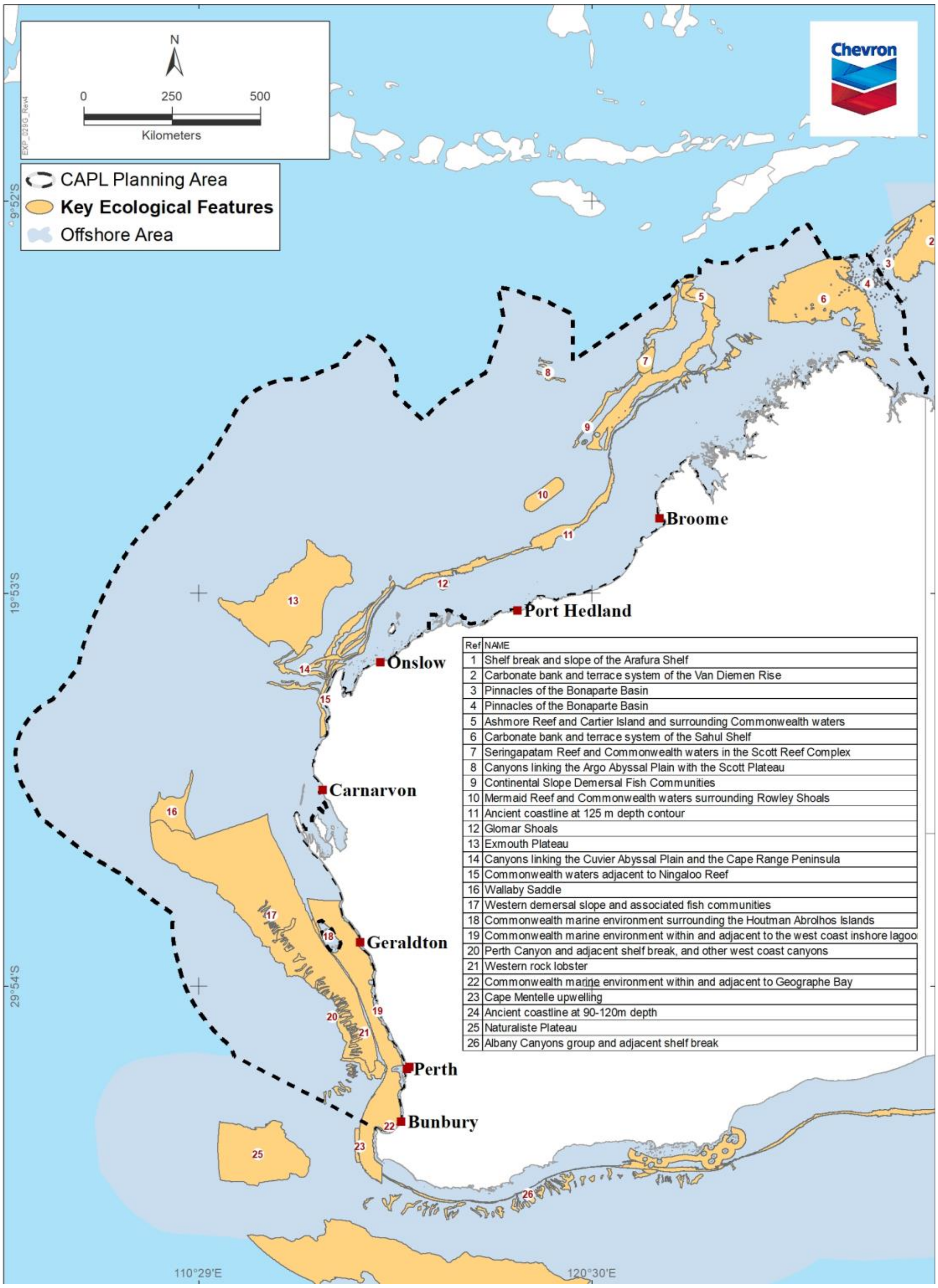


Figure 2-6: Key ecological features

3 Physical environment

3.1 Meteorology

Northwest WA is characterised by an arid, subtropical climate. In summer (between September and March), average daily temperatures range from 21 °C to 36 °C. During winter (May to July), mean daily temperatures range from 14 °C to 29 °C (Ref. 82; Ref. 83). April and August are considered transitional months during which either the summer or winter weather regime may dominate, or conditions may vary between the two (Ref. 83). The area receives relatively low rainfall, although heavy downpours can occur during tropical cyclones and depressions.

Wind patterns in north-west WA are dictated by the seasonal movement of atmospheric pressure systems. During summer, high-pressure cells produce prevailing winds from the north-west and south-west, which vary between 10 and 13 ms^{-1}. During winter, high-pressure cells over central Australia produce north-easterly to south-easterly winds with average speeds of between 6 and 8 ms^{-1}.

The cyclone season in north-west WA runs from November to April, with an average of five tropical cyclones per year (Ref. 84). Summer thunderstorms can have associated winds with gusts exceeding 20 ms^{-1}, but these winds are usually of short duration.

The air quality in the North-west Marine Region is largely unpolluted due to the Region's relative remoteness.

3.2 Oceanography

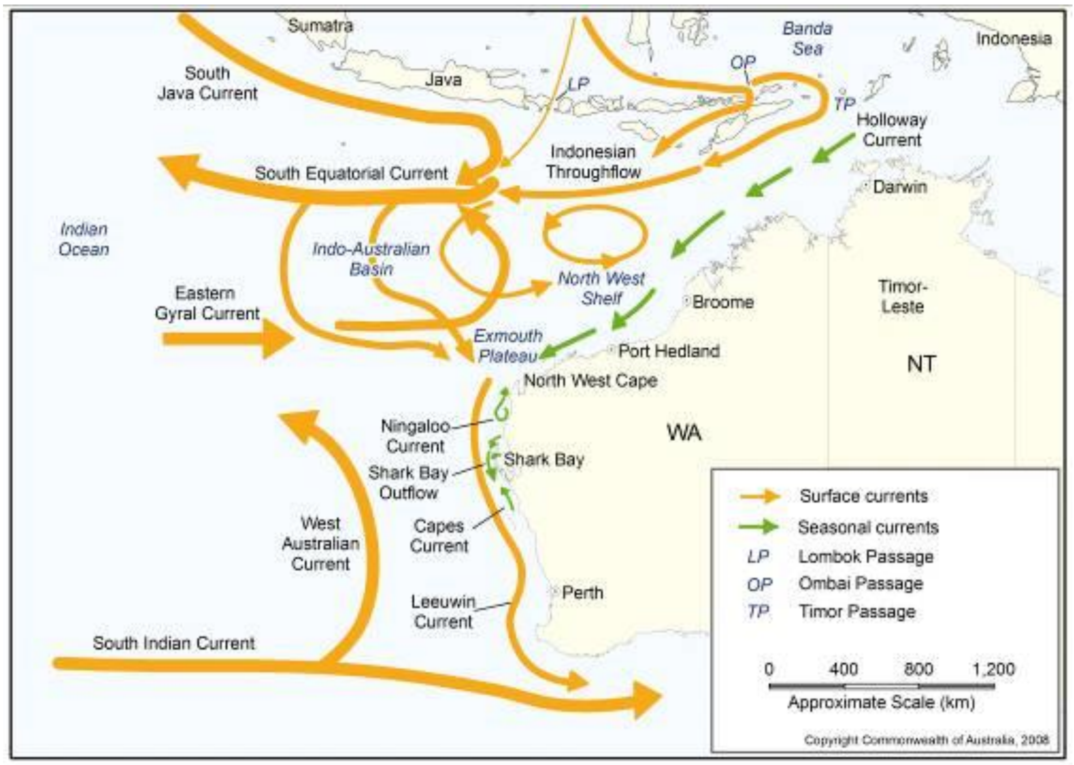
3.2.1 Water temperature

Waters in north-west WA are tropical year-round, with sea surface temperature in open shelf waters reaching ~26 °C in summer, and dropping to ~22 °C in winter. Nearshore temperatures of north-west WA fluctuate through a higher temperature range from ~17 °C in winter to ~31 °C in summer (Ref. 85).

3.2.2 Circulation and currents

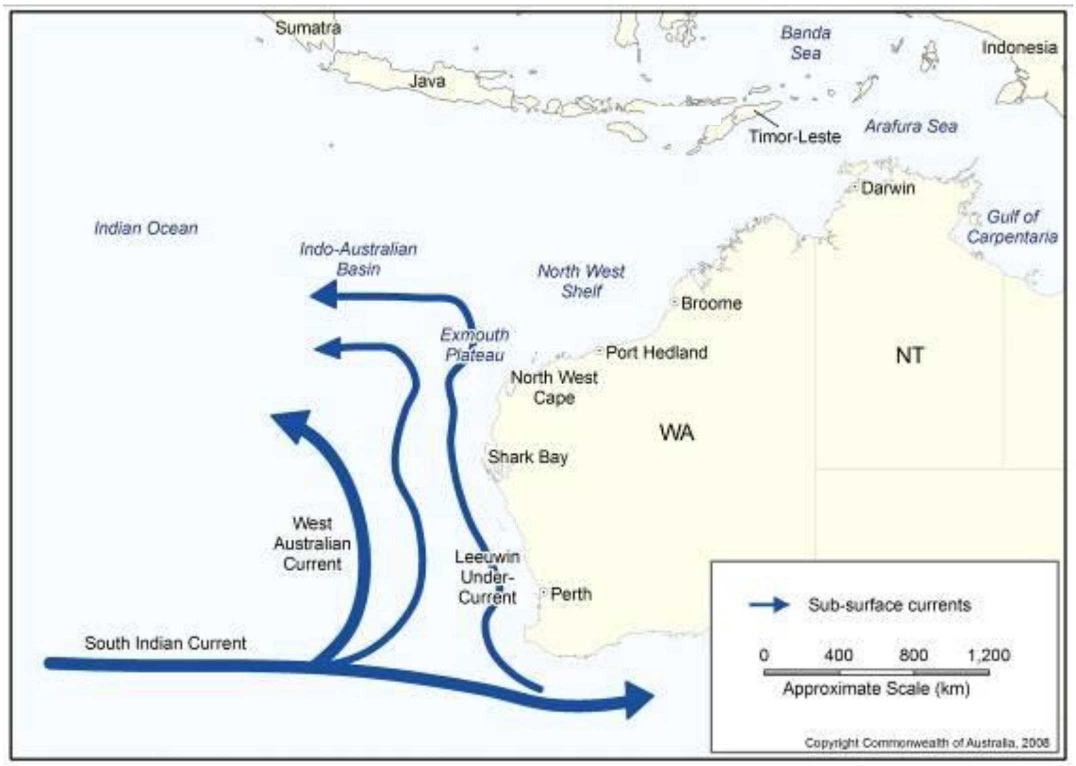
The major surface currents influencing north-west WA flow towards the poles and include the Indonesian Throughflow, the Leeuwin Current, the South Equatorial Current, and the Eastern Gyral Current. The Ningaloo Current, the Holloway Current, the Shark Bay Outflow, and the Capes Current are seasonal surface currents in the region. Below these surface currents are several subsurface currents, the most important of which are the Leeuwin Undercurrent and the West Australian Current. These subsurface currents flow towards the equator in the opposite direction to surface currents (Ref. 79). Figure 3-1 and Figure 3-2 show the main surface and subsurface currents in north-west WA.

Water circulation in north-west WA is strongly influenced by the southward-flowing Indonesian Throughflow. The strength of the Throughflow, and its influence in north-west WA, varies seasonally in association with the north-west monsoon (Ref. 79).



(Source: Ref. 79)

Figure 3-1: Surface and seasonal currents in the region



(Source: Ref. 79)

Figure 3-2: Subsurface currents in the region

3.2.3 Waves

The prevailing oceanic conditions in north-west WA are governed by a combination of sea and swell waves. Local wind-generated seas have variable wave heights, typically ranging from 0 to 4 m under non-tropical cyclone conditions. North-west WA typically experiences a persistent winter swell of ~2 m, generated by low-pressure systems in southern latitudes.

3.2.4 Tides

North-west WA has some of the largest tides along a coastline adjoining an open ocean in the world. Tides increase in amplitude from south to north, corresponding with the increasing width of the continental shelf (Ref. 79). Tidal movements are larger and stronger in the nearshore waters compared to the offshore waters. Tides in the region are broadly categorised as semidiurnal (i.e. two high tides and two low tides per day) with a spring/neap cycle (Ref. 79).

3.3 Marine water quality

3.3.1 Nutrients

North-west WA's surface waters are nutrient-poor due to the Indonesian Throughflow dominating the surface waters of the entire region.

Sporadic and variable nutrient loadings may occur within coastal waters due to changes in river run-off (e.g. Ashburton River), blooms of nitrogen-fixing microbes, tidal mixing, low-frequency circulation, and habitat influences (i.e. mangroves) (Ref. 86).

3.3.2 Turbidity

Water clarity in north-west WA varies according to water movement, depth, and seabed sediment type. Nearshore waters in the region may be relatively turbid as a result of local current-induced resuspension of fine sediments and episodic run-off from adjacent rivers, although there is high spatial and temporal variation. However, some protected coastal areas, such as the lagoon system of the fringing Ningaloo Reef, can be characterised by relatively clear water with low turbidity.

3.3.3 Water chemistry

Salinity varies spatially and temporally in the waters across north-west WA. Water salinity varies between 34.4 and 36.3 g/L in offshore waters around the North West Shelf (Ref. 87).

Wenziker *et al.* (Ref. 87) estimated natural background concentrations for a range of potential contaminants in the waters around the Dampier Archipelago, thus providing baseline information as to the water quality within nearshore waters of the North West Shelf. The contaminants investigated encompassed a range of heavy metals (e.g. cadmium, chromium, copper, lead, mercury, and zinc) and organic chemicals (e.g. polycyclic aromatic hydrocarbons, total petroleum hydrocarbons). The survey identified low background concentrations of metals and organic chemicals, with localised elevations of some contaminants (metals) near the coastal industrial centres and ports (e.g. Dampier). Except for a few select constituents, such as relatively high natural levels of cadmium, the concentrations of metals were low by world standards. Wenziker *et al.* (Ref. 87) recommended that guideline water quality trigger values from the Australian and New Zealand Environment and Conservation Council and Agriculture and

Resource Management Council of Australia and New Zealand (Ref. 88) are suitable for use in the North West Shelf.

3.3.4 Marine geomorphology

The sea floor of north-west WA comprises four general feature types: continental shelf, continental slope, continental rise, and abyssal plain. Most of the region is either continental slope or continental shelf.

3.4 Seabed features

The geomorphology of Australia's continental margin is varied, with several geomorphic features present, including basins, canyons, terraces, seamounts, and plateaus. The key geomorphic features (Ref. 89) that were mapped as potentially occurring within the PA, are:

- abyssal plain/deep ocean floor
- apron/fan
- bank/shoals
- basin
- canyon.

3.5 Marine habitat

The Seamap Australia spatial data layer is a nationally synthesised data product of sea floor marine habitat data (Ref. 90). Australian continental shelf benthic habitat layers in GIS format were collected from various stakeholders around the country, compiled and reviewed by Australian National Data Service and external independent assessors, to produce a national classification of marine habitats.

Seamap Australia spatial data were used to indicate the types of marine habitat present within the PA. Table 3-1 summarises the areas of marine habitat associated with the matters of NES identified in this document.

Table 3-1: Marine habitat and key sensitivities

Matter of national environmental significance	Key sensitivities							Habitat type				
	AMP	KEF	Ramsar wetland	National Heritage	Commonwealth Heritage	World Heritage	TEC	Seagrass	Mangrove	Coral	Saltmarsh	Macroalgae
Ashmore Reef	☒							☒		☒		
Ashmore Reef and Cartier Island and surrounding Commonwealth waters		☒								☒		
Ashmore reef National Nature Reserve			☒							☒		

Matter of national environmental significance	Key sensitivities							Habitat type				
	AMP	KEF	Ramsar wetland	National Heritage	Commonwealth Heritage	World Heritage	TEC	Seagrass	Mangrove	Coral	Saltmarsh	Macroalgae
Ashmore Reef National Nature Reserve					☒					☒		
Carbonate bank and terrace system of the Sahul Shelf		☒								☒		
Carbonate bank and terrace system of the Van Diemen Rise		☒								☒		
Cartier Island	☒							☒		☒		
Commonwealth marine environment in and adjacent to Geographe Bay		☒						☒				
Commonwealth marine environment in and adjacent to the west coast inshore lagoons		☒						☒				☒
Eighty-mile Beach			☒						☒		☒	
Geographe	☒							☒				
Joseph Bonaparte Gulf	☒									☒		
Mermaid Reef – Rowley Shoals					☒					☒		
Ningaloo Coast				☒						☒		
Ningaloo Coast						☒			☒	☒		
Ningaloo Marine Area – Commonwealth Waters					☒					☒		
Oceanic Shoals	☒									☒		
Ord River Floodplain			☒						☒		☒	
Roebuck Bay			☒					☒	☒			
Scott Reef and Surrounds – Commonwealth Area					☒			☒		☒		
Shark Bay						☒		☒				
Shark Bay (Wooramel Seagrass Bank)				☒				☒				
Subtropical and Temperate Coastal Saltmarsh							☒				☒	

Matter of national environmental significance	Key sensitivities							Habitat type				
	AMP	KEF	Ramsar wetland	National Heritage	Commonwealth Heritage	World Heritage	TEC	Seagrass	Mangrove	Coral	Saltmarsh	Macroalgae
The West Kimberley				☒					☒	☒		
Thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond)							☒					☒
Two Rocks	☒							☒				☒

3.6 Shoreline type

The Smartline Coastal Geomorphic Map of Australia (Ref. 91) is a detailed map of the coastal landform types—or geomorphology—of continental Australia and most of its adjacent islands. Using the intertidal classifications provided by the Smartline database, the types of shoreline that are present within the PA, their overall length, and percentage present in the PA is listed in Table 3-2.

Table 3-2: Shoreline type and length within PA

Shoreline type	Length (100 kms)
Unclassified	4608.46
Muddy tidal flats	2162.74
Hard bedrock shore	2151.61
Tidal flats (sediment undifferentiated)	1811.23
Sandy beach undifferentiated	966.09
Fine-medium sand beach	400.78
Hard rock cliff (>5 m)	248.45
Tidal sediment flats (inferred from mangroves)	192.49
Beach (sediment type undifferentiated)	161.49
Fine-medium sandy tidal flats	137.94
Sandy shore undifferentiated	102.32
Sandy tidal flats	68.28
Mixed sandy shore undifferentiated	37.96
Hard rocky shore platform	21.59
Artificial shoreline undifferentiated	13.87
Rocky shore (undifferentiated)	8.84
Boulder revetment	6.98
Sandy tidal flats with coarse stony debris	3.87

Shoreline type	Length (100 kms)
Perched sandy beach (undifferentiated)	2.81
Soft ‘bedrock’ shore	0.39
Concrete dock structures	0.23
Coral shingle beach	0.21

4 Socioeconomic environment

4.1 Commercial shipping

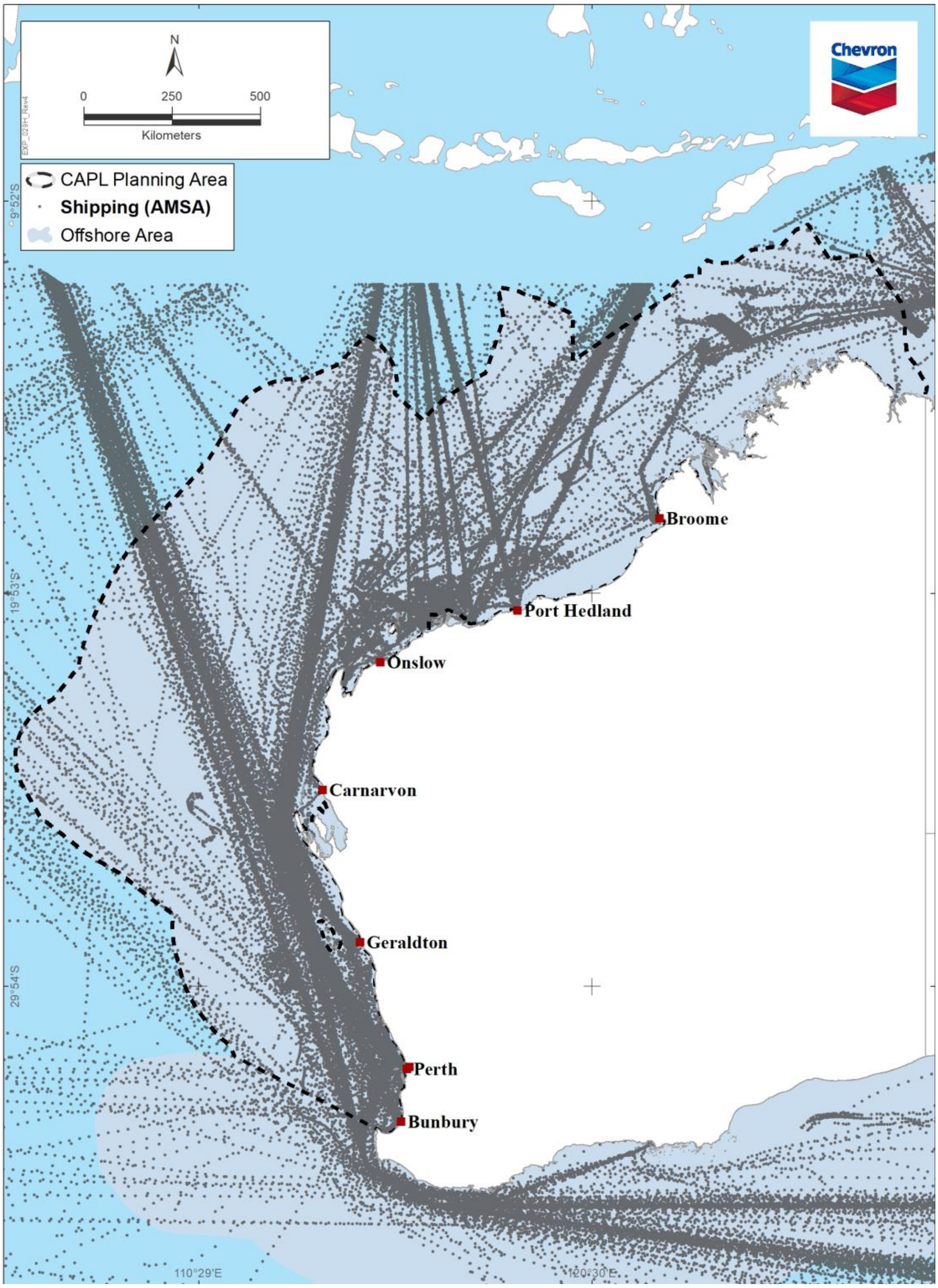
The Australian Maritime Safety Authority (AMSA) uses a satellite automatic identification system (AIS) service that provides AIS data across the Indo-Pacific and Indonesian region. The AIS can send and receive ship information (such as identity, position, course, speed, ship particulars, and cargo information) to and from other ships, suitably equipped aircraft, and shore. It can handle >2,000 reports per minute and updates information as often as every two seconds. Although the AIS is conventionally a line-of-sight radio broadcast system for communication between ships, and between ships and shore stations, recent technological developments have seen satellites adapted for receiving AIS messages from low Earth orbit.

Data provided by shipborne AISs were used to build a point density map from filtered satellite AIS data collected between 1 January 2016 and 31 December 2016 to indicate the level of shipping activity in Australian waters (Ref. 92).

Given the size of the PA, CAPL has reviewed this shipping density information to understand areas within the PA that comprise high activity and are important for the WA economy. Based on this data, the key shipping channels are those between:

- Fremantle, Dampier, and Port Hedland ports to Indonesia
- Fremantle, Dampier, and Port Hedland ports to Timor
- Port of Dampier to various offshore oil and gas developments.

The map also reflects the vessel density in and around known oil and gas facilities and developments within the PA (Figure 4-1).



(Source: Ref. 92)

Figure 4-1: Commercial shipping

4.2 Commercial fishing and aquaculture

Fishing and aquaculture activities are managed under various State and Commonwealth agencies. Table 4-1 and Table 4-2 list and summarise the State and Commonwealth managed fisheries that overlap the PA (Ref. 93; Ref. 94)

Table 4-1: State managed fisheries

Fishery	2019–2020 season summary^
Abalone	The 2019–2020 fishing season reported a commercial catch of 47 t. Catch was below TACC due to low catches in regional areas resulting from economic and accessibility issue.
Abrolhos Islands and Mid-West Trawl	The 2019–2020 fishing season reported a commercial catch of 796 t. Catch within acceptable range. The commercial fishery is in a planned expansion phase.
Broome Prawn	The 2019–2020 fishing season reported a negligible commercial catch. Minimal fishing occurred in 2019.
Cockburn Sound (Crab)	The fishery has been closed since April 2014. In 2019 recruitment and egg production remained below limit reference levels. Decline is consistent with an environmentally limited stock.
Cockburn Sound (Fish Net)	The 2019–2020 fishing season reported a commercial catch of 253 t (nearshore fisheries, total finfish). Metro Zone Garfish fishery closed in 2017. Declines in Garfish and Whitebait consistent with an environmentally limited stock. Review of acceptable catch ranges is required.
Cockburn Sound (Line and Pot)	The Cockburn Sound Line and Pot Managed Fishery record a catch of 32 t during 2018/10.
Exmouth Gulf Prawn	The 2019–2020 fishing season reported a commercial catch of 821 t. All species were within their acceptable catch ranges.
Inner Shark Bay Demersal	The 2019–2020 fishing season reported a commercial catch of 1 t. Incidental catch. Not considered a risk to stocks.
Gascoyne Demersal Scalefish	The 2019–2020 fishing season reported a commercial catch of 33.2 t of Snapper, and 139 t of other demersal species. Snapper spawning biomass was around the limit level. Additional management action undertaken in 2018 including TACC reduction. Management for other demersals adequate.
Kimberley Crab	The 2019–2020 fishing season reported a commercial catch of 7.4 t (Mud Crab). Catch rate: Below threshold, above limit.
Kimberley Gillnet and Barramundi	The 2019–2020 fishing season reported a commercial catch of 47 t (barramundi), and 73 t (total). Catch is above the acceptable range. The level of catch is lower than previous years, and is not considered a risk to stocks as the catch rate remains high.
Kimberley Prawn	The 2019–2020 fishing season reported a commercial catch of 100 t. Banana prawn catch well below acceptable and predicted range. Low effort in 2019.
Mackerel Fishery	The 2019–2020 fishing season reported a commercial catch of 291 t. The Spanish Mackerel catch is within tolerance range due to increased effort in 2019. Nominal catch rates declined in each area.
Marine Aquarium	The 2019 fishing season reported a commercial catch of 11.925 fish.
Nickol Bay Prawn	The 2019–2020 fishing season reported a commercial catch of 254 t. Catch within acceptable range. Banana prawn catches higher than predicted.
Northern Demersal Scalefish	The 2019–2020 fishing season reported a commercial catch of 1,507 t (total), 602 t (Goldband Snapper), 192 t (Red Emperor). Goldband Snapper and Red Emperor catches are above their catch ranges. Catches will be monitored closely in 2020.
Octopus	The 2019–2020 fishing season reported a commercial catch of 453 t. Catch was below TACC due to low catches in regional areas resulting from economic and accessibility issues.

Fishery	2019–2020 season summary^
Onslow Prawn	The 2019–2020 fishing season reported a commercial catch <60 t. Low effort by one boat in 2019.
Pearl Oyster Wildstock	The 2019–2020 fishing season reported a commercial catch of 611,816 oysters (14,022 dive hours). Catch below quota as MOP component was not fully utilised. Catch rates increased from 2018 to 2019.
Pilbara Crab	The 2019 fishing season reported a commercial catch of 19.3 t (Blue Swimmer Crab). Catch rate: Above threshold.
Pilbara Fish Trawl	The 2019–2020 fishing season reported a commercial catch of 2,142 t. Catches are increasing as the demersal scalefish assemblage in the Pilbara region recovers following effort reductions.
Pilbara Trap	The 2019–2020 fishing season reported a commercial catch of 680 t. Catches are increasing as the demersal scalefish assemblage in the Pilbara region recovers following effort reduction.
Pilbara Line	The 2019–2020 fishing season reported a commercial catch of 148 t. Catches are increasing as the demersal scalefish assemblage in the Pilbara region recovers following effort reduction.
Shark Bay Beach Seine and Mesh Net	The 2019–2020 fishing season reported a commercial catch of 175 t. Catch below the acceptable range due to ongoing low levels of effort.
Shark Bay Crab	The 2019–2020 fishing season reported a commercial catch of 529 t. Catch within acceptable range. Spawning and recruitment levels have further increased under the current environmental conditions and harvest levels.
Shark Bay Prawn	The 2019–2020 fishing season reported a commercial catch of 1.214 t. Brown tiger and western king prawn catches below the acceptable range due to lower recruitment levels. Additional management measures were implemented within the season to protect breeding stocks.
Shark Bay Scallop	The 2019–2020 fishing season reported a commercial catch of 657 t (to end of December). . Quota season extended to 30 April. Catch achieved to end of February from Denham Sound is estimated to be 1,370 t and that >90% of the total will be achieved. Northern Shark Bay closed to fishing due to recruitment below limit reference level. Decline is consistent with an environmentally limited stock and continues to be investigated.
Southern Demersal Gillnet & Demersal Longline West Coast Demersal Gillnet & Demersal Longline	The Temperate Demersal Gillnet and Demersal Longline Fishery (TDGDLF) comprises the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WCDGDLF), which operates between 26° and 33°S, and the Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (JASDGDLF), which operates from 33°S to the WA/SA border. The 2018–2019 fishing season reported a commercial catch of 838 t (sharks and rays) and 132 t (scalefish).
South West Coast Salmon / South Coast Salmon	The 2017–2018 fishing season for the South West Coast Salmon and South Coast Salmon reported a commercial catch of 50 t and 93 t respectively. In 2017, there were ~12 commercial fishers employed in the South Coast Salmon Fishery.
South West Trawl	Only one boat fished in the SWTMF in 2019 for a total of 32 boat days.
Specimen Shell	The 2019 fishing season reported a commercial catch of 7,232 shells.
West Coast Deep Sea Crustacean	The 2019–2020 fishing season reported a commercial catch of 155.7 t. TAC achieved with effort within acceptable range. The standardised catch rate of retained legal crabs is within the acceptable range.

Fishery	2019–2020 season summary^
West Coast Demersal Scalefish	The 2019–2020 fishing season reported a commercial catch of 270 t. Demersal suite catch within range.
West Coast Estuarine	The 2019–2020 fishing season reported a commercial catch of 66 t (Peel Harvey crab), 121 t (Peel Harvey finfish), and 35 t (other West Coast estuaries, crabs, and finfish). Catch and catch rates within acceptable ranges.
West Coast Purse Seine	The 2019–2020 fishing season reported a commercial catch of 527 t (all species). Catch was below quota.
West Coast Rock Lobster	The 2019–2020 fishing season reported a commercial catch of 6400 t. Catch within TACC plus 1.5% water loss i.e. 6400 t.
Western Australian Sea Cucumber	The 2019–2020 fishing season reported a commercial catch of 2 t (Sandfish), and 5 t (Redfish). Limited fishing due to due to planned rotational harvest schedule by industry.

^ *Source: Ref. 95.*

Table 4-2: Commonwealth managed fisheries

Fishery	2018–2019 season summary^
North-West Slope Trawl Fishery	The 2018–2019 fishing season reported a commercial catch of 41.1 t (scampi) and 67.4 t (total), with economic value withheld. The fishery recorded 151 active days comprising 2,869 trawl-hours. Seven permits were in place with four vessels active for the season.
Small Pelagic Fishery	The 2018–2019fishing season reported a commercial catch of 16,093 t. The fishery recorded 197 search-hours with 448 midwater trawl shots. In 2018–2019, 31 entities held quota statutory fishing right (SFRs), with three vessels actively using purse seine methods and one using trawl methods.
Southern Bluefin Tuna Fishery	The 2018–2019fishing season reported a commercial catch of 6,074 t worth an estimated AU$43.41 million. The fishery recorded 1,366 search-hours with 166 shots. In 2018–2019, 82 entities held quota SFRs, with seven vessels actively using purse seine methods and 20 using longline methods.
Western Deepwater Trawl Fishery	The 2018–2019fishing season reported a commercial catch of 53 t with economic value withheld. The fishery recorded 53 active days comprising 492.3 trawl-hours. Four permits were in place with one vessels active for the season.
Western Skipjack Fishery	There has been no fishing effort in the Skipjack Tuna Fishery (STF) since the 2008–2009 fishing season. Variability in the availability of skipjack tuna in the Australian Fishing Zone and the prices received for product influence participation levels in the fishery.
Western Tuna and Billfish Fishery	The 2018–2019fishing season reported a commercial catch of 218 t with the economic value withheld. The fishery recorded 366,821 hooks for the season. 94 entities held quota SFRs, with two vessels actively using pelagic longline and two vessels using minor line methods.

^ *Source: Ref. 96.*

4.3 Recreational fisheries

The WA Department of Primary Industries and Regional Development (DPIRD) conducts state-wide recreational fishing surveys every two years, with the first survey completed in 2011. The survey collects information from more than 3,000 recreational fishers who record their catches in logbooks over a 12-month period with DPIRD also conducting interviews throughout the State and monitoring the number of boat launches and retrievals using cameras at various boat ramps.

Key findings of the 2017–2018 survey report (Ref. 97) are included in Table 4-3.

Table 4-3: Recreational fishing survey outcomes

Component	Number
Number of participants	~6,000
Number of recreational fishing boat licences issued	~135 000
Most popular species	
Blue Swimmer Crab	Number caught ~667 000
School Whiting	Number caught ~259 000
Fishing effort by bioregion	
West Coast	76%
Gascoyne Coast	11%
North Coast	8%
South Coast	5%

Source: Ref. 97

4.4 Underwater cultural heritage

The Australasian Underwater Cultural Heritage Database (Ref. 98) records all known maritime cultural heritage (shipwrecks, aircraft, relics, and other underwater cultural heritage) in Australian waters. Historic shipwrecks and sunken aircraft (older than 75 years) are protected under the Commonwealth *Underwater Cultural Heritage Act 2018*. Shipwrecks and aircraft that have been underwater <75 years, and other types of underwater cultural heritage, can be protected through individual declaration based on an assessment of heritage significance.

Approximately 667 shipwrecks are present within the PA. Given this number, no additional detail is provided in this document. If shipwrecks are present within an EMBA described in a project-specific EP, CAPL will identify and detail the significance of these shipwrecks in that EP.

4.5 Defence

Table 4-4 lists the Australian Department of Defence's prohibited and training areas that are within the PA (Ref. 99).

Table 4-4: Department of Defence Prohibited and Training Areas

Area Type	Area Name
Practice Areas	Darwin AWR Central
	Learmonth AWR
	North-West Australian Exercise Area
Training Areas	North Australian Exercise Area
	Yampi Field Training Area
	Learmonth AWR
	West Australian Exercise Area

4.6 Tourism

Tourism is an important industry for WA, directly employing 73 200 people and indirectly employing a further 35,600 (Ref. 100). The value of the WA tourism industry is AU$12.9 billion by Gross State Product (Ref. 100). Table 4-5 lists the value of tourism to the state's economy.

Table 4-5: Western Australian Tourism Statistics

	WA Direct Tourism Gross Value Added ($million)	% of WA Direct Tourism Gross Value Added ($million)
Tourism characteristic industries		
Travel agency and tour operator services	$1138	19.1%
Air, water, and other transport	$823	13.8%
Accommodation	$654	11.0%
Cafes, restaurants, and takeaway food services	$552	9.3%
Ownership of dwellings	$370	6.2%
Clubs, pubs, taverns, and bars	$339	5.7%
Motor vehicle hiring	$157	2.6%
Other road transport	$87	1.5%
Casinos and other gambling services	$88	1.5%
Other sports and recreation services	$85	1.4%
Cultural services	$74	1.2%
Rail transport	$64	1.1%
Taxi transport	$56	0.9%
Tourism connected industries		
Automotive fuel retailing	$51	0.9%
Other retail trade	$631	10.6%
Education and training	$384	6.4%
All other industries	$413	6.9%
Total Gross Value Added	**$5966**	**100%**

Source: Ref. 100

5 terms, acronyms, and abbreviations

Table 5-1 defines the acronyms and abbreviations used in this document.

Table 5-1: Term, acronyms and abbreviations

Term, acronym, or abbreviation	Definition
~	Approximately
<	Less/fewer than
>	Greater/more than
AHC	Australian Heritage Commission
AIMS	Australian Institute of Marine Science
AIS	Automatic identification System
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
AU$	Australian dollar
AWR	Air Weapons Range
BIA	Biologically Important Area; a spatially defined area where aggregations of individuals of a species are known to display biologically important behaviours such as breeding, foraging, resting, or migration
BP	Before Present (present = 1950)
CAMBA	China–Australia Migratory Bird Agreement
CAPL	Chevron Australia Pty Ltd
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Diadromous	Fish that spend portions of their life cycles partially in fresh water and partially in salt water
Doline	A shallow depression, either funnel- or saucer-shaped, with a floor covered by cultivated soil, formed by solution in limestone country
DPIRD	Western Australian Department of Primary Industries and Regional Development
DTA	Defence Training Area
EEZ	Exclusive Economic Zone
EMBA	Environment that May Be Affected
Endangered Species	A species that is not critically endangered, but is facing a very high risk of extinction in the wild in the near future.
EP	Environment Plan
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
g/L	Grams per litre
GIS	Geographic Information System
GVP	Gross Value of Product
ha	Hectare
HMAS	His Majesty’s Australian Ship (during World War II)
HMS	His (or Her) Majesty’s Ship (British)

Term, acronym, or abbreviation	Definition
HSK	Ship of the German Navy (during World War II)
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
IUU	Illegal, unreported, and unregulated
JAMBA	Japan–Australia Migratory Bird Agreement
JASDGDLF	Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery
Karst	An area of irregular limestone in which erosion has produced fissures, sinkholes, underground streams, and caverns.
KEF	Key Ecological Feature
km	Kilometre
km^2	Square kilometre
m	Metre
MoU	Memorandum of Understanding
ms^{-1}	Metres per second
NES	[Matters of] National Environmental Significance, as defined in Part 3, Division 1 of the EPBC Act.
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
PA	Planning Area
PDSF	Pilbara Demersal Scalefish Fisheries
Photic zone	The depth of the water in a lake or ocean that is exposed to sufficient sunlight for photosynthesis to occur. The depth of the photic zone can be greatly affected by turbidity.
Priority Species	A species that does not meet the criteria for listing as Threatened Fauna or Declared Rare Flora, but which either may be suspected to be threatened; or is not threatened, but is rare and in need of ongoing monitoring; or is dependent on ongoing management intervention to prevent it from becoming threatened.
Prokaryote	A unicellular organism without a nucleus
Sessile	Permanently attached directly to the substratum by its base (i.e. immobile), without a stalk or stem
SFR	Statutory fishing right
SNES	Species of National Environmental Significance
Stochastic	Random
Swale	A low place in a tract of land, usually moister than the adjacent higher land
SWMR	South-West Marine Region
t	Tonne
TDGDLF	Temperate Demersal Gillnet and Demersal Longline Fishery
TEC	Threatened Ecological Community
Trophic	Relating to food or nutrition / nutritive processes
Vulnerable Species	A species is listed as vulnerable under the EPBC Act if it is not critically endangered or endangered and it is facing a high risk of extinction in the wild in

Term, acronym, or abbreviation	Definition
	the medium-term future, as determined in accordance with the prescribed criteria.
WA	Western Australia
WCB	West Coast Bioregion
WCDGDLF	West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery

6 references

The following documentation is either directly referenced in this document or is a recommended source of background information.

Where references and citations have been copied from Government Database sources, the database has been referenced but the references as cited by the databases have not been specified here. For source material, please refer to the governmental databases for specific source references.

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appendix a protected matters search report

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

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

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

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

Report created: 21/07/21 17:28:05

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 0.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	2
National Heritage Places:	8
Wetlands of International Importance:	6
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	139
Listed Migratory Species:	106

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	11
Commonwealth Heritage Places:	11
Listed Marine Species:	197
Whales and Other Cetaceans:	41
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	43

Extra Information

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

State and Territory Reserves:	103
Regional Forest Agreements:	1
Invasive Species:	62
Nationally Important Wetlands:	17
Key Ecological Features (Marine)	24

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Shark Bay, Western Australia	WA	Declared property
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
Lesueur National Park	WA	Listed place
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place
The West Kimberley	WA	Listed place
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place
Historic		
Batavia Shipwreck Site and Survivor Camps Area 1629 - Houtman Abrolhos	WA	Listed place
Dirk Hartog Landing Site 1616 - Cape Inscription Area	WA	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Ashmore reef national nature reserve	Within Ramsar site
Becher point wetlands	Within 10km of Ramsar
Eighty-mile beach	Within Ramsar site
Ord river floodplain	Within Ramsar site
Peel-yalgorup system	Within Ramsar site
Roebuck bay	Within 10km of Ramsar

Commonwealth Marine Area [Resource Information]

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

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

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

Name
North
North-west
South-west

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Endangered	Community likely to occur within area
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)	Critically Endangered	Community known to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii blaauwi Partridge Pigeon (western) [66501]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	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	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
Malurus leucopterus leucopterus White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren [26004]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Turnix varius scintillans Painted Button-quail (Houtman Abrolhos) [82451]	Vulnerable	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Fish		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Insects		
Hesperocolletes douglasi Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isoodon auratus auratus Golden Bandicoot (mainland) [66665]	Vulnerable	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Lagorchestes hirsutus bernieri Rufous Hare-wallaby (Bernier Island) [66662]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus dorreae Rufous Hare-wallaby (Dorre Island) [66663]	Vulnerable	Species or species habitat known to occur within area
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Osphranter robustus isabellinus Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Perameles bougainville bougainville Western Barred Bandicoot (Shark Bay) [66631]	Endangered	Species or species habitat known to occur within area
Petrogale concinna monastria Nabarlek (Kimberley) [87607]	Endangered	Species or species habitat known to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Phascogale tapoatafa kimberleyensis Kimberley brush-tailed phascogale, Brush-tailed Phascogale (Kimberley) [88453]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
Pseudomys fieldi Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Other		
Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat may occur within area
Kumonga exleyi Cape Range Remipede [86875]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
Androcalva bivillosa Straggling Androcalva [87807]	Critically Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Caladenia bryceana subsp. cracens Northern Dwarf Spider-orchid [64556]	Vulnerable	Species or species habitat may occur within area
Caladenia elegans Elegant Spider-orchid [56775]	Endangered	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Caladenia viridescens Dunsborough Spider-orchid [56776]	Endangered	Species or species habitat may occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat likely to occur within area
Chorizema varium Limestone Pea [16981]	Endangered	Species or species habitat known to occur within area
Conostylis micrantha Small-flowered Conostylis [17635]	Endangered	Species or species habitat may occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Drummondita ericoides Morseby Range Drummondita [9193]	Endangered	Species or species habitat likely to occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus beardiana Beard's Mallee [18933]	Vulnerable	Species or species habitat may occur within area
Eucalyptus x phylacis Meelup Mallee [87817]	Endangered	Species or species habitat likely to occur within area
Grevillea batrachioides Mt Lesueur Grevillea [21735]	Endangered	Species or species habitat may occur within area
Grevillea humifusa Spreading Grevillea [61182]	Endangered	Species or species habitat may occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
Marianthus paralius [83925]	Endangered	Species or species habitat known to occur within area
Minuria tridens Minnie Daisy [13753]	Vulnerable	Species or species habitat known to occur within area
Pityrodia augustensis Mt Augustus Foxglove [4962]	Vulnerable	Species or species habitat likely to occur within area
Seringia exastia Fringed Fire-bush [88920]	Critically Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat likely to occur within area
Wurmbea calcicola Naturaliste Nancy [64691]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus lancelini Lancelin Island Skink [1482]	Vulnerable	Species or species habitat known to occur within area
Ctenotus zastictus Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Liopholis pulchra longicauda Jurien Bay Skink, Jurien Bay Rock-skink [83162]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Breeding known to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Breeding known 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]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely 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 likely 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 likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Name	Threatened	Type of Presence
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
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
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area

Name	Threatened	Type of Presence
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

[Resource Information]

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

Name
Commonwealth Land -
Defence - EXMOUTH ADMIN & HF TRANSMITTING
Defence - EXMOUTH NAVAL HF RECEIVING STATION (H/F Receiving Station, Learmonth, WA)
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND
Defence - LEARMONTH - AIR WEAPONS RANGE
Defence - LEARMONTH - RAAF BASE
Defence - LEARMONTH RADAR SITE - TWIN TANKS EXMOUTH
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH
Defence - LEARMONTH TRANSMITTING STATION
Defence - YAMPI SOUND TRAINING AREA

Commonwealth Heritage Places

[Resource Information]

Name	State	Status
Natural		
Ashmore Reef National Nature Reserve	EXT	Listed place
Garden Island	WA	Listed place
Lancelin Defence Training Area	WA	Listed place
Learmonth Air Weapons Range Facility	WA	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place
Yampi Defence Area	WA	Listed place
Historic		
Cliff Point Historic Site	WA	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
J Gun Battery	WA	Listed place

Listed Marine Species

[Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous minutus Black Noddy [824]		Breeding known to occur within area
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat 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

Name	Threatened	Type of Presence
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
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
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding likely to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Puffinus assimilis Little Shearwater [59363]		Breeding known to occur within area

Name	Threatened	Type of Presence
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus huttoni Hutton's Shearwater [1025]		Foraging, feeding or related behaviour known to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish		Species or species

Name	Threatened	Type of Presence
[66202]		habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		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
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus fuscus Dusky Seasnake [1119]		Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Name	Threatened	Type of Presence
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely 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 likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area

Name	Status	Type of Presence
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Abrolhos	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	National Park Zone (IUCN II)
Abrolhos	Special Purpose Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)
Ashmore Reef	Recreational Use Zone (IUCN IV)
Ashmore Reef	Sanctuary Zone (IUCN Ia)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Cartier Island	Sanctuary Zone (IUCN Ia)
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Dampier	National Park Zone (IUCN II)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Geographe	Multiple Use Zone (IUCN VI)
Geographe	Special Purpose Zone (Mining
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Jurien	National Park Zone (IUCN II)
Jurien	Special Purpose Zone (IUCN VI)
Kimberley	Habitat Protection Zone (IUCN IV)
Kimberley	Multiple Use Zone (IUCN VI)
Kimberley	National Park Zone (IUCN II)
Mermaid Reef	National Park Zone (IUCN II)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)
Perth Canyon	Habitat Protection Zone (IUCN IV)
Perth Canyon	Multiple Use Zone (IUCN VI)
Perth Canyon	National Park Zone (IUCN II)
Roebuck	Multiple Use Zone (IUCN VI)
Shark Bay	Multiple Use Zone (IUCN VI)
South-west Corner	Multiple Use Zone (IUCN VI)
South-west Corner	National Park Zone (IUCN II)
South-west Corner	Special Purpose Zone (Mining
Two Rocks	Multiple Use Zone (IUCN VI)
Two Rocks	National Park Zone (IUCN II)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Adele Island	WA
Airlie Island	WA
Balanggarra	WA
Bardi Jawi	WA
Barrow Island	WA
Bedout Island	WA
Beekeepers	WA
Bernier And Dorre Islands	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Boullanger, Whitlock, Favourite, Tern And Osprey Islands	WA
Browse Island	WA
Bundegi Coastal Park	WA
Burnside And Simpson Island	WA
Cape Range	WA
Carnac Island	WA
Coulomb Point	WA
Dambimangari	WA

Name	State
Dirk Hartog Island	WA
Escape Island	WA
Giralia	WA
Gnandaroo Island	WA
Houtman Abrolhos Islands	WA
Jarrkunpungu	WA
Jinmarnkur	WA
Jinmarnkur Kulja	WA
Jurabi Coastal Park	WA
Karajarri	WA
Koks Island	WA
Kooljerrenup	WA
Lacepede Islands	WA
Lancelin And Edwards Islands	WA
Leeuwin-Naturaliste	WA
Len Howard	WA
Lesueur	WA
Lesueur Island	WA
Little Rocky Island	WA
Locker Island	WA
Low Rocks	WA
Lowendal Islands	WA
McLarty	WA
Mealup Point	WA
Mijing	WA
Montebello Islands	WA
Muiron Islands	WA
Nambung	WA
Niiwalarra Islands	WA
Nilgen	WA
North Sandy Island	WA
North Turtle Island	WA
Ord River	WA
Pelican Island	WA
Penguin Island	WA
Rottnest Island	WA
Round Island	WA
Serrurier Island	WA
Southern Beekeepers	WA
Swan Island	WA
Tanner Island	WA
Tent Island	WA
Unnamed WA11883	WA
Unnamed WA26400	WA
Unnamed WA28968	WA
Unnamed WA34039	WA
Unnamed WA36913	WA
Unnamed WA36915	WA
Unnamed WA37168	WA
Unnamed WA37338	WA
Unnamed WA37383	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA40877	WA
Unnamed WA41080	WA
Unnamed WA41160	WA
Unnamed WA41775	WA
Unnamed WA42030	WA
Unnamed WA44665	WA
Unnamed WA44667	WA
Unnamed WA44669	WA
Unnamed WA44672	WA
Unnamed WA44673	WA
Unnamed WA44677	WA
Unnamed WA44682	WA
Unnamed WA44688	WA

Name	State
Unnamed WA46982	WA
Unnamed WA46983	WA
Unnamed WA46984	WA
Unnamed WA48205	WA
Unnamed WA48858	WA
Unnamed WA48968	WA
Unnamed WA49994	WA
Unnamed WA51162	WA
Unnamed WA51943	WA
Uunguu	WA
Victor Island	WA
Wanagarren	WA
Wedge Island	WA
Weld Island	WA
Whalebone Island	WA
Whitmore,Roberts,Doole Islands And Sandalwood Landing	WA
Y Island	WA
Yalgorup	WA
Yampi	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Phasianus colchicus Common Pheasant [920]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus exulans Pacific Rat, Polynesian Rat [79]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass		Species or species habitat likely to occur

Name	Status	Type of Presence
[31754]		within area
Jatropha gossypifolia		
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Mimosa pigra		
Mimosa, Giant Mimosa, Giant Sensitive Plant, ThornySensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		Species or species habitat likely to occur within area
Olea europaea		
Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Prosopis spp.		
Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium		
Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla		
Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Vachellia nilotica		
Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands

[Resource Information]

Name	State
Ashmore Reef	EXT
Bunda-Bunda Mound Springs	WA
Bundera Sinkhole	WA
Cape Range Subterranean Waterways	WA
De Grey River	WA
Eighty Mile Beach System	WA
Exmouth Gulf East	WA
Lake MacLeod	WA
Lake Thetis	WA
Learmonth Air Weapons Range - Saline Coastal Flats	WA
Leslie (Port Hedland) Saltfields System	WA
Mermaid Reef	EXT
Ord Estuary System	WA
Rottnest Island Lakes	WA
Shark Bay East	WA
Yalgorup Lakes System	WA
Yampi Sound Training Area	WA

Key Ecological Features (Marine)

[Resource Information]

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

Name	Region
Carbonate bank and terrace system of the Van	North
Pinnacles of the Bonaparte Basin	North
Ancient coastline at 125 m depth contour	North-west
Ashmore Reef and Cartier Island and surrounding	North-west
Canyons linking the Argo Abyssal Plain with the	North-west
Canyons linking the Cuvier Abyssal Plain and the	North-west
Carbonate bank and terrace system of the Sahul	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west
Glomar Shoals	North-west
Mermaid Reef and Commonwealth waters	North-west
Pinnacles of the Bonaparte Basin	North-west
Seringapatam Reef and Commonwealth waters in	North-west
Wallaby Saddle	North-west
Ancient coastline at 90-120m depth	South-west
Cape Mentelle upwelling	South-west
Commonwealth marine environment surrounding	South-west
Commonwealth marine environment within and	South-west
Commonwealth marine environment within and	South-west
Naturaliste Plateau	South-west
Perth Canyon and adjacent shelf break, and other	South-west
Western demersal slope and associated fish	South-west
Western rock lobster	South-west

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-31.6854 111.3838,-30.4214 110.3839,-28.7096 109.8133,-27.9563 109.7791,-27.0319 108.5808,-26.4157 107.4738,-25.6396 106.4352,-24.5212 105.8532,-23.7338 105.8418,-23.1175 106.1271,-22.5697 106.789,-21.7823 107.3825,-20.0248 107.9645,-18.4156 108.8775,-16.4413 110.7377,-15.2658 111.3996,-14.4327 112.4952,-14.4099 113.1457,-14.0333 114.1043,-13.2686 114.6978,-13.6681 115.2456,-14.7637 115.4852,-15.437 116.2042,-15.049 116.5123,-14.2615 117.7677,-12.8161 118.2231,-12.1161 118.1014,-12.6944 120.0491,-13.9421 120.013,-11.8068 122.8951,-11.3553 123.3054,-11.4466 124.0054,-11.1118 124.5227,-10.9292 125.3748,-10.5336 126.0444,-11.2336 126.5922,-11.2031 127.6573,-10.4119 128.1442,-10.0771 128.1442,-10.0547 128.9033,-15.0663 129.0006,-15.0735 128.0863,-14.7089 128.1617,-13.9731 127.4448,-13.7461 126.9637,-14.1871 126.6423,-14.5893 125.2646,-15.4957 124.4516,-16.4216 124.6089,-16.186 123.5687,-17.1833 123.7342,-16.5875 122.9672,-17.3596 122.1501,-17.9493 122.2039,-19.2063 121.4347,-19.625 120.9721,-20.0762 119.5873,-20.6548 117.4099,-20.3016 116.83,-21.4925 115.4626,-21.8484 114.644,-22.4302 114.3765,-22.6288 113.668,-23.5261 113.755,-24.0899 113.4187,-25.1243 113.5933,-25.9153 113.0411,-26.9189 113.775,-28.0932 114.1696,-29.4877 114.9961,-30.5785 115.0875,-31.7296 115.7179,-33.2752 115.6808,-33.5316 115.0036,-33.4303 110.9954,-31.966 111.5089,-31.6854 111.3838

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 e protected matters search reports

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 30-Mar-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	23
Listed Migratory Species:	37

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	67
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
Habitat Critical to the Survival of Marine Turtles:	1

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:	28
Key Ecological Features (Marine):	2
Biologically Important Areas:	8
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
EEZ and Territorial Sea

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
FISH		

Scientific Name	Threatened Category	Presence Text
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely 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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis 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 Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		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
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may 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 borealis Sei Whale [34]	Vulnerable	Species or species habitat likely 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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Montebello	Multiple Use Zone (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatstone	2008/4469	Controlled Action	Post-Approval
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Not controlled action			
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		(Particular Manner)	
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Foxhound 3D Non-Exclusive Marine Seismic Survey	2009/4703	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval

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
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Marine Turtles		
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur

Scientific Name	Behaviour	Presence
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

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

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

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

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 30-Mar-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	32
Listed Migratory Species:	51

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	86
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
Habitat Critical to the Survival of Marine Turtles:	3

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:	59
Key Ecological Features (Marine):	3
Biologically Important Areas:	11
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
EEZ and Territorial Sea

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
FISH		
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
REPTILE		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely 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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat may occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalasseus bengalensis as Sterna bengalensis Lesser Crested Tern [66546]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		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

Scientific Name	Threatened Category	Presence Text
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely 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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Montebello	Multiple Use Zone (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Ashburton Infrastructure Project	2021/9064	Controlled Action	Guidelines Issued
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatstone	2008/4469	Controlled Action	Post-Approval
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Proposed West Pilbara Iron Ore Project	2009/4706	Controlled Action	Post-Approval
Not controlled action			
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for the extraction of natural gas	2004/1703	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
HCA05X Macedon Experimental Survey	2004/1926	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Infill Production Well (Griffin-9)	2001/417	Not Controlled Action	Completed
Klammer 2D Seismic Survey	2002/868	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Subsea Gas Pipeline From Stybarrow Field to Griffin Venture Gas Export Pipeline	2005/2033	Not Controlled Action	Completed
Thevenard Island Retirement Project	2015/7423	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Wanda Offshore Research Project, 80 km north-east of Exmouth, WA	2018/8293	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Kate' 3D marine seismic survey, exploration permits WA-320-P and WA-345-P, 60km	2005/2037	Not Controlled Action (Particular Manner)	Post-Approval
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D seismic surveys	2005/2151	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
3D Marine Seismic Survey in Permit Areas WA-15-R, WA-18-R, WA-205-P, WA-253-P, WA-267-P and WA-268-P	2003/1271	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Surveys - Contos CT-13 & Supertubes CT-13, offshore WA	2013/6901	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2715	Not Controlled Action (Particular Manner)	Post-Approval
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
Babylon 3D Marine Seismic Survey, Commonwealth Waters, nr Exmouth WA	2013/7081	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Draeck 3D Marine Seismic Survey, WA-205-P	2006/3067	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Drilling 35-40 offshore exploration wells in deep water	2008/4461	Not Controlled Action (Particular Manner)	Post-Approval
Eendracht Multi-Client 3D Marine Seismic Survey	2009/4749	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas MC3D Marine Seismic Survey (HZ-13) Carnarvon Basin, offshore WA	2013/7003	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas phase 2 marine seismic survey, Exmouth Plateau, Northern Carnarvon Basin, WA	2013/7093	Not Controlled Action (Particular Manner)	Post-Approval
John Ross & Rosella Off Bottom Cable Seismic Exploration Program	2008/3966	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval
Munmorah 2D seismic survey within permits WA-308/9-P	2003/970	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Survey	2005/2017	Not Controlled Action (Particular Manner)	Post-Approval
Orcus 3D Marine Seismic Survey in WA-450-P	2010/5723	Not Controlled Action (Particular Manner)	Post-Approval
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Pomodoro 3D Marine Seismic Survey in WA-426-P and WA-427-P	2010/5472	Not Controlled Action (Particular Manner)	Post-Approval
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval
Triton 3D Marine Seismic Survey, WA-2-R and WA-3-R	2006/2609	Not Controlled Action (Particular Manner)	Post-Approval
Warramunga Non-Inclusive 3D Seismic Survey	2008/4553	Not Controlled Action (Particular Manner)	Post-Approval
West Anchor 3D Marine Seismic Survey	2008/4507	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Bianchi 3D Marine Seismic Survey, Carnavon Basin, WA	2013/7078	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
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	North-west
Continental Slope Demersal Fish Communities	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Marine Turtles		
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur

Scientific Name	Behaviour	Presence
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

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

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

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

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Mar-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	52
Listed Migratory Species:	64

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	79
Commonwealth Heritage Places:	2
Listed Marine Species:	110
Whales and Other Cetaceans:	31
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	9
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

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

State and Territory Reserves:	33
Regional Forest Agreements:	None
Nationally Important Wetlands:	2
EPBC Act Referrals:	214
Key Ecological Features (Marine):	6
Biologically Important Areas:	35
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Legal Status
The Ningaloo Coast	WA	Declared property

National Heritage Places [Resource Information]

Name	State	Legal Status
Natural		
The Ningaloo Coast	WA	Listed place

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea
Extended Continental Shelf

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		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	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
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
CRUSTACEAN		
Kumonga exleyi Cape Range Remipede [86875]	Vulnerable	Species or species habitat likely to occur within area
FISH		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Osphranter robustus isabellinus Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Pseudomys fieldi Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama		
Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus zastictus		
Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
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 likely to occur within area
Ardenna pacifica		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor 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 Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely 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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may 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
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

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 - EXMOUTH ADMIN & HF TRANSMITTING [50127]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50128]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50129]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50126]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50124]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50125]	WA
Defence - EXMOUTH VLF TRANSMITTER STATION [50123]	WA
Defence - EXMOUTH VLF TRANSMITTER STATION [50122]	WA
Defence - LEARMONTH - AIR WEAPONS RANGE [50193]	WA
Defence - LEARMONTH - RAAF BASE [50106]	WA
Defence - LEARMONTH - RAAF BASE [50107]	WA
Defence - LEARMONTH - RAAF BASE [50101]	WA
Defence - LEARMONTH - RAAF BASE [50102]	WA
Defence - LEARMONTH - RAAF BASE [50103]	WA
Defence - LEARMONTH - RAAF BASE [50108]	WA
Defence - LEARMONTH - RAAF BASE [50109]	WA
Defence - LEARMONTH - RAAF BASE [50100]	WA

Commonwealth Land Name	State
Defence - LEARMONTH - RAAF BASE [50105]	WA
Defence - LEARMONTH - RAAF BASE [50097]	WA
Defence - LEARMONTH RADAR SITE - TWIN TANKS EXMOUTH [50002]	WA
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH [50001]	WA
Defence - LEARMONTH TRANSMITTING STATION [50239]	WA
Unknown	
Commonwealth Land - [51442]	WA
Commonwealth Land - [51471]	WA
Commonwealth Land - [51473]	WA
Commonwealth Land - [51474]	WA
Commonwealth Land - [51476]	WA
Commonwealth Land - [51465]	WA
Commonwealth Land - [52099]	WA
Commonwealth Land - [52198]	WA
Commonwealth Land - [52097]	WA
Commonwealth Land - [52105]	WA
Commonwealth Land - [52104]	WA
Commonwealth Land - [52100]	WA
Commonwealth Land - [52102]	WA
Commonwealth Land - [51104]	WA
Commonwealth Land - [52107]	WA
Commonwealth Land - [52106]	WA
Commonwealth Land - [52101]	WA
Commonwealth Land - [51887]	WA
Commonwealth Land - [51884]	WA
Commonwealth Land - [51475]	WA

Commonwealth Land Name	State
Commonwealth Land - [52103]	WA
Commonwealth Land - [51454]	WA
Commonwealth Land - [51455]	WA
Commonwealth Land - [52236]	WA
Commonwealth Land - [51453]	WA
Commonwealth Land - [51450]	WA
Commonwealth Land - [51451]	WA
Commonwealth Land - [51457]	WA
Commonwealth Land - [51443]	WA
Commonwealth Land - [52110]	WA
Commonwealth Land - [51447]	WA
Commonwealth Land - [51446]	WA
Commonwealth Land - [51445]	WA
Commonwealth Land - [51444]	WA
Commonwealth Land - [51449]	WA
Commonwealth Land - [51448]	WA
Commonwealth Land - [50385]	WA
Commonwealth Land - [52108]	WA
Commonwealth Land - [51466]	WA
Commonwealth Land - [51467]	WA
Commonwealth Land - [51468]	WA
Commonwealth Land - [51464]	WA
Commonwealth Land - [52098]	WA
Commonwealth Land - [52109]	WA
Commonwealth Land - [51463]	WA
Commonwealth Land - [51462]	WA
Commonwealth Land - [51461]	WA

Commonwealth Land Name	State
Commonwealth Land - [51460]	WA
Commonwealth Land - [51452]	WA
Commonwealth Land - [51459]	WA
Commonwealth Land - [51458]	WA
Commonwealth Land - [52195]	WA
Commonwealth Land - [51456]	WA
Commonwealth Land - [51472]	WA
Commonwealth Land - [51470]	WA
Commonwealth Land - [51469]	WA
Commonwealth Land - [51477]	WA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area overfly marine 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
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area
Onychoprion fuscatus as Sterna fuscata Sooty Tern [90682]		Breeding known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may occur within area
Sternula nereis as Sterna nereis Fairy Tern [82949]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Thalasseus bengalensis as Sterna bengalensis Lesser Crested Tern [66546]		Breeding known to occur within area
Thalasseus bergii as Sterna bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Gascoyne	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Ningaloo	Recreational Use Zone (IUCN IV)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		

Scientific Name	Behaviour	Presence
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas		
Green Turtle [1765]	Nesting	Known to occur
Nov-Feb		
Caretta caretta		
Loggerhead Turtle [1763]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Airlie Island	Nature Reserve	WA
Barrow Island	Nature Reserve	WA
Barrow Island	Marine Park	WA
Barrow Island	Marine Management Area	WA
Bessieres Island	Nature Reserve	WA
Boodie, Double Middle Islands	Nature Reserve	WA
Bundegi Coastal Park	5(1)(h) Reserve	WA
Burnside And Simpson Island	Nature Reserve	WA
Cape Range	National Park	WA
Giralia	NRS Addition - Gazettal in Progress	WA
Gnandaroo Island	Nature Reserve	WA
Jurabi Coastal Park	5(1)(h) Reserve	WA
Locker Island	Nature Reserve	WA
Lowendal Islands	Nature Reserve	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Marine Park	WA
Montebello Islands	Conservation Park	WA
Muiron Islands	Nature Reserve	WA
Muiron Islands	Marine Management Area	WA
Ningaloo	Marine Park	WA
Rocky Island	Nature Reserve	WA
Round Island	Nature Reserve	WA
Serrurier Island	Nature Reserve	WA
Tent Island	Nature Reserve	WA
Thevenard Island	Nature Reserve	WA
Unnamed WA40322	5(1)(h) Reserve	WA
Unnamed WA40828	5(1)(h) Reserve	WA
Unnamed WA41080	5(1)(h) Reserve	WA
Unnamed WA44665	5(1)(h) Reserve	WA
Victor Island	Nature Reserve	WA
Whalebone Island	Nature Reserve	WA
Whitmore,Roberts,Doole Islands And Sandalwood Landing	Nature Reserve	WA
Y Island	Nature Reserve	WA

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Cape Range Subterranean Waterways	WA
Exmouth Gulf East	WA

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Action clearly unacceptable			
Highlands 3D Marine Seismic Survey	2012/6680	Action Clearly Unacceptable	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
'Van Gogh' Petroleum Field Development	2007/3213	Controlled Action	Post-Approval
Ashburton Infrastructure Project	2021/9064	Controlled Action	Assessment Approach
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319	Controlled Action	Final PER or EIS
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatstone	2008/4469	Controlled Action	Post-Approval
Construction and operation of a Solar Salt Project, SW Onslow, WA	2016/7793	Controlled Action	Assessment Approach
Develop Jansz-Io deepwater gas field in Permit Areas WA-18-R, WA-25-R and WA-26-	2005/2184	Controlled Action	Post-Approval
Development of Angel gas and condensate field, North West Shelf	2004/1805	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Development of Coniston/Novara fields within the Exmouth Sub-basin	2011/5995	Controlled Action	Post-Approval
Development of Stybarrow petroleum field incl drilling and facility installation	2004/1469	Controlled Action	Post-Approval
Echo-Yodel Production Wells	2000/11	Controlled Action	Post-Approval
Enfield full field development	2001/257	Controlled Action	Post-Approval
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Gorgon Gas Revised Development	2008/4178	Controlled Action	Post-Approval
Greater Enfield (Vincent) Development	2005/2110	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Greater Gorgon Development - Optical Fibre Cable, Mainland to Barrow Island	2005/2141	Controlled Action	Completed
Learmonth Bundle Site and Launchway, WA	2017/8079	Controlled Action	Completed
Light Crude Oil Production	2001/365	Controlled Action	Post-Approval
Nava-1 Cable System	2001/510	Controlled Action	Completed
Ningaloo Lighthouse Development, 17km north west Exmouth, Western Australia	2020/8693	Controlled Action	Assessment Approach
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Proposed West Pilbara Iron Ore Project	2009/4706	Controlled Action	Post-Approval
Pyrenees Oil Fields Development	2005/2034	Controlled Action	Post-Approval
Simpson Development	2000/59	Controlled Action	Completed
Simpson Oil Field Development	2001/227	Controlled Action	Post-Approval
Single Jetty Deep Water Port Renewable Hub, WA	2021/8942	Controlled Action	Proposed Decision
The Scarborough Project - FLNG & assoc subsea infrastructure, Carnarvon Basin	2013/6811	Controlled Action	Post-Approval
Vincent Appraisal Well	2000/22	Controlled Action	Post-Approval
Yannarie Solar Salt Project	2004/1679	Controlled Action	Completed
Yardie Creek Road Realignment Project	2021/8967	Controlled Action	Assessment Approach
Not controlled action			
'Goodwyn A' Low Pressure Train Project	2003/914	Not Controlled Action	Completed
'Van Gogh' Oil Appraisal Drilling Program, Exploration Permit Area WA-155-P(1)	2006/3148	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Airlie Island soil and groundwater investigations, Exmouth Gulf, offshore Pilbara coast	2014/7250	Not Controlled Action	Completed
APX-West Fibre-optic telecommunications cable system, WA to Singapore	2013/7102	Not Controlled Action	Completed
Baniyas-1 Exploration Well, EP-424, near Onslow	2007/3282	Not Controlled Action	Completed
Barrow Island 2D Seismic survey	2006/2667	Not Controlled Action	Completed
Bollinger 2D Seismic Survey 200km North of North West Cape WA	2004/1868	Not Controlled Action	Completed
Bultaco-2, Laverda-2, Laverda-3 and Montesa-2 Appraisal Wells	2000/103	Not Controlled Action	Completed
Carnarvon 3D Marine Seismic Survey	2004/1890	Not Controlled Action	Completed
Cazadores 2D seismic survey	2004/1720	Not Controlled Action	Completed
Construct 110km buried natural gas pipeline from Onslow, connecting to Dampier/Bunbury natural gas pipeline	2013/7039	Not Controlled Action	Completed
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for the extraction of natural gas	2004/1703	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2007/3262	Not Controlled Action	Completed
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Development of Mutineer and Exeter petroleum fields for oil production, Permit	2003/1033	Not Controlled Action	Completed
Differential Global Positioning System (DGPS)	2001/445	Not Controlled Action	Completed
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	Not Controlled Action	Completed
Eagle-1 Exploration Drilling, North West Shelf, WA	2019/8578	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Echo A Development WA-23-L, WA-24-L	2005/2042	Not Controlled Action	Completed
Exploration drilling well WA-155-P(1)	2003/971	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
Exploration Well (Taunton-2)	2002/731	Not Controlled Action	Completed
Exploration Well in Permit Area WA-155-P(1)	2002/759	Not Controlled Action	Completed
Exploratory drilling in permit area WA-225-P	2001/490	Not Controlled Action	Completed
Extension of Simpson Oil Platforms & Wells	2002/685	Not Controlled Action	Completed
Gulf Fishing Lodge	2010/5499	Not Controlled Action	Completed
HCA05X Macedon Experimental Survey	2004/1926	Not Controlled Action	Completed
Hess Exploration Drilling Programme	2007/3566	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO West Submarine Telecommunications Cable, WA	2017/8126	Not Controlled Action	Completed
Infill Production Well (Griffin-9)	2001/417	Not Controlled Action	Completed
Jansz-2 and 3 Appraisal Wells	2002/754	Not Controlled Action	Completed
Klammer 2D Seismic Survey	2002/868	Not Controlled Action	Completed
Mahimahi Aquaculture Facility	2002/891	Not Controlled Action	Completed
Maia-Gaea Exploration wells	2000/17	Not Controlled Action	Completed
Manaslu - 1 and Huascaran - 1 Offshore Exploration Wells	2001/235	Not Controlled Action	Completed
Montesa-1 and Bultaco-1 Exploration Wells	2000/102	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
North Rankin B gas compression facility	2005/2500	Not Controlled Action	Completed
Onslow Power Infrastructure Upgrade Project, Onslow, WA	2014/7314	Not Controlled Action	Completed
Onslow Water Supply Infrastructure Upgrade Project, Onslow, WA	2014/7329	Not Controlled Action	Completed
Pipeline System Modifications Project	2000/3	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Searipple gas and condensate field development	2000/89	Not Controlled Action	Completed
Spool Base Facility	2001/263	Not Controlled Action	Completed
Subsea Gas Pipeline From Stybarrow Field to Griffin Venture Gas Export Pipeline	2005/2033	Not Controlled Action	Completed
sub-sea tieback of Perseus field wells	2004/1326	Not Controlled Action	Completed
Telstra North Rankin Spur Fibre Optic Cable	2016/7836	Not Controlled Action	Completed
Thevenard Island Retirement Project	2015/7423	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
WA-295-P Kerr-McGee Exploration Wells	2001/152	Not Controlled Action	Completed
Wanda Offshore Research Project, 80 km north-east of Exmouth, WA	2018/8293	Not Controlled Action	Completed
Western Flank Gas Development	2005/2464	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Kate' 3D marine seismic survey, exploration permits WA-320-P and WA-345-P, 60km	2005/2037	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D seismic surveys	2005/2151	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey	2012/6296	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey	2008/4493	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey Permit Area WA-352-P	2008/4628	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey within permit WA-291	2007/3265	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey	2008/4281	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey (WA-482-P, WA-363-P), WA	2013/6761	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in Permit Areas WA-15-R, WA-18-R, WA-205-P, WA-253-P, WA-267-P and WA-268-P	2003/1271	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in WA 457-P & WA 458-P, North West Shelf, offshore WA	2013/6862	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
3D marine seismic survey over petroleum title WA-268-P	2007/3458	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Surveys - Contos CT-13 & Supertubes CT-13, offshore WA	2013/6901	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2715	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, WA	2008/4428	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey in the Carnarvon Bsin on the North West Shelf	2002/778	Not Controlled Action (Particular Manner)	Post-Approval
3D sesmic survey	2006/2781	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2009/4968	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2008/4565	Not Controlled Action (Particular Manner)	Post-Approval
Agrippina 3D Seismic Marine Survey	2009/5212	Not Controlled Action (Particular Manner)	Post-Approval
Apache Northwest Shelf Van Gogh Field Appraisal Drilling Program	2007/3495	Not Controlled Action (Particular Manner)	Post-Approval
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Artemis-1 Drilling Program (WA-360-P)	2010/5432	Not Controlled Action (Particular Manner)	Post-Approval
Australia to Singapore Fibre Optic Submarine Cable System	2011/6127	Not Controlled Action (Particular Manner)	Post-Approval
Babylon 3D Marine Seismic Survey, Commonwealth Waters, nr Exmouth WA	2013/7081	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Bonaventure 3D seismic survey	2006/2514	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
Cerberus exploration drilling campaign, Carnarvon Basin, WA	2016/7645	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Charon 3D Marine Seismic Survey	2007/3477	Not Controlled Action (Particular Manner)	Post-Approval
Consturction & operation of the Varanus Island kitchen & mess cyclone refuge building, compression plant & accomidation camp, Varanus Island	2013/6952	Not Controlled Action (Particular Manner)	Post-Approval
Coverack Marine Seismic Survey	2001/399	Not Controlled Action (Particular Manner)	Post-Approval
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		(Particular Manner)	
CVG 3D Marine Seismic Survey	2012/6654	Not Controlled Action (Particular Manner)	Post-Approval
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval
Decommissioning of the Legendre facilities	2010/5681	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Drilling Program	2010/5532	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Demeter 3D Seismic Survey, off Dampier, WA	2002/900	Not Controlled Action (Particular Manner)	Post-Approval
Draeck 3D Marine Seismic Survey, WA-205-P	2006/3067	Not Controlled Action (Particular Manner)	Post-Approval
Drilling 35-40 offshore exploration wells in deep water	2008/4461	Not Controlled Action (Particular Manner)	Post-Approval
Earthworks for kitchen/mess, cyclone refuge building & Compression Plant, Varanus Island	2013/6900	Not Controlled Action (Particular Manner)	Post-Approval
Eendracht Multi-Client 3D Marine Seismic Survey	2009/4749	Not Controlled Action (Particular Manner)	Post-Approval
Effect of marine seismic sounds to demersal fish and pearl oysters, north-west WA	2018/8169	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Enfield M3 & Vincent 4D Marine Seismic Surveys	2008/3981	Not Controlled Action (Particular Manner)	Completed
Enfield M3 4D, Vincent 4D & 4D Line Test Marine Seismic Surveys	2008/4122	Not Controlled Action (Particular Manner)	Post-Approval
Enfield M4 4D Marine Seismic Survey	2008/4558	Not Controlled Action (Particular Manner)	Post-Approval
Enfield oilfield 3D Seismic Survey	2006/3132	Not Controlled Action (Particular Manner)	Post-Approval
Exmouth West 2D Marine Seismic Survey	2008/4132	Not Controlled Action (Particular Manner)	Post-Approval
Exploration drilling of Zeus-1 well	2008/4351	Not Controlled Action (Particular Manner)	Post-Approval
Fletcher-Finucane Development, WA26-L and WA191-P	2011/6123	Not Controlled Action (Particular Manner)	Post-Approval
Foxhound 3D Non-Exclusive Marine Seismic Survey	2009/4703	Not Controlled Action (Particular Manner)	Post-Approval
Gazelle 3D Marine Seismic Survey in WA-399-P and WA-42-L	2010/5570	Not Controlled Action (Particular Manner)	Post-Approval
Geco Eagle 3D Marine Seismic Survey	2008/3958	Not Controlled Action (Particular Manner)	Post-Approval
Glencoe 3D Marine Seismic Survey WA-390-P	2007/3684	Not Controlled Action (Particular Manner)	Post-Approval
Greater Western Flank Phase 1 gas Development	2011/5980	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Grimalkin 3D Seismic Survey	2008/4523	Not Controlled Action (Particular Manner)	Post-Approval
Guacamole 2D Marine Seismic Survey	2008/4381	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
Harpy 1 exploration well	2001/183	Not Controlled Action (Particular Manner)	Post-Approval
Honeycombs MC3D Marine Seismic Survey	2012/6368	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas MC3D Marine Seismic Survey (HZ-13) Carnarvon Basin, offshore WA	2013/7003	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas phase 2 marine seismic survey, Exmouth Plateau, Northern Carnarvon Basin, WA	2013/7093	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
John Ross & Rosella Off Bottom Cable Seismic Exploration Program	2008/3966	Not Controlled Action (Particular Manner)	Post-Approval
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2009/4801	Not Controlled Action (Particular Manner)	Post-Approval
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2008/4630	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular Manner)	Post-Approval
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular Manner)	Post-Approval
Laverda 3D Marine Seismic Survey and Vincent M1 4D Marine Seismic Survey	2010/5415	Not Controlled Action (Particular Manner)	Post-Approval
Laying a submarine optical fibre telecommunications cable, Perth to Singapore and Jakarta	2014/7332	Not Controlled Action (Particular Manner)	Post-Approval
Leopard 2D marine seismic survey	2005/2290	Not Controlled Action (Particular Manner)	Post-Approval
Lion 2D Marine Seismic Survey	2007/3777	Not Controlled Action (Particular Manner)	Post-Approval
Macedon Gas Field Development	2008/4605	Not Controlled Action (Particular Manner)	Post-Approval
Marine reconnaissance survey	2008/4466	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval
Munmorah 2D seismic survey within permits WA-308/9-P	2003/970	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Program, WA-264-P	2007/3844	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Survey	2005/2017	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Drilling Campaign	2011/5830	Not Controlled Action (Particular Manner)	Post-Approval
Onslow Seawater Desalination Plant Marine Geophysical Investigation	2020/8794	Not Controlled Action (Particular Manner)	Post-Approval
Orcus 3D Marine Seismic Survey in WA-450-P	2010/5723	Not Controlled Action (Particular Manner)	Post-Approval
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular Manner)	Post-Approval
Palta-1 exploration well in Petroleum Permit Area WA-384-P	2011/5871	Not Controlled Action (Particular Manner)	Post-Approval
Pomodoro 3D Marine Seismic Survey in WA-426-P and WA-427-P	2010/5472	Not Controlled Action (Particular Manner)	Post-Approval
Pyrenees 4D Marine Seismic Monitor Survey, HCA12A	2012/6579	Not Controlled Action (Particular Manner)	Post-Approval
Pyrenees-Macedon 3D marine seismic survey	2005/2325	Not Controlled Action (Particular Manner)	Post-Approval
Quiberon 2D Seismic Survey, permit area WA-385P, offshore of Carnarvon	2009/5077	Not Controlled Action (Particular Manner)	Post-Approval
Reindeer gas reservior development, Devil Creek, Carnarvon Basin - WA	2007/3917	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Rose 3D Seismic Program	2008/4239	Not Controlled Action (Particular Manner)	Post-Approval
Rydal-1 Petroleum Exploration Well, WA	2012/6522	Not Controlled Action (Particular Manner)	Post-Approval
Salsa 3D Marine Seismic Survey	2010/5629	Not Controlled Action (Particular Manner)	Post-Approval
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval
Skorpion Marine Seismic Survey WA	2001/416	Not Controlled Action (Particular Manner)	Post-Approval
Sovereign 3D Marine Seismic Survey	2011/5861	Not Controlled Action (Particular Manner)	Post-Approval
Stag 4D & Reindeer MAZ Marine Seismic Surveys, WA	2013/7080	Not Controlled Action (Particular Manner)	Post-Approval
Stag Off-bottom Cable Seismic Survey	2007/3696	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow 4D Marine Seismic Survey	2011/5810	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow Baseline 4D marine seismic survey	2008/4530	Not Controlled Action (Particular Manner)	Post-Approval
Tantabiddi Boat Ramp Sand Bypassing	2015/7411	Not Controlled Action (Particular Manner)	Post-Approval
Tidepole Maz 3D Seismic Survey Campaign	2007/3706	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Tortilla 2D Seismic Survey, WA	2011/6110	Not Controlled Action (Particular Manner)	Post-Approval
Triton 3D Marine Seismic Survey, WA-2-R and WA-3-R	2006/2609	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a 3D marine seismic survey	2010/5695	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5679	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5715	Not Controlled Action (Particular Manner)	Post-Approval
Vincent M1 and Enfield M5 4D Marine Seismic Survey	2010/5720	Not Controlled Action (Particular Manner)	Post-Approval
Warramunga Non-Inclusive 3D Seismic Survey	2008/4553	Not Controlled Action (Particular Manner)	Post-Approval
West Anchor 3D Marine Seismic Survey	2008/4507	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
3D Marine Seismic Survey in the offshore northwest Carnarvon Basin	2011/6175	Referral Decision	Completed
3D Seismic Survey	2008/4219	Referral Decision	Completed
Bianchi 3D Marine Seismic Survey, Carnavon Basin, WA	2013/7078	Referral Decision	Completed
CVG 3D Marine Seismic Survey	2012/6270	Referral Decision	Completed
Enfield 4D Marine Seismic Surveys, Production Permit WA-28-L	2005/2370	Referral Decision	Completed
Rose 3D Seismic acquisition survey	2008/4220	Referral Decision	Completed
Stybarrow Baseline 4D Marine Seismic Survey (Permit Areas WA-255-P, WA-32-L, WA-	2008/4165	Referral Decision	Completed
Two Dimensional Transition Zone Seismic Survey - TP/7 (R1)	2010/5507	Referral Decision	Completed
Varanus Island Compression Project	2012/6698	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
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west

Name	Region
Exmouth Plateau	North-west
Glomar Shoals	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	Known to occur
Dugong dugon Dugong [28]	Foraging (high density seagrass beds)	Known to occur
Dugong dugon Dugong [28]	Nursing	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Aggregation	Known to occur
Chelonia mydas Green Turtle [1765]	Basking	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Mating	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Natator depressus Flatback Turtle [59257]	Aggregation	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Mating	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Rhincodon typus Whale Shark [66680]	Foraging (high density prey)	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Resting	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

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

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

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

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EEA

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Mar-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	2
National Heritage Places:	4
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	60
Listed Migratory Species:	70

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	79
Commonwealth Heritage Places:	4
Listed Marine Species:	138
Whales and Other Cetaceans:	36
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	24
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

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

State and Territory Reserves:	41
Regional Forest Agreements:	None
Nationally Important Wetlands:	3
EPBC Act Referrals:	237
Key Ecological Features (Marine):	12
Biologically Important Areas:	46
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Legal Status
Shark Bay, Western Australia	WA	Declared property
The Ningaloo Coast	WA	Declared property

National Heritage Places [Resource Information]

Name	State	Legal Status
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place
Natural		
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea
Extended Continental Shelf

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		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	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	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
CRUSTACEAN		
Kumonga exleyi		
Cape Range Remipede [86875]	Vulnerable	Species or species habitat likely to occur within area
FISH		
Milyeringa veritas		
Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum		
Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies		
Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Osphranter robustus isabellinus Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Pseudomys fieldi Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
PLANT		
Minuria tridens Minnie Daisy [13753]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus zastictus Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Centrophorus zeehaani Southern Dogfish, Endeavour Dogfish, Little Gulper Shark [82679]	Conservation Dependent	Species or species habitat likely to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor 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 Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Congregation or aggregation known to occur within area

Scientific Name	Threatened Category	Presence Text
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely 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	Migration route known to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely 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 - EXMOUTH ADMIN & HF TRANSMITTING [50129]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50128]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50124]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50125]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50126]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50127]	WA

Commonwealth Land Name	State
Defence - EXMOUTH VLF TRANSMITTER STATION [50123]	WA
Defence - EXMOUTH VLF TRANSMITTER STATION [50122]	WA
Defence - LEARMONTH - AIR WEAPONS RANGE [50193]	WA
Defence - LEARMONTH - RAAF BASE [50097]	WA
Defence - LEARMONTH - RAAF BASE [50105]	WA
Defence - LEARMONTH - RAAF BASE [50101]	WA
Defence - LEARMONTH - RAAF BASE [50102]	WA
Defence - LEARMONTH - RAAF BASE [50106]	WA
Defence - LEARMONTH - RAAF BASE [50107]	WA
Defence - LEARMONTH - RAAF BASE [50100]	WA
Defence - LEARMONTH - RAAF BASE [50103]	WA
Defence - LEARMONTH - RAAF BASE [50109]	WA
Defence - LEARMONTH - RAAF BASE [50108]	WA
Defence - LEARMONTH RADAR SITE - TWIN TANKS EXMOUTH [50002]	WA
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH [50001]	WA
Defence - LEARMONTH TRANSMITTING STATION [50239]	WA
Unknown	
Commonwealth Land - [52098]	WA
Commonwealth Land - [52099]	WA
Commonwealth Land - [51463]	WA
Commonwealth Land - [52109]	WA
Commonwealth Land - [52097]	WA
Commonwealth Land - [52198]	WA
Commonwealth Land - [51470]	WA
Commonwealth Land - [51477]	WA
Commonwealth Land - [51476]	WA

Commonwealth Land Name	State
Commonwealth Land - [51474]	WA
Commonwealth Land - [51473]	WA
Commonwealth Land - [51471]	WA
Commonwealth Land - [52195]	WA
Commonwealth Land - [51459]	WA
Commonwealth Land - [51458]	WA
Commonwealth Land - [51453]	WA
Commonwealth Land - [51452]	WA
Commonwealth Land - [51451]	WA
Commonwealth Land - [51450]	WA
Commonwealth Land - [51457]	WA
Commonwealth Land - [51456]	WA
Commonwealth Land - [51460]	WA
Commonwealth Land - [51461]	WA
Commonwealth Land - [51462]	WA
Commonwealth Land - [51464]	WA
Commonwealth Land - [51465]	WA
Commonwealth Land - [51466]	WA
Commonwealth Land - [51467]	WA
Commonwealth Land - [51472]	WA
Commonwealth Land - [51468]	WA
Commonwealth Land - [51469]	WA
Commonwealth Land - [51448]	WA
Commonwealth Land - [50385]	WA
Commonwealth Land - [51449]	WA
Commonwealth Land - [51475]	WA
Commonwealth Land - [52110]	WA

Commonwealth Land Name	State
Commonwealth Land - [52236]	WA
Commonwealth Land - [52103]	WA
Commonwealth Land - [51455]	WA
Commonwealth Land - [51454]	WA
Commonwealth Land - [51442]	WA
Commonwealth Land - [51446]	WA
Commonwealth Land - [51443]	WA
Commonwealth Land - [51447]	WA
Commonwealth Land - [51444]	WA
Commonwealth Land - [51445]	WA
Commonwealth Land - [51887]	WA
Commonwealth Land - [52101]	WA
Commonwealth Land - [51884]	WA
Commonwealth Land - [52108]	WA
Commonwealth Land - [51104]	WA
Commonwealth Land - [52107]	WA
Commonwealth Land - [52106]	WA
Commonwealth Land - [52105]	WA
Commonwealth Land - [52104]	WA
Commonwealth Land - [52100]	WA
Commonwealth Land - [52102]	WA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place

Name	State	Status
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area overfly marine 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	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area
Onychoprion fuscatus as Sterna fuscata Sooty Tern [90682]		Breeding known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Stercorarius skua as Catharacta skua Great Skua [823]		Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Congregation or aggregation known to occur within area
Sternula nereis as Sterna nereis Fairy Tern [82949]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalasseus bengalensis as Sterna bengalensis Lesser Crested Tern [66546]		Breeding known to occur within area
Thalasseus bergii as Sterna bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		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

Scientific Name	Threatened Category	Presence Text
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		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
Mammal		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely 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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Park Name	Zone & IUCN Categories
Abrolhos	Habitat Protection Zone (IUCN IV)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Dampier	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Gascoyne	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Shark Bay	Multiple Use Zone (IUCN VI)
Abrolhos	National Park Zone (IUCN II)
Abrolhos	National Park Zone (IUCN II)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Dampier	National Park Zone (IUCN II)
Gascoyne	National Park Zone (IUCN II)
Mermaid Reef	National Park Zone (IUCN II)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Ningaloo	Recreational Use Zone (IUCN IV)
Abrolhos	Special Purpose Zone (IUCN VI)
Abrolhos	Special Purpose Zone (IUCN VI)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas		
Green Turtle [1765]	Nesting	Known to occur
Nov-Feb		
Caretta caretta		
Loggerhead Turtle [1763]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

State and Territory Reserves

[Resource Information]

Protected Area Name	Reserve Type	State
Airlie Island	Nature Reserve	WA
Barrow Island	Nature Reserve	WA
Barrow Island	Marine Park	WA
Barrow Island	Marine Management Area	WA
Bessieres Island	Nature Reserve	WA
Boodie, Double Middle Islands	Nature Reserve	WA
Bundegi Coastal Park	5(1)(h) Reserve	WA
Burnside And Simpson Island	Nature Reserve	WA
Cape Range	National Park	WA
Giralia	NRS Addition - Gazettal in Progress	WA
Gnandaroo Island	Nature Reserve	WA

Protected Area Name	Reserve Type	State
Great Sandy Island	Nature Reserve	WA
Jurabi Coastal Park	5(1)(h) Reserve	WA
Little Rocky Island	Nature Reserve	WA
Locker Island	Nature Reserve	WA
Lowendal Islands	Nature Reserve	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Marine Park	WA
Muiron Islands	Nature Reserve	WA
Muiron Islands	Marine Management Area	WA
Ningaloo	Marine Park	WA
North Sandy Island	Nature Reserve	WA
Rocky Island	Nature Reserve	WA
Round Island	Nature Reserve	WA
Rowley Shoals	Marine Park	WA
Serrurier Island	Nature Reserve	WA
Tent Island	Nature Reserve	WA
Thevenard Island	Nature Reserve	WA
Unnamed WA36915	Nature Reserve	WA
Unnamed WA37500	5(1)(g) Reserve	WA
Unnamed WA40322	5(1)(h) Reserve	WA
Unnamed WA40828	5(1)(h) Reserve	WA
Unnamed WA40877	5(1)(h) Reserve	WA
Unnamed WA41080	5(1)(h) Reserve	WA
Unnamed WA44665	5(1)(h) Reserve	WA
Unnamed WA44667	5(1)(h) Reserve	WA
Victor Island	Nature Reserve	WA
Whalebone Island	Nature Reserve	WA
Whitmore,Roberts,Doole Islands And Sandalwood Landing	Nature Reserve	WA
Y Island	Nature Reserve	WA

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Cape Range Subterranean Waterways	WA
Exmouth Gulf East	WA
Mermaid Reef	EXT

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Action clearly unacceptable			
Highlands 3D Marine Seismic Survey	2012/6680	Action Clearly Unacceptable	Completed
Controlled action			
'Van Gogh' Petroleum Field Development	2007/3213	Controlled Action	Post-Approval
Ashburton Infrastructure Project	2021/9064	Controlled Action	Assessment Approach
Boating Facility	2002/830	Controlled Action	Completed
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319	Controlled Action	Final PER or EIS
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatstone	2008/4469	Controlled Action	Post-Approval
Construction and operation of a Solar Salt Project, SW Onslow, WA	2016/7793	Controlled Action	Assessment Approach
Develop Jansz-Io deepwater gas field in Permit Areas WA-18-R, WA-25-R and WA-26-	2005/2184	Controlled Action	Post-Approval
Development of Angel gas and condensate field, North West Shelf	2004/1805	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Development of Coniston/Novara fields within the Exmouth Sub-basin	2011/5995	Controlled Action	Post-Approval
Development of Stybarrow petroleum field incl drilling and facility installation	2004/1469	Controlled Action	Post-Approval
Echo-Yodel Production Wells	2000/11	Controlled Action	Post-Approval
Enfield full field development	2001/257	Controlled Action	Post-Approval
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Eramurra Industrial Salt Project, near Karratha, WA	2019/8448	Controlled Action	Completed
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Gorgon Gas Revised Development	2008/4178	Controlled Action	Post-Approval
Greater Enfield (Vincent) Development	2005/2110	Controlled Action	Post-Approval
Greater Gorgon Development - Optical Fibre Cable, Mainland to Barrow Island	2005/2141	Controlled Action	Completed
Learmonth Bundle Site and Launchway, WA	2017/8079	Controlled Action	Completed
Light Crude Oil Production	2001/365	Controlled Action	Post-Approval
Mardie Project, 80 km south west of Karratha, WA	2018/8236	Controlled Action	Post-Approval
Mauds Landing Marina	2000/98	Controlled Action	Completed
Nava-1 Cable System	2001/510	Controlled Action	Completed
Ningaloo Lighthouse Development, 17km north west Exmouth, Western Australia	2020/8693	Controlled Action	Assessment Approach
North West Shelf Project Extension, Carnarvon Basin, WA	2018/8335	Controlled Action	Assessment Approach

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Proposed West Pilbara Iron Ore Project	2009/4706	Controlled Action	Post-Approval
Pyrenees Oil Fields Development	2005/2034	Controlled Action	Post-Approval
Simpson Development	2000/59	Controlled Action	Completed
Simpson Oil Field Development	2001/227	Controlled Action	Post-Approval
Single Jetty Deep Water Port Renewable Hub, WA	2021/8942	Controlled Action	Proposed Decision
The Scarborough Project - FLNG & assoc subsea infrastructure, Carnarvon Basin	2013/6811	Controlled Action	Post-Approval
Vincent Appraisal Well	2000/22	Controlled Action	Post-Approval
Yannarie Solar Salt Project	2004/1679	Controlled Action	Completed
Yardie Creek Road Realignment Project	2021/8967	Controlled Action	Assessment Approach
Not controlled action			
'Goodwyn A' Low Pressure Train Project	2003/914	Not Controlled Action	Completed
'Van Gogh' Oil Appraisal Drilling Program, Exploration Permit Area WA-155-P(1)	2006/3148	Not Controlled Action	Completed
Airlie Island soil and groundwater investigations, Exmouth Gulf, offshore Pilbara coast	2014/7250	Not Controlled Action	Completed
APX-West Fibre-optic telecommunications cable system, WA to Singapore	2013/7102	Not Controlled Action	Completed
Baniyas-1 Exploration Well, EP-424, near Onslow	2007/3282	Not Controlled Action	Completed
Barrow Island 2D Seismic survey	2006/2667	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Boating Facility	2002/832	Not Controlled Action	Completed
Bollinger 2D Seismic Survey 200km North of North West Cape WA	2004/1868	Not Controlled Action	Completed
Bultaco-2, Laverda-2, Laverda-3 and Montesa-2 Appraisal Wells	2000/103	Not Controlled Action	Completed
Carnarvon 3D Marine Seismic Survey	2004/1890	Not Controlled Action	Completed
Cazadores 2D seismic survey	2004/1720	Not Controlled Action	Completed
Construct 110km buried natural gas pipeline from Onslow, connecting to Dampier/Bunbury natural gas pipeline	2013/7039	Not Controlled Action	Completed
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for the extraction of natural gas	2004/1703	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2007/3262	Not Controlled Action	Completed
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Development of Mutineer and Exeter petroleum fields for oil production, Permit	2003/1033	Not Controlled Action	Completed
Differential Global Positioning System (DGPS)	2001/445	Not Controlled Action	Completed
Drilling between Kalbarri and Cliff Head	2005/2185	Not Controlled Action	Completed
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	Not Controlled Action	Completed
Eagle-1 Exploration Drilling, North West Shelf, WA	2019/8578	Not Controlled Action	Completed
Echo A Development WA-23-L, WA-24-L	2005/2042	Not Controlled Action	Completed
Exploration drilling well WA-155-P(1)	2003/971	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Exploration Well (Taunton-2)	2002/731	Not Controlled Action	Completed
Exploration Well in Permit Area WA-155-P(1)	2002/759	Not Controlled Action	Completed
Exploratory drilling in permit area WA-225-P	2001/490	Not Controlled Action	Completed
Extension of Simpson Oil Platforms & Wells	2002/685	Not Controlled Action	Completed
Gulf Fishing Lodge	2010/5499	Not Controlled Action	Completed
Hadda 1,Flying Foam 1,Magnat 1 exploration drill	2004/1697	Not Controlled Action	Completed
HCA05X Macedon Experimental Survey	2004/1926	Not Controlled Action	Completed
Hess Exploration Drilling Programme	2007/3566	Not Controlled Action	Completed
Huascaran-1 exploration well (WA-292-P)	2001/539	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO West Submarine Telecommunications Cable, WA	2017/8126	Not Controlled Action	Completed
Infill Production Well (Griffin-9)	2001/417	Not Controlled Action	Completed
Jansz-2 and 3 Appraisal Wells	2002/754	Not Controlled Action	Completed
Klammer 2D Seismic Survey	2002/868	Not Controlled Action	Completed
Mahimahi Aquaculture Facility	2002/891	Not Controlled Action	Completed
Maia-Gaea Exploration wells	2000/17	Not Controlled Action	Completed
Manaslu - 1 and Huascaran - 1 Offshore Exploration Wells	2001/235	Not Controlled Action	Completed
Mermaid Marine Australia Desalination Project	2011/5916	Not Controlled Action	Completed
Montesa-1 and Bultaco-1 Exploration Wells	2000/102	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Murujuga archaeological excavation, collection and sampling, Dampier Archipelago, WA	2014/7160	Not Controlled Action	Completed
North Rankin B gas compression facility	2005/2500	Not Controlled Action	Completed
Onslow Power Infrastructure Upgrade Project, Onslow, WA	2014/7314	Not Controlled Action	Completed
Onslow Water Supply Infrastructure Upgrade Project, Onslow, WA	2014/7329	Not Controlled Action	Completed
Pipeline System Modifications Project	2000/3	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Searipple gas and condensate field development	2000/89	Not Controlled Action	Completed
Seismic Survey, Bremer Basin, Mentelle Basin and Zeewyck Sub-basin	2004/1700	Not Controlled Action	Completed
Spool Base Facility	2001/263	Not Controlled Action	Completed
Subsea Gas Pipeline From Stybarrow Field to Griffin Venture Gas Export Pipeline	2005/2033	Not Controlled Action	Completed
sub-sea tieback of Perseus field wells	2004/1326	Not Controlled Action	Completed
Telstra North Rankin Spur Fibre Optic Cable	2016/7836	Not Controlled Action	Completed
Thevenard Island Retirement Project	2015/7423	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
WA-295-P Kerr-McGee Exploration Wells	2001/152	Not Controlled Action	Completed
Wanda Offshore Research Project, 80 km north-east of Exmouth, WA	2018/8293	Not Controlled Action	Completed
Western Flank Gas Development	2005/2464	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Kate' 3D marine seismic survey, exploration permits WA-320-P and WA-345-P, 60km	2005/2037	Not Controlled Action (Particular Manner)	Post-Approval
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D seismic surveys	2005/2151	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey	2012/6296	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey	2008/4493	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey Permit Area WA-352-P	2008/4628	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey within permit WA-291	2007/3265	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey	2008/4281	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey (WA-482-P, WA-363-P), WA	2013/6761	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
3D Marine Seismic Survey in Permit Areas WA-15-R, WA-18-R, WA-205-P, WA-253-P, WA-267-P and WA-268-P	2003/1271	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in WA 457-P & WA 458-P, North West Shelf, offshore WA	2013/6862	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey over petroleum title WA-268-P	2007/3458	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Surveys - Contos CT-13 & Supertubes CT-13, offshore WA	2013/6901	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2715	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, WA	2008/4428	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey in the Carnarvon Bsin on the North West Shelf	2002/778	Not Controlled Action (Particular Manner)	Post-Approval
3D sesmic survey	2006/2781	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2009/4968	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2008/4565	Not Controlled Action (Particular Manner)	Post-Approval
Agrippina 3D Seismic Marine Survey	2009/5212	Not Controlled Action (Particular Manner)	Post-Approval
Apache Northwest Shelf Van Gogh Field Appraisal Drilling Program	2007/3495	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
Artemis-1 Drilling Program (WA-360-P)	2010/5432	Not Controlled Action (Particular Manner)	Post-Approval
Australia to Singapore Fibre Optic Submarine Cable System	2011/6127	Not Controlled Action (Particular Manner)	Post-Approval
Babylon 3D Marine Seismic Survey, Commonwealth Waters, nr Exmouth WA	2013/7081	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Bonaventure 3D seismic survey	2006/2514	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
Cerberus exploration drilling campaign, Carnarvon Basin, WA	2016/7645	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Charon 3D Marine Seismic Survey	2007/3477	Not Controlled Action (Particular Manner)	Post-Approval
Consturction & operation of the Varanus Island kitchen & mess cyclone refuge building, compression plant & accomidation camp, Varanus Island	2013/6952	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Coverack Marine Seismic Survey	2001/399	Not Controlled Action (Particular Manner)	Post-Approval
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval
CVG 3D Marine Seismic Survey	2012/6654	Not Controlled Action (Particular Manner)	Post-Approval
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval
Decommissioning of the Legendre facilities	2010/5681	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Drilling Program	2010/5532	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Demeter 3D Seismic Survey, off Dampier, WA	2002/900	Not Controlled Action (Particular Manner)	Post-Approval
Draeck 3D Marine Seismic Survey, WA-205-P	2006/3067	Not Controlled Action (Particular Manner)	Post-Approval
Drilling 35-40 offshore exploration wells in deep water	2008/4461	Not Controlled Action (Particular Manner)	Post-Approval
Earthworks for kitchen/mess, cyclone refuge building & Compression Plant, Varanus Island	2013/6900	Not Controlled Action (Particular Manner)	Post-Approval
Eendracht Multi-Client 3D Marine Seismic Survey	2009/4749	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Effect of marine seismic sounds to demersal fish and pearl oysters, north-west WA	2018/8169	Not Controlled Action (Particular Manner)	Post-Approval
Enfield M3 & Vincent 4D Marine Seismic Surveys	2008/3981	Not Controlled Action (Particular Manner)	Completed
Enfield M3 4D, Vincent 4D & 4D Line Test Marine Seismic Surveys	2008/4122	Not Controlled Action (Particular Manner)	Post-Approval
Enfield M4 4D Marine Seismic Survey	2008/4558	Not Controlled Action (Particular Manner)	Post-Approval
Enfield oilfield 3D Seismic Survey	2006/3132	Not Controlled Action (Particular Manner)	Post-Approval
Exmouth West 2D Marine Seismic Survey	2008/4132	Not Controlled Action (Particular Manner)	Post-Approval
Exploration drilling of Zeus-1 well	2008/4351	Not Controlled Action (Particular Manner)	Post-Approval
Fletcher-Finucane Development, WA26-L and WA191-P	2011/6123	Not Controlled Action (Particular Manner)	Post-Approval
Foxhound 3D Non-Exclusive Marine Seismic Survey	2009/4703	Not Controlled Action (Particular Manner)	Post-Approval
Gazelle 3D Marine Seismic Survey in WA-399-P and WA-42-L	2010/5570	Not Controlled Action (Particular Manner)	Post-Approval
Geco Eagle 3D Marine Seismic Survey	2008/3958	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Glencoe 3D Marine Seismic Survey WA-390-P	2007/3684	Not Controlled Action (Particular Manner)	Post-Approval
Greater Western Flank Phase 1 gas Development	2011/5980	Not Controlled Action (Particular Manner)	Post-Approval
Grimalkin 3D Seismic Survey	2008/4523	Not Controlled Action (Particular Manner)	Post-Approval
Guacamole 2D Marine Seismic Survey	2008/4381	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
Harpy 1 exploration well	2001/183	Not Controlled Action (Particular Manner)	Post-Approval
Honeycombs MC3D Marine Seismic Survey	2012/6368	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas MC3D Marine Seismic Survey (HZ-13) Carnarvon Basin, offshore WA	2013/7003	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas phase 2 marine seismic survey, Exmouth Plateau, Northern Carnarvon Basin, WA	2013/7093	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
John Ross & Rosella Off Bottom Cable Seismic Exploration Program	2008/3966	Not Controlled Action (Particular Manner)	Post-Approval
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2009/4801	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2008/4630	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular Manner)	Post-Approval
Laverda 3D Marine Seismic Survey and Vincent M1 4D Marine Seismic Survey	2010/5415	Not Controlled Action (Particular Manner)	Post-Approval
Laying a submarine optical fibre telecommunications cable, Perth to Singapore and Jakarta	2014/7332	Not Controlled Action (Particular Manner)	Post-Approval
Leopard 2D marine seismic survey	2005/2290	Not Controlled Action (Particular Manner)	Post-Approval
Lion 2D Marine Seismic Survey	2007/3777	Not Controlled Action (Particular Manner)	Post-Approval
Macedon Gas Field Development	2008/4605	Not Controlled Action (Particular Manner)	Post-Approval
Marine reconnaissance survey	2008/4466	Not Controlled Action (Particular Manner)	Post-Approval
Mariner Non-Exclusive 2D Seismic Survey	2011/6172	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval
Munmorah 2D seismic survey within permits WA-308/9-P	2003/970	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Program, WA-264-P	2007/3844	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Survey	2005/2017	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Drilling Campaign	2011/5830	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Onslow Seawater Desalination Plant Marine Geophysical Investigation	2020/8794	Not Controlled Action (Particular Manner)	Post-Approval
Orcus 3D Marine Seismic Survey in WA-450-P	2010/5723	Not Controlled Action (Particular Manner)	Post-Approval
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular Manner)	Post-Approval
Outer Canning exploration drilling program off NW coast of WA	2012/6618	Not Controlled Action (Particular Manner)	Post-Approval
Palta-1 exploration well in Petroleum Permit Area WA-384-P	2011/5871	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Phoenix 3D Seismic Survey, Bedout Sub-Basin	2010/5360	Not Controlled Action (Particular Manner)	Post-Approval
Pomodoro 3D Marine Seismic Survey in WA-426-P and WA-427-P	2010/5472	Not Controlled Action (Particular Manner)	Post-Approval
Pyrenees 4D Marine Seismic Monitor Survey, HCA12A	2012/6579	Not Controlled Action (Particular Manner)	Post-Approval
Pyrenees-Macedon 3D marine seismic survey	2005/2325	Not Controlled Action (Particular Manner)	Post-Approval
Quiberon 2D Seismic Survey, permit area WA-385P, offshore of Carnarvon	2009/5077	Not Controlled Action (Particular Manner)	Post-Approval
Reindeer gas reservior development, Devil Creek, Carnarvon Basin - WA	2007/3917	Not Controlled Action (Particular Manner)	Post-Approval
Repsol 3d & 2D Marine Seismic Survey	2012/6658	Not Controlled Action (Particular Manner)	Post-Approval
Rose 3D Seismic Program	2008/4239	Not Controlled Action (Particular Manner)	Post-Approval
Rydal-1 Petroleum Exploration Well, WA	2012/6522	Not Controlled Action (Particular Manner)	Post-Approval
Salsa 3D Marine Seismic Survey	2010/5629	Not Controlled Action (Particular Manner)	Post-Approval
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Scarborough Development nearshore component, NWS, WA	2018/8362	Not Controlled Action (Particular Manner)	Post-Approval
search for HMAS Sydney	2006/3071	Not Controlled Action (Particular Manner)	Post-Approval
Skorpion Marine Seismic Survey WA	2001/416	Not Controlled Action (Particular Manner)	Post-Approval
Sovereign 3D Marine Seismic Survey	2011/5861	Not Controlled Action (Particular Manner)	Post-Approval
Stag 4D & Reindeer MAZ Marine Seismic Surveys, WA	2013/7080	Not Controlled Action (Particular Manner)	Post-Approval
Stag Off-bottom Cable Seismic Survey	2007/3696	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow 4D Marine Seismic Survey	2011/5810	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow Baseline 4D marine seismic survey	2008/4530	Not Controlled Action (Particular Manner)	Post-Approval
Tantabiddi Boat Ramp Sand Bypassing	2015/7411	Not Controlled Action (Particular Manner)	Post-Approval
Tidepole Maz 3D Seismic Survey Campaign	2007/3706	Not Controlled Action (Particular Manner)	Post-Approval
Tortilla 2D Seismic Survey, WA	2011/6110	Not Controlled Action (Particular Manner)	Post-Approval
Triton 3D Marine Seismic Survey, WA-2-R and WA-3-R	2006/2609	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Undertake a 3D marine seismic survey	2010/5695	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5715	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5679	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Vincent M1 and Enfield M5 4D Marine Seismic Survey	2010/5720	Not Controlled Action (Particular Manner)	Post-Approval
Warramunga Non-Inclusive 3D Seismic Survey	2008/4553	Not Controlled Action (Particular Manner)	Post-Approval
West Anchor 3D Marine Seismic Survey	2008/4507	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
3D Marine Seismic Survey in the offshore northwest Carnarvon Basin	2011/6175	Referral Decision	Completed
3D Seismic Survey	2008/4219	Referral Decision	Completed
Bianchi 3D Marine Seismic Survey, Carnavon Basin, WA	2013/7078	Referral Decision	Completed
CVG 3D Marine Seismic Survey	2012/6270	Referral Decision	Completed
Enfield 4D Marine Seismic Surveys, Production Permit WA-28-L	2005/2370	Referral Decision	Completed
Eramurra Industrial Salt Project	2021/9027	Referral Decision	Referral Publication
Mardie Salt Project, Pilbara region, WA	2018/8183	Referral Decision	Completed
Rose 3D Seismic acquisition survey	2008/4220	Referral Decision	Completed
Stybarrow Baseline 4D Marine Seismic Survey (Permit Areas WA-255-P, WA-32-L, WA-	2008/4165	Referral Decision	Completed
Two Dimensional Transition Zone Seismic Survey - TP/7 (R1)	2010/5507	Referral Decision	Completed
Varanus Island Compression Project	2012/6698	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
Ancient coastline at 125 m depth contour	North-west
Ancient coastline at 90-120m depth	South-west
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west
Glomar Shoals	North-west
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	North-west
Perth Canyon and adjacent shelf break, and other west coast canyons	South-west
Wallaby Saddle	North-west
Western demersal slope and associated fish communities	South-west
Western rock lobster	South-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	Known to occur
Dugong dugon Dugong [28]	Foraging (high density seagrass beds)	Known to occur
Dugong dugon Dugong [28]	Nursing	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Aggregation	Known to occur

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Basking	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Mating	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Natator depressus Flatback Turtle [59257]	Aggregation	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Known to occur

Scientific Name	Behaviour	Presence
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Mating	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Anous stolidus Common Noddy [825]	Foraging (provisioning young)	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Foraging (in high numbers)	Known to occur
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Onychoprion anaethetus Bridled Tern [82845]	Foraging (in high numbers)	Known to occur
Onychoprion fuscata Sooty Tern [82847]	Foraging	Known to occur
Pelagodroma marina White-faced Storm petrel [1016]	Foraging (in high numbers)	Known to occur
Phaethon lepturus White-tailed Tropicbird [1014]	Breeding	Known to occur
Puffinus assimilis tunneyi Little Shearwater [59363]	Foraging (in high numbers)	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Sternula albifrons sinensis Little Tern [82850]	Resting	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Sula leucogaster Brown Booby [1022]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Rhincodon typus Whale Shark [66680]	Foraging (high density prey)	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Known Foraging Area	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Resting	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

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

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

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

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