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gorgon gas development

gorgon and jansz feed gas pipeline and wells operations (commonwealth waters) environment plan

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Approvals

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1 environment plan summary

This *Gorgon and Jansz Feed Gas Pipeline and Wells Operations (Commonwealth Waters) Environment Plan Summary* (Table 1-1) has been prepared from material provided in this Environment Plan, and as required by Regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

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
11(4)(a)(v)	a summary of the control measures for the activity	Section 6
11(4)(a)(vi)	a summary of the arrangements for ongoing monitoring of the titleholder's environmental performance	Section 7
11(4)(a)(vii)	a summary of the response arrangements in the oil pollution emergency plan	Section 6.14, 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 at: appendix d*
* *Available publicly at: https://docs.nopsema.gov.au/A748691*

2 introduction

2.1 Overview

On behalf of the Gorgon Joint Venturers, Chevron Australia Pty Ltd (CAPL) is operating the Gorgon and Jansz–Io gas fields which includes offshore production wells and Feed Gas Pipeline infrastructure. The Feed Gas Pipeline infrastructure gathers and transports gas to the Gorgon Gas Treatment Plant (GTP) on Barrow Island.

This Environment Plan (EP) documents the assessment and management of potential environmental impacts and risks associated with operating the Gorgon and Jansz–Io production wells and Feed Gas Pipelines, including in-fill commissioning and start-up activities, in Commonwealth waters; this includes infrastructure and activities associated with both the Gorgon Foundation Project (GFP) and Gorgon Stage 2 (GS2).

This EP has been prepared in accordance with the requirements of the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R) as administered and for regulatory acceptance by the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA).

2.2 Location

The Gorgon gas field is located within production licences WA-37-L and WA-38-L, ~130 km off the north-west coast of Western Australia (WA), and ~65 km north-west of Barrow Island (Figure 2-1).

The Jansz–Io gas fields are located within production licences WA-36-L, WA-39-L and WA-40-L ~200 km off the north-west coast of WA in water depths of ~1350 m (Figure 2-1).

Detailed information regarding the location and layout of subsea hydrocarbon infrastructure is included in Section 3.1.

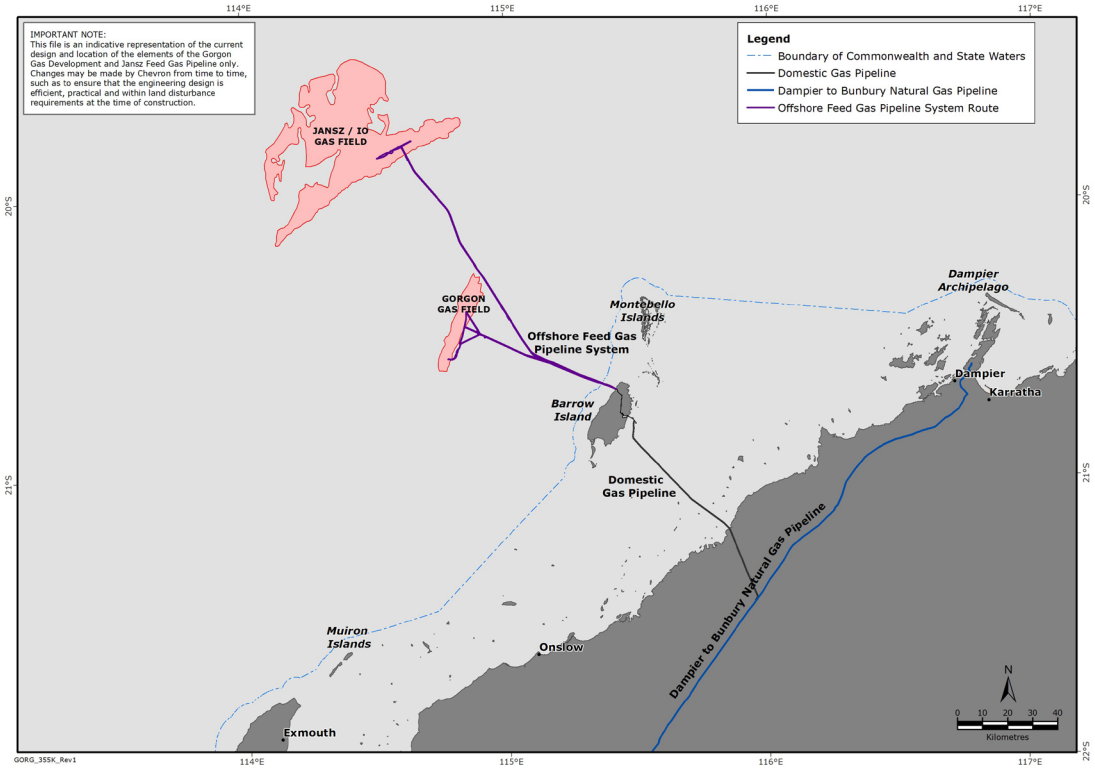


Figure 2-1: Location of Gorgon and Jansz–Io gas fields

2.3 Scope

2.3.1 In scope

This EP addresses activities in Commonwealth waters associated with the Gorgon and Jansz–Io production wells and the Feed Gas Pipeline (the 'petroleum activity'); this hydrocarbon system is further described in Section 3.2. Specifically, this EP addresses the following primary activities associated with the Gorgon and Jansz–Io hydrocarbon system:

- commissioning and start-up (Section 3.3)
- operations (Section 3.4)
- inspection, maintenance, and repairs (IMR) (Section 3.5)
- decommissioning (Section 3.6)
- field support (Section 3.7).

2.3.2 Out of scope

The following activities are excluded from the scope of this EP:

- installation and pre-commissioning activities (associated with the GFP) completed in accordance with the NOPSEMA-accepted *Offshore Feed Gas Pipeline System Installation Management Plan*[1] (Ref. 4)

[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.

- installation and pre-commissioning activities (associated with GS2) which are covered under the NOPSEMA-accepted *Pipeline and Subsea Infrastructure Installation and Pre-commissioning Environment Plan* (Ref. 5)
- drilling, completion, and well maintenance activities (associated with both the GFP and GS2) which are covered under the NOPSEMA-accepted *Gorgon and Jansz-Io Drilling, Completions and Well Maintenance Program Environment Plan* (Ref. 6)
- commissioning, start-up and operation activities within State waters which are covered under the NOPSEMA-accepted *Gorgon and Jansz Feed Gas Pipeline Operations Environment Plan (State)* (Ref. 7)
- vessels (including emergency response vessels) transiting to or from the operational area (OA) (refer to Section 3.1.1 for definition of the OA); these vessels are deemed to be operating under the Commonwealth *Navigation Act 2012* and are not performing the petroleum activity
- end of facility life (EOFL) decommissioning and removal of infrastructure under Section 572(3) of the Commonwealth OPGGS Act; these activities are not scheduled to occur within the 5-year in-force period of this EP (refer to Section 3.6.1).

2.4 Titleholder details

CAPL is the nominated titleholder of the production and pipeline licences on behalf of the titleholder companies listed in Table 2-1. Regulation 286A of the OPGGS Act requires notification is provided to NOPSEMA and the National Offshore Petroleum Titles Administrator (NOPTA) if there is a change to one of the registered titleholders or contact details for the registered titleholders; this notification is to occur within 30 days of such a change.

The contact details for the nominated liaison person for this EP is listed in Table 2-2. Regulation 15(3) of the OPGGS(E)R requires that CAPL notifies NOPSEMA if the titleholder's nominated liaison person or contact details for the nominated liaison person changes.

Table 2-1: Titleholder details

Titles	Details	Titleholders	Nominated Titleholder	Address
WA-36-L WA-37-L WA-38-L WA-39-L WA-40-L WA-19-PL WA-20-PL	Production Licence Production Licence Production Licence Production Licence Production Licence Pipeline Licence Pipeline Licence	Chevron Australia Pty Ltd	Chevron Australia Pty Ltd (ACN: 086 197 757)	250 St Georges Terrace, Perth WA 6000
		Chevron (TAPL) Pty Ltd		
		Mobil Australia Resources Company Pty Limited		
		Shell Australia Pty Ltd		
		Osaka Gas Gorgon Pty Ltd		
		Tokyo Gas Gorgon Pty Ltd		
		JERA Gorgon Pty Ltd		

Table 2-2: Titleholders' nominated liaison person

Name	Kate Yates / Asten Roopra (public contact)
Company	Chevron Australia Pty Ltd
ACN	086 197 757
Position	Gorgon Operations Manager / PGPA Operations Manager
Business Address	250 St Georges Terrace, Perth WA 6000
Telephone Number	+61 8 9216 4000
Email Address	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 7.

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

In accordance with Regulation 13(4) of the OPGGS(E)R, the legislative framework relevant to the petroleum activity is described in Table 2-3 and Table 2-4.

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 6.7
		Australian Ballast Water Management Requirements (Ref. 8)	
Environment Protection and Biodiversity	Provides for the protection and management of	The EP must describe matters protected under Part 3 of the	Section 4 and Section 6

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Conservation Act 1999 (EPBC Act) EPBC Regulations 2000	nationally and internationally important flora, fauna, ecological communities, and heritage places	EPBC Act and assess any impacts and risks to these protected matters	
		EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans	Section 0 and Section 6.6
		Injury or fatality caused to EPBC-listed fauna shall be reported	Section 7.4.2
Navigation Act 2012	Provides for vessel and seafarer safety, and marine pollution prevention	Notice to Mariners	Section 6.1 and Section 6.12
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 6.12
		Marine order 91—Marine pollution prevention—oil	Section 6.8, Section 6.11 and Section 6.12
		Marine order 95—Marine pollution prevention—garbage	Section 6.8 and Section 6.10
		Marine order 96—Marine pollution prevention—sewage	Section 6.8
		Marine order 97—Marine pollution prevention—air pollution	Section 6.4
		Marine order 98—Marine pollution prevention—anti-fouling systems	Section 6.7
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)

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
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 to manage well integrity and well activities	A WOMP for a petroleum well activity must be accepted by NOPSEMA before activities commence	WOMP (Ref. 9)
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 and Section 6

Table 2-4: Standards and guidelines

Standard / guideline	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Ref. 10)	International Maritime Organization (IMO) guidelines for global management of biofouling	Requires a biofouling management plan and record book to be available and maintained	Section 6.7
National Light Pollution Guidelines for Wildlife, including Marine Turtles, Seabirds and Migratory Shorebirds (Ref. 11)	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	The EP must assess if artificial lighting is likely to affect wildlife and identify the management tools to minimise and mitigate impacts and risks	Section 6.5

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 is guidance sourced from:

- NOPSEMA's *Environment plan decision making* guideline (Ref. 12)
- NOPSEMA's *Clarifying statutory requirements and good practice consultation* bulletin (Ref. 13)
- NOPSEMA's *Consultation with Commonwealth agencies with responsibilities in the marine area* guideline (Ref. 14)
- NOPSEMA's *Considerations for five-year environment plan revisions* information paper (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 depends on the nature and scale of the petroleum activity and its associated impacts and risks. In accordance with Regulation 11A of the OPGGS(E)R, 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. 14) has been taken into consideration in identifying relevance with respect to the activities provided for in this EP.

With regards to "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", NOPSEMA (Ref. 13) has provided the additional clarifications:

- that there must be a direct connection between the activities that an EP provides for and a potential effect to a person or organisation functions, interests, or activities, for them to be considered as a 'relevant person'
- that the definition of "the activities to be carried out" is limited to the conduct of the activity that is provided for in the EP and does not extend to a hypothetical, remote or speculative consequence from an activity such as a major oil spill.

Based on the impact assessment 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.

Since commencing the GFP, CAPL has developed and maintained a list of stakeholders who are considered relevant to the potential impacts and risks associated with the Gorgon Gas Development. CAPL engaged with stakeholders in 2014/2015 before starting the commissioning and start-up activities associated with the GFP and submission of the original version of this EP. As per NOPSEMA guidance (Ref. 15), 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 2-5.

Table 2-5: 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
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

Group	Stakeholder
Other petroleum operators	• Santos Ltd • Woodside Burrup Pty Ltd
Emergency response	• AECOM • Australian Marine Oil Spill Response Centre • Gorgon HSE/Emergency Management Specialists • DoT Oil Spill Response Coordination (OSRC) Unit • Oil Spill Response Limited (OSRL) • BMT • GHD • Cleanaway • Port Authorities

2.6.3 Provision of material

Under NOPSEMA's *Environment plan decision making* guideline (Ref. 12), 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 on 01 April 2021.This fact sheet summarised the activity, aspects, and the proposed control measures to manage impacts and risks. WAFIC was also used to convey an additional factsheet, tailored for the commercial fishing sector, on 31 March 2021. A copy of the consultation materials is included in appendix b.

All records and responses from relevant persons were included in a sensitive information report provided separately to NOPSEMA 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.

2.6.5 Ongoing consultation

The stakeholder notifications and ongoing consultation required for this petroleum activity is captured in Table 2-6.

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 7.3.2.2.

Table 2-6: Notifications and ongoing consultation

Stakeholder	Notification or ongoing consultation requirement	Timing	Frequency
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 (phone: 1800 641 792 or +61 2 6230 6811)	At least 24 to 48 hours before commencing activities, or as otherwise agreed with AMSA	As required
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
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 7.3.2.2, 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 2-5 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

This section provides a description of the petroleum activity as required under Regulation 13(1) of the OPGGS(E)R. The description of the petroleum activity is presented in six sections:

- the hydrocarbon system—includes the infrastructure (including the wells, flowlines, and production pipelines) used for gathering and transporting hydrocarbon to the GTP on Barrow Island, and other supporting infrastructure (umbilicals, pipelines, etc.)(Section 3.2)
- commissioning and start-up—the verification and testing of infrastructure and the introduction of hydrocarbon to the system (Section 3.3)
- operations—the gathering and transport of hydrocarbon and other fluids from the subsea wells to the GTP (Section 3.4)
- IMR—undertaken to ensure the integrity of hydrocarbon system (Section 3.5)
- decommissioning—long-term planning for decommissioning of redundant infrastructure (Section 3.6)
- field support—includes IMR vessel operations, and helicopters for personnel transfers (Section 3.7).

3.1.1 Operational area

The location of the Gorgon and Jansz–Io gas fields and the Feed Gas Pipeline system is described in Section 2.2 and shown in Figure 2-1.

The OA for the petroleum activity is defined as the petroleum titles (WA-36-L, WA-37-L, WA-38-L, WA-39-L, WA-40-L) plus a 200 m wide corridor centred over the Gorgon and Jansz–Io pipeline within Commonwealth 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 hydrocarbon system associated with the GFP infrastructure.

Commissioning and start-up activities associated with GS2 infrastructure is expected to commence from Q2 2022 (pending the completion of installation and pre-commissioning activities as covered under Ref. 5). The duration of GS2 commissioning and start-up activities is expected to be approximately six months. This timing is indicative and subject to potential delays caused by weather events, vessel availability, and other unforeseen factors.

Operations for the Gorgon Gas Development are expected to continue for the nominal operational design life of 50 years. IMR activities may occur at any time during commissioning, start-up and operations.

Activities covered by this EP can occur 24 hours a day and 7 days a week.

3.2 Hydrocarbon system

3.2.1 Overview

The hydrocarbon system includes the infrastructure for gathering and transporting hydrocarbons from the production wells to the GTP on Barrow Island.

The initial field development comprised of wells and subsea infrastructure, including the Feed Gas Pipeline, associated with the GFP. This field development is being supplemented by GS2, which comprises additional wells and subsea infrastructure within the Gorgon and Jansz-Io gas fields. GS2 was part of the original field development plans for the Gorgon Gas Development.

3.2.1.1 Gorgon Foundation Project

The Gorgon production pipeline and umbilical route from the Gorgon field heads south-east toward Barrow Island. The pipeline and umbilical then crosses the Halyard Electrohydraulic Umbilical (EHU) at a water depth of ~95 m and continues south-east to Barrow Island. Flowlines and pipelines run from the Gorgon midline pipeline termination structure (PTS) to each of the three drill centres (Gorgon M1, Gorgon M2 and Gorgon M3).

The Jansz–Io production pipeline and umbilical route from the Jansz–Io gas field traverses the scarp between the Chrysaor Canyons and the Gorgon gas field, on to the continental shelf. The pipeline and umbilical then cross the Halyard EHU at a water depth of ~83 m and then converge with the Gorgon production pipeline and umbilical at ~70 m water depth. Flowlines and pipelines run from the Jansz–Io midline PTS to each of the two drill centres (Jansz DC-1 and Jansz DC-2).

A schematic diagram showing the layout of the GFP subsea infrastructure is presented in Figure 3-1.

3.2.1.2 Gorgon Stage 2

GS2 supplements the existing Gorgon and Jansz–Io gas field development with additional subsea infrastructure:

- three new tiebacks (from new infill wells) to the existing manifold at the Gorgon M1 drill centre
- four new tiebacks (from new production wells) to the new manifold (GOR-M4) at the new Gorgon M4 drill centre, which in turn is connected to the existing Gorgon gas gathering system via a new M4 PTS and associated flowlines and pipelines
- four new tiebacks (from new production wells) to a new Jansz DC-3 drill centre with a combined manifold/PTS, which in turn is connected to the existing Jansz–Io gas gathering system via associated flowlines and pipelines
- two infield control umbilicals for the new Gorgon M4 and Jansz DC-3 drill centres, and all interconnecting flying leads to allow control of the facility.

A schematic diagram showing the layout of the GS2 subsea infrastructure within the Gorgon and Jansz–Io fields is presented in Figure 3-2 and Figure 3-3 respectively.

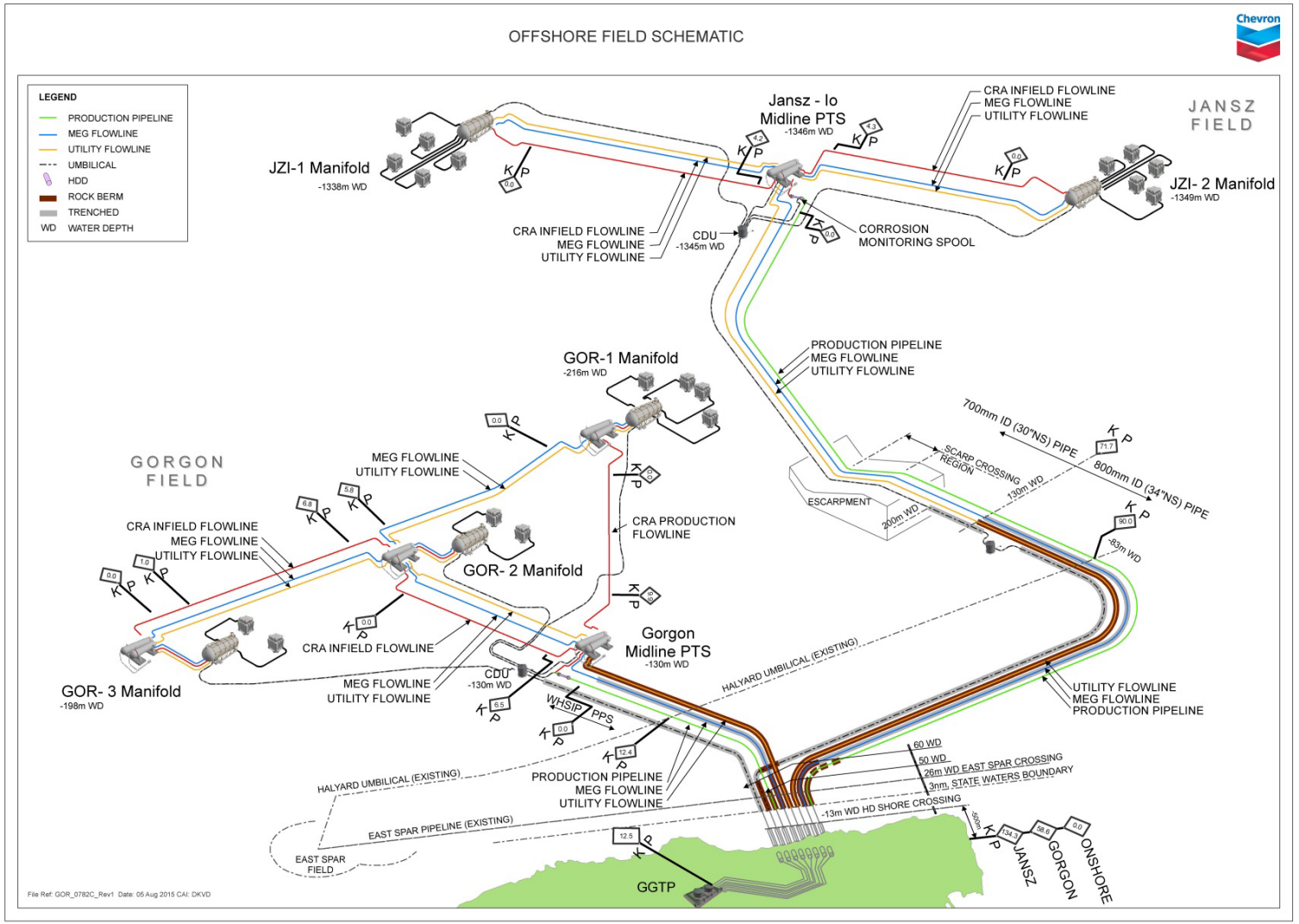


Figure 3-1: Schematic of the Gorgon and Jansz–Io subsea infrastructure associated with the Gorgon Foundation Project

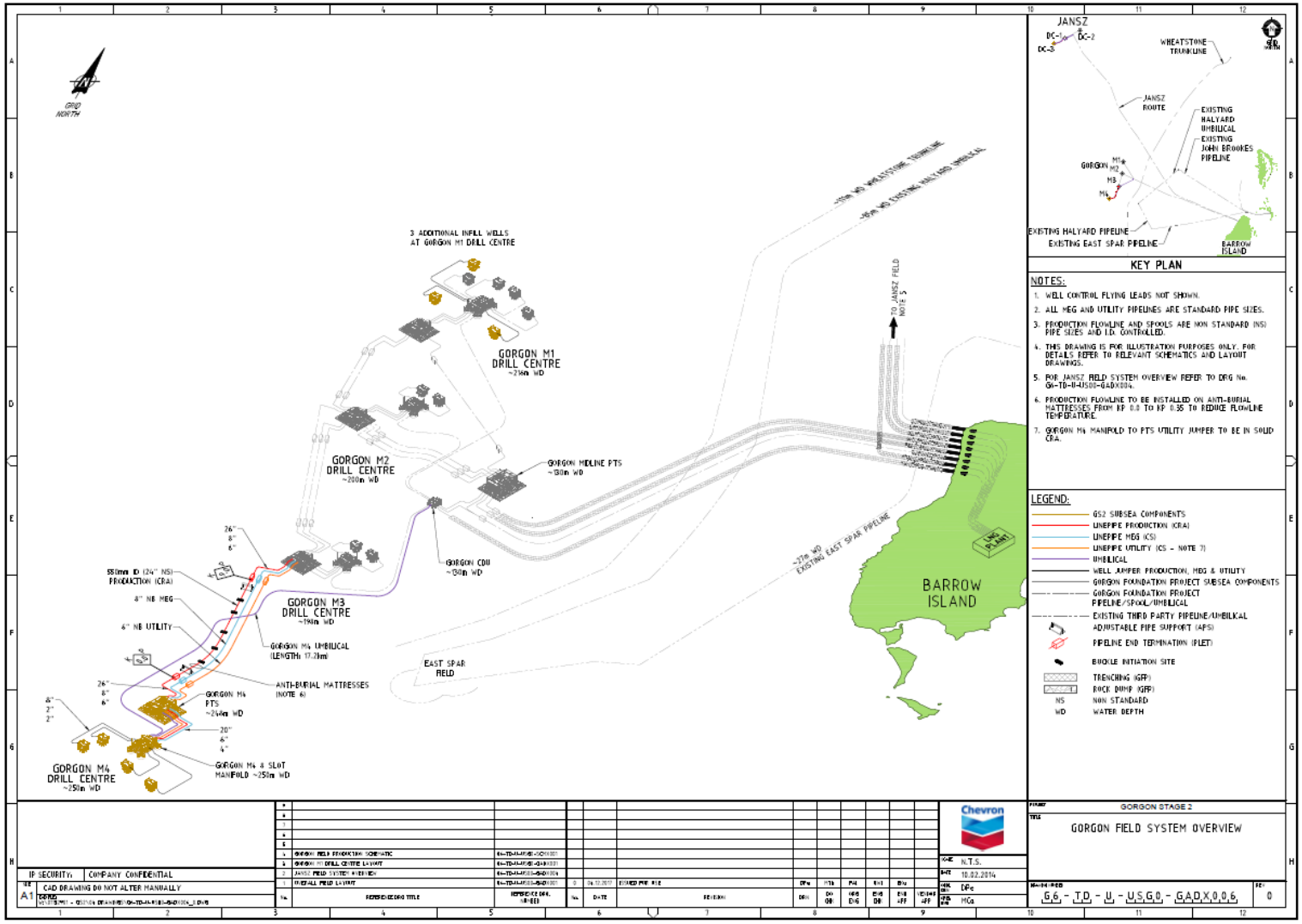


Figure 3-2: Schematic of the GS2 infrastructure within the Gorgon field

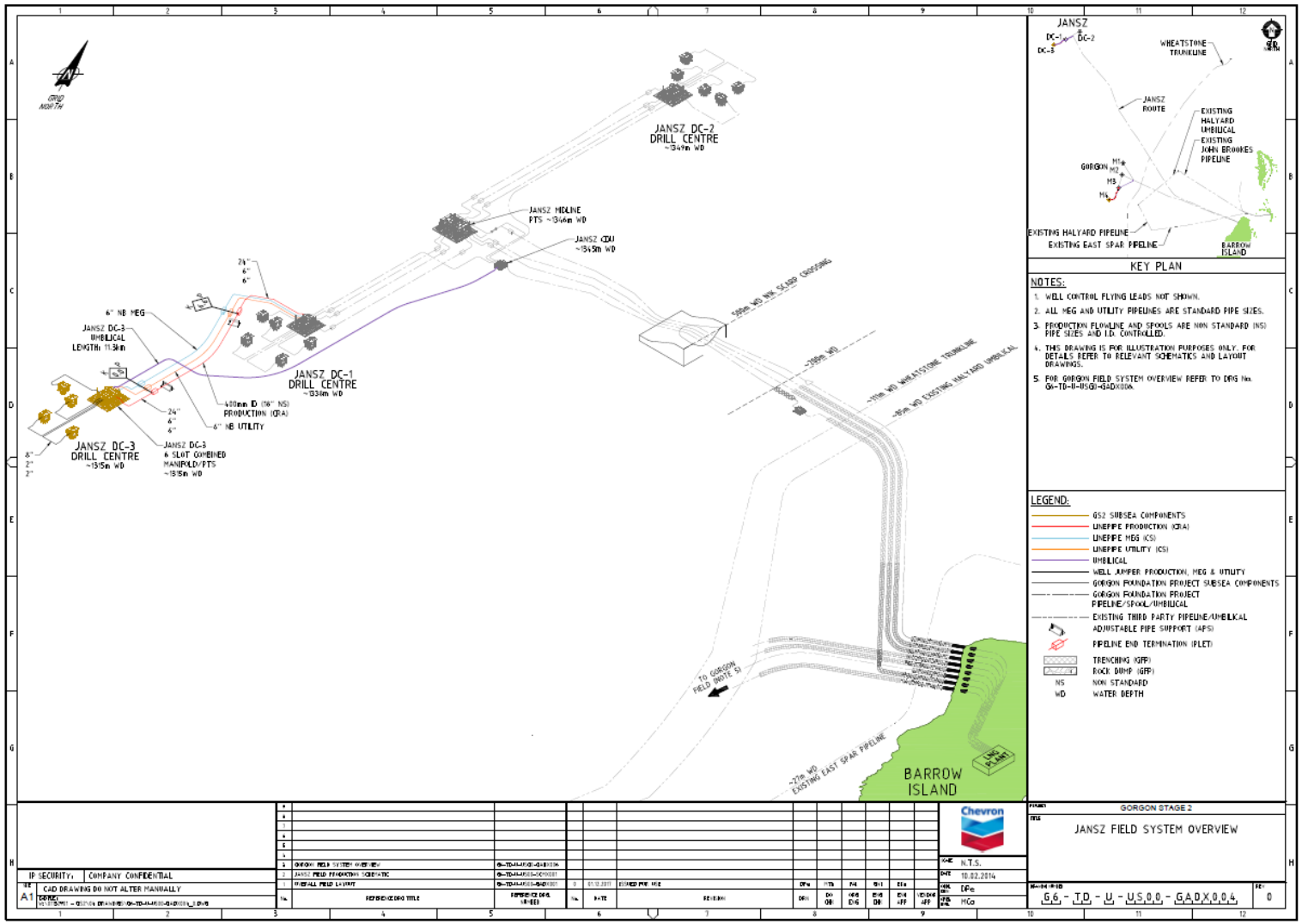


Figure 3-3: Schematic of the GS2 infrastructure within the Jansz–Io field

3.2.1.3 Reservoir characteristics

Table 3-1 summarises the compositional reservoir analyses undertaken by Shell Development Australia in 1999 (Ref. 17). More recent assays conducted during well flowbacks in 2014 (Ref. 18) and ongoing analysis indicate that the original compositional analysis is still accurate. The hydrocarbon from the additional GS2 wells is not expected to vary significantly from previous GFP assays and analyses.

Table 3-1: Hydrocarbon properties

Property	Gorgon	Jansz–Io
Classification	Group II, light persistent oil	Group I, non-persistent oil
Density	848 kg/m^3 at 15 °C	743.1 kg/m^3 at 15 °C
API gravity	35.3 °API	47.9 °API
Dynamic viscosity	2.4 cP at 20 °C	1.2 cP at 25 °C
Pour point	−9 °C	−30 °C
Gas to condensate ratio	5.9 bbl/MMscf	4.09 bbl/MMscf

3.2.1.4 Flow rates

All Gorgon wells have a steady-state design gas flow rate of 270 MMscfd, and all Jansz–Io wells have a steady-state design gas flow rate of 240 MMscfd.

3.2.2 Production wells

Under the current field development (GFP and GS2) there are a total of 15 production wells centred around four drill centres within the Gorgon gas field (Table 3-2). There is spare well slots at each of the subsea production manifolds available for future well tie-in.

Each well is fitted with a subsea christmas tree, which includes an arrangement of valves, controls, and instrumentation. Rigid well jumpers connect each christmas tree to the production manifolds at the drill centres.

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).

Table 3-2: Indicative locations and water depths for the production wells

Field development	Well name	Associated drill centre	Latitude	Longitude	Approximate water depth
Gorgon field					
GS2	GOR-1A	Gorgon M1	20°24’29.13” S	114°50’56.00” E	216 m
GS2	GOR-1B		20°24’27.69” S	114°50’57.03” E	216 m
GFP	GOR-1C		20°24’28.37” S	114°50’56.84” E	215 m
GFP	GOR-1D		20°24’28.61” S	114°50’57.73” E	215 m
GFP	GOR-1E		20°24’29.17” S	114°50’58.31” E	215 m
GFP	GOR-1F		20°24’30.02” S	114°50’58.54” E	215 m
GS2	GOR-1G		20°24´29.87” S	114°50’59.26” E	216 m
GFP	GOR-2B	Gorgon M2	20°27´36.54” S	114°50’31.39” E	199 m

Field development	Well name	Associated drill centre	Latitude	Longitude	Approximate water depth
GFP	GOR-2C		20°27´37.10” S	114°50’31.96” E	199 m
GFP	GOR-3B	Gorgon M3	20°31’11.28” S	114°49’25.85” E	199 m
GFP	GOR-3C		20°31’11.84” S	114°49’26.42” E	199 m
GS2	GOR-4C	Gorgon M4	20°34’38.62” S	114°46’38.40” E	250 m
GS2	GOR-4D		20°34’38.34” S	114°46’37.54” E	250 m
GS2	GOR-4E		20°34’37.79” S	114°46’36.95” E	250 m
GS2	GOR-4F		20°34’36.94” S	114°46’36.39” E	250 m
Jansz–Io field					
GFP	JZI-1B	Jansz DC-1	19°49’36.51” S	114°34’13.94” E	1338 m
GFP	JZI-1C		19°49’36.40” S	114°34’12.96” E	1338 m
GFP	JZI-1D		19°49’35.44” S	114°34’12.47” E	1338 m
GFP	JZI-1E		19°49’34.62” S	114°34’12.95” E	1338 m
GFP	JZI-1F		19°49’33.97” S	114°34’12.93” E	1338 m
GFP	JZI-2B	Jansz DC-2	19°47’28.31” S	114°38’40.03” E	1349 m
GFP	JZI-2C		19°47’28.40” S	114°38’41.00” E	1349 m
GFP	JZI-2D		19°47’29.36” S	114°38’41.54” E	1349 m
GFP	JZI-2E		19°47’30.17” S	114°38’41.01” E	1349 m
GFP	JZI-2F		19°47’30.83” S	114°38’41.04” E	1349 m
GS2	JZI-3C	Jansz DC-3	19°51’11.42” S	114°30’54.64” E	1315 m
GS2	JZI-3D		19°51’10.40” S	114°30’54.33” E	1315 m
GS2	JZI-3E		19°51’09.69” S	114°30’54.97” E	1315 m
GS2	JZI-3F		19°51’09.04” S	114°30’55.05” E	1315 m

3.2.3 Subsea production manifolds

The production wells are connected to subsea production manifolds via rigid jumpers. This enables gas condensate from each wellhead to be commingled via the production manifolds before entering the corrosion-resistant alloy (CRA) infield production flowlines. These infield production flowlines then run from the production manifolds to the PTSs.

Double-valve isolation is provided on the subsea production manifolds. Individual header valves on the manifolds are actuated valves. Generally, these valves are remotely operated from the GTP; however, they can also be operated by remotely operated vehicle (ROV) if required.

Under the current field development (GFP and GS2) there are a total of four subsea production manifolds within the Gorgon gas field, and three subsea production manifolds within the Jansz–Io gas field (Table 3-3). The new Jansz drill centre (Jansz DC-3) has a combined manifold and PTS.

Table 3-3: Indicative locations and dimensions for the subsea production manifolds

Field development	Manifold	Approximate dimensions (length x width x height)	Latitude	Longitude
Gorgon field				

Field development	Manifold	Approximate dimensions (length x width x height)	Latitude	Longitude
GFP	GOR-1	25 x 19 x 7 m	20°24'29.58" S	114°50'57.27" E
GFP	GOR-2	25 x 19 x 7 m	20°27'37.44" S	114°50'30.99" E
GFP	GOR-3	25 x 19 x 7 m	20°31'12.18" S	114°49'25.45" E
GS2	GOR-4	19 × 15 × 6 m	20°34’37.38″ S	114°46’37.97″ E
Jansz–Io field				
GFP	JZI-1	32 × 27 × 3 m	19°49'35.16" S	114°34'14.31" E
GFP	JZI-2	32 × 27 × 3 m	19°47'29.65" S	114°38'39.66" E
GS2	JZI-3 (combined manifold/PTS)	19 × 23 × 7 m	19°51’10.44” S	114°30’56.19” E

3.2.4 Pipeline termination structure

The PTS connects the infield production flowlines (running from the subsea production manifolds) and the main production pipelines to the GTP. Gas condensate from the subsea production manifolds flows into the PTS where it is commingled before entering the main production pipelines.

The PTS includes several isolation valves, which are used for various purposes; these include:

- double-valve isolation at the pig launcher tie-in point to enable intelligent pigging operations to be undertaken
- isolation valves to enable subsea infrastructure to be isolated from the large pipeline inventory.

All valves on the PTS are operated by ROV and cannot be operated remotely from the GTP.

Under the current field development (GFP and GS2) there are two PTS within the Gorgon gas field, and two PTS within the Jansz–Io gas field (Table 3-4). The new Jansz drill centre (Jansz DC-3) has a combined manifold and PTS.

Table 3-4: Indicative locations and dimensions of PTSs

Field development	PTS	Approximate dimensions (length x width x height)	Latitude	Longitude
Gorgon field				
GFP	Gorgon Midline PTS	30 × 25 x 10 m	20°29’11.20” S	114º53’53.29” E
GS2	Gorgon M4 PTS	22 × 15 × 10 m	20°34’36.47” S	114°46’40.40” E
Jansz–Io field				
GFP	Jansz-Io Midline PTS	37 × 32 × 3 m	19°48’33.90” S	114º36’26.26” E
GS2	JZI-3 (combined manifold/PTS)	19 × 23 × 7 m	19°51’10.44” S	114°30’56.19” E

3.2.5 Infield flowlines and pipelines

The flowlines and pipelines[2] connecting the subsea production manifolds to the PTSs comprise infield production flowlines, monoethylene glycol (MEG) pipelines and utility pipelines (Table 3-5). There are also additional MEG and utility pipelines that run from the PTSs to the GTP (Table 3-5); these are located adjacent to the main Gorgon and Jansz–Io production pipelines (refer to Section 3.2.7).

The CRA infield flowlines collect and transfer gas condensate from the production manifolds to the PTSs.

MEG pipelines provide continuous injection of MEG into the production system for hydrate management. In addition, MEG pipelines deliver production chemicals (for corrosion and scale management) to the field. MEG and production chemicals are then returned via the production pipelines to the GTP, where MEG will be regenerated for re-use.

Utility pipelines support a subsea maintenance depressurisation capability, annulus depressurisation, and double-sided depressurisation of the production system in the unlikely event of a hydrate blockage. The utility pipelines are filled with preservation fluid (e.g., MEG) when not in use to reduce susceptibility to corrosion and hydrate formation if gas bubbles are trapped in the pipeline.

All flowlines and pipelines are connected to the subsea production manifolds and PTSs by jumpers and spool pieces.

Table 3-5: Indicative locations of flowlines and pipelines

Field development	Flowlines and pipelines between subsea production manifolds and PTSs	Pipelines between the PTSs to GTP
Gorgon field		
GFP	• 3 x 26” CRA infield production flowlines • 3 x 8” MEG pipelines • 3 x 6” utility pipelines	• 1 x 8” MEG pipeline • 1 x 6” utility pipeline
GS2	• 1 x 24” M4 CRA infield production flowline • 1 x 8” MEG pipeline • 1 x 6” utility pipeline	
Jansz–Io field		
GFP	• 2 x 24” CRA infield production flowlines • 2 x 6” MEG pipelines • 2 x 6” utility pipelines	• 1 x 6” MEG pipeline • 1 x 6” utility pipeline
GS2	• 1 x 18” DC-3 CRA infield production flowline • 1 x 6” MEG pipeline • 1 x 6” utility pipeline	

3.2.6 Umbilicals

The fibre-optic and electrohydraulic control umbilicals provide hydraulic power, electric power, and a fibre-optic control link from the GTP to the subsea

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

infrastructure within the Gorgon and Jansz–Io gas fields. A Central Distribution Unit (CDU) is a termination point for the main control umbilical from the GTP into which the individual drill centre umbilicals connect. This is where the umbilical splits to provide links between the PTSs, christmas trees, production manifolds, and other components.

As part of GS2, new electrohydraulic umbilicals were installed between the existing Gorgon CDU and the new Gorgon M4 drill centre, and between the existing Jansz CDU and the umbilical termination assembly on the combined manifold/PTS at the new Jansz DC-3 drill centre.

3.2.7 Production pipeline

The Gorgon production pipeline runs for ~65 km between the Gorgon midline PTS to the shore crossing at North Whites Beach on Barrow Island (Figure 3-1). The Gorgon pipeline route crosses the Halyard EHU at a water depth of ~95 m and converges with the Jansz production pipeline at ~70 m water depth.

The Jansz–Io production pipeline runs for ~134 km between the Jansz–Io midline PTS to the shore crossing at North Whites Beach on Barrow Island (Figure 3-1). The pipeline transitions from 30” to 34” diameter at the top of the escarpment where it then crosses the Halyard EHU in ~83 m of water depth. The pipeline from the escarpment to the shore is a 34” pipeline.

3.2.8 Valves

The valves associated with the Gorgon electrohydraulic control system are located on christmas trees and production manifolds in waters deeper than 199 m. In addition to this, the Gorgon midline PTS contains several valves that cannot be actuated remotely, but are actuated manually via ROV.

The valves associated with the Jansz electrohydraulic control system are located on christmas trees and production manifolds in waters deeper than 1300 m. In addition to this, the Jansz–Io midline PTS contains several valves that are not a part of the Jansz electrohydraulic control system, and subsequently cannot be actuated remotely, but are actuated manually via ROV.

3.3 Commissioning and start-up

CAPL is currently operating the hydrocarbon system associated with the GFP infrastructure; and therefore, the commissioning and start-up activities described in this EP primarily relate to the additional infrastructure associated with GS2 (as described in Section 3.2). However, these commissioning and start-up activities are also relevant to all infrastructure (GFP and GS2) for any additional verification testing undertaken, or following any module/component change-outs, or field shut-ins.

The purpose of commissioning activities is to ensure that all components of the system are installed, tested, and function as per the project design documentation and specifications. Once commissioning is complete, start-up activities introduce hydrocarbons to the system. Commissioning and start-up activities therefore involve:

- verification and pre-start-up testing
- introduction of hydrocarbons.

3.3.1 Commissioning (verification and pre-start-up testing)

Verification and pre-start-up activities typically occur before initial start-up as well as after a field shut-in. Shut-ins, which are expected to occur infrequently, may be required to allow maintenance or repair activities to be undertaken.

The verification and pre-start-up testing activities include the testing of the subsea electrohydraulic control and monitoring systems. This involves testing subsea valves and the emergency shutdown of infrastructure such as the subsea trees and choke module. These tests are likely to result in small discharges of control fluids from individual valves. In total, up to ~5 m^3 of control fluid is expected to be discharged from each of the Gorgon and Jansz–Io systems during verification and testing activities.

Verification testing may also include leak testing of jumpers. While unlikely, this testing could result in the release of small volumes of MEG to the environment.

These activities will be supported by a vessel (refer to Section 3.7.1 for vessel operations) and ROVs equipped with video cameras.

3.3.2 Start-up (introduction of hydrocarbons)

Start-up activities commence with the controlled introduction of hydrocarbon into the infield production flowlines and production pipeline. The subsea infrastructure including the MEG and utility pipelines, and the umbilicals are then subject to function testing.

During the introduction of hydrocarbons, residual drilling fluids (within the wells) and other residual fluids (which may include MEG/water preservation media), within the CRA infield flowlines and production pipeline will be displaced. These fluids are expected to be displaced via production from the christmas tree back to the GTP.

3.4 Operations

The principal activity during operations will be the flow and transportation of hydrocarbon and other produced fluids from the wells to the GTP, via the infield production flowlines and the Gorgon and Jansz–Io production pipelines. The subsea infrastructure in Commonwealth waters is predominantly a closed system, however there are discharge points (valves) located at the subsea electrohydraulic control systems and at the Gorgon and Jansz–Io midline PTSs (as described in Section 3.2.8). Operation of this system will result in discharges of hydraulic control fluid to the marine environment from the valves, with each valve actuation estimated to result in a loss of a few litres to the marine environment. As an estimate, up to ~40 m^3/year of hydraulic control fluid is expected to be discharged from both the Gorgon and Jansz–Io subsea infrastructure during operations.

If an alternative pathway is required to supply production chemicals to the field, the chemical cores within the umbilicals may be used as a contingency measure. If these lines are required for this purpose, the hydraulic spacer fluid (~20 m^3) within the cores would normally be displaced via production back to the GTP (however may be displaced at the respective drill centre) and replaced with the required chemicals.

If field shut-in is required, system verification and pre-start-up testing will be required prior to start-up (refer to Section 3.3).

3.5 Inspection, maintenance, and repairs

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 of subsea infrastructure 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 commissioning and start-up.

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. 19).

IMR typically requires the support of a vessel; these vessel operations are covered within Section 3.7.1.

3.5.1 Inspections

Inspections provide assurance that asset integrity is being maintained and operated according to design, as well as 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 hydrocarbon system with an autonomous underwater vehicle (AUV) or ROV (or in some cases, divers).

Inspections will be undertaken with a frequency determined using a risk-based approach. 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. Typically, vessels will be on site for 40 to 100 days per year depending on the type and complexity of the inspection. Events such as cyclones or seismic activity that could affect the subsea infrastructure may also trigger inspections. 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
- pigging—temporary pig launchers are deployed from a vessel and tied in to the midline PTS; they may use a combination of inhibiters, water, gel, MEG, and/or nitrogen slugs to complete pigging activities including internal inspection of the pipeline. Fluids used to drive the pig train are directed to the GTP, and pigs may be equipped with tracking transmitters.

3.5.2 Maintenance and repairs

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.

The exact frequency of maintenance and repair activities will be dependent on the results of inspections. If minor maintenance and repair is required, a vessel may remain on site for between ~10–90 days at a time, depending on the type of maintenance or repair required. If major maintenance or repair is required, a vessel may be on site for between ~90–180 days at a time.

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

- module/component change-out (including back testing of seals)—may include, but is not limited to, the replacement of subsea pipeline equipment or control modules, such as choke modules, tree caps, or power and control distribution equipment
- installation of foundations and/or mudmats to support equipment and facilitate maintenance and repair activities
- stabilisation/span correction—may involve activities such as installation of grout bags or concrete mattresses
- subsea excavation—excavation alongside infrastructure may be required to gain access to, or enable minor repairs of, infrastructure
- maintenance of cathodic protection systems / additional anodes—cathodic protection equipment may be added to, or placed adjacent to, production pipelines using a vessel and ROV spread
- removal of marine biological growth and calcareous deposits—may be undertaken 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 and as such is estimated to have the same frequency as these activities.

3.5.2.1 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 main production flowlines and production pipelines. The EPRS also includes methodologies for the repair of support infrastructure such as umbilicals and non-production 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 flowline or 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 adapters.

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 the pipeline requires deburial or rock removal prior to repair, or if concrete mattresses or rock stabilisation measures are required post repair.

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

3.5.2.1.1 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 pipeline would then be flooded with seawater 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.

3.5.2.1.2 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:

- SSS or MBES or similar
- ROV
- piezocone 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.

Remove damaged section

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 ~1–2 m^2 (per transponder). Once no longer needed these transponders are recovered back to the vessel using a 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 mudmats 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 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 will be determined at the time of event.

3.5.2.1.3 Pipeline recommissioning

Following the 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 appropriate Gorgon or Jansz PTS.

3.6 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.

3.6.1 End of facility life

As described in Section 3.1.2 the operational design life for the Gorgon field development is expected to be 50 years. Therefore, no end of facility life (EOFL) decommissioning activities for the subsea 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 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), alternative arrangements that may be satisfactory are ones that deliver equal or better environmental, safety and well integrity outcomes compared to complete removal (Ref. 20). The Decommissioning EP will be developed to meet the requirements of the OPGGS Act and OPGGS(E)R, as well as any additional relevant legislation (e.g., *Environment Protection (Sea Dumping) Act 1981*) or guidelines (e.g., Ref. 19 and Ref. 20) in force at the time.

3.6.2 Subsea inventory

To assist with the long-term planning for decommissioning an internal inventory of subsea property is maintained by CAPL.

A static summary of the inventory has been included in appendix c.

3.6.3 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. 19).

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 (refer to Section 3.6.2), and will be subject to inspections to ensure that the property does not degrade to a state that would prevent future removal (refer to Section 3.5).

3.7 Field support

3.7.1 Vessel operations

Typically, a light construction or 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. Vessel operations may occur for periods of ~40–100 days for inspections (Section 3.5.1) and 10–180 days for maintenance and repairs (Section 3.5.2)

Vessels will typically use dynamic positioning (DP), however in certain circumstances, anchoring 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 bunker at sea if required. Vessels routinely discharge a variety of wastewater streams to the marine environment including sewage, greywater, food waste, cooling water, brine, and oily bilge water; vessels may also incinerate solid wastes.

3.7.2 Helicopter operations

Where required, helicopters may be used for crew transfers to/from the IMR vessels. Helicopters will typically operate from Barrow Island.

4 description of the environment

4.1 Overview

This section provides a description of the environment as required under Regulation 13(2) of the OPGGS(E)R. 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
- 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 6-8])
- 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 6-7]).

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. 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 (PA). Therefore, the description of the environment as provided for the PA (Ref. 1; appendix d) is appropriate for use in this EP.

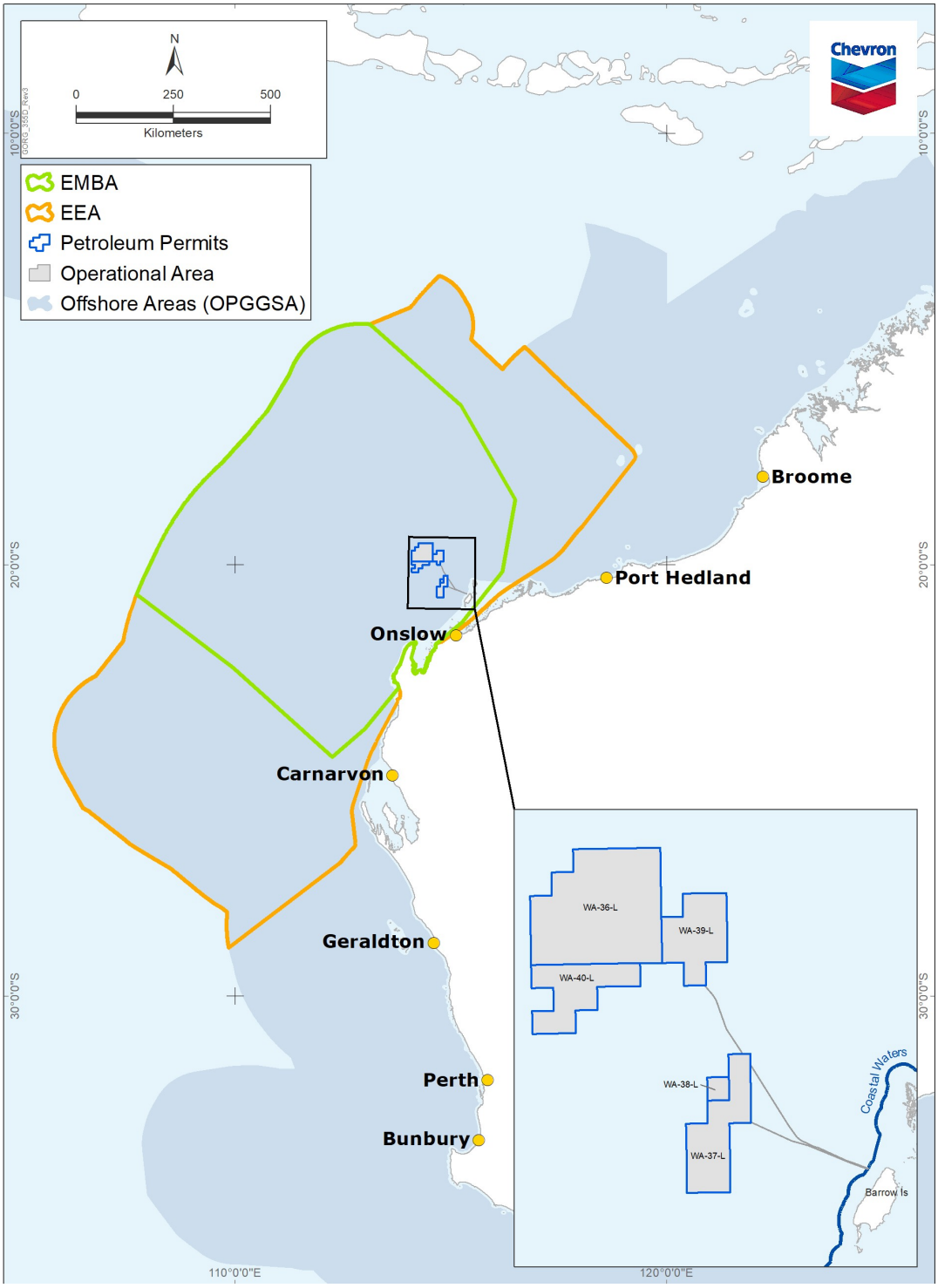


Figure 4-1: OA, EMBA and EEA for Gorgon operations in Commonwealth waters

4.2 Physical environment

CAPL's *Description of the Environment* (Ref. 1; appendix d) identifies and summarises the physical environment within the PA.

4.3 Biological environment

CAPL's *Description of the Environment* (Ref. 1; appendix d) identifies and summarises the biological environment within the PA. Key threats and relevant

management actions from any Conservation Advices or Recovery Plans for threatened or migratory species have also been described (Ref. 1; appendix d).

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. 21; 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	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)			
Indo-Pacific 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	EMBA	EEA
Humpback Whale	Migration (north and south)	Northern migration, late July to September	✓	✓	✓
Pygmy Blue Whale	Distribution	(Not defined in database)	✓	✓	✓
	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)	✓	✓	✓
Dugong	Breeding	Year round		✓	✓
	Calving	Year round		✓	✓

Common name	BIA behaviour	Seasonal presence	OA	EMBA	EEA
	Foraging (high density seagrass beds)	Year round		✓	✓
	Nursing	Year round		✓	✓

4.3.2 Reptiles

Based on searches of the protected matters database (Ref. 21; 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.

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

Common name	OA	EMBA	EEA
Turtles			
Flatback Turtle	✓	✓	✓
Green Turtle	✓	✓	✓
Hawksbill Turtle	✓	✓	✓
Leatherback Turtle	✓	✓	✓
Loggerhead Turtle	✓	✓	✓
Seasnakes			
Leaf-scaled Seasnake	✓	✓	✓
Short-nosed Seasnake	✓	✓	✓

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

Common name	Nesting location	Internesting buffer	Seasonal presence	OA	EMBA	EEA
Flatback Turtle	Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island	60 km	October to March	✓	✓	✓
	Dampier Archipelago, including Delambre Island and Hauy Island	60 km	October to March		✓	✓
Green Turtle	Barrow Island, Montebello Islands, Serrier Island, and Thevenard Island	20 km	November to March	✓	✓	✓
	Exmouth Gulf and Ningaloo Coast	20 km	November to March		✓	✓
Hawksbill Turtle	Cape Preston to mouth of Exmouth Gulf including Montebello Islands and Lowendal Islands	20 km	October to February	✓	✓	✓
Loggerhead Turtle	Exmouth Gulf and Ningaloo Coast	20 km	November to May		✓	✓

Table 4-5: Presence of BIAs for reptiles

Common name	BIA behaviour	Seasonal presence	OA	EMBA	EEA
Flatback Turtle	Aggregation			✓	✓
	Foraging	Summer		✓	✓
	Internesting			✓	✓
	Internesting buffer	Summer	✓	✓	✓
	Mating	Summer		✓	✓
	Nesting	Summer		✓	✓
Green Turtle	Aggregation			✓	✓
	Basking	Summer		✓	✓
	Foraging	Summer, Year-round		✓	✓
	Internesting	Summer		✓	✓
	Internesting buffer	Summer	✓	✓	✓
	Mating	Summer		✓	✓
	Nesting	Summer		✓	✓
Hawksbill Turtle	Foraging	Year-round, spring, early-summer		✓	✓
	Internesting	Spring and 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. 21; 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	EMBA	EEA
Dwarf Sawfish, Queensland 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)	✓	✓	✓
Killer Whale, Orca			
Longfin Mako	✓	✓	✓

Common name	OA	EMBA	EEA
Narrow Sawfish, Knifetooth Sawfish	✓	✓	✓
Oceanic Whitetip Shark	✓	✓	✓
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray	✓	✓	✓
Porbeagle, Mackerel Shark		✓	✓
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	EMBA	EEA
Whale Shark	Foraging	Spring	✓	✓	✓
	Foraging (high density prey)	April–June, Autumn		✓	✓

4.3.4 Seabirds and shorebirds

Based on searches of the protected matters database (Ref. 21; 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	EMBA	EEA
Abbott's Booby		✓	✓
Amsterdam Albatross			✓
Australian Fairy Tern	✓	✓	✓
Australian Lesser Noddy			✓
Australian Painted Snipe		✓	✓
Bar-tailed Godwit		✓	✓
Black-browed Albatross		✓	✓
Bridled Tern		✓	✓
Campbell Albatross, Campbell Black-browed Albatross		✓	✓
Caspian Tern		✓	✓
Common Greenshank, Greenshank		✓	✓
Common Noddy	✓	✓	✓
Common Sandpiper	✓	✓	✓
Curlew Sandpiper	✓	✓	✓
Eastern Curlew, Far Eastern Curlew	✓	✓	✓
Flesh-footed Shearwater		✓	✓
Fork-tailed Swift	✓	✓	✓
Great Frigatebird, Greater Frigatebird		✓	✓

Common name	OA	EMBA	EEA
Greater Crested Tern		✓	✓
Indian Yellow-nosed Albatross			✓
Lesser Frigatebird, Least Frigatebird	✓	✓	✓
Little Tern			✓
Northern Giant Petrel			✓
Northern Siberian Bar-tailed Godwit, Russkoye Bartailed Godwit		✓	✓
Oriental Plover, Oriental Dotterel		✓	✓
Oriental Pratincole		✓	✓
Osprey	✓	✓	✓
Pectoral Sandpiper	✓	✓	✓
Red Knot	✓	✓	✓
Roseate Tern	✓	✓	✓
Sharp-tailed Sandpiper	✓	✓	✓
Shy Albatross		✓	✓
Soft-plumaged 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	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	✓	✓	✓
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			✓

Common name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
White-tailed Tropicbird	Breeding	May and October			✓

4.3.5 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* (Ref. 1; appendix d), were identified within the OA, EMBA, and EEA (Table 4-10).

Table 4-10: Marine habitat and key sensitivities

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

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

In addition to the broad marine habitat description provided for the EMBA and EEA, CAPL conducted pre-construction seabed surveys within the OA.

Geophysical and geotechnical surveys, using techniques such as echo sounder, sub-bottom profilers, side-scan sonar, and ROV, were carried out along within the OA prior to pipeline construction. Surveys of benthic habitats targeting specific areas of interest along the route were then carried out based on the results of these surveys.

The substrate along the OA from the State Water boundary to water depth of ~50 m was found to be dominated by bare sand (Figure 4-2). Sand was the dominant substrate in most of the observations (~90%) along the operational area. Limestone pavement with a shallow sand veneer was the next most common substrate encountered, dominating the substrate in less than 10% of observations. Reef (low and high profile) was the dominant substrate in less than 5% of observations (Ref. 22).

Towed video surveys were also conducted at the inner reef area (~40 m water depth), the outer reef area (~50–55 m water depth), and the area between them. Most of the OA in this area is classified as unvegetated, in terms of the dominant ecological element observed (Ref. 22). The inner reef rises several metres above the surrounding seabed and is characterised by areas of exposed rocky platform reef and areas of upstanding reef. The platform reef supports scattered corals and sponges; however, this reef is too deep to support well-developed benthic primary producer assemblages. The reef appears to be part of a linear series of reefs that run north–south; side-scan sonar data revealed features of a similar profile ~5 km south of the OA (Ref. 23). The outer reef comprises limestone and supports encrusting sponges and scattered deep water coral (Ref. 23). Black coral, *Cirrhipathes* sp., was observed at nine locations along the outer reef. In locations

where black coral was observed, it was present as a subdominant taxa in areas dominated by sponges and other benthic macroinvertebrates (Ref. 22).

Further offshore in the Gorgon gas field, at ~200 m water depth, the seabed comprises soft bioturbated sediments. The benthos in this area is well below the photic zone so there are no marine macrophytes (Ref. 23). Similarly, during an ROV survey in the gully region along the Jansz pipeline route in ~250 m water depth, the seabed was found to be dominated by silty mud with little evidence of life (Figure 4-3) (Ref. 24).

To determine the type of benthic habitat present in the deeper area, five transects, which ranged from 558 m to 714 m water depth, were filmed along the OA. An additional transect was also run along a narrow depth band between 643 m and 656 m water depth, following a hard outcropping area of the scarp (Figure 4-4). The substrate most found in this deeper water comprised soft sediments—sand, silt, and mud. However, these habitat types are widespread in the region and are not considered to be of regional significance due to their ubiquity and the sparseness of biota supported (Ref. 24). The steep scarp face was found to comprise mainly over-consolidated silt materials, mostly devoid of marine growth, with occasional sparse communities of benthic invertebrates including soft corals, bryozoans, and colonial ascidians (Figure 4-4). These over-consolidated silt sediments provide structural diversity to an otherwise flat benthos. They are of higher conservation significance than the soft sediment habitats found in the area as they are less widespread and support more abundant biota. However, based on the high-resolution bathymetry data from the area, these hard scarp features probably stretch at least 10 km to the north and 5 km to the south of the operational area (Ref. 24).

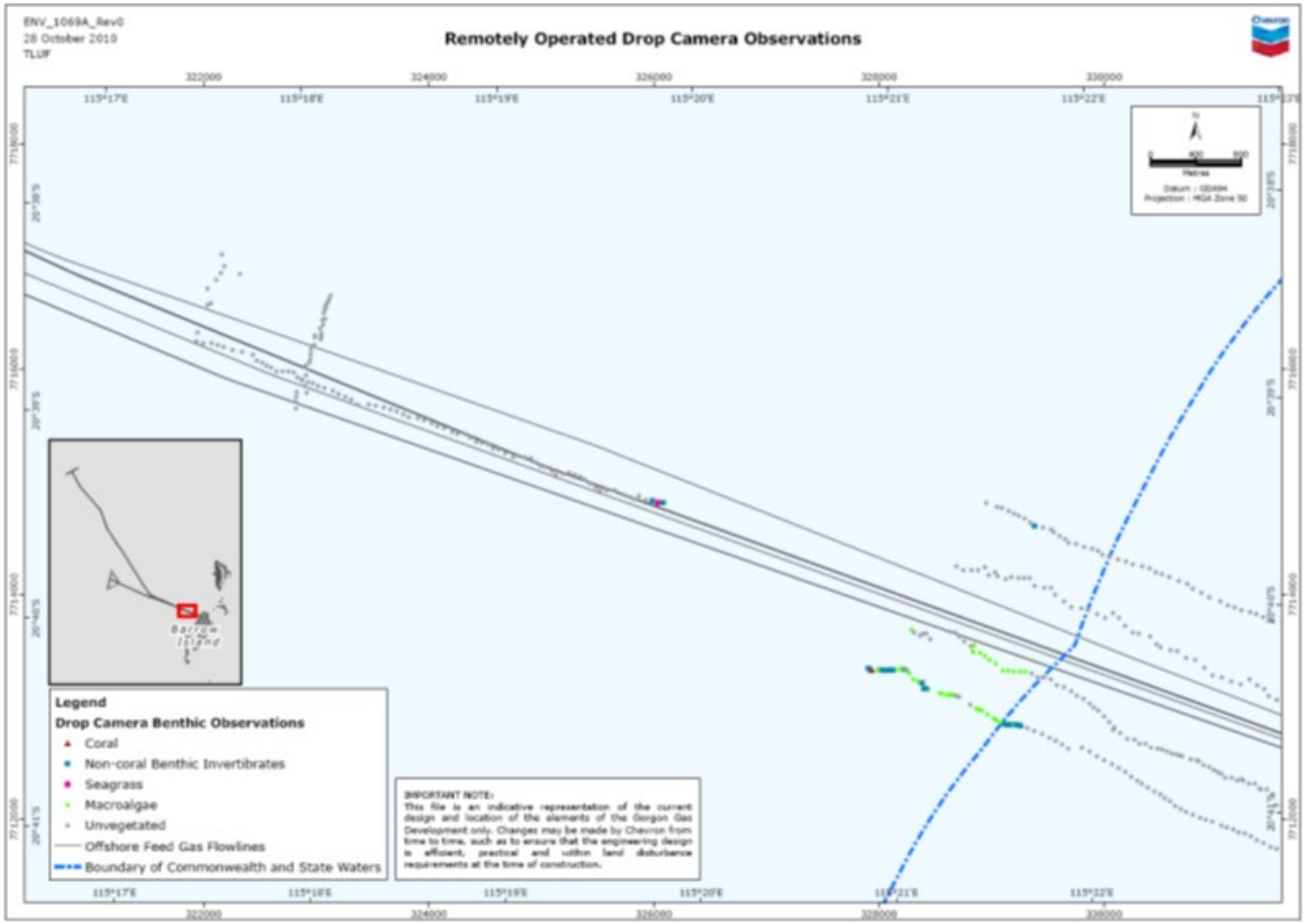
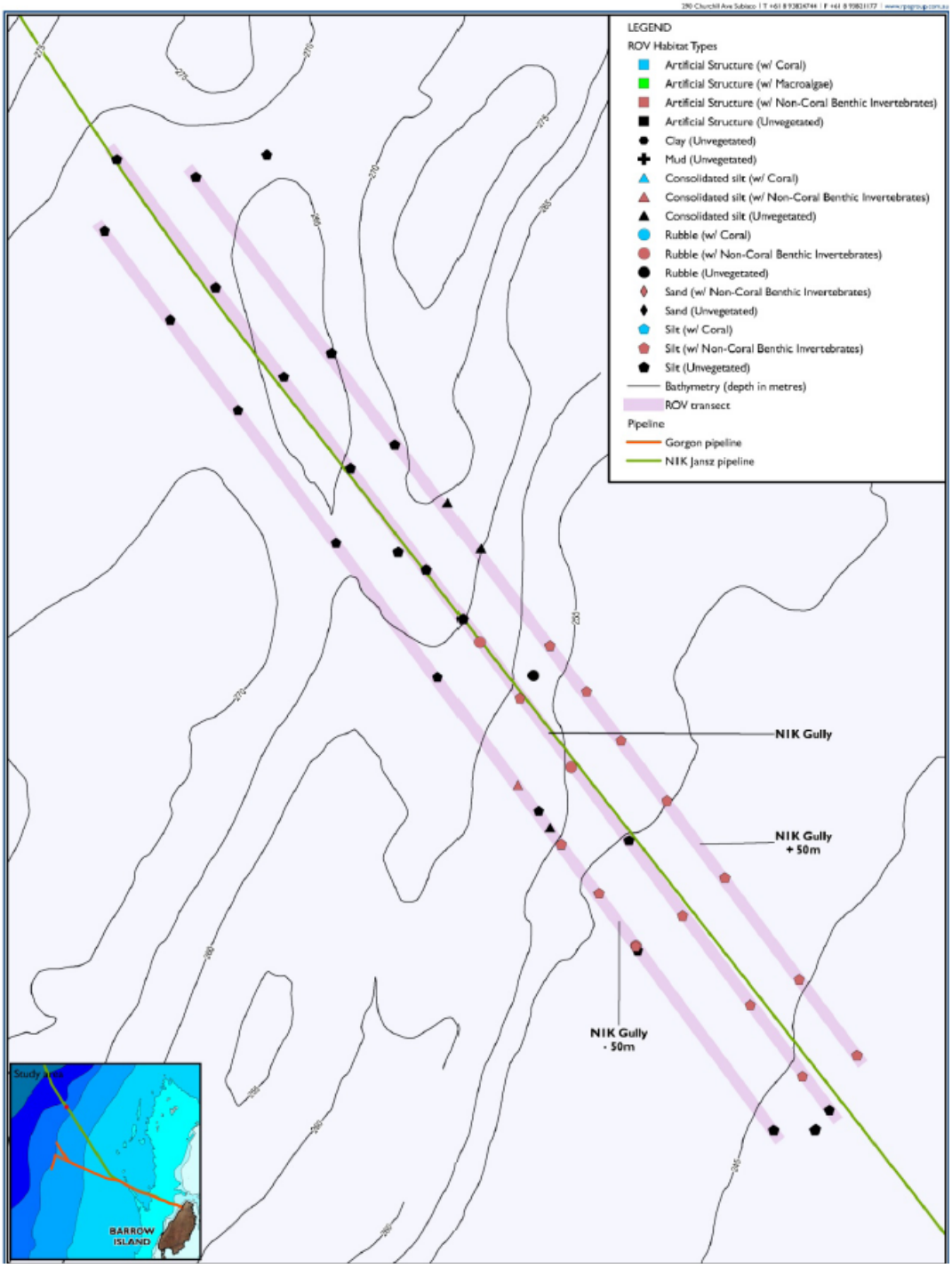
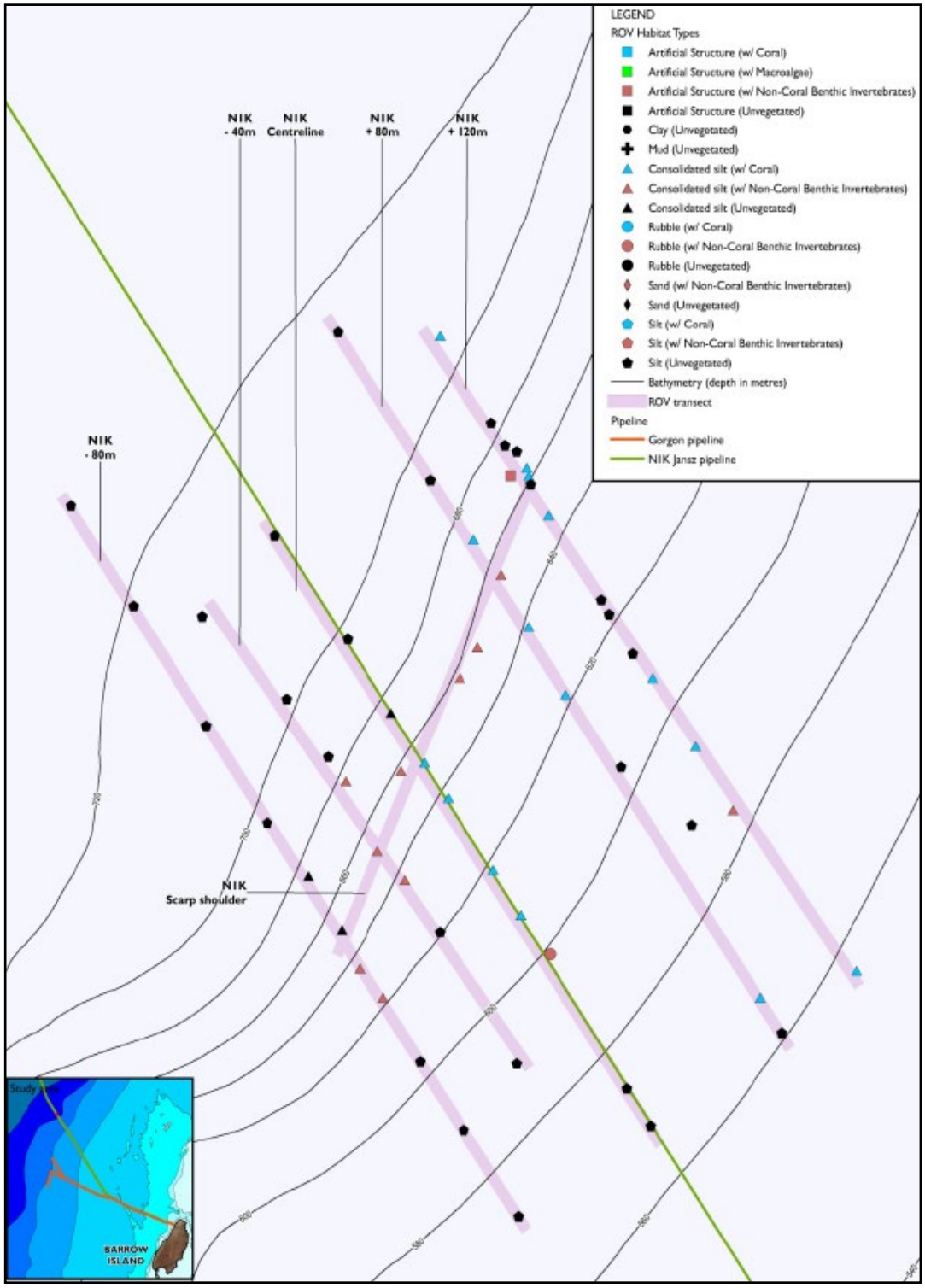


Figure 4-2: Dominant marine habitats within the OA



(Source: Ref. 24)

Figure 4-3: Benthic habitat at the gully region



(Source: Ref. 24)

Figure 4-4: Benthic habitat at the scarp region

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* (Ref. 1; appendix d) identifies and summarises the commercial fisheries.

The State-managed commercial fisheries with fishing effort recorded over a five-year period (2014–2018) (Ref. 25) within areas that overlap the OA, EMBA, and EEA are listed in Table 4-11. Three fisheries were identified with activity within the vicinity of the OA; these are shown in Figure 4-5, Figure 4-6, and Figure 4-7.

The Commonwealth-managed commercial fisheries with fishing effort recorded over a five-year period (2014–2018) (Ref. 26) within areas that overlap the OA, EMBA, and EEA are listed in Table 4-12. The only fishery with fishing effort recorded within the OA was the North West Slope Trawl Fishery, and this was only recorded during 2015 (Ref. 26). 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. 26). This indicative spawning area extends into the OA, EMBA, and EEA.

Table 4-11: Presence of recent (2014-2018) fishing effort recorded within State-managed commercial fisheries

Fishery	OA	EMBA	EEA
North Coast Bioregion			
Mackerel Managed Fishery	✓	✓	✓
Nickol Bay Prawn Managed Fishery		✓	✓
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			✓
Statewide			
Marine Aquarium Fish Managed Fishery		✓	✓

Fishery	OA	EMBA	EEA
Specimen Shell Managed Fishery		✓	✓

Table 4-12: Presence of recent (2014-2018) fishing effort recorded within Commonwealth-managed commercial fisheries

Fishery	OA	EMBA	EEA
North-West Slope Trawl Fishery	✓	✓	✓
Western Deepwater Trawl		✓	✓
Western Tuna and Billfish Fishery			✓

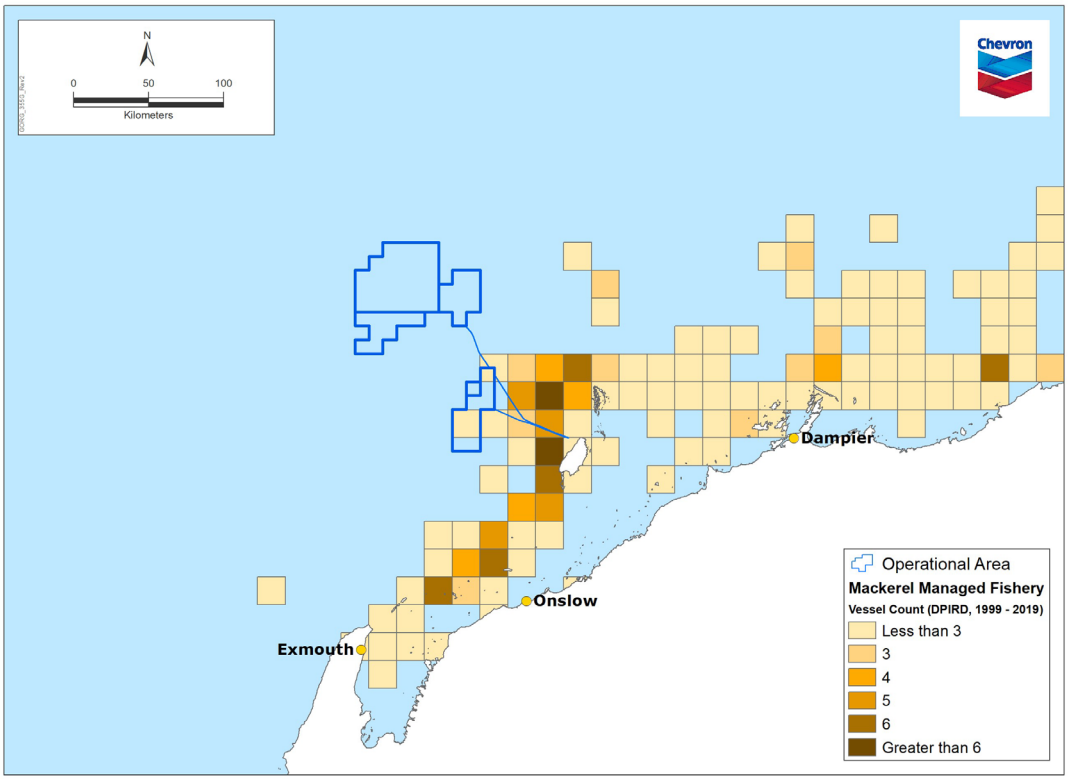


Figure 4-5: Recorded fishing effort for the Mackerel Managed Fishery within the vicinity of the OA

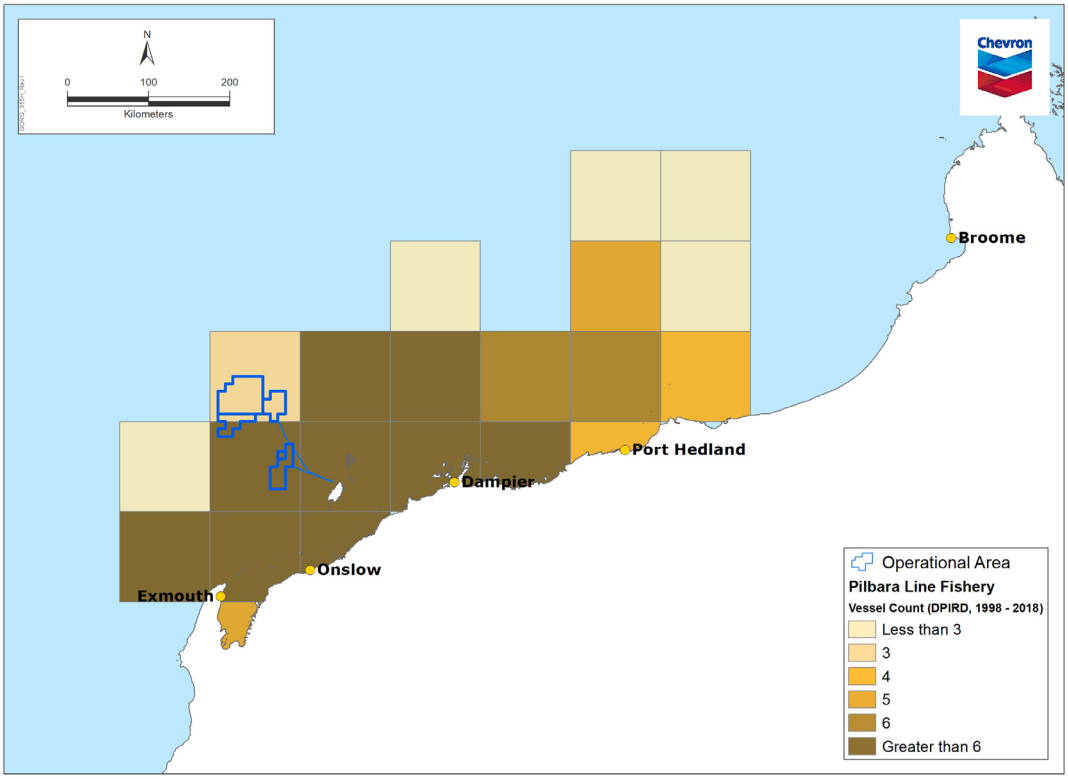


Figure 4-6: Recorded fishing effort for the Pilbara Line Fishery within the vicinity of the OA

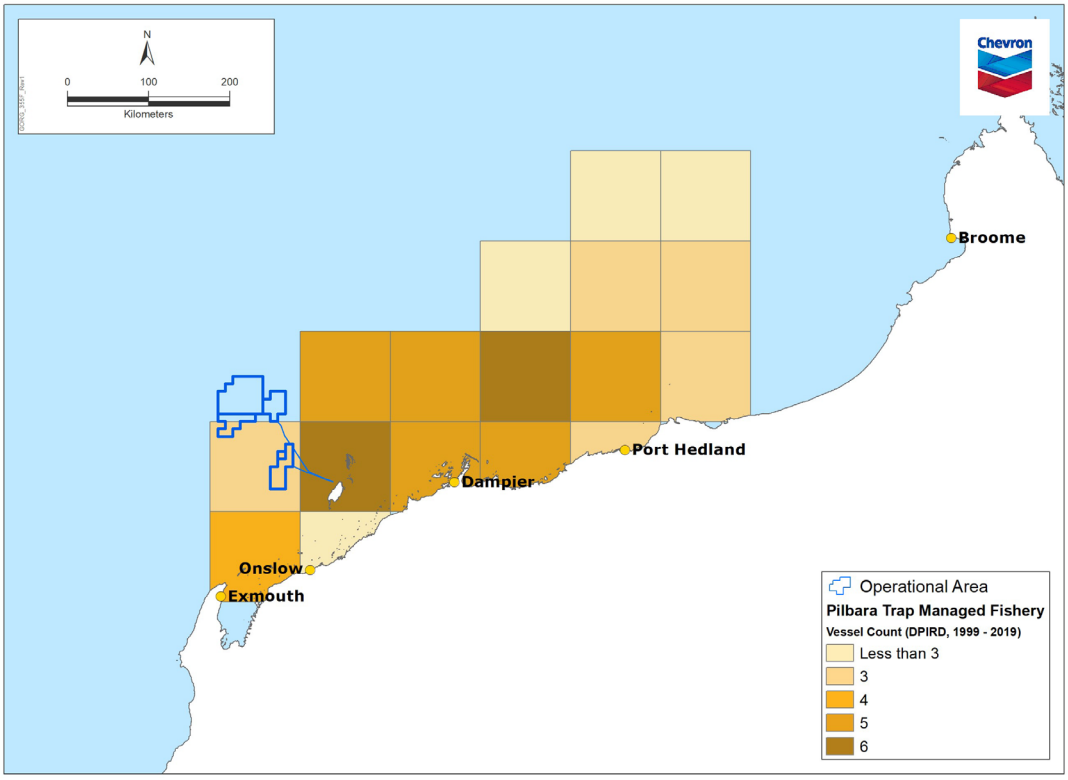


Figure 4-7: Recorded fishing effort for the Pilbara Trap Managed Fishery within the vicinity of the OA

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 4-8, which shows recent vessel traffic within the vicinity of the OA. The figure shows 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 North West Shelf (NWS).

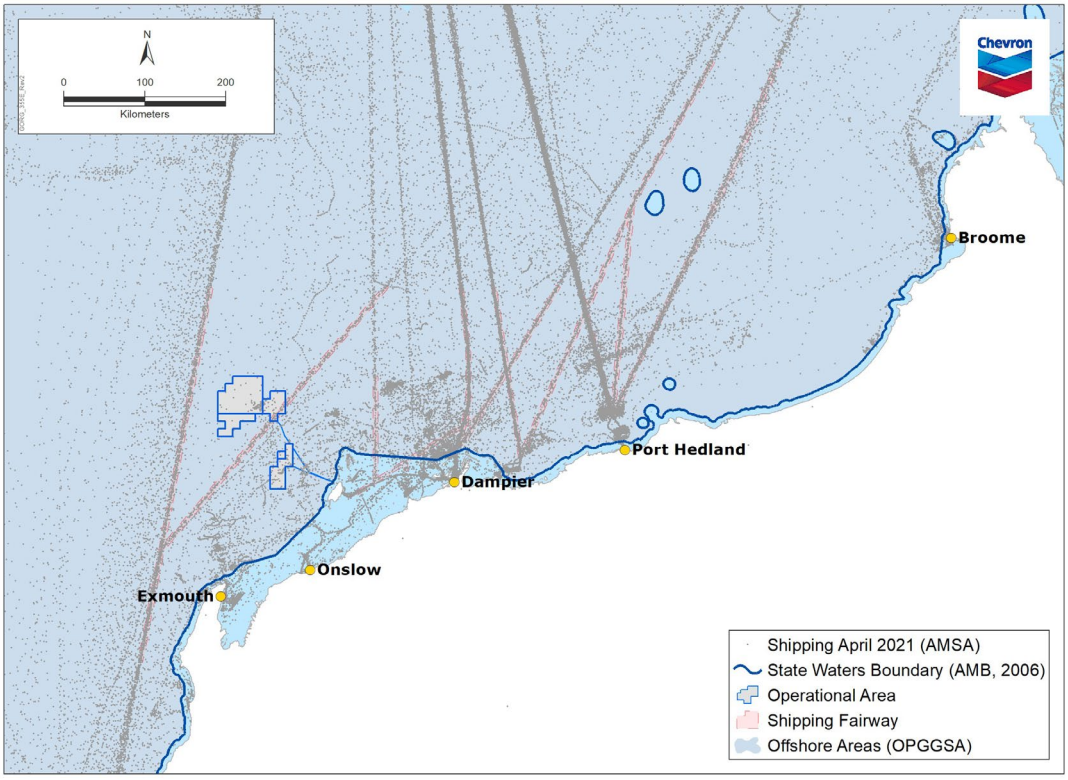


Figure 4-8: Vessel traffic within the vicinity of the OA

4.5 Qualities and characteristics of locations, places, and areas

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

- Ramsar wetlands
- Threatened ecological communities (TECs)
- Australian Marine Parks (AMPs)
- Key ecological features (KEFs).

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 4-13 and Table 4-14 respectively.

Table 4-13: Presence of AMPs

Australian Marine Park	OA	EMBA	EEA
Abrolhos			✓
Argo-Rowley Terrace			✓
Carnarvon Canyon		✓	✓
Gascoyne		✓	✓
Montebello	✓	✓	✓
Ningaloo		✓	✓
Shark Bay			✓

Table 4-14: Presence of KEFs

Key ecological feature	OA	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			✓
Wallaby Saddle			✓
Western demersal slope and associated fish communities			✓

4.6 Heritage value of places

CAPL's *Description of the Environment* (Ref. 1; appendix d) identifies and describes heritage values. The World Heritage properties, National Heritage places, and Commonwealth Heritage places within the OA, EMBA and EEA are listed in Table 4-15, Table 4-16, and Table 4-17 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. 27) 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 4-15: World Heritage properties

World Heritage Properties	OA	EMBA	EEA
The Ningaloo Coast		✓	✓

Table 4-16: National Heritage places

National Heritage Properties	OA	EMBA	EEA
HMAS Sydney II and *HSK Kormoran* shipwreck sites			✓
The Ningaloo Coast		✓	✓

Table 4-17: Commonwealth Heritage places

Commonwealth Heritage Properties	OA	EMBA	EEA
HMAS Sydney II and *HSK Kormoran* shipwreck sites			✓
Learmonth Air Weapons Range Facility			✓
Ningaloo Marine Area – Commonwealth Waters		✓	✓

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. These methods support the environmental impact and risk assessment as required under Regulation 13(5) of the OPGGS(E)R.

The impact and risk assessment for this EP was undertaken in accordance with the CAPL's *ABU OE Risk Management Process* (Ref. 28) 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. 29) and the HB 203:2012 *Managing environment-related risk* (Ref. 30).

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 are described and evaluated during the impact and risk assessment. The petroleum activity is described in detail in Section 3.

5.2 Identification of particular values and sensitivities

The presence of environmental values and sensitivities within the OA, EMBA, and wider EEA is documented in Section 4, with these values and sensitivities further described in CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1; appendix d). In accordance with Regulation 13(3) of the OPGGS(E)R, the particular values and sensitivities were identified as:

- 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 disturbance
- air emissions
- light emissions
- underwater sound
- invasive marine pests
- 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

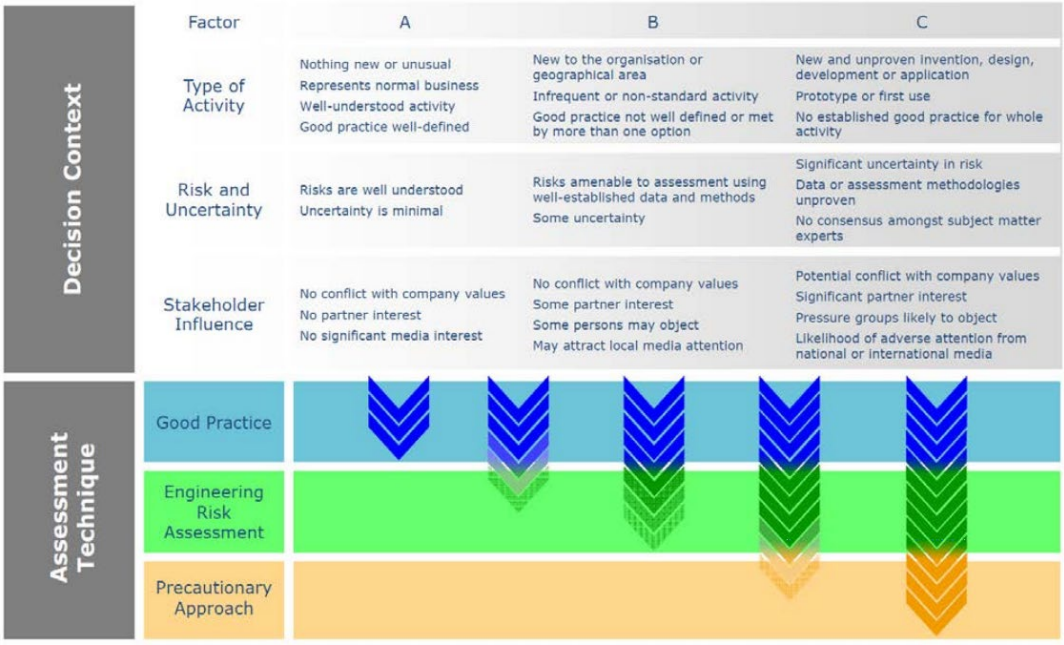
In alignment with NOPSEMA's ALARP guidance note (Ref. 31), CAPL has adapted the approach developed by Oil and Gas UK (OGUK) (Ref. 32) for use in an environmental context to determine the assessment technique required to demonstrate that impacts and risks are ALARP. Specifically, the framework considers 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. 31)

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. The assessment techniques considered include:

- good practice
- engineering risk assessment
- precautionary approach.

5.5.2.2 Good practice

OGUK (Ref. 32) 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. 32), 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. 32) 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 (as defined under the OPGGS(E)R).

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

In alignment with NOPSEMA's ALARP guidance note (Ref. 31), 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-order 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 consider 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

Criteria	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?

Criteria	Test
	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.
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 the management of the identified environmental risks as:

- **Environmental performance outcomes**—are the level of performance in managing the potential environmental impacts and risks from each petroleum activity
- **Environmental performance standards**—are measurable statements of performance of a system, item of equipment, person, or procedure that are used to manage environmental impacts and risks for the duration of the petroleum activity
  - 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.

6 environmental impact and risk assessment and management strategy

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, as required under Regulations 13(5), 13(6) and 13(7) of the OPGGS(E)R.

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

Section	Aspect	Impact	Risk			Decision context	ALARP	Acceptable
		C^	C^	L	R			
6.1	Physical presence—Other marine users	–	6	4	9	A	Yes	Yes
0	Physical presence—Marine fauna	–	6	3	8	A	Yes	Yes
6.3	Seabed disturbance	5	–	–	–	A	Yes	Yes
6.4	Air emissions	6	–	–	–	A	Yes	Yes
6.5	Light emissions	6	6	5	10	A	Yes	Yes
6.6	Underwater sound	5	5	3	7	A	Yes	Yes
6.7	Invasive marine pests	–	2	6	6	A	Yes	Yes
6.8	Planned discharges—Vessel operations	6	6	6	10	A	Yes	Yes
6.9	Planned discharges—Subsea operations	6	6	6	10	A	Yes	Yes
6.10	Unplanned release—Waste	–	6	5	10	A	Yes	Yes
6.11	Unplanned release—Loss of containment	–	5	5	9	A	Yes	Yes
6.12	Unplanned release—Vessel collision event	–	5	5	9	A	Yes	Yes
6.13	Unplanned release—Major defect event	–	5	5	9	A	Yes	Yes
6.14.4.1	Ground disturbance—shoreline spill response	–	5	5	9	A	Yes	Yes
6.14.4.2	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.

6.1 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
- 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 • entanglement of trawl fishing gear on subsea infrastructure.	6

Consequence evaluation

The hydrocarbon system infrastructure associated with this activity is contained wholly within the OA. Support vessels undertaking IMR activities will also be present within the OA but only have a temporary presence (e.g., estimates of 40–100 days for inspections, 10–90 days for minor maintenance/repairs, or 90–180 days for major maintenance/repairs). The OA consists of an area of ~1550 km^2.

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 fishery also has only a small number of active permits (e.g., six within the 2017-2018 season [Ref. 1; appendix d]), and does not regularly record fishing effort within the OA (Ref. 26).

Subsea infrastructure has been in place within the OA since 2012, 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).

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, there are several commercial fisheries that have management areas and/or recent fishing effort that overlaps with the OA. However, fishing effort records obtained from DPIRD (Ref. 25) for State managed commercial fisheries indicate that fishing effort within the OA is limited. Specifically, between 2014 and 2018, no fishery was recorded to have more than five active vessels within the OA each year (Ref. 25). Similarly, low numbers of active permits exist in areas overlapping the OA for the Commonwealth managed fisheries (Ref. 1; appendix d).

The OA is predominantly located outside major shipping fairways and commercial vessel traffic density within and around most of the OA is low (Figure 4-8). Therefore, the temporary presence of IMR vessels within the OA are not expected to affect 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 hydrocarbon system or support vessels 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 and vessels 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 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**	
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.	
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. 35) 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.	
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 interaction with other marine users is considered low. 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).	
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	Legislation and other requirements considered relevant for this aspect include: • Commonwealth *Navigation Act 2012.*	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 35).	
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**
Reduce the risk of impacts to other marine users from petroleum activities	**Stakeholder engagement** Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information	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

6.2 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:

- Humpback Whale (migration)
- Pygmy Blue Whale (migration and distribution)
- Flatback Turtle, Green Turtle, Hawksbill Turtle (interesting buffer)
- Whale Shark (foraging).

The *Recovery Plan for Marine Turtles in Australia* (Ref. 55) identify vessel disturbance as a key threat; however, it also notes that this is particularly an issue in shallow coastal foraging habitats. The OA within this EP occurs in Commonwealth waters only and does not include shallow coastal habitats. Therefore, 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. 57], Fin Whale [Ref. 58], Humpback Whale [Ref. 59], Sei Whale [Ref. 60] and Blue Whale [Ref. 61]) 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. 62).

Both the *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 61) and *Conservation Advice Megaptera novaeangliae Humpback Whale* (Ref. 59) indicate 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. 63) found that larger vessels with reduced maneuverability moving >10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling >14 knots. Given that vessels 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. 64), although the data indicates deaths are more likely to be associated with container ships and fast ferries. Mackay et al. (Ref. 65) 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 vessel operations 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. 66, Ref. 67) spent ~25% of their time <2 m from the surface and >40% of their time in the upper 15 m of the water column. Spending such considerable time within 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 cetaceans are not harmed during offshore interactions with people.

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 Seldom (3).
Risk level	Low (8)

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	Legislation and other requirements considered relevant for this aspect include: • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 61) • *Conservation Advice Megaptera novaeangliae Humpback Whale* (Ref. 59) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 60) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 58) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 57) • *Recovery Plan for Marine Turtles in Australia* (Ref. 55) • *Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)* (Ref. 56).	
Internal context	No CAPL environmental performance standards or 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 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 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, Humpback Whales, Sei Whales, and Fin Whales (Ref. 61; Ref. 59; Ref. 60; Ref. 58) 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 7.4).	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Reduce the risk of injury or mortality to marine fauna from petroleum activities	**EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans** Vessels will implement caution and no approach zones, where practicable: • caution zone (300 m either side of whales; 150 m either side of dolphins)–vessels must operate at ≤6 knots within in 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 the front and rear of dolphins and 50 m either side)–vessels should not enter this zone, and should not wait in front of the direction of travel of 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 No incident reports of marine fauna strikes that are attributable to offshore IMR activities

6.3 Seabed disturbance

Source

Activities identified as having the potential to result in seabed disturbance are:

- subsea IMR
- vessel anchoring.

Potential impacts and risks

Impacts	C	Risks	C
Seabed disturbance may result in: • alternation of marine habitats.	5	N/A	–

Consequence 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 typical 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 3.5.2.1). This indicative seabed disturbance area represents <1% of the OA.

Although anchoring is not a planned 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. 68), a vessel anchored within water depths greater than 70 m with a single anchor could result in a total disturbance area of up to 1300 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 the following KEFs:

- ancient coastline at 125 m depth contour
- continental slope demersal fish communities
- Exmouth Plateau.

Although these KEFs have been identified as having the potential to be impacted from IMR activities, any planned disturbance would be in close proximity of existing infrastructure. As such, exposure of Exmouth Plateau is not considered likely given its location at the northwestern extent of the Jansz-Io permits and away from existing infrastructure. The areas with the existing infrastructure have been historically disturbed, and any additional disturbance is expected to be minimal. Benthic habitats within the OA mostly comprise unvegetated, soft, and unconsolidated sediments with a low but varying degree of benthic invertebrate habitation (Section 4.3.5).

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 7.3.2.2).	
MSRE process	CAPL's *ABU MSRE Corporate OE Process* (Ref. 35) 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 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. 69).	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 35).	
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 complex habitats 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)
	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
	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

6.4 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. 70). 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 of ~5 km from the MODU (Ref. 70), 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 atmospheric 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. 35) 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. 35).	
External context	During stakeholder consultation, no objections or claims were raised regarding atmospheric 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**
Reduce the risk of impacts to air quality 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

6.5 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. 71) 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. 71), CAPL expects that its vessel activities will result in temporary changes to ambient light emissions no larger than a radius of ~1.4 km from the support vessel. Navigational lighting is expected to be the less on support vessels in comparison to a MODU, therefore referencing this modelling is considered an overly conservative 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. 72), 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 also overlap with the OA, including:

- Flatback Turtle, Green Turtle, Hawksbill Turtle (interesting buffer)
- Whale Shark (foraging)
- Fairy Tern, Lesser Crested Tern, Roseate 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. 73) and that lighting can attract birds from large catchment areas (Ref. 74). 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. 75). The *National Light Pollution Guidelines* (Ref. 11) 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. 76; Ref. 77) and fledgling seabirds grounded in response to artificial light 15 km away (Ref. 78). At its closest, the OA is located ~6 km from the coast (Barrow Island). 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 coastal areas (and therefore turtle hatchlings or fledgling seabirds) are expected to be exposed.

The *Recovery Plan for Marine Turtles in Australia* (Ref. 55) 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 IMR activities described

Source		
in this EP, vessel operations would be located offshore and light emissions would not affect critical behaviours as described in the Recovery Plan. Anthropogenic disturbance and artificial lighting is identified as a threat within the *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 79). 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. 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).		
ALARP decision context justification		
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.		
Good practice control measures and source		
Control measure	**Source**	
None identified	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.	
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 this petroleum activity, vessel activities are likely to be focused within offshore waters away from the coast. As such the likelihood of exposing sensitive receptors resulting in the identified consequence was considered Remote (5).	
Risk level	Very low (10)	
Determination of acceptability		
Principles of ESD	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). 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: • *National Light Pollution Guidelines* (Ref. 11) • *Recovery Plan for Marine Turtles in Australia* (Ref. 55) • *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 79).	
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 light emissions arising from the activity.	

Source		
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

6.6 Underwater sound

Source

Activities identified as having the potential to result in underwater sound are:

- vessels or helicopter operations within the OA
- IMR marine acoustic surveys (SSS or MBES) within the OA.

These activities result in the emission of two types of sound:

Continuous sound (vessel operations)

Studies of underwater noise generated from propellers of offshore vessels when holding position indicate highest measured sound pressure level (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. 82).

Continuous sound (helicopter operations)

Sound emitted from helicopter operations is typically below 500 Hz (Ref. 80). 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. 62; Ref. 81). Richardson et al. (Ref. 62) 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.

Impulsive sound (IMR acoustic surveys)

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. 83). Further to this, Lurton (Ref. 84) 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.

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

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, Brydes, 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 6-2.

Exposure criteria for marine turtles is provided in Table 6-3. Behavioural responses have been taken from McCauley et al. (Ref. 85) 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 .

Exposure criteria for fish is provided in Table 6-4.

Table 6-2: Noise exposure criteria for mid-frequency and low-frequency cetaceans

Cetacean hearing group	PTS onset thresholds (received level) (Ref. 86)		TTS onset thresholds (received level) (Ref. 86)		Behavioural response (Ref. 87)	
	Impulsive	Continuous	Impulsive	Continuous	Impulsive	Continuous
Low-- frequency cetaceans	L_{pk}: 219 dB	$L_{E, 24h}$: 199 dB	L_{pk}: 213 dB	$L_{E, 24h}$: 179 dB	L_{pk}: 160 dB	L_{pk}: 120 dB

	$L_{E, 24h}$: 183 dB		$L_{E, 24h}$: 168 dB			
Mid-frequency cetaceans	L_{pk}: 230 dB $L_{E, 24h}$: 185 dB	$L_{E, 24h}$: 198 dB	L_{pk}: 224 dB $L_{E, 24h}$: 170 dB	$L_{E, 24h}$: 178 dB	L_{pk}: 160 dB	L_{pk}: 120 dB

Peak sound pressure level (L_{pk}) has a reference value of 1 µPa, and weighted cumulative sound exposure level (L_E) has a reference value of 1 µPa^2 s. The subscript also describes the accumulation period (being 24 hours).

Table 6-3: Noise exposure criteria for marine turtles

PTS onset thresholds (received level) (Ref. 88)		TTS onset thresholds (received level) (Ref. 88)		Behavioural response (Ref. 85)
Impulsive	**Continuous**	**Impulsive**	**Continuous**	**Impulsive**
L_{pk}: 232 dB $L_{E, 24h}$: 204 dB	$L_{E, 24h}$: 220 dB	L_{pk}: 226 dB $L_{E, 24h}$: 189 dB	$L_{E, 24h}$: 200 dB	L_{pk}: 175 dB

Table 6-4: Noise exposure criteria for fish

Hearing group	Non-recoverable injury / potential mortal injury (Ref. 89)	Recoverable Injury (Ref. 89)		TTS onset thresholds (received level) (Ref. 89)	
	Impulsive	**Impulsive**	**Continuous**	**Impulsive**	**Continuous**
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	$L_{E, 48h}$: 170 dB	$L_{E, 24h}$: 186 dB	$L_{E, 12h}$: 158 dB

Continuous sound (vessel and helicopter operations)

Acoustic modelling undertaken by Woodside for support vessels (Ref. 90) is considered suitable to inform potential sound exposures from this activity as the vessels are expected to be similar in size to those modelled thus source sound levels are expected to be similar, 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 166 dB re 1 µPa was 0.046 km (Ref. 90). Noting that the United States

National Marine Fisheries Service (NMFS) recommend applying a noise exposure criterion of 120 dB re 1 µPa for behavioural disturbance (Table 6-2), cetaceans would need to be located close (~0.046 km) to the vessels in order to display some form of avoidance behaviour.

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. 62; Ref. 81), 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. 62). 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 6-2). Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to 170 dB re µPa^2.s was 0.010 km (Ref. 90). 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 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 behavioral disturbance continuous noise exposure criteria for turtles, CAPL has applied noise exposure criteria associated with impulsive sound sources. Specifically, 175 dB re 1 µPa (Table 6-3) 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 BIAs for marine turtles (Table 4-5), 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 some internesting areas, due to the distance offshore (>6 km) and increasing water depths it would be very unlikely that turtles would be aggregating within the OA. 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 (Ref. 90) 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 6-3). Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to 170 dB re µPa^2.s was less than 0.010 km (Ref. 90). Consequently, TTS and PTS is not expected to occur given that, exceedance of noise exposure criteria requires turtles to remain in vicinity (<10 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 6-4) 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. 92).

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 (~70–1350 m) 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. 89) 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. 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. 90).

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 (~70–1350 m) within 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.

Impulsive sound (IMR acoustic surveys)

Marine Mammals

Behavioural disturbance

Modelling undertaken by Zykov (Ref. 93) indicates that sound levels associated with the site survey would exceed the behavioural response noise exposure criteria of 160 dB re 1 μPa (Table 6-2) within 290 m of the vessel.

Within the OA, both mid-frequency (Indo-Pacific Humpback and Spotted Bottlenose dolphins, Killer Whale, Sperm Whale) and low-frequency (Blue, Brydes, Fin, Humpback, Sei, Antarctic Minke whales]) cetaceans have been identified as having the potential to be present.

If migrating cetaceans are present, CAPL does not expect that exposure to sound levels from IMR acoustic surveys would result in a significant change to migration behaviours or displace species outside of any relevant 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 acoustic surveys associated with this EP and as marine mammal species are expected to display transient (not sedentary) behaviours within the OA, the 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. 93) indicates that sound levels associated with the acoustic surveys would likely 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 6-2) within 20 m of the source. Further to this, Zykov (Ref. 93) indicates that SPL levels of 208 dB re 1 μPa would only occur within 20 m of the source.

On this basis, neither TTS nor PTS is 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 and infrequent, consequently, TTS and PTS effects associated with the site survey has not been considered further.

Turtles

Behavioural disturbance

Modelling undertaken by Zykov (Ref. 93) 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 6-3) within 290 m of the Vessel.

On the basis that only transient individual turtles are expected to be encountered within the OA, 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. 93) 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 6-3) 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 @ 1) is likely below which these impacts will occur.

On this basis, neither TTS nor 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 and infrequent, 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 6-4) to inform the evaluation for this potential impact. Modelling undertaken by Zykov (Ref. 93) 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. 92). Although both pelagic and demersal fish species are likely to be present within the OA, demersal species that may reside around existing subsea infrastructure are likely to be most affected by this activity. However, as acoustic surveys covered under this EP are of limited duration and occur relatively infrequently, 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. 93) 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 6-4) 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 commercial vessel operations and IMR 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.		
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.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	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. 86). 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. 94), 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. 94; Ref. 95). 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 Seldom (3).	
Risk level	Low (7)	
Determination of acceptability		
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, 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.	
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 • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 61) • *Conservation Advice Megaptera novaeangliae Humpback Whale* (Ref. 59) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 60) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 58)	

	• *Conservation Advice Rhincodon typus Whale Shark* (Ref. 57) • *Recovery Plan for Marine Turtles in Australia* (Ref. 55).	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 35).	
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. 61) 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 ~140 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 to marine fauna from underwater sound emissions from petroleum activities	**EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans** Vessels will implement caution and no approach zones, where practicable: • caution zone (300 m either side of whales; 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 the front and rear of dolphins and 50 m either side)–vessels should not enter this zone, and should not wait in front of the direction of travel of 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

6.7 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. 96).

The particular values and sensitivities within the OA with the potential to be impacted by the introduction of a marine pest include the following KEFs:

- ancient coastline at 125 m depth contour
- continental slope demersal fish communities
- Exmouth Plateau.

Although these KEFs have been identified as having the potential to be impacted from IMR activities, any planned disturbance would be in close proximity of existing infrastructure. As such, exposure of Exmouth Plateau is not considered likely given its location at the northwestern extent of the Jansz-Io permits and away from existing infrastructure. Although KEFs have been identified as having the potential to be exposed, as described in Section 4.3.5, the benthic habitats within the OA mostly comprise unvegetated, soft, and unconsolidated sediments.

The OA does not present a benthic habitat or community structure that is typically favourable to IMP survival. The OA is in water depths of ~70–1350 m, and rocky or hard outcrops are not known to occur; thus the typical requirements of hard substrate and light for IMP survival do not occur within the OA.

Once established, some IMPs can be difficult to eradicate (Ref. 97) 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. 98; Ref. 99; Ref. 100; Ref. 101). Although marine pests are identified as being of concern to marine reptile species under the *North-west Marine Bioregional Plan* (Ref. 69), the risk is associated with terrestrial based IMPs 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-practiced 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.

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.

Good practice control measures and source	
Control measure	**Source**
Quarantine procedure	CAPL's *Quarantine Procedure Marine Vessels* (Ref. 41) 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. 102) 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. 10) The quarantine procedure requires that all relevant biofouling information is provided to enable suitable risk assessments to be completed.
Ballast water management	The *Australian Ballast Water Management Requirements* (Ref. 8) 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.
Anti-fouling certificate	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.
Maritime Arrivals Reporting System (MARS)	Under the Commonwealth *Biosecurity Act 2015*, pre-arrival information must be reported through MARS before a vessel arrives in Australian waters.

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

Likelihood and risk level summary	
Likelihood	As vessel activities are occurring in deeper Commonwealth waters (not within shallow coastal areas), 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.
Risk level	Moderate (6)

Determination of acceptability	
Principles of ESD	The potential risks 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.

	As such, there is limited scientific uncertainty associated with this aspect; consequently the precautionary principle has not been applied.	
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. 8) • *Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines)* MPEC.207(62)) 2011 (Ref. 10) • *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry* (Ref. 102).	
Internal context	This CAPL environmental performance standard / procedure was deemed relevant for this aspect: • *Quarantine Procedure Marine Vessels* (Ref. 41)	
External context	During stakeholder consultation, no objections or claims were raised regarding IMPs 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 the marine environment by preventing introduction of IMPs during 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*
	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
	Anti-fouling certificate Marine vessels greater than 400 GT with an anti-foul coating are to maintain up-to-date international antifouling coating certification in accordance with *Protection*	Inspection reports confirm that international antifouling coating certifications are up-to-date

	of the Sea (Harmful Anti-fouling Systems) Act 2006 and/or the International Convention on the Control of Harmful Anti-fouling Systems on Ships	
	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)

6.8 Planned discharges—Vessel operations

Source

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.

Potential impacts and risks

Impacts	C	Risks	C
Planned discharges from vessels may result in: • localised and temporary reduction in water quality.	6	A change in ambient water quality may result in: • changes to predator-prey dynamics.	6

Consequence evaluation

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. 103). 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. 103). This outcome was verified by sewage discharge monitoring for another offshore project (Ref. 71), 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. 71).

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. 104; Ref. 105). 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. 106; Ref. 107) and further dilution of the foam mixtures in dispersive aquatic environments may then occur before there is any substantial demand for dissolved oxygen (Ref. 108).

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).

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. 103).

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. 109) 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. 110; Ref. 111; Ref. 112).

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

Likelihood and risk level summary

Likelihood	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.	
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	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	
Internal context	These CAPL environmental performance standard / procedures were deemed relevant for this aspect: • *Hazardous Materials Management Procedure* (Ref. 36) • MSRE process (Ref. 35).	
External context	During stakeholder consultation, no objections or claims were raised regarding planned discharges from vessel 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**
Reduce the risk of impacts to marine habitats and fauna from vessel discharges during petroleum activities	**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.	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)
	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 • unmacerated when the marine vessel is at least 12 nm from the nearest land.	Records show food waste is discharged in accordance with MARPOL 73/78 Annex V

	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

6.9 Planned discharges—Subsea operations

Source

Activities identified as having the potential to result in planned subsea operational discharges are:

- commissioning and start-up activities
- operational activities
- IMR operations within the OA.

The types of planned subsea operational discharges include small volumes of control fluids, spacer fluids, hydrotest fluids, MEG, and chemically treated potable water.

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. These fluids have positive buoyancy, upon release the plume will dilute and disperse (Ref. 113). The discharges occur at the wells or near the drill centres, which are located in water depths of ~200–250 m for Gorgon and ~1315–1350 m for Jansz

Previously completed fluid dispersion modelling for subsea releases of control fluids indicate that in similar water depths with a similar product the residence time or plume persistence was estimated to be in the order of 18 minutes (Ref. 70).

This suggests that the residence time associated with a release of control fluids from valve actuations is well below the release frequency. As the receiving environment is open and enables dispersion (i.e., water movement is not restricted), accumulation effects from this release are not expected.

Due to the small discharge volumes (e.g., up to ~40 m^3 of control fluid during operations [Section 3.4]), within open marine waters (which are typically influenced by large-scale ocean currents), 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.

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:

- 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 habitats within the OA mostly comprise unvegetated, soft, and unconsolidated sediments. Given that biologically important habitats tend to be found in areas of rocky escarpment rather than soft sediments (Ref. 69), exposure to habitats comprising high levels of diversity are not expected. The *North-West Marine Bioregional Plan* (Ref. 69) 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		
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. 36)	
IMR work procedures	Activity specific work procedures are developed and address 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 7.3.2.2).	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	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 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. 36).	
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**
Reduce the risk of impacts to marine habitats and fauna 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

6.10 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 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. 55; Ref. 114). 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. 69), 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).

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 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.

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 to this aspect include: • Marine Order 95 • MARPOL 73/78 • *Recovery Plan for Marine Turtles in Australia* (Ref. 55) • *National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016* (Ref. 114) • *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 79).	
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	**Marine Order 95 (Marine pollution prevention – garbage)** Marine vessels >100 T (or certified to carry >15 persons) will have a Garbage Management Plan on board, in accordance with MARPOL 73/78 Annex V	OVIS report / ABU Marine OE Inspection Checklist verifies that a Garbage Management Plan is 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	Current International Air Pollution Prevention (IAPP) Certificate (for marine vessels >400 T or certified to carry >15 persons)

	incinerator is to be IMO-approved and the waste incinerated is to be recorded 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).

6.11 Unplanned release—Loss of containment

Source

The operation of vessels includes handling, using, and transferring hazardous materials, and has the potential to result in a loss of containment (LOC) event. Based on the activities described in this EP, the following potential LOC scenarios were identified:

- using, handling, and transferring hazardous materials and chemicals on board (<1 m^3)[1]
- transferring hazardous materials between vessels (50 m^3)[2]
- dropped objects (and interaction with the subsea infrastructure) resulting in a loss of various fluids including treated sea water, hydraulic fluids, or MEG[3].

[1] A range of hydrocarbons and other hazardous chemicals / materials are likely to be present during IMR 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. 115) 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.

[3] Dropped objects may damage subsea infrastructure resulting in a release of hydrocarbons, treated sea water, hydraulic fluid, or MEG. CAPL defined the credible worst-case credible scenario during IMR activities as a ~50 m^3 release from one of the larger subsea valves (1" valve).

CAPL engaged RPS APASA to run the OILMAP DEEP model to understand the near-field plume dynamics to determine whether visible oil and gas, at levels of concern, would reach the surface (from each release location) (Ref. 116). Both Jansz-Io and Gorgon condensate properties were considered on the basis that when under pressure, a volume of 50 m^3 of hydrocarbon has the potential to be released over a 24-hour period until the release is controlled. Modelling indicated that due to the depth of water at the Jansz DC-1 release site (1,338 m), no visible oil was predicted to reach the sea surface and that oil/gas plume execution depths ranged from 977 to 1,224 m below the sea surface (Ref. 116). Modelling indicated that due to the depth of water at the Gorgon M3 release site (200 m), no visible oil was predicted to reach the sea surface and that oil/gas plume execution depths ranged from 69 to 172 m below the sea surface (Ref. 116). These droplets of oil will be removed from the environment through biodegradation processes.

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 6.12), and thus are not evaluated further here.

Modelling was conducted for a 50 m^3 subsea release of condensate from the Gorgon field to understand the potential impacts associated with a release arising from a dropped object damaging previously installed subsea infrastructure. Modelling predicts that the extent of exposure to hydrocarbons (from the Gorgon field) was limited to within 22 m of the release location and that a subsea release from the Jansz–Io field was not expected to result in any surface exposures and limited in-water exposure due to rapid dilution and dispersion (Ref. 116).

The values and sensitivities with the potential to be exposed to decreased water quality from an accidental subsea release include:

- Humpback Whale (migration)
- Pygmy Blue Whale (migration and distribution)
- Flatback Turtle, Green Turtle, Hawksbill Turtle (interesting buffer)
- Whale Shark (foraging).
- 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 short term and limited to a small number of individuals, thus the consequence level was determined as Minor (5).

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.

Modelling was undertaken for several scenarios associated with this aspect to support the environmental risk evaluation. Modelling has removed some of the uncertainty associated with this aspect, and supports the evaluation that due to the distance offshore and distance to sensitive receptors, these risks are 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
MSRE process	The MSRE process (Ref. 35) 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.
Ship Oil Pollution Emergency Plan (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.

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 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 large 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, which are known to be transient and unlikely to be present at the exact location of the 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. 35).	
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 leak or spill 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.

6.12 Unplanned release—Vessel collision event

6.12.1 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 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. 115) 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, previous modelling of spills in the order of 1,500–1,750 m^3 have been used in the following analyses.

6.12.2 Spill modelling

CAPL commissioned RPS to conduct spill modelling to inform the risk assessment associated with a vessel collision event within the both the Gorgon (Ref. 117), and Jansz-Io (Ref. 118; Ref. 119) fields.

A three-dimensional oil spill model (SIMAP) was used to simulate the drift, spread, weathering and fate of the spilled oil (Ref. 117; Ref. 118; Ref. 119). 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 6-5 summarises the model settings; Table 6-6 summarises the hydrocarbon properties for MDO; and Table 6-7 and Table 6-8 describe the modelled environmental exposure and impact thresholds respectively.

Table 6-5: Vessel collision spill scenario model settings

Parameter	Details	
Release Location	Gorgon	Jansz-Io
Latitude	20°34'38.60" S	19°51’8.7” S
Longitude	114°46'38.39" E	114°30’57.8” E
Water Depth	~267 m	~1,350 m
Oil type	MDO	
Simulation spill type	Surface	
Simulation spill volume	1,500 m^3	1,750 m^3
Simulation spill duration	24 hours	
Total simulation duration	50 days	
Number of randomly selected spill simulation start times	100 per season (300 total)	

Parameter	Details
Seasons modelled	Summer (December to February) Transitional (March, October and November) Winter (April to September)

Table 6-6: 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%

Table 6-7: Hydrocarbon environmental exposure thresholds

Environmental exposure threshold^	Justification
Surface ≥1 g/m^2 (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 120), CAPL has set the surface exposure threshold at ≥1 g/m^2. This threshold is used to establish a planning area for scientific monitoring (Ref. 120).
In-water (dissolved) ≥10 ppb (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 120), 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. 120).
In-water (entrained) ≥10 ppb (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 120), 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. 120).
Shoreline ≥10 g/m^2 (low)	CAPL has set the shoreline exposure threshold at ≥10 g/m^2. This threshold is consistent with the low exposure value for shoreline oil within NOPSEMA's oil spill modelling bulletin (Ref. 120).

^ *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 6-8 Hydrocarbon environmental impact thresholds

Environmental impact threshold	Justification
Surface ≥1 g/m^2 (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 120), CAPL has set the surface impact threshold for socio-economic effects at ≥1 g/m^2. This threshold is equivalent to ~1,000 L/km^2 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. 121) 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.

Environmental impact threshold	Justification
Surface ≥10 g/m^2 (moderate)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 120), CAPL has set the surface impact threshold for ecological effects at ≥10 g/m^2. This threshold is equivalent to ~10,000 L/km^2 or a layer thickness of ~10 µm. The Bonn Agreement Oil Appearance Code (Ref. 121) 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. 120). This threshold is consistent with observations ranging from physical oiling to toxicity effects for marine fauna within literature, including French et al. (Ref. 122), French-McCay (Ref. 123), Engelhardt (Ref. 124), Clark (Ref. 125), Geraci and St. Aubin (Ref. 126) and Jenssen (Ref. 127).
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. 128], Nordtug et al. [Ref. 129], Redman [Ref. 130]). 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. 120), 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. 120). 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. 131) 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. 120), 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. 120). 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. 132) 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

Environmental impact threshold	Justification
	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. 120), 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. 120), CAPL has set the shoreline impact threshold for ecological effects at ≥100 g/m^2. This threshold is equivalent to ~100 mL/m^2 or 20 teaspoons/m^2. French et al. (Ref. 122) and French-McCay (Ref. 123) define shoreline oil accumulation at ≥100 g/m^2 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. 133) demonstrated that loadings of >1,000 g/m^2 of oil during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing oil impacts on mangroves (e.g., Grant et al. [Ref. 134], Suprayogi and Murray [Ref. 135]).

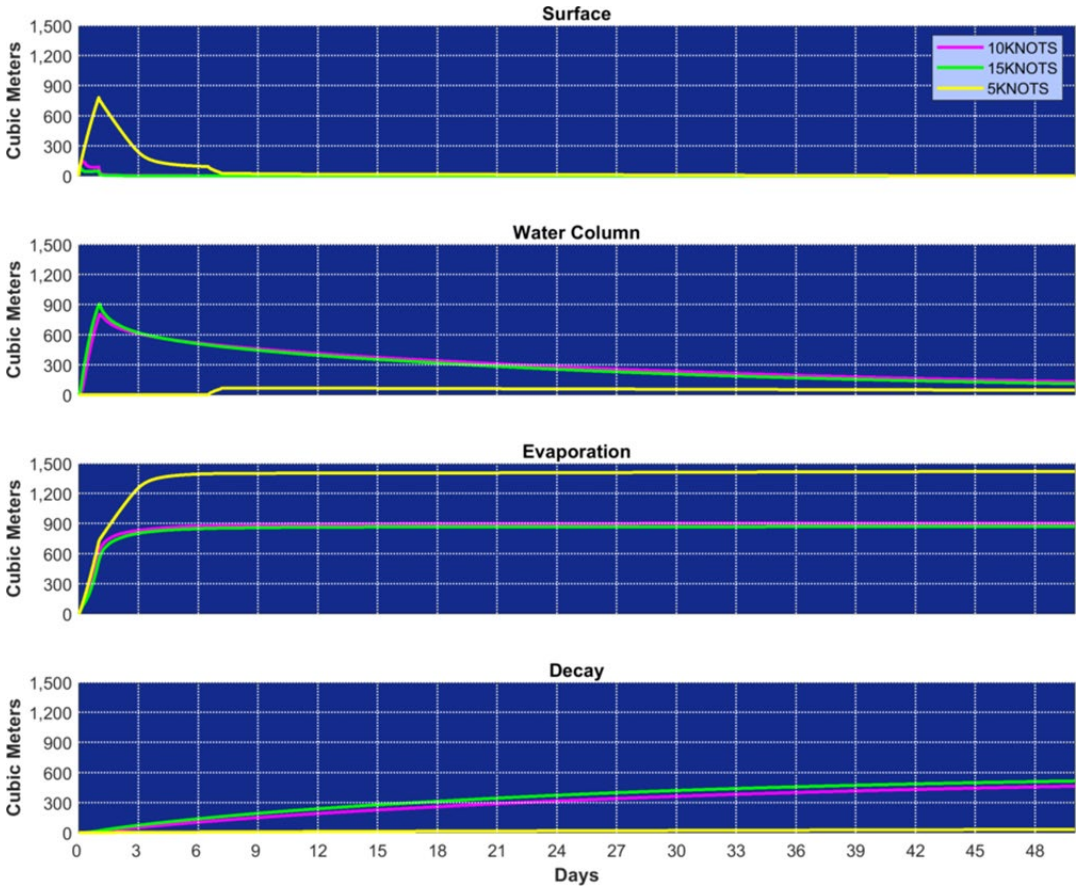
^ *Environmental impact thresholds have been used to define the EMBA, and the presence of environmental values and sensitivities within this area have been identified in Section 4. These impact thresholds and the spatial extent of the EMBA is used as part of the environmental impact and risk assessment presented below.*

6.12.2.1 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 6-6). 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.

Figure 6-1 shows predicted weathering for a 1,500 m^3 release of MDO over 24 hours (tracked for 50 days) during three static wind conditions. Typically, <50% of the slick volume, and potentially far less, will remain on the water surface after ~3 days (Figure 6-1).



(Source: Ref. 117)

Figure 6-1: Predicted weathering

6.12.2.2 Modelling outputs

Stochastic modelling outputs from RPS (Ref. 117; Ref. 118; Ref. 119) are summarised in Table 6-9 and Table 6-10 having regard to the particular values and sensitivities within the EMBA, as identified in Section 4.

For the 1,500 m^3 MDO release within the Gorgon field:

- The maximum distance from the release location to the ≥1 g/m^2 and ≥10 g/m^2 surface impact thresholds was ~277 km southwest (transitional) and ~65 km south-southwest (transitional), respectively.
- The probability of contact to any shoreline at ≥10 g/m^2 was 3% in summer, with no contact predicted in transitional and winter months. The minimum time before shoreline contact was ~3 days and the maximum volume of oil ashore was 2.7 m^3. No shoreline contact at the ≥100 g/m^2 impact threshold was predicted to occur during any season.
- No dissolved oil at ≥50 ppb or ≥4,800 ppb.hrs impact thresholds was predicted to occur during any season.
- Entrained oil at ≥100 ppb or ≥9,600 ppb.hrs impact thresholds was predicted to occur. However, entrained oil was predicted to remain in the surface layers, with no exposure at depths >20 m below the surface predicted to occur during any season.

For the 1,750 m^3 MDO release within the Jansz-Io field:

- The maximum distance from the release location to the ≥1 g/m^2 and ≥10 g/m^2 surface impact thresholds was ~208 km east-northeast (transitional) and ~120 km northeast (transitional), respectively.
- No shoreline contact was predicted to occur during any season.
- Dissolved oil at ≥50 ppb impact thresholds was predicted to occur. However, dissolved oil was predicted to remain in the surface layers only (no predicted exposure at depths >10 m below the surface). No dissolved oil at ≥4,800 ppb.hrs impact thresholds was predicted to occur during any season.
- Entrained oil at ≥100 ppb and ≥9,600 ppb.hrs 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 6-9: Gorgon 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	≥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%, 15–19 days	—	—	—	8–14%	1–2%	—	—
	Montebello	—	—	—	—	1–5%	0–1%	—	—
	Ningaloo	0–2%, 4 days	—	—	—	6–13%	0–3%	—	—
KEF	Ancient coastline at 125 m depth contour	4–16%, <1 day	2–4%, <1–1 day	—	—	11–26%	3–10	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	0–1%, 9 days	—	—	—	10–20%	0–1%	—	—
	Commonwealth waters adjacent to Ningaloo Reef	0–2%, 4 days	—	—	—	6–13%	0–3%	—	—
	Continental slope demersal fish communities	—	—	—	—	88–92%	78–85%	—	—
	Exmouth Plateau	0–1%, 19 days	—	—	—	6–7%	1%	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast *(inferred from Cape Range IBRA, Exmouth shoreline)*	0–3%, 3 days	—	—	—	0–6%	0–3%	0–3%, 3 days, 8 km	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	0–4%, 3 days	—	—	—	6–18%	0–4%	—	—

^ *Ranges in values shown are due to the different results between seasons.*

Table 6-10: Jansz-lo 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	≥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	—	—	—	—	7–10%	0–2%	—	—
	Montebello	—	—	—	—	0–1%	—	—	—
	Ningaloo	—	—	—	—		—	—	—
KEF	Ancient coastline at 125 m depth contour	—	—	—	—	0–1%	—	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	—	—	—	—	4–5%	—	—	—
	Commonwealth waters adjacent to Ningaloo Reef	—	—	—	—	—	—	—	—
	Continental slope demersal fish communities	0–1%, 50 days	—	—	—	3–12%	1–3%	—	—
	Exmouth Plateau	5–10%, 16–27 days	0–1%, 50 days	0–1%	—	12–14%	3–9%	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast *(inferred from Cape Range IBRA, Exmouth shoreline)*	—	—	—	—	—	—	—	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	—	—	—	—	—	—	—	—

^ *Ranges in values shown are due to the different results between seasons.*

6.12.3 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. 136; Ref. 137).

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. 138). 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. 138). French-McCay (Ref. 139) 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. 138; Ref. 140).

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. 138).

Stochastic modelling was used to identify BIAs for marine mammals that may be exposed to hydrocarbon concentrations greater than impact thresholds. These were:

- Humpback and Pygmy Blue Whales (distribution, migration, foraging)

- Dugong (breeding, calving, foraging, and 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. The deterministic model indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~15 km^2. This deterministic scenario is considered most relevant for offshore waters (where surface exposures were deemed to be larger) and subsequent impacts to offshore BIA's associated with whales. 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.

Deterministic analysis for largest volume of oil ashore, predicts that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~1 km^2. This deterministic scenario is considered most relevant for nearshore waters and subsequent impacts to nearshore BIA's. 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, as behaviours in nearshore waters are likely to result in increased sensitivity to hydrocarbon exposures as species are less likely to be transient, impacts to nearshore environments are expected to be larger than that associated with offshore exposures.

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. 141).

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. 142). 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. 141).

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, intenesting, mating, and nesting.

Stochastic modelling predicted no shoreline accumulation above the ≥100 g/m^2 impact threshold; therefore, shoreline exposure to marine turtles is not discussed further.

Deterministic analysis for largest volume of oil ashore, predicts that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~1 km^2. This deterministic scenario is considered most relevant for nearshore waters and subsequent impacts to nearshore BIA's. Using the Flatback Turtle internesting BIA around Barrow Island as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. 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. 143). 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. 144; Ref. 145; Ref. 146).

Demersal fish are not expected to be impacted given the presence of entrained oil is predicted 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. 147). 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. 148). 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. 149). 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 most sensitive to (surface) hydrocarbon exposures deterministic analysis for the largest sea surface swept area were analysed. The deterministic model indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~15 km^2. This deterministic scenario is considered most relevant for offshore waters and subsequent impacts to offshore BIA's. Comparing this 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. 150; Ref. 142). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 151). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 151).

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.

As these species are most sensitive to surface and shoreline hydrocarbon exposures, deterministic analysis for the largest volume of oil ashore to understand the potential extent and duration of nearshore hydrocarbon exposures.

Deterministic analysis for largest volume of oil ashore, predicts that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~1 km^2. This deterministic scenario is considered most relevant for nearshore waters and subsequent impacts to nearshore BIA's. Using the Roseate Tern breeding BIA surrounding Lowendal Islands as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. This information indicates that if a vessel spill event occurred during the breeding season, it is unlikely to impact entire local nesting populations.

Stochastic modelling predicted no shoreline accumulation above the ≥100 g/m^2 impact threshold; therefore, direct shoreline exposure to seabirds is not discussed further.

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. 152; Ref. 153).

Stochastic modelling predicted coral reefs associated with the following key values or sensitivities within the EMBA 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 6-9). Therefore, impacts from smothering within intertidal areas due to surface oil is not expected to occur. The probability of exposure to entrained oil (≥100 ppb) at the Ningaloo Coast area was low; 6–18% (Table 6-9); and stochastic modelling showed all 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 around some of the Pilbara islands (including Barrow Island), the deterministic analysis for largest volume of oil ashore was used as an indicator. This deterministic scenario is considered most relevant for nearshore waters and subsequent impacts to nearshore corals. Deterministic analysis for largest volume of oil ashore, predicts that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~1 km^2. 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. 154). 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. 154).

Stochastic modelling predicted no shoreline accumulation above the ≥100 g/m^2 impact threshold; 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; ≥4,800 ppb.hrs) was predicted to occur during any season. Entrained oil above impact thresholds (≥10 ppb; ≥9,600 ppb.hrs) was predicted to occur; however, was predicted to remain in the surface layers, with no exposure at depths >20 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. 155). 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 has the potential to occur along a small area of North West Cape coast during summer months, depending on the environmental conditions at the time of the event. No shoreline contact was predicted to occur during other (winter, transitional) seasons.

Deterministic analysis for largest volume of oil ashore, predicts the maximum length of shoreline oil above the visible impact threshold (≥10 g/m^2) at any given time was ~15 km, and the maximum volume of oil ashore was ~2.7 m^3. No shoreline contact was predicted above the ≥100 g/m^2 impact threshold.

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. 35) 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)

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: • 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. 61)

	• *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 60) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 58) • *Recovery Plan for Marine Turtles in Australia* (Ref. 55) • North-west Marine Parks Network Management Plan (Ref. 156).	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 35) • 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. 55) 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 leak or spill 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	**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
		Records show drills conducted in accordance with SOPEP

hydrocarbons / hazardous materials during petroleum activities	**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

6.13 Unplanned release—Major defect event

6.13.1 Credible scenario

The *Gorgon Project: Producing Phase Well Operations Management Plan* (Ref. 9) identifies the following key risks to well integrity during start-up and operations:

- mechanical failure (leaks in annulus or production casing)
- overpressure (overpressure of annulus leading to burst casing or collapsed tubing)
- 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).

The WOMP only identified a full loss of well control event as a risk during well interventions (Ref. 9). This type of activity is not within this scope of this EP (Section 2.3.2).

Therefore, upon evaluating the risks associated with activities covered under this EP, CAPL considers that a major defect in a flowline or production pipeline is the most credible (but unlikely) unplanned event. Specifically, a full-bore rupture was selected as the worst-case major defect event.

For the purpose of this risk assessment, identification of a location along the pipeline within the OA for a major rupture event was based on:

- the location with the greatest potential environmental consequence (closest to sensitive receptors)
- areas along the pipeline identified in engineering studies as most susceptible to potential materials fatigue or exposure to third-party interference.

Based on these considerations, three locations were identified and modelled to provide an indication of the EMBA from a major defect event. The locations were:

- Jansz-Io field (approximate location of Midline PTS)
- the base of the escarpment
- nearshore location (~15 km offshore from Barrow Island) in Commonwealth Waters.

Modelling was undertaken by Intecsea (Ref. 157) to understand potential volumes released during a major defect event. Model calculations were based upon:

- maximum allowable operating pressure (MAOP) of the pipeline
- water depth at the release location (and subsequent pressure differential)
- time to detect defect and enact emergency procedures
- time for pipeline to equalise with the ambient pressure at the release location.

Table 6-11 summarises the inputs and subsequent estimated volumes.

Table 6-11: Major defect volume calculations

Parameter	Release location			
	Jansz-lo field	Escarpment	Nearshore	Nearshore
Pipeline	Jansz	Jansz	Jansz	Gorgon
MAOP	260 bar	260 bar	260 bar	287 bar
Water depth	1,345 m	763 m	50 m	50 m
Time to detect defect and enact emergency procedures^	30 minutes	30 minutes	30 minutes	30 minutes
Time for pipeline to equalize with the ambient pressure at the release location	~7 hours	~6 hours	~12 hours	~5 hrs
Estimated volume	276 m^3	388 m^3	529 m^3	494 m^3

^ *Duration is based on 15 minutes detection for alarms from the FMT, and 15 minutes for the operator to enact emergency procedures.*

6.13.2 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. 158). 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 6-12 summarises the model settings; Table 6-13 and Table 6-14 summarises the hydrocarbon properties for Jansz and Gorgon condensates respectively; and Table 6-7 and Table 6-8 (in Section 6.12) describe the modelled environmental exposure and impact thresholds respectively.

Table 6-12: Major defect spill scenario model settings

Parameter	Details			
Release Location	Jansz-lo field	Escarpment	Nearshore	Nearshore
Latitude	19º48’34.09” S	20º12’55.273” S	20º38’19.099” S	20º38’25.549” S
Longitude	114º36’26.52” E	114º51’59.59” E	115º16’54.56” E	115º16’47.64” E
Water Depth	1,346 m	765 m	50 m	50 m
Oil type	Jansz condensate	Jansz condensate	Jansz condensate	Gorgon condensate
Simulation spill type	Subsea			
Simulation spill volume	276 m^3	388 m^3	529 m^3	494 m^3
Simulation spill duration	7.2 hours	5.8 hours	12.2 hours	4.7 hours
Total simulation duration	28 days			

Parameter	Details
Number of randomly selected spill simulation start times	100 per season (300 total)
Seasons modelled	Summer (September to March) Transitional (April and August) Winter (May to July)

Table 6-13: Physical properties and boiling point ranges for Jansz condensate

Characteristic	Value			
Density	772.8 kg/m^3 (at 25 °C)			
Dynamic viscosity	1.2 cP (at 25 °C)			
Pour point	-81 °C			
API gravity	51.4 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
	72.5%	13.0%	14.0%	0.5%

Table 6-14: Physical properties and boiling point ranges for Gorgon condensate

Characteristic	Value			
Density	847.8 kg/m^3 (at 15 °C)			
Dynamic viscosity	2.4 cP (at 20 °C)			
Pour point	-9 °C			
API gravity	35.3 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
	33.3%	28.5%	32.3%	5.9%

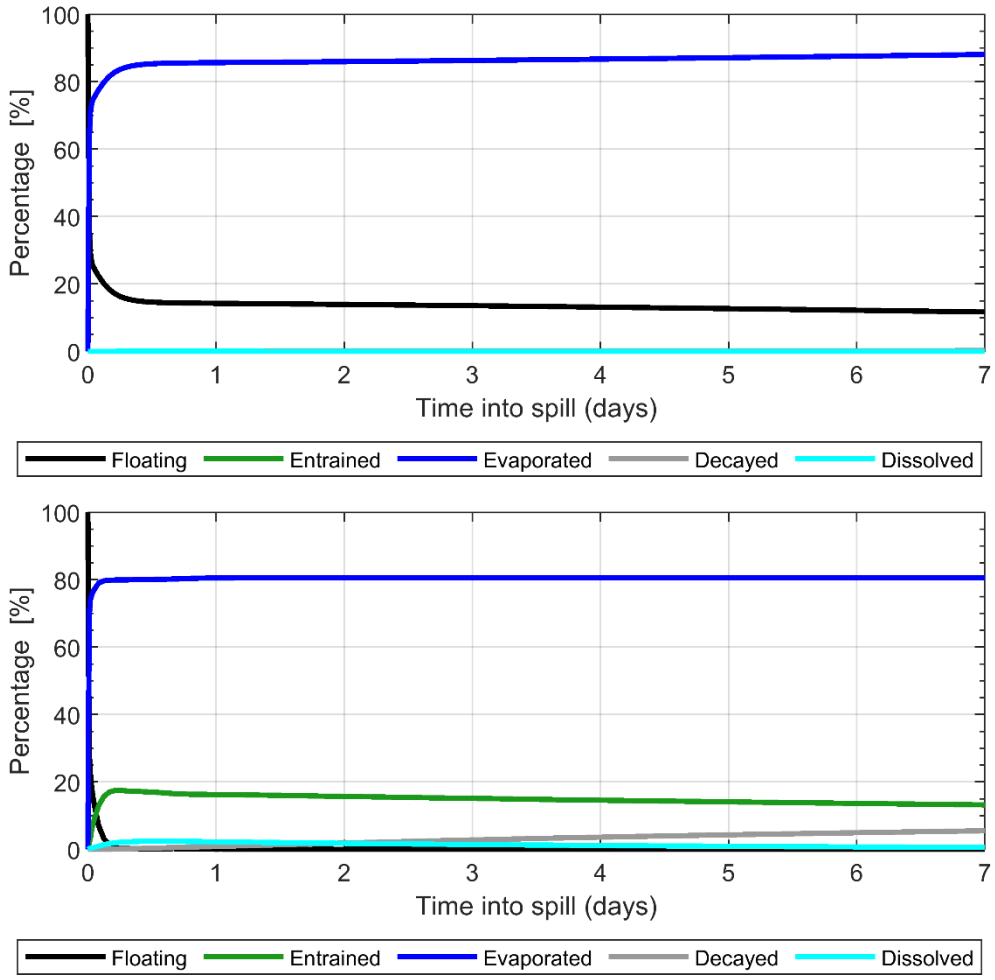
6.13.2.1 Weathering and fate

Jansz condensate is non-persistent oil, with a density of 772.8 kg/m^3, an API of 51.4, and a low pour point (−81 °C) (Table 6-13). The low viscosity (1.2 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, 72.5% of the Jansz condensate mass should evaporate within the first 12 hours (boiling point <180 °C); a further 13.0% should evaporate within the first 24 hours (boiling point 180°C–265 °C); and an additional 14% should evaporate over several days (boiling point 265°C–380 °C). Approximately 0.5% (by mass) of Jansz condensate will not evaporate at atmospheric temperatures. These compounds will persist in the environment.

Figure 6-2 shows predicted weathering for an instantaneous 50 m^3 surface release of Jansz condensate (tracked for 7 days) under calm and variable wind conditions. Predictions show that under calm conditions, ~86% of the slick volume

evaporated within the initial 24 hours; and under variable conditions ~80% has evaporated and ~16% has entrained within the initial 24 hours.



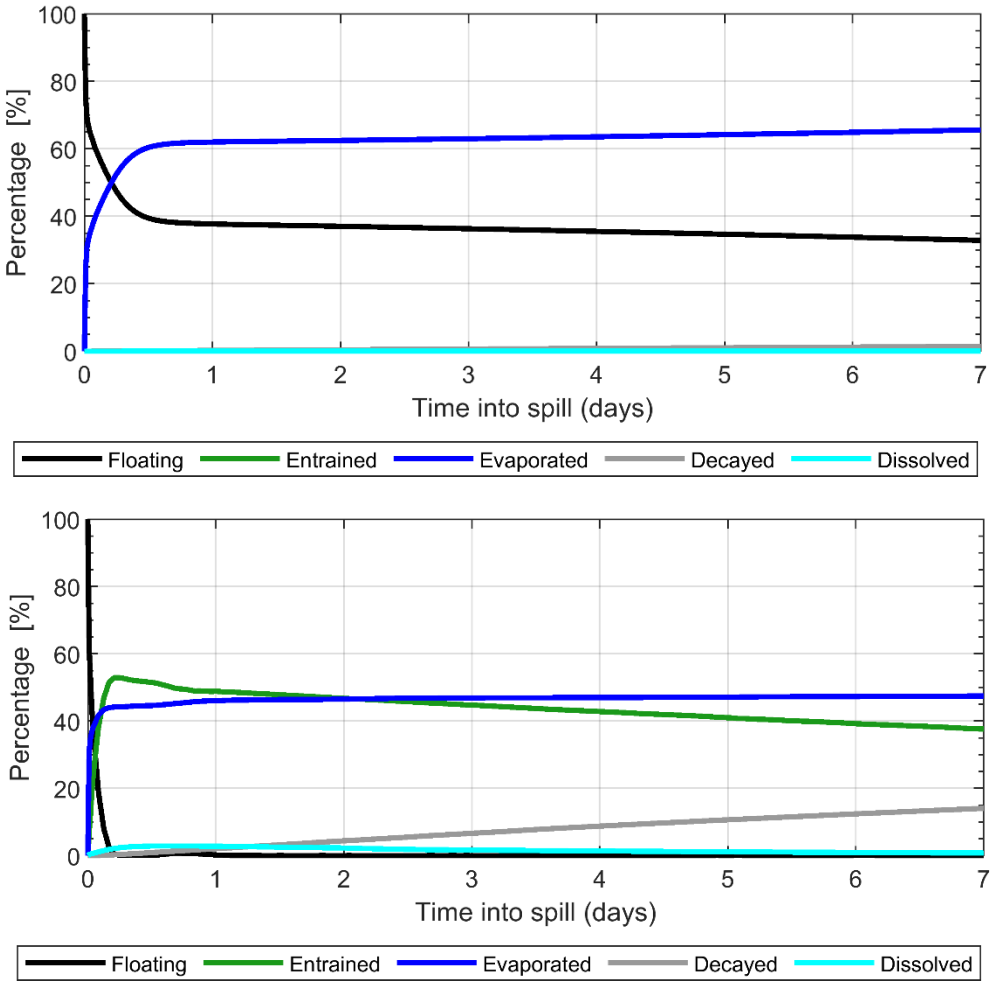
(Source: Ref. 158)

Figure 6-2: Predicted weather of an instantaneous surface release of 50 m^3 of Jansz condensate under calm (top image) and variable (bottom image) wind conditions

Gorgon condensate is light persistent oil, with a density of 847.8 kg/m^3, an API of 35.3, and a low pour point (−9 °C) (Table 6-13). The low viscosity (2.4 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, 33.3% of the Gorgon condensate mass should evaporate within the first 12 hours (boiling point <180 °C); a further 28.5% should evaporate within the first 24 hours (boiling point 180°C–265 °C); and an additional 32.3% should evaporate over several days (boiling point 265°C–380 °C). Approximately 5.9% (by mass) of Gorgon condensate will not evaporate at atmospheric temperatures. These compounds will persist in the environment.

Figure 6-3 shows predicted weathering for an instantaneous 50 m^3 surface release of Gorgon condensate (tracked for 7 days) under calm and variable wind conditions. Predictions show that under calm conditions, ~62% of the slick volume evaporated within the initial 24 hours; and under variable conditions ~46% has evaporated and ~49% has entrained within the initial 24 hours.



(Source: Ref. 158)

Figure 6-3: Predicted weathering of an instantaneous surface release of 50 m^3 of Gorgon condensate under calm (top image) and variable (bottom image) wind conditions

6.13.2.2 Modelling outputs

Stochastic modelling outputs from RPS (Ref. 158) are summarised in Table 6-15 having regard to the particular values and sensitivities within the EMBA as identified in Section 4.

For the 276 m^3 Jansz pipeline rupture within the Jansz-Io field:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~28 km west-northwest (summer). No surface oil was predicted to occur at the ≥10 g/m^2 impact threshold
- No shoreline accumulation above impact thresholds was predicted to occur during any season
- No dissolved oil above impact thresholds was predicted to occur during any season
- No entrained oil above impact thresholds was predicted to occur during any season.

For the 388 m^3 Jansz pipeline rupture at the escarpment:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~39 km south (summer), and ~2.5 km east (transitional) for the ≥10 g/m^2 impact threshold
- The probability of contact to any shoreline at ≥10 g/m^2 was 4% in summer, with no contact predicted in transitional and winter months. The minimum time before shoreline contact was ~5 days and the maximum volume of oil ashore was 1.8 m^3. No shoreline contact at the ≥100 g/m^2 impact threshold was predicted to occur during any season.
- Dissolved oil at ≥50 ppb and ≥4,800 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 216 ppb.
- Entrained oil at ≥100 ppb or ≥9,600 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 7,840 ppb.

For the 529 m^3 Jansz pipeline rupture nearshore:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~21 km southwest (summer), and ~1.7 km west-southwest (transitional) for the ≥10 g/m^2 impact threshold
- The probability of contact to any shoreline at ≥10 g/m^2 was 8–21% (depending on the season). The minimum time before shoreline contact was ~1 day (transitional) and the maximum volume of oil ashore was 3 m^3 (summer). Shoreline contact at ≥100 g/m^2 was only predicted to occur during winter at Airlie Island, with a low probability of occurrence of 1%. The minimum time before shoreline contact was ~7 days and the maximum volume of oil ashore was 1.2 m^3.
- Dissolved oil at ≥50 ppb and ≥4,800 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 285 ppb.
- Entrained oil at ≥100 ppb or ≥9,600 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 5,821 ppb.

For the 494 m^3 Gorgon pipeline rupture nearshore:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~47 km south-southwest (winter), and ~15 km southwest (transitional) for the ≥10 g/m^2 impact threshold.
- The probability of contact to any shoreline at ≥10 g/m^2 was 6–31% (depending on the season). The minimum time before shoreline contact was <1 day (summer) and the maximum volume of oil ashore was 15.8 m^3 (summer).
- Shoreline contact at ≥100 g/m^2 was only predicted to occur during summer at Barrow, Montebello and Serrurier islands, with low probability of occurrence of 2–4%. The minimum time before shoreline contact was ~1 day, the maximum volume of oil ashore was 15.8 m^3, and maximum length of shoreline accumulation was ~4.8 km.

- Dissolved oil at ≥50 ppb and ≥4,800 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 9,015 ppb.
- Entrained oil at ≥100 ppb or ≥9,600 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 13,916 ppb.

Table 6-15: 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	—	—	—	—	—	—	—	—
	Montebello	100%, <1 day	100%, <1 day	78%	43%	100%	100%	—	—
	Ningaloo	—	—	—	—	1%	—	—	—
KEF	Ancient coastline at 125 m depth contour	1%	—	2%	—	9%	—	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	—	—	1%	—	3%	—	—	—
	Commonwealth waters adjacent to Ningaloo Reef	—	—	—	—	1%	—	—	—
	Continental slope demersal fish communities	96%	62%	56%	0–31%	98%	—	—	—
	Exmouth Plateau	—	—	—	—	—	—	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast *(inferred from Cape Range IBRA, Exmouth shoreline)*	—	—	1%	—	6%	—	2%, 6 days, 11.6 km	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	—	—	—	—	1%	—	—	—

^ *Values shown represent the highest probability, shortest minimum time to exposure, and longest mean length of shoreline from all four scenarios modelled. Actual probabilities of exposure for listed sensitivities vary greatly between each individual scenario (e.g., from 0% to 100% probability of exposure of Montebello Marine Park, depending on the location of the spill).*

6.13.3 Risk assessment

Source

Activities identified as having the potential to result in a major defect event are:

- dropped objects from vessels during IMR activities within the OA
- pipeline degradation (e.g., corrosion) or functional errors (e.g., overpressure)
- operating error.

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. 136; Ref. 137).

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. 138). 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. 138). French-McCay (Ref. 139) 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. 138; Ref. 140).

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. 138).

Stochastic modelling was used to identify BIAs for marine mammals that may be exposed to hydrocarbon concentrations greater than impact thresholds. These were:

- Humpback and Pygmy Blue Whales (distribution, migration, foraging)
- Dugong (breeding, calving, foraging, and 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 four scenarios modelled, deterministic analysis from the Gorgon condensate was selected for use as it is a slightly more persistent oil compared to Jansz condensate (Section 6.13.2.1). The deterministic model indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 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.

Similarly, deterministic analysis for the largest area of entrained hydrocarbon indicates that entrained hydrocarbons concentrations ≥100 ppb are present for ~2 days following the spill event, with a maximum area of coverage of ~35 km^2. Using the Pygmy Blue Whale migration BIA as an example, modelling indicates that the extent of entrained 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. 141).

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. 142). 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. 141).

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 Gorgon condensate scenario) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~12 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~4.8 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 (from the Gorgon condensate scenario) indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 km^2. Using the Flatback Turtle internesting BIA around Barrow Island as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. 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. 143). 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. 144; Ref. 145; Ref. 146).

Demersal fish are not expected to be impacted given the presence of dissolved and entrained oil 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. 147). 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. 148). 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. 149). 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 fish species are sensitive to entrained hydrocarbon exposures, deterministic analysis for the largest area of entrained hydrocarbon were analysed. The deterministic model indicates that entrained hydrocarbons concentrations ≥100 ppb are present for ~2 days following the spill event, with a maximum area of coverage of ~35 km^2. Using the Whale Shark foraging BIA as an example, modelling indicates that the extent of entrained exposures was predicted to be limited to <1% of the entire BIA.

As Whale Sharks are also sensitive to surface hydrocarbon exposures deterministic analysis for the largest sea surface swept area were analysed. The deterministic model indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 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. 150; Ref. 142). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 151). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 151).

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 Gorgon condensate scenario) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~12 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~4.8 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 (from the Gorgon condensate scenario) indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 km^2. Using the Roseate Tern breeding BIA surrounding Lowendal Islands as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% 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. 152; Ref. 153).

Stochastic modelling predicted coral reefs associated with the following key values or sensitivities within the EMBA 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 6-15). 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 was low (less than 10%) (Table 6-15)); and 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 around some of the Pilbara islands (including Barrow Island), the deterministic analysis for the largest sea surface swept area (from the Gorgon condensate scenario) indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 km^2. Similarly, the deterministic analysis for the largest area of entrained hydrocarbon indicates that entrained hydrocarbons concentrations ≥100 ppb are present for ~2 days following the spill event, with a maximum area of coverage of ~35 km^2.

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. 154). 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. 154).

Mangroves and intertidal mudflats associated with key values and sensitivities (e.g., the Ningaloo Coast; Table 4-10) within the EMBA were not predicted to be exposed to shoreline hydrocarbons above impact thresholds.

For assessment of other mangrove and intertidal habitats that occur around some of the Pilbara islands (including Barrow Island), the deterministic analysis for the largest volume of oil ashore (from the Gorgon condensate scenario) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~12 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~4.8 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 (<10 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. 155). 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 Barrow and Montebello islands, and several other Pilbara inshore islands.

Deterministic analysis for the largest volume of oil ashore (from the Gorgon condensate scenario) indicates that shoreline hydrocarbons concentrations ≥10 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~15.8 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥10 g/m^2 is ~18 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. There is limited access to Barrow and Montebello islands; however, there is more likelihood of tourism or recreational activities occurring on some of the smaller islands closer to the mainland.

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 *Gorgon and Jansz Subsea and Pipelines Inspection and Monitoring Plan* (IM Plan) (Ref. 159). 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. 160) that provides guidance to operations personnel to detect, isolate and stabilise non-routine events such as trunkline/flowline loss of containment scenarios.
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	Analysis of the 2001 PARLOC database (Ref. 161) 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. 162). This frequency was used as a guide to inform the likelihood of consequence. Given these statistics are based on incident history, largely for North Sea and European operations, their use is considered conservative given the geographically remote location of the Gorgon and Jansz Feed Gas Pipeline and the reduced risk of potential external interference. 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: • Marine Order 91, Marine Pollution Prevention – oil • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 61) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 60) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 58) • *Recovery Plan for Marine Turtles in Australia* (Ref. 55) • North-west Marine Parks Network Management Plan (Ref. 156).
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • IM Plan (Ref. 159) • 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. 55) 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 leak or spill 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 subsea pipeline, 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 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
	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

6.14 Spill response

6.14.1 Response option selection

6.14.1.1 Strategic NEBA

CAPL has developed a series of strategic Net Environmental Benefit Analysis (NEBA) (Ref. 163) 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. 164). 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.

6.14.1.2 Protection prioritisation process

CAPL has developed a Protection Prioritisation Process (PPP) (Ref. 165) 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. 165) 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. 165) aligns with WA Department of Transport (DoT) PPP (Ref. 166) 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. 165)) 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. 165), 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 6-16 below. 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 6-16: Priority planning areas for major defect spill scenario

Potential area of impact	Distance from source of spill	Shoreline values	Planned response tactics
DoT Shoreline Cell # 320 and #321 (Barrow Island)	15 km	Turtles – BIAs including nesting Seabirds – BIAs including breeding Coral and reef communities Australian Marine Park	Monitor, Evaluation and Surveillance Shoreline Protection and Deflection Shoreline Clean-up Oiled Wildlife Response
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

* Note that the modelling for both Gorgon and Jansz-Io vessel collision event did not predict any impact to High and Very High ranked areas within 4 days.

6.14.2 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 – Jansz condensate
- Group 2 – Gorgon condensate, 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 6-16 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.

6.14.3 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).

6.14.3.1 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. 163) 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.

6.14.3.2 CAPL planned response vessel collision

No shoreline contact was predicted for either the Gorgon or Jansz-Io scenarios, therefore there is no need to implement SPD and SHC responses. Offshore Containment and Recovery (CAR) would not be effective because of the hydrocarbon properties (Group 2). Consequently, in accordance with the Strategic NEBA (Ref. 163), the primary response CAPL proposes for these spill scenarios is MES.

Implement MES response

A MES response will commence for every spill to water 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.

6.14.3.3 CAPL planned response major defect

In accordance with the Strategic NEBA (Ref. 163), 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 and 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 an SPD response

Deterministic analysis for the largest volume of oil ashore indicates that 15.8 m^3 may wash ashore within ~2 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 15.8 m^3 washes ashore on the second 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 6-17.

Modelling suggests there would only be a very short window to implement SPD on the west coast of Barrow Island (~1.7 days). This short timeframe, coupled with the remoteness, access constraints and the high energy environment of the western coastline would likely result in limited effectiveness, Regardless, a SPD response could be targeted at accessible areas of lower energy with known environmental sensitives, such as turtle nesting beaches.

A SPD response within the other Priority Planning area (Montebello Islands) would not be possible due to the predicted time to exposure (<1 day).

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 15.8 m^3 may wash ashore within ~2 days after release, and a maximum length of shoreline exposed to above actionable quantities was ~5 km. This scenario predicted exposure to the western coastlines of Barrow Islands.

The west-coast of Barrow Island comprises:

- High energy wave environment

- High / steep rocky cliffs
- Very limited vehicle access

From a tactical planning perspective, based upon these conditions, it is unlikely that a shoreline clean-up would be feasible along most of the west coast. Consequently, priority areas for clean-up would be those west coast bays / beaches accessible by vehicles or vessels and those that support Green Turtle nesting populations. Regardless, a conservative planning approach taken by CAPL is that it would attempt to clean up the entire volume of oil washed ashore.

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 two clean-up teams are mobilised on day 3 and used each day, all hydrocarbons can be recovered within 5 days. If required, these efforts could be ramped up as directed and informed by MES activities.

Table 6-17: 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	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	2	2	2	2	2	0	0	0	0	0
Does CAPL have the required capability?			Y	Y	Y	Y	Y					

6.14.4 Spill response environmental risk assessment

6.14.4.1 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 at a nearshore location releasing Gorgon condensate), 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 subsequent impacts to fauna such as turtles and birds.	5
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.			
Control Measure	**Source of Good Practice Control Measure**		
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 Outcomes	**Performance Standards / Control Measures**	**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

6.14.4.2 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 at a nearshore location releasing Gorgon condensate), 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 Ningaloo coast and Barrow and 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.			
Control Measure	**Source of Good Practice Control Measure**		
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 Outcomes	**Performance Standards / Control Measures**	**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 implementation strategy

This section provides a description of the implementation strategy as required under Regulation 14 of the OPGGS(E)R. The 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 Section 6 are achieved.

7.1 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. 33) 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 7-1):

- **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 7-1) 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 7-1) provides the verification and validation that the safeguards are in place and functioning as intended.

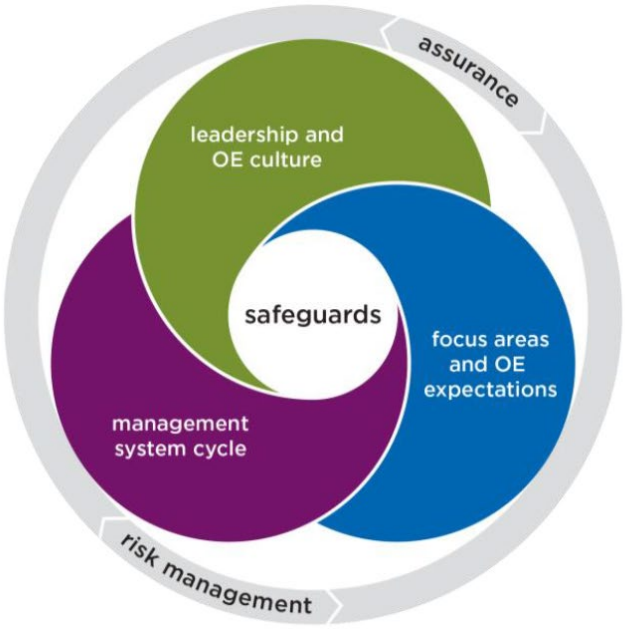


Figure 7-1: Overview of Chevron Corporation's OEMS

7.2 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.

7.2.1 Roles and accountability

CAPL leaders have the overall accountability for the implementation of the OEMS.

7.2.1.1 Chain of command (petroleum activity)

As required under Regulation 14(4) of the OPGGS(E)R, a clear chain of command for implementing the petroleum activity is outlined in Figure 7-2.

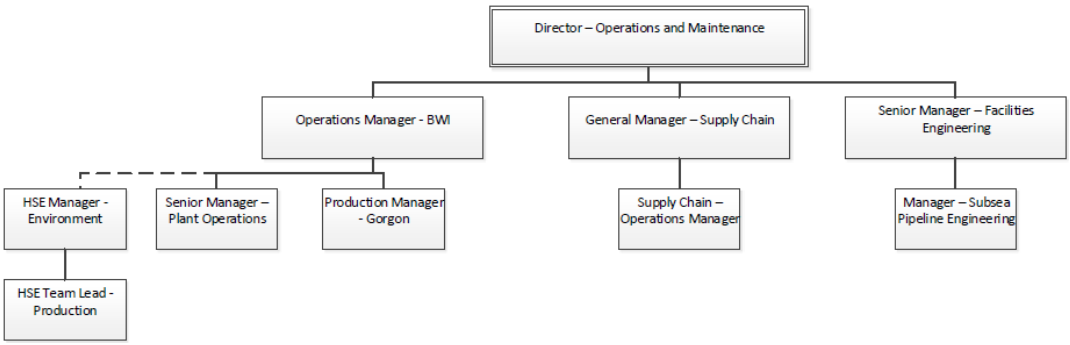


Figure 7-2: Chain of command—petroleum activities

7.2.1.2 Roles and responsibilities (petroleum activity)

The roles and responsibilities of key CAPL and contractor personnel for implementing task-specific control measures are detailed in Section 6, and are summarised in Table 7-1.

Table 7-1: Key roles and responsibilities—petroleum activities

Roles	Responsibilities
CAPL personnel	
Operations Manager - BWI	• Overall responsibility for implementing, managing, and reviewing this EP
Supply Chain – Operations Manager	• Ensure that all third-party vessels or contractors are aware of any requirements within this EP
Manager - Subsea Pipeline Engineering	• Ensure that inspection and monitoring of the hydrocarbon system is undertaken in accordance with the IM Plan (Ref. 159)
Production Manager - Gorgon	Ensure that: • hydrocarbon system is operated in accordance with NOPSEMA accepted *Gorgon Project: Producing Phase Well Operations Management Plan* (Ref. 9 • source control response is undertaken in accordance with the EOP – Loss of Containment (Hazardous or Environmental Release) Operating Procedure – Gorgon Operations (Ref. 160)
HSE Manager - Environment	Ensure that: • all personnel are made aware of their requirements under this EP • impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Sections 6 and 7 • all changes to this EP are subject to a Management of Change assessment as described in Section 7.3.2.2 • compliance with this EP is verified in accordance with Section 7.3.6 • this EP is reviewed in accordance with Section 7.5
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

7.2.1.3 Training and competency (petroleum activity)

In accordance with Regulation 14(5) of the OPGGS(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 7.2.1.2) 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 that are relevant to their role (Table 7-2).

Table 7-2: Inductions—petroleum activities

Induction	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 • good waste management and hazardous materials housekeeping requirements • incident reporting requirements • incident response arrangements.

7.3 Focus areas and OE expectations

The OE expectations are organised into six focus areas (Figure 7-3). 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 7-3.

Figure 7-3: 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 7-3. Each of these focus areas and common expectations are described in further detail in the following subsections.

Table 7-3: 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. 34) • *Marine Safety Reliability and Efficiency: ABU Standardised OE Process* (Ref. 35) • *ABU Hazardous Materials Management Procedure: ABU Standardised OE Procedure* (Ref. 36)
Process safety, reliability and integrity	• OE Information Management: ABU Standardised OE Process (Ref. 37) • *Management of Change for Facilities and Operations: ABU Standardised OE Process* (Ref. 38) • *ABU Surface Equipment Reliability and Integrity Process (SERIP) Base Business: Standardised OE Process (Ref. 39)*
Environment	• *Environmental Stewardship: ABU Standardised OE Process (Ref. 40)* • *Quarantine Procedure Marine Vessels. ABU Standardised OE Process (Ref. 41)*
Stakeholders	• *Stakeholder Engagement and Issues Management: ABU Standardised OE Process* (Ref. 42)
Common expectation	
Risk management	• *ABU OE Risk Management Process* (Ref. 28)
Assurance	• *OE Assurance Corporate Process* (Ref. 43) • *Managing Instances of Potential Nonconformance* (Ref. 46)
Incident investigation and reporting	• *Incident Investigation and Reporting (II&R) Execution Manual* (Ref. 47)
Emergency management	• *Emergency Management OE Process* (Ref. 48) • OPEP (Ref. 2) • *Operational and Scientific Monitoring Plan* (OSMP) (Ref. 3)

7.3.1 Workforce safety and health

7.3.1.1 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. 34) 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.

7.3.1.2 Marine

The Marine Safety Reliability and Efficiency (MSRE) process (Ref. 35) 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. 49), 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.

7.3.1.3 Hazardous materials

CAPL's *Hazardous Materials Management Procedure* (Ref. 36) 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 7-4.

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 7-4: 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. 50).
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.

7.3.2 Process safety, reliability and integrity

7.3.2.1 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.

The OE information management process (Ref. 37) 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.

7.3.2.2 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 7.3.5), the *Management of Change for Facilities and Operations* process (Ref. 38) 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 this EP must be resubmitted to NOPSEMA 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.

7.3.2.3 Surface equipment reliability and integrity

The SERIP (Ref. 39) provides a systematic and staged approach to deploy and execute standardised surface equipment processes, sub-processes and procedures that enable operation and maintenance of facilities to sustain integrity and prevent incidents. The computerised maintenance management system (CMMS) is a key enabler for SERIP, used to prioritize, plan, schedule and complete necessary maintenance for all structures, equipment and protective devices. Each item (down to component level) is assessed, has a criticality

assigned based on consequence of failure, and equipment whose failure may contribute to a major incident or event (MIE) is aligned to an operational performance standard with a start date and frequency for inspections and maintenance. Work orders for items of high consequence/criticality are to be completed by the due date, or managed under the deviation process. In 2021, CAPL are commencing the transition from the upstream SERIP process to the enterprise Facilities Integrity and Reliability Management (FIRM) process. The principles of managing high consequence equipment are similar across these two processes.

7.3.3 Environment

The Environment Focus Area provides CAPL's framework for the protection of the environment and community health using a risk-based approach that addresses potential environmental impacts.

7.3.3.1 Environmental Stewardship

The Environmental Stewardship process (Ref. 40) 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.

7.3.3.2 Quarantine

The *Quarantine Procedure Marine Vessels* (Ref. 41) defines the procedure for marine vessels intending to approach or access Barrow Island or undertake activities in title areas outside the boundaries of the Montebello/Barrow Island Marine Management Area. It 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.

7.3.4 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. 42) 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.

In accordance with Regulation 14(9) of the OPGGS(E)R, 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.

7.3.5 Risk management

The risk management process (Ref. 28) 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. 33) and ISO 31000:2018 *Risk management – Principles and guidelines* (Ref. 29).

This risk management process is summarised in Section 5 of this EP. Additional risk assessments must be undertaken if the MoC process (Section 7.3.2.2) is triggered. Risk assessments are undertaken in accordance with this process.

The *ABU OE Risk Management Process* (Ref. 28) and the *Management of Change for Facilities and Operations* process (Ref. 38) are the key systems CAPL use to ensure, that in accordance with Regulation 14(3)(a) of the OPGGS(E)R, the impacts and risks of the petroleum activity continue to be identified and reduced to ALARP.

7.3.6 Assurance

Within the OEMS, assurance is a common expectation that supports the OE objective of each focus area. The *ABU OE Assurance Process* (Ref. 43) 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. 44) is a multi-year plan that documents the CAPL ABU integrated assurance system and associated assurance activities (Figure 7-4). 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).

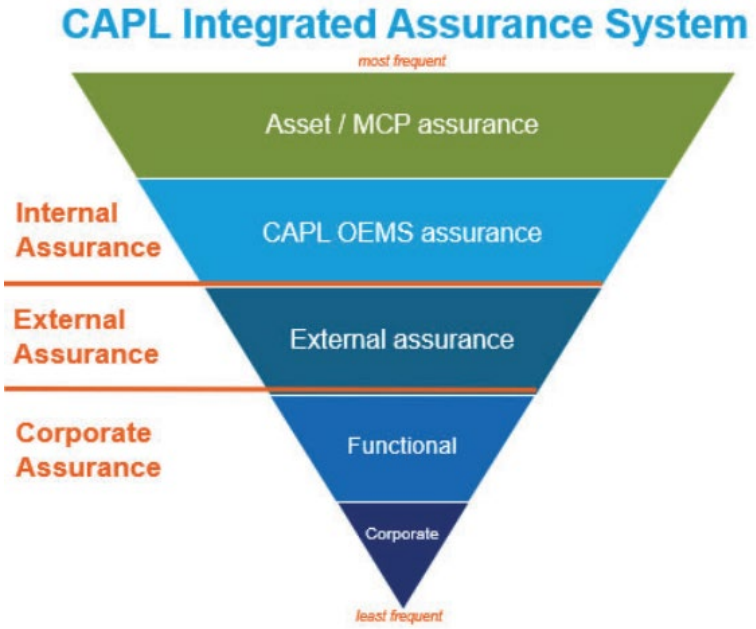


Figure 7-4: ABU integrated assurance system

To support the implementation of the *ABU OE Assurance Process*, CAPL have developed an ABU integrated assurance system (Figure 7-4), 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 *Gorgon OE Assurance Plan* (Ref. 45) documents the specific assurance activities for this EP and is reviewed annually, however 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 *Gorgon OE Assurance Plan* (Ref. 45). 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 3.5) also have a role in verifying environmental performance. The type and frequency of these inspections is documented in the *Gorgon and Jansz Subsea and Pipelines Inspection and Monitoring Plan (*IM Plan) (Ref. 159).

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 Gorgon and Jansz Feed Gas Pipeline and well operations activities described in this EP will be summarised in the annual report submitted to NOPSEMA (Section 7.4.3).

7.3.6.1 Managing Instances of Potential Nonconformance

The *Managing Instances of Potential Nonconformance* procedure (Ref. 46) applies 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 Section 6.

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 7.4.2.

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 7.3.2.2.

7.3.7 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. 47) 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 7.4.2.

7.3.8 Emergency management

7.3.8.1 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. 51) and is consistent with the core aspects presented in the International Maritime Organisation (IMO) equivalent courses.

The ERO comprises the groups listed in Table 7-5; this table also describes the major functions of teams during an emergency.

Figure 7-5 to Figure 7-7 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. 52).

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 7-5: 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.

7.3.8.2 Emergency management process

The *Emergency Management OE Process* (Ref. 48) 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. 48) 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. 53).

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.

7.3.8.3 Chain of command (emergency response)

A well-delineated EMT chain of command has been established for emergency response (Figure 7-5 to Figure 7-7). 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.

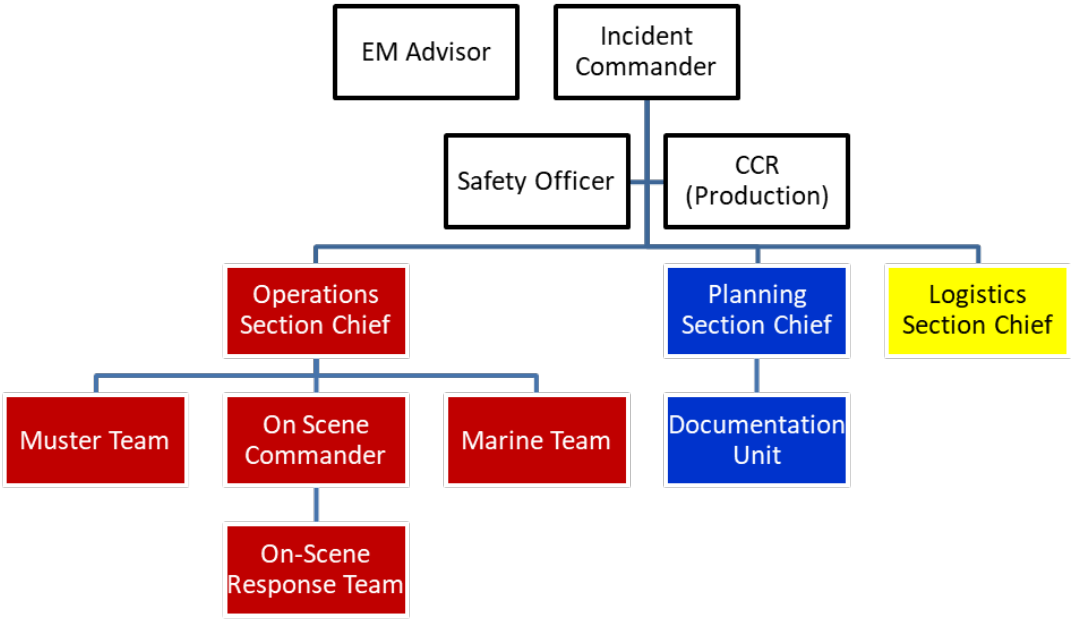


Figure 7-5: Basic installation EMT organisation chart

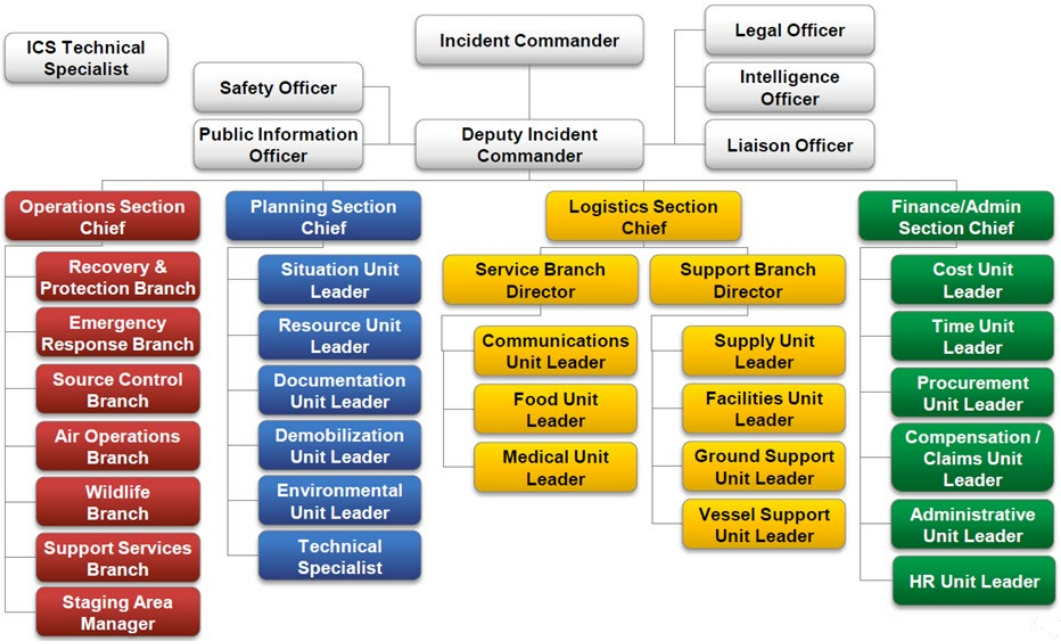


Figure 7-6: Expanded EMT organisation chart

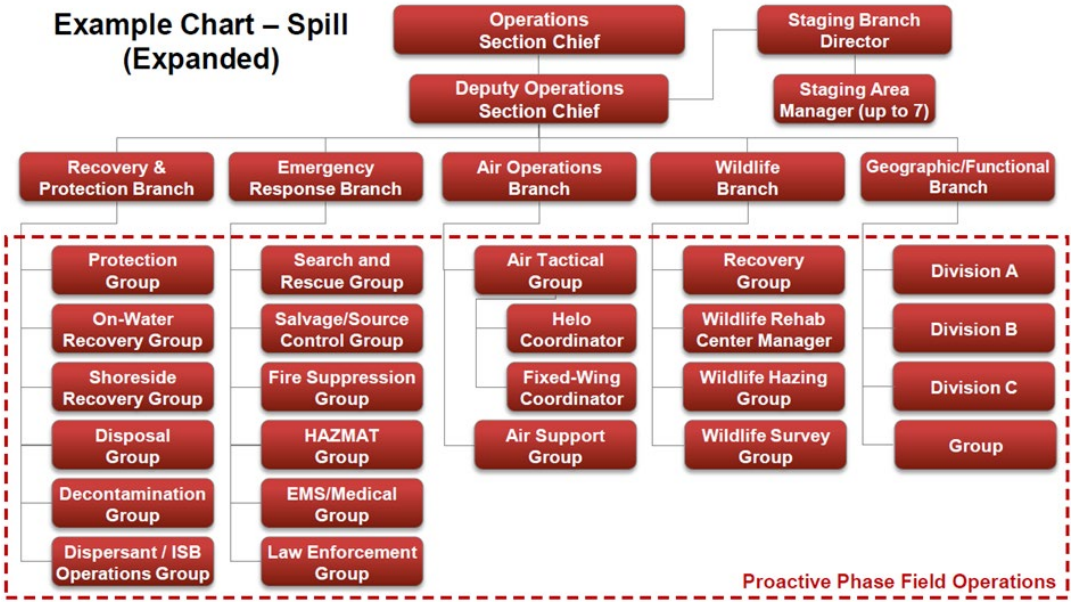


Figure 7-7: Example expanded operations section organisation chart

7.3.8.4 Roles and responsibilities (emergency response)

Table 7-6 provides additional information about the structure of these teams and the key individual roles and responsibilities during emergency response.

Table 7-6: Key roles and responsibilities—emergency response

Role	Responsibilities
On-Site Response Team	
On-Scene Commander (OC) *(Vessel Master)*	• Safely and effectively organises and manages the ORT response operations • 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

7.3.8.5 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 7-7. Competency and training records for personnel, including contractors and subcontractors, are maintained.

Table 7-7: 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)	

Role	Summary	Training Standard
	• 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.		
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

7.3.8.6 Oil spill exercise schedule

The CAPL *Oil Spill Response Multi-Year Exercise and Drill Schedule* (Ref. 54) 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. 54) outlines the proposed testing arrangements to be completed, including the exercise types (Table 7-8) and proposed level of response to be tested (Table 7-9) that may be used to meet the defined objectives. A minimum of one test for each level will be conducted each year.

Table 7-8: 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 7-9: Exercise levels

Level	Details
Level 1 – ORT	• At least two ORT exercises held per year • May be held in conjunction with a Level 2 EMT exercise • Designed to evaluate the ability of ORTs to implement the Gorgon 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 the Gorgon 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 the Gorgon 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

7.4 Environmental monitoring and reporting

7.4.1 Environmental monitoring

Regulation 14(7) of OPGGS(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 Section 6 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 6.12 and 6.13. 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.

7.4.2 Incident reporting

Environmental incidents will be reported by CAPL in accordance with Table 7-10.

Table 7-10: Incident reporting

Recordable Incident reporting – Regulation 26B	
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.	
Reporting requirements	**Report to / Timing**
Written notification to NOPSEMA by the 15th of each month	Submit written report to NOPSEMA by the 15th of each month

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.	

Reportable Incident reporting – Regulations 26, 26A, and 26AA

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 6.7)
- Vessel collision emergency condition (Section 6.12)
- Major defect emergency condition (Section 6.13).

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
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@dmp.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

7.4.3 Routine environmental reporting

Regulation 26C of the OPGGS(E)R requires environmental performance reporting for the activity described in this EP, as summarised in Table 7-11. Routine notifications required by Regulations 29 and 30 of the OPGGS(E)R and also included in Table 7-11.

Table 7-11: 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
Notification of start of activity	CAPL must complete Form FM1405 and submit to NOPSEMA at least 10 days before activity commencement	NOPSEMA submissions@nopsema.gov.au or: https://securefile.nopsema.gov.au/filedrop/submissions	Once prior to activity commencement

Reporting requirement	Description	Reporting to	Timing
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

7.5 Environment Plan review

As required under Regulation 19 of the OPGGS(E)R, CAPL will submit a proposed revision of this EP to NOPSEMA at least 14 days before the end of the five-year period since the EP was last accepted.

An additional review of the EP 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.

Additional revisions and/or resubmission of this EP to NOPSEMA, in accordance with Regulation 17 of the OPGGS(E), will be undertaken in accordance with the OEMS, and particularly the MoC process (Section 7.3.2.2).

8 acronyms and abbreviations

Table 8-1 defines the acronyms and abbreviations used in this document.

Table 8-1: Acronyms and abbreviations

Acronym or abbreviation	Definition
ABU	Australian Business Unit
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AIIMS	Australasian Inter-service Incident Management System
AIS	Automated identification system
ALARP	As low as reasonably practicable
AMSA	Australian Maritime Safety Authority
AMP	Australian Marine Park
API	American petroleum index
APPEA	Australian Petroleum Production and Exploration Association
ASOG	Activity-specific operational guideline
AUV	Autonomous underwater vehicle
bar	Metric unit of atmospheric pressure
BIAs	Biologically important areas
CAPL	Chevron Australia Pty Ltd
CDU	Central Distribution Unit
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CHARM	Chemical Hazard Assessment and Risk Management
CMMS	Computerised Maintenance Management System
CMT	Crisis Management Team
CRA	Corrosion-resistant alloy
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DC	Drill Centre
DoT	Western Australian Department of Transport
DP	Dynamic positioning
DPIRD	Western Australian Department of Primary Industries and Regional Development
EEA	Environmental exposure area
EHU	Electrohydraulic umbilical
EMBA	Environment that may be affected
EMT	Emergency Management Team
EOFL	End of facility life
EP	Environment Plan

Acronym or abbreviation	Definition
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPRS	Emergency pipeline repair system
ESD	Ecologically sustainable development
FE	Facilities Engineering
Feed Gas Pipeline	Pipeline system from the offshore gas wells to the Gas Treatment Plant
FIRM	Facilities Integrity and Reliability Management
FMT	Flow Management Tool
g/m2	Grams per square metre
GFP	Gorgon Foundation Project
GS2	Gorgon Stage 2
GTP	Gas Treatment Plant
HB	Handbook
HSE	Health, safety, and environment
HFO	Heavy fuel oil
HIRA	Hazard Identification and Risk Assessment
IAPP	International Air Pollution Prevention
IC	Incident Commander
IEE	International energy efficiency
IEMT	Installation Emergency Management Team
IIR	Incident investigation and reporting
IMO	International Maritime Organisation
IMR	Inspection, maintenance, and repair
IMC	Incident management system
IOPP	International Oil Pollution Prevention
ISO	International Organization for Standardisation
ITOPF	International Tanker Owners Pollution Federation Limited
JRCC	Joint Resource Coordination Centre
KEF	Key ecological feature
km	Kilometre
LC50	Lethal Concentration with the potential to result in a 50% mortality of a sample population
LOC	Loss of containment
LNG	Liquefied Natural Gas
m	Metre
MAOP	Maximum allowable operating pressure

Acronym or abbreviation	Definition
MARPOL	The 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 aArrivals Reporting System
MBES	Multibeam echo sounder
MDO	Marine Diesel Oil
MEG	Monoethylene glycol
MGO	Marine Gas Oil
MES	Monitoring, evaluation, and surveillance
MNES	Matters of national environmental significance
MoC	Management of change
MODU	Mobile offshore drilling unit
MSC	Management System Cycle
MSRE	Marine Safety Reliability and Efficiency
MSW	Managing Safe Work
N/A	Not Applicable
NEBA	Net Environmental Benefit Analysis
NEPM	National Environmental Protection Measure
NMFS	National Marine Fisheries Service
NO_2	Nitrogen dioxide
NO_x	Nitrous oxides
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NWS	North West Shelf (of Western Australia)
OA	Operational area
OC	On-Scene Commander
OCNS	Offshore Chemical Notification Scheme
OSC	Operations Section Chief
OE	Operational Excellence
OEMS	Operational Excellence Management System
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
OSMP	Operational and Scientific Monitoring Plan
OWR	Oiled wildlife response

Acronym or abbreviation	Definition
PA	Planning area
PAH	Polycyclic aromatic hydrocarbon
PCPT	Piezocone penetration test
PEMT	Perth Emergency Management Team
PFA	Pipeline flange adaptor
ppb	Parts per billion
ppm	Parts per million
PPP	Protection Prioritisation Process
PTS	Pipeline termination structure
PTS	Permanent threshold shift
PTW	Permit to Work
Q2	Quarter 2 (April to June)
ROV	Remotely operated vehicle
SEEMP	Ship Energy Efficiency Management Plan
SEL	Sound exposure level
SERIP	Surface Equipment Reliability and Integrity Process
SHC	Shoreline Clean-up
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous operations
SME	Subject matter expert
SOPEP	Ship Oil Pollution Emergency Plan
SO_2	Sulfur oxides
SPD	Shoreline protection and deflection
SPL	Sound pressure level
SSS	Side scan sonar
TEC	Threatened ecological community
TRG	Tactical response guide
TTS	Temporary threshold shift
UK	United Kingdom
WA	Western Australia
WAFIC	Western Australian Fisheries Industry Council
WOMP	Well operations management plan

9 references

The following documentation is either directly referenced in this document or is a recommended source of background information.

Table 9-1: References

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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.

Mark Hatfield
Managing Director, Australasia Business Unit

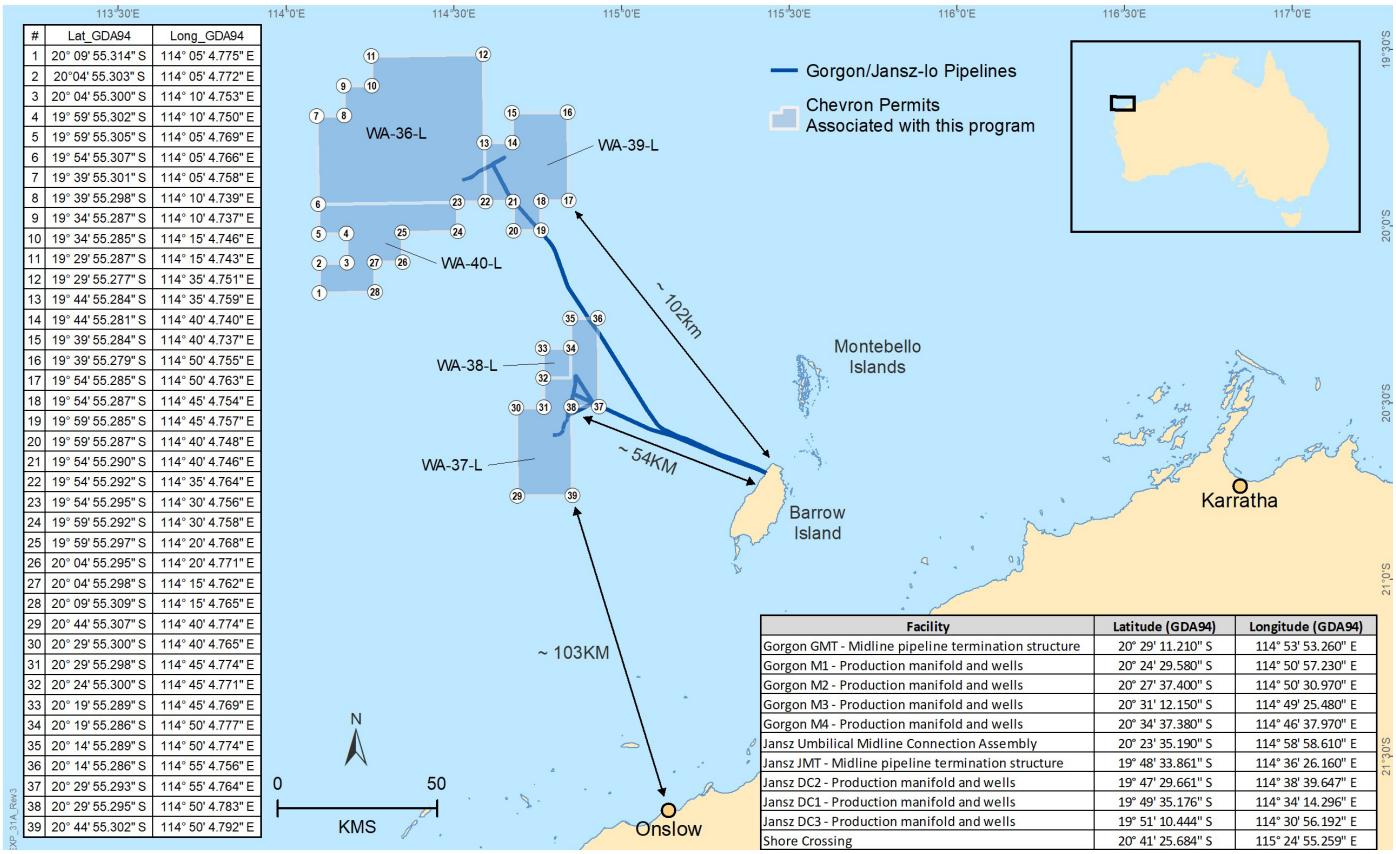
the human energy company™

appendix b stakeholder engagement—fact sheets

gorgon and jansz feed gas pipeline and well operations

environment plan commercial fishing consultation

March 2021



#	Lat_GDA94	Long_GDA94
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15	19° 39' 55.284" S	114° 40' 4.737" E
16	19° 39' 55.279" S	114° 50' 4.755" E
17	19° 54' 55.285" S	114° 50' 4.763" E
18	19° 54' 55.287" S	114° 45' 4.754" E
19	19° 59' 55.285" S	114° 45' 4.757" E
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21	19° 54' 55.290" S	114° 40' 4.746" E
22	19° 54' 55.292" S	114° 35' 4.764" E
23	19° 54' 55.295" S	114° 30' 4.756" E
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Jansz DC2 - Production manifold and wells	19° 47' 29.661" S	114° 38' 39.647" E
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Jansz DC3 - Production manifold and wells	19° 51' 10.444" S	114° 30' 56.192" E
Shore Crossing	20° 41' 25.684" S	115° 24' 55.259" E

overview

The Chevron Australia-operated Gorgon Project includes offshore production wells and subsea infrastructure associated with the Gorgon and Jansz–Io gas fields.

The Gorgon gas field is located within production licences WA-37-L and WA-38-L, and the Jansz-Io gas field is located within production licences WA-36-L, WA-39-L and WA-40-L.

Initial field development comprised of wells and subsea infrastructure, including feed gas pipelines, associated with the Gorgon Foundation Project.

This development is now being supplemented by the Gorgon Stage 2 Project, which comprises additional wells and subsea infrastructure within the Gorgon and Jansz-Io gas fields. The Gorgon Stage 2 Project was always envisaged as part of the original field development plans for the Gorgon Project.

Gas and fluids (hydrocarbons) from the offshore wells are transported by subsea gathering systems (flowlines and the feed gas pipelines) to the Gorgon Gas Treatment Plant on Barrow Island, where it is processed.

location and water depths

The subsea gathering system delivers hydrocarbons from the wells through the flowlines. Ocean depths in the hydrocarbon gathering area range from approximately 200 to 1300 metres.

The locations and depths of the manifolds and associated wells are provided below:

Infrastructure	Latitude South	Longitude East	Depth (m)
Gorgon GMT – Midline pipeline termination structure	20° 29' 11.21"	114° 53' 53.26"	130
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Jansz Umbilical Midline Connection Assembly	20° 23' 35.19"	114° 58' 58.61"	107
Jansz Drill Centre 1 and wells	19° 49' 35.18”	114° 34' 14.30"	1338
Jansz Drill Centre 2 and wells	19° 47' 29.66"	114° 38' 39.65"	1349
Jansz Drill Centre 3 and wells	19° 51' 10.44"	114° 30' 56.19"	1315

The Gorgon feed gas pipeline runs for approximately 65 kilometres between the Gorgon gas field to the shore crossing at North Whites Beach on Barrow Island. The Jansz feed gas pipeline runs for approximately 134 kilometres between the Jansz–Io gas field to the same shore crossing at North Whites Beach on Barrow Island.

The feed gas pipelines are located predominately in Commonwealth waters. Water depth varies from approximately 50 metres (near the State waters maritime boundary) to 200 metres (within the Gorgon gas field) and 1300 metres (within the Jansz-Io gas field).

There are no exclusion zones over the subsea gas pipelines, Chevron Australia asks commercial fishers to exercise due caution when fishing over these areas.

exclusion zones

The Gorgon GMT – Midline pipeline termination structure, Gorgon M1 – Production manifold and wells, Gorgon M2 – Production manifold and wells and Gorgon M3 – Production manifold and wells and Jansz Umbilical Midline Connection Assembly are subject to pre-existing site specific 500 metre radius petroleum safety exclusion zone (PSZ).

A new site specific 500 metre radius PSZ will be sought for the Gorgon M4 – Production manifold and wells.

environment plan approvals

installation approvals

Primary environment approval for installation of infrastructure for the Gorgon Project was received in 2009.

In 2019, NOPSEMA approved the installation of Gorgon Stage 2 infrastructure, and construction commenced in 2020.

operations approvals

In August 2016, the original *Gorgon and Jansz Feed Gas Pipeline and Wells Operations (Commonwealth Waters) Environment Plan* was approved by NOPSEMA.

In accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009, an Environment Plan is subject to a five-yearly review and resubmission to NOPSEMA.

Consequently, the *Gorgon and Jansz Feed Gas Pipeline and Wells Operations (Commonwealth Waters) 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.

In addition, start-up and operation of the wells and subsea infrastructure from the Gorgon Stage 2 Project have been included in the revised Environment Plan.

The Environment Plan describes the environment in which the petroleum activity takes place, provides an assessment of the impacts and risks arising from the activity, and identifies the 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 the activities associated with this 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 marine environment and the commercial fishing sector, along with a list of the control measures currently being implemented are summarised in Table 1. No additional aspects have been identified in the revised Environment Plan as a result of the five-yearly review or the inclusion of the Gorgon Stage 2 Project.

Further details will be provided in the Environment Plan and will incorporate feedback received from commercial fishers during this consultation process.

Table 1: 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.
Planned Discharges	• 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
Air Emissions	• Vessels will hold a valid International Air Pollution Prevention certificate and a current international energy efficiency certificate.

Aspect	Proposed Control
	• 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
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
Vessel Spills	• Chevron Australia's Marine, Safety Reliability and Efficiency process implemented • Operational and scientific monitoring undertaken in accordance with the Operational and Scientific Monitoring Plan in the event of a spill • Spill response implemented in accordance with the response arrangements and strategies detailed in the Oil Pollution Emergency Plan
Infrastructure Spills	• 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 • 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	• Garbage managed in accordance with MARPOL 73/78, Annex V.

providing feedback

Feedback from the commercial fishing sector on potential or perceived impacts associated with Chevron Australia's activities will be carefully considered and assessed.

Please note that stakeholder feedback and Chevron Australia's response will be included in the Environment Plan.

If feedback is identified as sensitive by a stakeholder, Chevron Australia will make this known to NOPSEMA for the information to remain confidential.

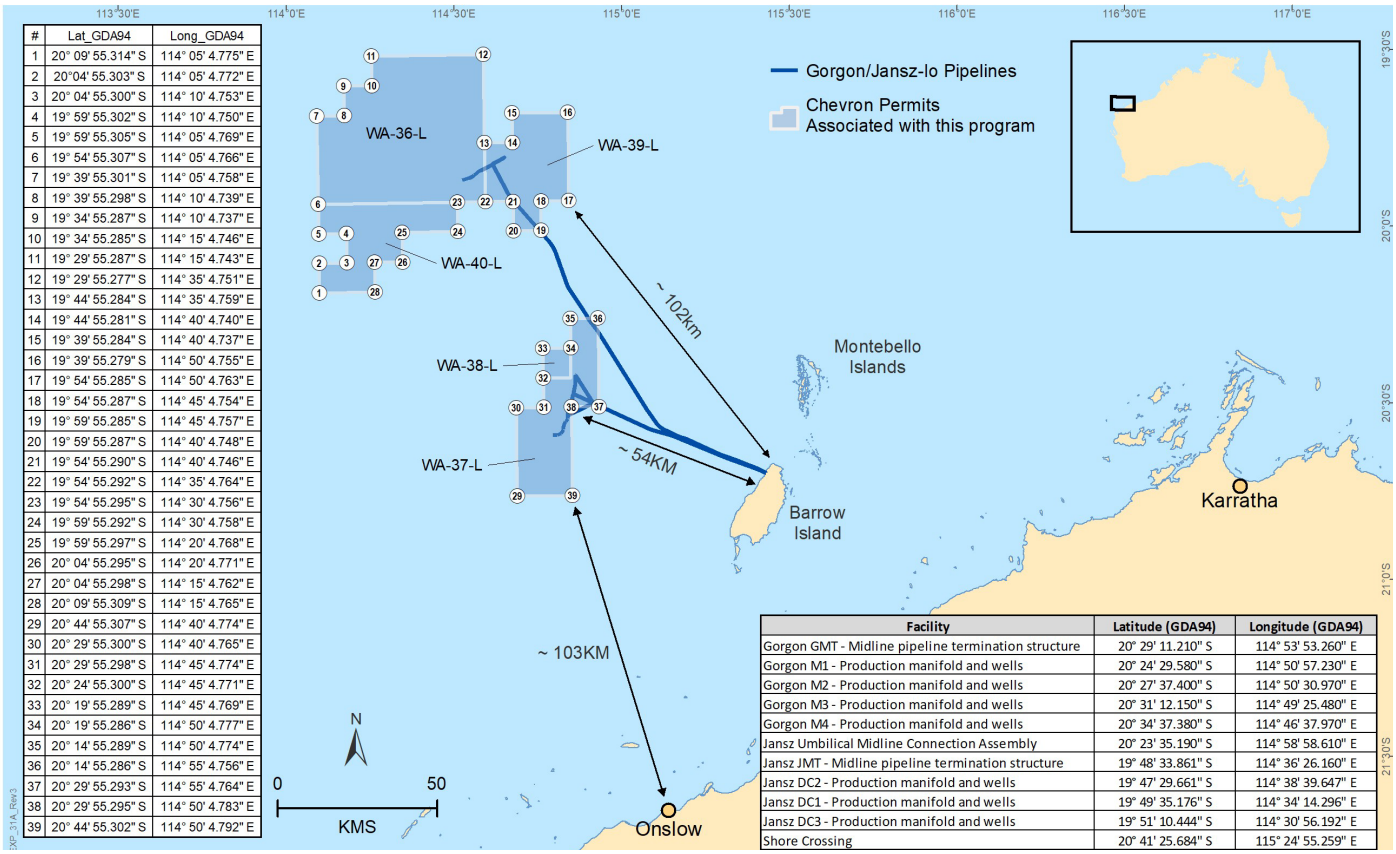
Feedback can be directed to:

Micha Stoker
Partnerships Advisor
abuenvplaninfo@chevron.com
(08) 9216 4000

gorgon and jansz feed gas pipeline and well operations

environment plan consultation

March 2021



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appendix c subsea inventory summary

The following table provides the status of subsea infrastructure associated with the Gorgon Gas Development (current as of July 2021).

Item	Status	IM Plan	EP reference
Wells			
Gorgon field			
GOR-1A	Currently utilised	In place	Section 3.2.2
GOR-1B	Currently utilised	In place	Section 3.2.2
GOR-1C	Currently utilised	In place	Section 3.2.2
GOR-1D	Currently utilised	In place	Section 3.2.2
GOR-1E	Currently utilised	In place	Section 3.2.2
GOR-1F	Currently utilised	In place	Section 3.2.2
GOR-1G	Currently utilised	In place	Section 3.2.2
GOR-2B	Currently utilised	In place	Section 3.2.2
GOR-2C	Currently utilised	In place	Section 3.2.2
GOR-3B	Currently utilised	In place	Section 3.2.2
GOR-3C	Currently utilised	In place	Section 3.2.2
GOR-4C	Currently utilised	In place	Section 3.2.2
GOR-4D	Currently utilised	In place	Section 3.2.2
GOR-4E	Currently utilised	In place	Section 3.2.2
GOR-4F	Currently utilised	In place	Section 3.2.2
Jansz–Io field			
JZI-1B	Currently utilised	In place	Section 3.2.2
JZI-1C	Currently utilised	In place	Section 3.2.2
JZI-1D	Currently utilised	In place	Section 3.2.2
JZI-1E	Currently utilised	In place	Section 3.2.2
JZI-1F	Currently utilised	In place	Section 3.2.2
JZI-2B	Currently utilised	In place	Section 3.2.2
JZI-2C	Currently utilised	In place	Section 3.2.2
JZI-2D	Currently utilised	In place	Section 3.2.2
JZI-2E	Currently utilised	In place	Section 3.2.2
JZI-2F	Currently utilised	In place	Section 3.2.2
JZI-3C	Currently utilised	In place	Section 3.2.2
JZI-3D	Currently utilised	In place	Section 3.2.2
JZI-3E	Currently utilised	In place	Section 3.2.2
JZI-3F	Currently utilised	In place	Section 3.2.2

Item	Status	IM Plan	EP reference
Manifolds			
Gorgon field			
Gorgon M1 manifold	Currently utilised	In place	Section 3.2.3
Gorgon M2 manifold	Currently utilised	In place	Section 3.2.3
Gorgon M3 manifold	Currently utilised	In place	Section 3.2.3
Gorgon M4 manifold	Currently utilised	In place	Section 3.2.3
Jansz–Io field			
Jansz DC-1 manifold	Currently utilised	In place	Section 3.2.3
Jansz DC-2 manifold	Currently utilised	In place	Section 3.2.3
Jansz DC-3 combined manifold/PTS module	Currently utilised	In place	Section 3.2.3
Pipeline termination sructures			
Gorgon field			
Gorgon Midline PTS	Currently utilised	In place	Section 3.2.4
Gorgon M4 PTS	Currently utilised	In place	Section 3.2.4
Jansz–Io field			
Jansz-Io Midline PTS	Currently utilised	In place	Section 3.2.4
Jansz DC-3 combined manifold/PTS module	Currently utilised	In place	Section 3.2.4
Production pipelines and support infrastructure			
Gorgon field			
Production pipeline (1)	Currently utilised	In place	Section 3.2.7
8” MEG pipeline (1)	Currently utilised	In place	Section 3.2.5
6” utility pipeline (1)	Currently utilised	In place	Section 3.2.5
Jansz–Io field			
Production pipeline (1)	Currently utilised	In place	Section 3.2.7
8” MEG pipeline (1)	Currently utilised	In place	Section 3.2.5
6” utility pipeline (1)	Currently utilised	In place	Section 3.2.5
Infield flowlines			
Gorgon field			
26” CRA infield production flowlines (3)	Currently utilised	In place	Section 3.2.5
24” M4 CRA infield production flowline	Currently utilised	In place	Section 3.2.5
8” MEG pipelines (4)	Currently utilised	In place	Section 3.2.5
6” utility pipelines (4)	Currently utilised	In place	Section 3.2.5
Jansz–Io field			
24” CRA infield production flowlines (2)	Currently utilised	In place	Section 3.2.5
18” DC-3 CRA infield production flowline (2)	Currently utilised	In place	Section 3.2.5
6” MEG pipelines (3)	Currently utilised	In place	Section 3.2.5
6” utility pipelines (3)	Currently utilised	In place	Section 3.2.5

appendix d description of the environment (CAPL planning area)

appendix e protected matters search reports

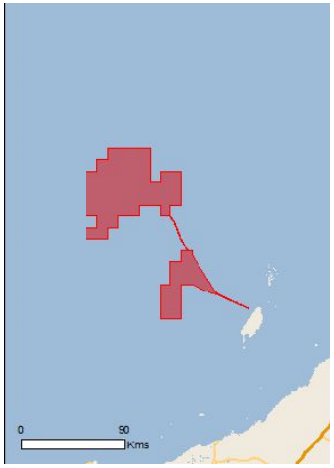
EPBC Act Protected Matters Report

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.

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: 29/06/21 14:31:20



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:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	21
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at 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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	66
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	3

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 the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

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

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
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
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Mammals		
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
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Reptiles		
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	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation 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	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation 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	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 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

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat 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

Name	Threatened	Type of Presence
		area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to 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	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Congregation or aggregation 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
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 likely to occur within area

Name	Threatened	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known 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
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 chinensis Indo-Pacific Humpback Dolphin [50]		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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may 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
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
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
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to 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

Name	Threatened	Type of Presence
		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
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		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
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

Name	Threatened	Type of Presence
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 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
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
Mammals		
Dugong dugon Dugong [28]		Species or species habitat 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 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

Name	Threatened	Type of Presence
area		
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to 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
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	Congregation or aggregation known to 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 ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		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]

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	Species or species habitat likely to occur within area

Name	Status	Type of Presence
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
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 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
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	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
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		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

Name	Status	Type of Presence
		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 likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Montebello	Multiple Use Zone (IUCN VI)

Extra Information

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
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-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

-19.66536 114.084652,-19.665359 114.167985,-19.582025 114.167985,-19.582025 114.251318,-19.498691 114.251317,-19.498688 114.58465,-19.74869 114.584652,-19.748689 114.667986,-19.665355 114.667985,-19.665354 114.834651,-19.915356 114.834654,-19.915356 114.75132,-19.99869 114.751321,-19.99869 114.748165,-20.035091 114.78027,-20.044486 114.786515,-20.054413 114.791779,-20.064736 114.795989,-20.14358 114.823588,-20.150577 114.826384,-20.157293 114.829786,-20.163747 114.833784,-20.221656 114.87326,-20.238205 114.884551,-20.239926 114.885651,-20.241882 114.886716,-20.24354 114.887577,-20.248691 114.890028,-20.248691 114.917981,-20.28578 114.917981,-20.544169 115.08989,-20.548525 115.093077,-20.552581 115.096628,-20.556337 115.100526,-20.559762 115.104758,-20.562836 115.109279,-20.565556 115.114101,-20.614358 115.210543,-20.642192 115.293468,-20.643311 115.296387,-20.659554 115.336146,-20.660489 115.338298,-20.665404 115.348338,-20.66943 115.356542,-20.670502 115.359256,-20.671638 115.364188,-20.675158 115.363322,-20.675013 115.362656,-20.676159 115.362374,-20.675108 115.357916,-20.673765 115.354562,-20.668923 115.344929,-20.666832 115.340769,-20.665845 115.338403,-20.656266 115.310262,-20.654929 115.307263,-20.653421 115.304394,-20.650997 115.300132,-20.648856 115.296033,-20.647006 115.291823,-20.645435 115.287449,-20.623268 115.218546,-20.621323 115.213455,-20.620162 115.21101,-20.579541 115.130866,-20.577762 115.126123,-20.576337 115.121239,-20.57527 115.116214,-20.568492 115.078604,-20.566871 115.073177,-20.547721 115.028401,-20.498231 114.917976,-20.498694 114.917976,-20.49958 114.839087,-20.507028 114.834645,-20.748696 114.834639,-20.748698 114.667978,-20.498695 114.667984,-20.498695 114.751315,-20.332026 114.751318,-20.332026 114.834649,-20.248692 114.834651,-20.248691 114.885778,-20.24334 114.883246,-20.241711 114.882323,-20.240117 114.881303,-20.165637 114.830523,-20.158988 114.826406,-20.151998 114.822865,-20.144785 114.819982,-20.065952 114.792389,-20.055876 114.788281,-20.046261 114.783184,-20.037158 114.777133,-19.99869 114.743144,-19.998691 114.667988,-19.915395 114.667987,-19.915358 114.501321,-19.998692 114.501322,-19.998694 114.334655,-20.082028 114.334656,-20.082028 114.251323,-20.165362 114.251323,-20.165364 114.084657,-20.08203 114.084656,-20.082029 114.167989,-19.998695 114.167989,-19.998696 114.084655,-19.66536 114.084652

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.

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 16:00:34

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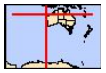
Coordinates
Buffer: 0.0Km



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:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	45
Listed Migratory Species:	58

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:	3
Commonwealth Heritage Places:	2
Listed Marine Species:	104
Whales and Other Cetaceans:	31
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	7

Extra Information

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

State and Territory Reserves:	25
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	5

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	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 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-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
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
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
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
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 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
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
Mammals		
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 likely 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

Name	Status	Type of Presence
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
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	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
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Mororong, 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
Reptiles		
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
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	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	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

Name	Status	Type of Presence
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]		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
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
Sterna dougallii Roseate Tern [817]		Breeding known to 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
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species

Name	Threatened	Type of Presence
		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	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
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
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
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
Orcinus orca Killer Whale, Orca [46]		Species or species

Name	Threatened	Type of Presence
		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 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 chinensis Indo-Pacific Humpback Dolphin [50]		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
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 may 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
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
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 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 VLF TRANSMITTER STATION
Defence - LEARMONTH - RAAF BASE

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]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
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
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 may occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat 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
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
Larus novaehollandiae		
Silver Gull [810]		Breeding known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		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
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
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely 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
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
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to 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 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		Species or species

Name	Threatened	Type of Presence
Pipefish [66194]		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
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

Name	Threatened	Type of Presence
		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
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
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
Mammals		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		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
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
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
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		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 mcdowelli null [25926]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		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]

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	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 simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area

Name	Status	Type of Presence
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	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 chinensis Indo-Pacific Humpback Dolphin [50]		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]

Name	Label
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Airlie Island	WA
Barrow Island	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Bundegi Coastal Park	WA
Burnside And Simpson Island	WA
Cape Range	WA
Giralia	WA
Gnandaroo Island	WA
Jurabi Coastal Park	WA
Locker Island	WA
Lowendal Islands	WA
Montebello Islands	WA
Muiron Islands	WA
Round Island	WA
Serrurier Island	WA
Tent Island	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA41080	WA
Unnamed WA44665	WA
Victor Island	WA
Whalebone Island	WA
Whitmore,Roberts,Doole Islands And Sandalwood Landing	WA
Y Island	WA

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		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
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
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 rattus Black Rat, Ship Rat [84]		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		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		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
Prosopis spp. Mesquite, Algaroba [68407]		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 may occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Cape Range Subterranean Waterways	WA
Exmouth Gulf East	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
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-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

-18.7354 108.6727,-17.8634 109.4095,-17.6816 109.6473,-16.4459 110.7245,-15.5832 111.2374,-15.3034 111.3633,-14.8651 111.6851,-14.6319 111.9835,-14.4827 112.3425,-14.3988 112.7436,-14.4035 113.1353,-16.3013 115.2429,-18.4836 116.4973,-20.1541 116.1942,-21.3339 115.2593,-21.8453 114.6496,-21.9138 114.6467,-21.9444 114.6172,-21.9791 114.6149,-22.0018 114.5706,-22.0155 114.5758,-22.0272 114.5543,-22.0625 114.547,-22.0648 114.5327,-22.1216 114.5222,-22.1286 114.5006,-22.1697 114.505,-22.1551 114.4814,-22.1598 114.4563,-22.2119 114.4943,-22.2091 114.4526,-22.2339 114.4515,-22.2414 114.4593,-22.2381 114.451,-22.2465 114.4596,-22.2426 114.443,-22.2716 114.458,-22.274 114.4295,-22.293 114.4558,-22.3004 114.4238,-22.3313 114.408,-22.3466 114.4247,-22.3429 114.4433,-22.3517 114.4308,-22.3571 114.4397,-22.355 114.4283,-22.3644 114.4022,-22.3836 114.3965,-22.3934 114.4153,-22.3903 114.3933,-22.4267 114.3973,-22.4326 114.3847,-22.4393 114.3942,-22.4422 114.3799,-22.4594 114.3914,-22.5007 114.355,-22.479 114.3247,-22.4868 114.3194,-22.4347 114.3087,-22.457 114.2253,-22.4967 114.2186,-22.5238 114.1806,-22.5246 114.1551,-22.4738 114.1217,-22.413 114.1223,-22.41 114.1401,-22.3974 114.1463,-22.3976 114.1312,-22.3563 114.1772,-22.3058 114.1778,-22.3015 114.1501,-22.3295 114.115,-22.2619 114.1329,-22.192 114.0847,-22.155 114.0802,-21.9582 114.1383,-21.865 114.15,-21.8125 114.1908,-21.7857 114.164,-21.802 114.1366,-21.8067 114.1214,-21.8032 114.1092,-21.8183 114.0748,-21.872 113.9978,-21.9728 113.9326,-22.1485 113.8731,-22.2261 113.8475,-22.3126 113.8177,-22.4079 113.7495,-22.4717 113.7382,-22.4962 113.7245,-22.4965 113.7087,-22.5169 113.7134,-22.5499 113.665,-22.5775 113.6542,-22.5942 113.6723,-22.628 113.6673,-22.6644 113.6857,-22.7171 113.67,-22.7151 113.7099,-22.7542 113.7557,-22.8393 113.7851,-23.8086 113.0081,-24.4588 112.253,-22.3878 109.9503,-20.6845 107.6935,-19.6307 108.1785,-18.7354 108.6727

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.

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 16:15:19

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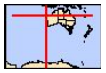
Coordinates
Buffer: 0.0Km



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:	1
National Heritage Places:	2
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	51
Listed Migratory Species:	65

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:	4
Commonwealth Heritage Places:	3
Listed Marine Species:	122
Whales and Other Cetaceans:	36
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	12

Extra Information

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

State and Territory Reserves:	27
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	9

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The Ningaloo Coast	WA	Listed place
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	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 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-west
South-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may 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
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
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
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	Foraging, feeding or related behaviour 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
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
Mammals		

Name	Status	Type of Presence
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 likely 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
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	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
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Mororong, 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
Reptiles		
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

Name	Status	Type of Presence
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
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	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	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

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		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
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

Name	Threatened	Type of Presence
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 likely 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
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour 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
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	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	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

Name	Threatened	Type of Presence
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
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
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
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 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

Name	Threatened	Type of Presence
		to occur within area
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		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 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 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
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 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 VLF TRANSMITTER STATION
Defence - LEARMONTH - RAAF BASE

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
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	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
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
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Catharacta skua		
Great Skua [59472]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species

Name	Threatened	Type of Presence
		habitat may 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 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
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within 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
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		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
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
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 likely to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Congregation or aggregation 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
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour 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

Name	Threatened	Type of Presence
		area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
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 [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

Name	Threatened	Type of Presence
		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
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
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
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
Mammals		
Dugong dugon		
Dugong [28]		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
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
Aipysurus pooleorum		
Shark Bay Seasnake [66061]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
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
Hydrelaps darwiniensis		
Black-ringed Seasnake [1100]		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 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
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

Name	Status	Type of Presence
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
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
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

Name	Status	Type of Presence
		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
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 chinensis Indo-Pacific Humpback Dolphin [50]		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]

Name	Label
Abrolhos	Habitat Protection Zone (IUCN IV)

Name	Label
Abrolhos	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Shark Bay	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Airlie Island	WA
Barrow Island	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Bundegi Coastal Park	WA
Burnside And Simpson Island	WA
Cape Range	WA
Giralia	WA
Gnandaroo Island	WA
Jurabi Coastal Park	WA
Locker Island	WA
Lowendal Islands	WA
Montebello Islands	WA
Muiron Islands	WA
North Sandy Island	WA
Round Island	WA
Serrurier Island	WA
Tent Island	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA41080	WA
Unnamed WA44665	WA
Unnamed WA44667	WA
Victor Island	WA
Whalebone Island	WA
Whitmore,Roberts,Doole Islands And Sandalwood Landing	WA
Y Island	WA

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		
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
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
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 rattus		
Black Rat, Ship Rat [84]		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		
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		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
Prosopis spp.		
Mesquite, Algaroba [68407]		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 may occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Cape Range Subterranean Waterways	WA
Exmouth Gulf East	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
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west

Name	Region
Glomar Shoals	North-west
Mermaid Reef and Commonwealth waters	North-west
Wallaby Saddle	North-west
Western demersal slope and associated fish	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

-20.8682 107.6137,-18.8057 108.6309,-17.303 109.9392,-16.4445 110.7028,-14.8766 111.5988,-14.3913 112.4294,-14.3913 113.148,-14.0179 114.0533,-13.2993 114.7159,-13.4206 115.1079,-14.2233 115.5652,-14.7599 115.4812,-15.4319 116.1858,-14.9419 116.6991,-17.4104 119.3263,-19.8183 117.4691,-20.3409 116.6478,-20.5194 116.3672,-20.709 116.0913,-21.1348 115.6387,-21.4235 115.2934,-21.6813 114.9364,-21.6892 114.9157,-21.7922 114.7748,-21.798 114.7223,-21.8435 114.6491,-21.9149 114.6453,-21.945 114.6165,-21.9794 114.6147,-22.0019 114.5698,-22.0159 114.5759,-22.0263 114.5532,-22.0625 114.5473,-22.0666 114.5159,-22.0841 114.5293,-22.1223 114.5223,-22.1287 114.501,-22.1695 114.5054,-22.1556 114.482,-22.1596 114.4552,-22.2113 114.494,-22.2089 114.4531,-22.2334 114.4517,-22.241 114.4587,-22.2375 114.452,-22.2471 114.459,-22.2419 114.4429,-22.2713 114.4575,-22.2737 114.4298,-22.2923 114.4552,-22.2996 114.4237,-22.332 114.4074,-22.3466 114.4246,-22.3428 114.4426,-22.3504 114.4316,-22.3568 114.4386,-22.3539 114.4243,-22.3626 114.403,-22.3836 114.3963,-22.3932 114.4149,-22.39 114.3934,-22.4262 114.3969,-22.4323 114.3852,-22.4385 114.3937,-22.442 114.3802,-22.4594 114.3913,-22.5003 114.3552,-22.4799 114.3248,-22.4857 114.3196,-22.435 114.3091,-22.4562 114.226,-22.4974 114.2184,-22.5236 114.1819,-22.5248 114.1542,-22.4734 114.121,-22.4142 114.1224,-22.4105 114.1399,-22.3973 114.146,-22.3979 114.1315,-22.3571 114.177,-22.3052 114.1787,-22.3011 114.1501,-22.3282 114.1151,-22.262 114.132,-22.1914 114.0845,-22.1561 114.0804,-21.9628 114.1376,-21.8655 114.1485,-21.8126 114.191,-21.7837 114.1647,-21.8158 114.0787,-21.8738 113.995,-21.9765 113.9317,-22.1499 113.8735,-22.3154 113.8171,-22.407 113.7509,-22.4708 113.7386,-22.4959 113.7231,-22.4962 113.7071,-22.5172 113.7124,-22.551 113.6642,-22.5796 113.6537,-22.5948 113.673,-22.628 113.668,-22.6633 113.6855,-22.717 113.6707,-22.7155 113.7103,-22.7563 113.7561,-22.9541 113.8273,-23.034 113.8302,-23.0833 113.813,-23.1206 113.7611,-23.1568 113.7678,-24.107 113.26,-24.1216 113.2559,-24.2096 113.2142,-24.3208 113.1559,-24.4969 113.0891,-24.5004 113.085,-25.0216 112.9062,-25.5734 112.7231,-25.6901 112.7067,-26.5148 112.7919,-26.8742 112.4618,-28.8889 109.8451,-28.6112 109.7961,-28.3009 109.7891,-28.0629 109.8101,-27.6359 109.2035,-27.0573 108.5035,-26.4693 107.5352,-25.6387 106.4596,-24.8688 105.9533,-24.0615 105.7573,-23.5668 105.8623,-22.9602 106.189,-22.7316 106.4969,-22.5388 106.8017,-21.7548 107.3897,-20.8682 107.6137

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-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
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-Reef Life Survey Australia
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-Other groups and individuals

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

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