Gorgon Gas Development

Pipeline and Subsea Infrastructure Installation and Pre-commissioning Environment Plan

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1 Environment Plan Summary

This summary table was prepared from material provided in this Environment Plan (EP), and, as required by Regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R), comprises:

Regulation (11)(4)(a)	EP Summary Material Requirements	Relevant Section of EP Containing EP Summary Material
(i)	the location of the activity	Section 3
(ii)	describes the receiving environment	Section 4
(iii)	describes the activity	Section 3
(iv)	details the environmental impacts and risks	Section 6
(v)	summarises the control measures for the activity	Section 6
(vi)	summarises the arrangements for ongoing monitoring of the titleholder's environmental performance	Section 7
(vii)	summarises the response arrangements in the oil pollution emergency plan	Appendix D
(viii)	details the consultation already undertaken, and plans for ongoing consultation	Section 2.6
(ix)	details the titleholder's nominated liaison person for the activity	Section 2.4

2 Introduction

2.1 Overview

On behalf of the Gorgon Joint Venturers, Chevron Australia Pty Ltd (CAPL) has developed the Gorgon Foundation Project (GFP). The GFP included the construction of a Liquified Natural Gas Plant (LNG Plant) and domestic gas plant on Barrow Island. The Gorgon Gas Development was approved under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the construction and operation of facilities associated with the production and transport of gas (including offshore production wells and feed gas pipeline infrastructure) from the Gorgon and Jansz–Io gas fields to the Gorgon LNG Plant. The Gorgon Gas Development Area is defined under the Western Australian (WA) *Barrow Island Act 2003*.

To maintain gas supply for the three-train Gorgon LNG Plant, CAPL plans to expand the subsea gathering network within the existing Gorgon and Jansz–Io fields. This involves a drilling campaign, installing additional subsea manifolds to accommodate the new wells, and infield flowlines to tie into the existing subsea infrastructure.

This Environment Plan (EP) documents how the potential environmental impacts and risks associated with the installation and pre-commissioning of subsea infrastructure (as defined in the scope [Section 2.3]) in Commonwealth Waters were assessed and how those impacts and risks will be managed.

This EP was prepared in accordance with the requirements of the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and the 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 WA, and ~65 km north-west of Barrow Island (Figure 2-1).

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

Section 3.3 details the location and layout of the subsea hydrocarbon infrastructure.

2.3 Scope

2.3.1 In Scope

This EP addresses the installation of subsea infrastructure associated with the Gorgon Stage 2 (GS2) Project in Commonwealth Waters, except for production well construction, tubing head spools, and Christmas tree installation (see Section 2.3.2). Installation of subsea infrastructure includes these primary activities, which are described further in Section 3:

- installation of infield flowlines, pipelines, and umbilicals
- installation of subsea structures, jumpers, and tie-in spools

- installation of flying leads
- leak testing and pre-commissioning
- field suspension
- inspection, maintenance, and repair (IMR) (before start-up and operations commence)
- support operations.

2.3.2 Out of Scope

Activities excluded from the scope of this EP are:

- drilling and completion activities (including constructing production wells, and installing tubing head spools and Christmas trees, which are covered under the NOPSEMA-accepted Gorgon and Jansz–Io Drilling, Completions, and Well Maintenance Program (Ref. 1)
- commissioning and operating the pipelines and wells, which are covered under the NOPSEMA-accepted Gorgon and Jansz Feed Gas Pipeline and Wells Operations Environment Plan (Ref. 2)
- vessels transiting to or from the operational area (OA). These vessels are deemed to be operating under the Commonwealth *Navigation Act 2012* and not performing a petroleum activity.

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.

Table 2-2 details the titleholder's nominated liaison person, in accordance with Regulation 15(2) of the OPGGS(E)R.

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.

In the unlikely event that the titleholder changes, an evaluation will be conducted (in accordance with Section 7.1.2). If it is found that the change in titleholder has modified how the environmental impacts and risks of an activity are managed, the new titleholder will submit a proposed revision of this EP for the activity as soon as practicable.

Table 2-1: Titleholder Details

Production Licence	Pipeline Licence	Titleholders	Nominated TItleholder	Address
WA-36-L WA-39-L WA-40-L	WA-19-L	Chevron Australia Pty Ltd	Chevron Australia Pty Ltd	QV1, 250 St Georges Tce, Perth, WA, 6000
		Chevron (TAPL) Pty Ltd		
		Shell Development (Australia) Pty Ltd		
		Mobil Australia Resources Company Pty Ltd		
		Tokyo Gas Gorgon Pty Ltd		
		Osaka Gas Gorgon Pty Ltd		
		JERA Gorgon Pty Ltd		

Production Licence	Pipeline Licence	Titleholders	Nominated TItleholder	Address
		Chubu Electric Power Gorgon Pty Ltd		
WA-37-L WA-38-L	WA-20-PL	Chevron Australia Pty Ltd	Chevron Australia Pty Ltd	QV1, 250 St Georges Tce, Perth, WA, 6000
		Chevron (TAPL) Pty Ltd		
		Shell Development (Australia) Pty Ltd		
		Mobil Australia Resources Company Pty Ltd		
		Tokyo Gas Gorgon Pty Ltd		
		Osaka Gas Gorgon Pty Ltd		
		JERA Gorgon Pty Ltd		
		Chubu Electric Power Gorgon Pty Ltd		

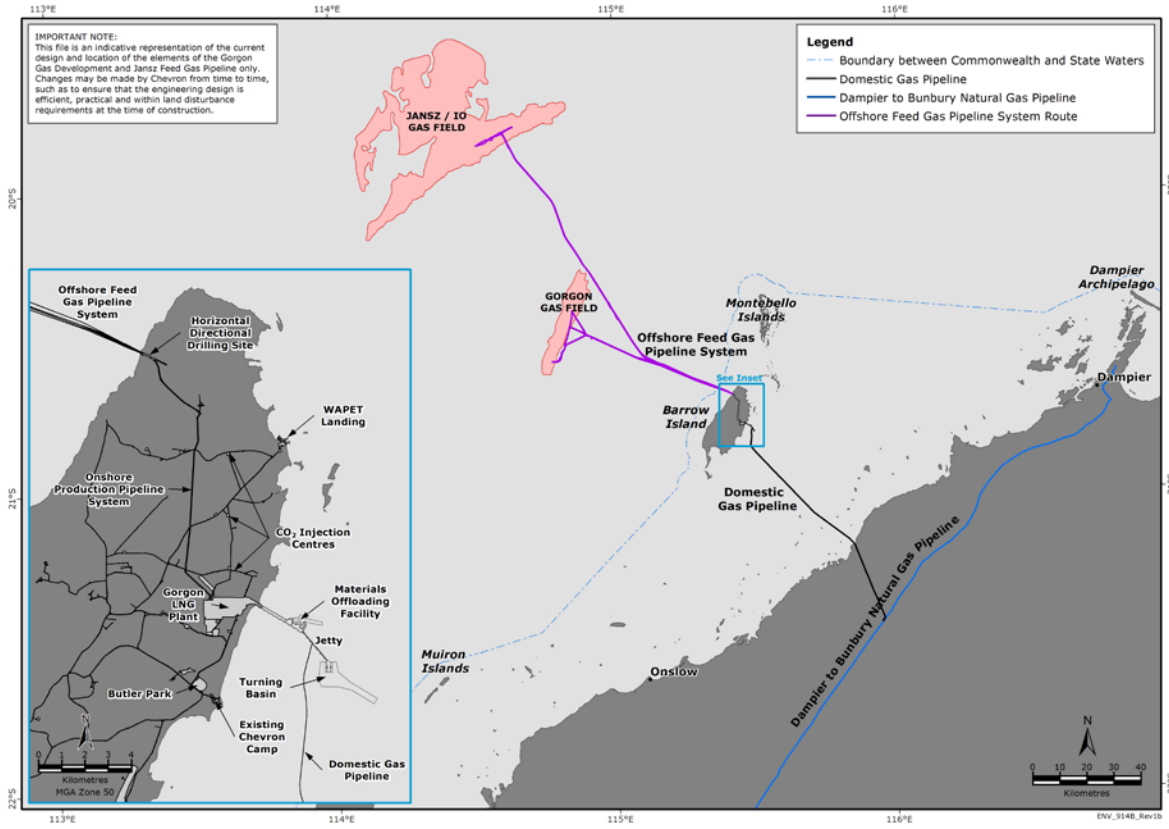


Figure 2-1: Location of Gorgon and Jansz–Io Gas Fields

Table 2-2: Titleholder Nominated Liaison Contact Person

Contact Person	Details
Company Name	Chevron Australia Pty Ltd
Nominated Liaison Person	Lawrence Fletcher
Position	Gorgon Stage 2 – Project Manager
Business Address	QV1, 250 St Georges Tce, Perth, WA, 6000
Telephone Number	08 9216 4000
Email Address	ABUEnvPlanInfo@chevron.com

2.5 Environmental Management Framework

CAPL's activities are managed in accordance with Chevron Corporation's Operational Excellence Management System (OEMS), which is described in Section 7.1.

2.5.1 Chevron Corporation's Environmental Policy

CAPL's commitment to environmental management in all aspects of its operations is documented in Chevron Corporation's Operational Excellence Policy 530 (Appendix A).

2.5.2 Legislative Requirements

The proposed activities are located within Commonwealth Waters and thus are subject to Commonwealth legislation. In accordance with Regulation 13(4)(a) of the OPGGS(E)R, Table 2-3 details the Commonwealth legislative requirements relevant to the environmental management of the proposed activity.

Table 2-3: Commonwealth Legislative Requirements

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection and management of nationally and internationally important flora, fauna, ecological communities, and heritage places. The GS2 Program is approved under EPBC References: 2003/1294 (Gorgon Gas Development) and 2005/2184 (Jansz–Io Deepwater gas field).	Condition 16B of EPBC 2003/1294 - Pipeline Installation Plan	As allowed by Condition 29 of EPBC 2003/1294: • This EP • Oil Pollution Emergency Plan (OPEP; Appendix D)
		EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans	Section 6.1
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) and OPGGS(E)R 2009	The OPGGS(E)R under the OPGGS Act require a titleholder to have an accepted EP in place for a petroleum activity. The regulations ensure petroleum activities are undertaken in an ecologically sustainable manner and in accordance with an EP.	An EP for a petroleum activity must be accepted by NOPSEMA before activities commence	• This EP • OPEP (Appendix D) • Operational and Scientific Monitoring Plan (OSMP; Appendix E)
Navigation Act 2012 and *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and various marine orders	Gives effect to the requirements under the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) in Australia in conjunction with the *Navigation Act 2012*. Applies to waste discharge from vessels.	Marine Order 96, Sewage	Management of sewage waste Section 6.6.3
		Marine Order 95, Garbage	Management of food waste (Section 6.6.3) and other wastes (Section 6.7.1)
		Marine Order 91, Marine Pollution Prevention – Oil	Requirement to have an approved Shipboard Oil Pollution Emergency Plan (SOPEP) in

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
			place for installation vessels Sections 6.7.2 and 6.7.3
		Marine Order 94, Packaged Harmful Substances	Section 6.7.1
Navigation Act 2012	Provides standards regarding collision prevention for vessels	Notice to Mariners	Section 6.1
Biosecurity Act 2015	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 6.6.2
		Australian Ballast Water Management Requirements (Ref. 53)	Section 6.6.2
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006	Provides minimum requirements for antifouling vessel systems	Marine Order 98, Marine Pollution – Antifouling systems	Section 6.6.2

Table 2-4 lists the standards and guidelines considered relevant to this activity.

Table 2-4: Standards and Guidelines Relevant to This Activity

Standard/Guideline	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met in this EP
Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) MPEC.207(62) 2011 (Ref. 52)	International Maritime Organization (IMO) guidelines for global management of biofouling	Requires a biofouling management plan and record book to be available and maintained	Section 6.6.2
Guidelines for Offshore Marine Operations (GOMO 0611-1401; Ref. 64)	Guidelines for marine and petroleum operations in the North Sea	Guidelines for all vessels servicing and supporting offshore facilities, specifically bulk transfer processes and planned maintenance	Section 6.7.2

2.6 Stakeholder Engagement

CAPL applied the following methodology to undertake consultation for this 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 based on:

- NOPSEMA Decision-Making Guideline – Criterion-10A(g) Consultation Requirements (Ref. 3)
- NOPSEMA's Bulletin – Number 2 Clarifying statutory requirements and good practice (Ref. 134)
- Australian Petroleum Production and Exploration Association (APPEA) Stakeholder Consultation and Engagement Principles and Methodology – Draft (Ref. 4).

2.6.1 Identification of Relevant Stakeholders

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 GFP.

For this Environment Plan, CAPL 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.

Establishing relevance under the OPGGS(E)R depends on the nature and scale of the activity and its associated 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 environment plan, or the revision of the environment plan, may be relevant
- each department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant
- 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 environment plan, or the revision of the environment plan
- any other person or organisation that the titleholder considers relevant.

NOPSEMA (Ref. 134) states that persons or organisations whose functions, interests, or activities are **directly connected** to the activities that an environment plan provides for (e.g. a drilling or seismic survey activity) are considered relevant persons.

Specifically, NOPSEMA (Ref. 134) clarify that 'the activities to be carried out' in the context of Regulation 11A(1)(d), do not extend to a hypothetical, remote, or speculative consequence from an activity such as a major oil spill.

Based on the risk 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 in this area are taken to be relevant.

Table 2-5 summarises these stakeholders. A Stakeholder Engagement Log and consultation records are provided in Appendix B.

Table 2-5: List of Relevant Stakeholders

Stakeholders	Stakeholders consulted
Fisheries – government and commercial	• Australian Fisheries Management Authority (AFMA) • Australian Southern Bluefin Tuna Industry Association • Commonwealth Fisheries Association • Department of Primary Industries and Regional Development (DPIRD) • Pearl Producers Association • Western Australian Fishing Industry Council (WAFIC)
Fisheries – Commonwealth and state	• North West Slope Trawl Fishery (Commonwealth) • Pearl Oyster Managed Fishery (State) • Pilbara Line Fishery (State) • Pilbara Trap Managed Fishery (State) • Western Tuna and Billfish Fishery (Commonwealth)
Recreational fishers	• RecFishWest
Other petroleum operators in the area	• Santos Ltd • BHP Macedon • Vermilion Energy • Woodside Burrup Pty Ltd
Government departments and agencies – Commonwealth and state	• Australian Hydrographic Office (AHO; Commonwealth) • Australian Maritime Safety Authority (AMSA; Commonwealth) • Director of National Parks (Australian Marine Parks) • Department of Infrastructure, Transport, Regional Development and Communications (Commonwealth) • Department of Defence (Royal Australian Navy, Royal Australian Air Force, (Defence Estate and Infrastructure Group) (Commonwealth) • Department of Defence (Australian Border Force) • Department of Mines, Industry Regulation and Safety (DMIRS) (WA) • Department of Biodiversity, Conservation and Attractions (WA) • DPIRD (WA; includes the former Department of Fisheries) • Department of Transport (DoT) – Navigational Safety (WA) • DoT – Pilbara Office (WA)
Emergency response	• AECOM • Australian Marine Oil Spill Response Centre • Barrow Island Emergency Management Coordinator • DoT Oil Spill Response Coordination (OSRC) Unit • Environmental Resources Management • Intertek Geotech • Oil Spill Response Limited • Port Authorities

2.6.2 Provision of Sufficient Information to Stakeholders

Under the NOPSEMA Decision-Making Guideline – Criterion-10A(g) Consultation Requirements (Ref. 3), stakeholders must be provided with sufficient information to enable them to understand how an activity may affect their functions, interests, or activities.

CAPL first engaged with stakeholders in 2011 before starting the drilling activities associated with the GFP Project. To ensure that sufficient information was provided to relevant stakeholders regarding the activities associated with this EP, CAPL sent a detailed fact sheet to a broad list of stakeholders (including all relevant stakeholders) on 20 December 2019—this fact sheet summarised the activity, impacts, and risks, and the proposed control measures to manage those impacts and risks.

In addition, CAPL engaged WAFIC to advise on relevant fisheries and fishers and its service to identity and address specific interests for this group. WAFIC was also used to convey an additional factsheet – tailored for the commercial fishing sector – on 13 May 2020.

A copy of the consultation materials, including supporting emails and fact sheets, are 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€R.

2.6.3 Assessment of Merit of any Objections or Claims and Response

Table 2-6 summarises the responses, objections, and claims made during consultation with relevant stakeholders, assesses their merits, and describes how CAPL will manage the objection or claim in this EP.

A record of all consultation undertaken specifically for this activity is included in the Stakeholder Engagement Log, which was provided in the sensitive information report sent separately to NOPSEMA.

Table 2-6: Summary of Stakeholder Response and Objections and Claims

Stakeholder	Date	Sensitive Information Ref.	Matter	Objection or Claim	Assessment of Merits	Titleholder Response
DoT – OSRC Unit	10 Jan 2020	1. DoT	Response to GS2 Factsheet	• No objection or claim • Requested that if there is a risk of a spill impacting State Waters from the activity, that DoT be consulted	DoT are the response agency for State Waters thus the request is in line with their interests, functions, and activities	CAPL discussed the information requested to be sent and agreed that the entire OPEP would be sent through for review
DoT – Maritime Environmental Emergency Response Unit	18 Feb 2020	2. DoT_OPEP	Acknowledgement that consolidated OPEP has been provided for review	No objection or claim	Not applicable (N/A)	N/A
AMSA	20 Dec 2019	3. AMSA	Response to GS2 Factsheet	• No objection or claim • Requested that AMSA's Joint Rescue Coordination Centre (JRCC) be notified: – at least 24–48 hours before operations commence – when operations start and end • Requested that the AHO be contacted no less than four working weeks before operations, with details relevant to the operations	AMSA have the authority to request such notifications given that their functions, interests, and activities have the potential to be affected by the activity. These requests are in line with standard industry practice.	Acknowledged and included as a control measure in Section 6.1 of this EP

Stakeholder	Date	Sensitive Information Ref.	Matter	Objection or Claim	Assessment of Merits	Titleholder Response
DMIRS	24 Dec 2019	4. DMIRS	Response to GS2 Factsheet	• No objection or claim • Requested that DMIRS be informed on any updates relating to GS2	N/A	Included requirement for ongoing consultation in Table 2-7
WAFIC	20 Dec 2019	5. WAFIC	Response to GS2 Factsheet	Requested: • Clear fact sheet including information, assessment, and mitigations relating to activities effecting fisheries • Overlay maps displaying relevant fisheries and activities • A licence list for each relevant and potentially affected fishery • Suggested liaison with DPIRD (Fisheries) and obtaining FishCube information • Allow at least eight weeks to complete an open and transparent engagement with commercial fishing sector • Provide further information regarding activity timing, water depths, exclusion zones, and cautionary zones	WAFIC is the peak industry body for the WA commercial fishing, pearling and aquaculture sector. The Operational area of this EP intersects with the stakeholders identified in this document.	CAPL met with WAFIC on 5 March 2020 and addressed WAFIC requests by electing to use the WAFIC Consultation Service to: • Provide advice to assist development of a “bespoke” commercial fishing sector factsheet • Assist in the identification of relevant commercial fishers who should be consulted for this EP • Circulation of the new bespoke factsheet on 13 May 2020 to the fishers and stakeholders identified by WAFIC as relevant for this EP.

Stakeholder	Date	Sensitive Information Ref.	Matter	Objection or Claim	Assessment of Merits	Titleholder Response
				• Provide compliance policy regarding recreational fishing from support and commercial vessels • Provide policy ensuring rights of active commercial fishers in area • Provide assessment framework for damage in an emergency spill event		
Australian Marine Parks (AMPs)	08 Jan 2020	6. Director of National Parks (DNP)	Response to GS2 Factsheet	• No objections or claims • Requested: – an update if the activities change and result in an overlap with or new impact to a marine park, or for emergency responses – that in an emergency situation, the DNP should be made aware of oil/gas pollution incidents that occur within a marine park or are likely to impact on a marine park as soon as possible	The DNP have authority to request such notifications where their functions, interests, and activities have the potential to be affected by the activity. These requests are in line with standard industry practice.	Included requirements for ongoing consultation and for notifying the DNP in the event of an incident in Table 2-7

2.6.4 Ongoing Consultation

The stakeholder notifications and ongoing consultation required for this activity is captured in Table 2-7.

Any objections or claims arising from ongoing consultation that have merit and have the potential to result in changes to the description of environment or risk assessment (and control measures), will be subject to CAPL's Management of Change (MOC) process, in accordance with Section 7.1.2.

During the GS2 Project, CAPL will review its stakeholder list annually to identify any additional stakeholders that need to be consulted with.

Table 2-7: Summary of Notifications and Ongoing Consultation

Stakeholder	Notification/Ongoing Consultation Requirement	Timing	Objective	Frequency
AMSA	Notify AMSA's JRCC through rccaus@amsa.gov.au (phone: 1800 641 792 or +61 2 6230 6811)	24 to 48 hours before commencing activities	Provide information to enable promulgation of radionavigation warnings	One-off – before commencing operations
AHO	Notify AHO via datacentre@hydro.gov.au	At least four working weeks before commencing activities	Provide information to enable promulgation of Notice to Mariners	One-off – before commencing operations
WAFIC	CAPL will continue to liaise with WAFIC on an as-required basis	Prior to new or significant changes to activities or impacts/risks occurring	To inform of changes to activities or impacts/risks occurring that may affect fisheries	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 7.1.2, that may potentially impact marine users	Prior to new or significant changes to activities or impacts/risks occurring	Location, start and finish dates	As required

2.6.4.1 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 to predict trajectory, as described in the OPEP (Ref. 90; Appendix D).

Once oil spill trajectory modelling is completed, CAPL will start engaging with potentially affected stakeholders (those considered relevant from Table 2-5 and others identified from the 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 Activity

3.1 Legislative Definitions

The petroleum activities detailed in this EP cover works in an offshore area (Commonwealth waters) undertaken for either exercising a right conferred on CAPL as the titleholder under the OPGGS Act, or for discharging an obligation imposed on CAPL as the titleholder under the OPGGS Act or a legislative instrument under the OPGGS Act. Activities are categorised in alignment with Regulation 59C (7) of the OPGGS (Regulatory Levies) Regulations 2004 as 'Any other petroleum-related operations or works carried out under an instrument, authority, or consent granted or issued under the OPGGS Act'.

3.2 Overview

3.2.1 Time Frame

Installation of pipelines, flowlines, and subsea infrastructure is expected to start in Q4 2020 and be completed within approximately 24 months. Given that schedules and timeframes for accessing vessels and equipment are expected to be significantly delayed, this EP is expected to be in force for a prolonged period. Construction activities will commence with site preparation and pipelay, followed by structure, spool, and jumper installation.

As construction activities will take place at any time of the year, the environmental risk assessment covers all seasons.

Activities covered by this EP may be conducted 24 hours a day, 7 days a week.

3.2.2 Operational Area

The OA associated with installing the subsea infrastructure as described in this EP, is defined as a 1500 m corridor centred over this infrastructure (i.e. 750 m either side of infrastructure) including any initiation anchors, wires, and abandonment wires.

The transit of vessels outside this area is outside the scope of this EP—these vessel activities are managed under the Commonwealth *Navigation Act 2012* (Section 2.3).

3.3 Hydrocarbon System Overview

The following subsections describes the subsea infrastructure associated with the GS2 Project; Figure 3-1 is a schematic diagram of the layout of that infrastructure.

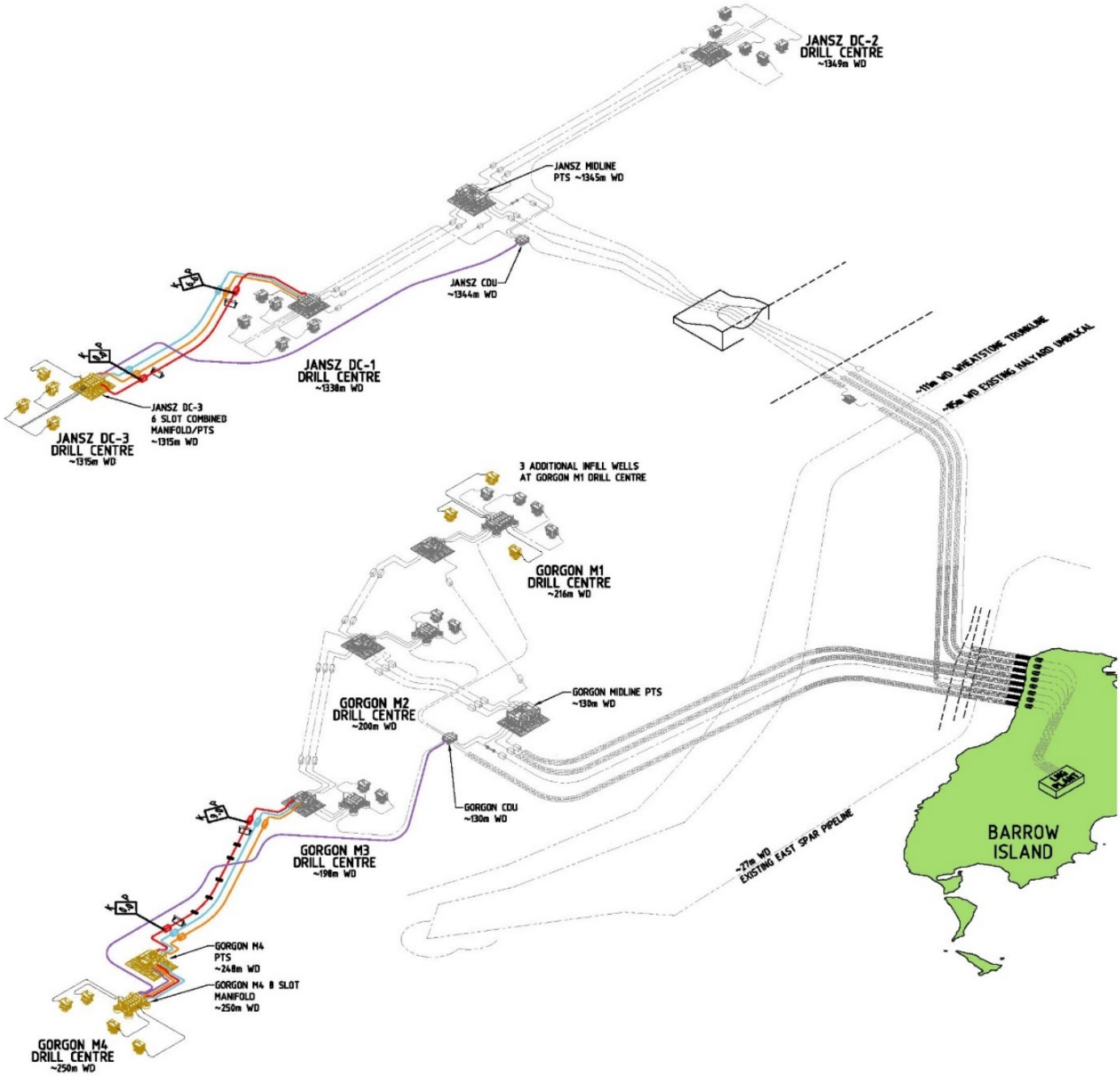


Figure 3-1: Schematic of GS2 Gorgon and Jansz Subsea Infrastructure

The GS2 Project supplements the existing Gorgon and Jansz gas field development with these additional wells and supporting infrastructure:

- three additional infill wells tied back to the existing Gorgon M1 manifold.
- four wells tied back to a new Gorgon M4 manifold, which in turn is connected to the existing Gorgon gas gathering system via a new M4 Pipeline Termination Structure (PTS) and 9.0 km 24″ M4 Production Flowline, 9.1 km 8″ Gorgon M4 Monoethylene Glycol (MEG) Pipeline, and 9.1 km 6″ Gorgon M4 Utility Pipeline. MEG is used to prevent hydrate (e.g. frozen ice) formation in undersea infrastructure.
- four wells tied back to a new Jansz Drill Centre 3 (DC-3) combined manifold/PTS, which in turn is connected to the existing Jansz gas gathering system via a 6.6 km 18″ Jansz DC-3 Production Flowline, 6″ Jansz DC-3 MEG Pipeline, and 6″ Jansz DC-3 Utility Pipeline.
- few infield control umbilicals for Gorgon M4 and Jansz DC-3. Installation of all interconnecting flying leads to allow control of the facility.

Note: Although the additional production wells are described in Section 3.3.1, the construction of these wells, installation of Christmas trees, and installation of the tubing hanger spools are outside the scope of this EP and will be managed under the NOPSEMA-accepted Gorgon and Jansz–Io Drilling, Completion and Well Maintenance Program EP (Ref. 1). However, the tie-in of all additional wells is within the scope of this EP (Section 2.3).

3.3.1 Production Well Locations

An additional 11 production wells (seven in the Gorgon field, four in the Jansz–Io field) are proposed to be drilled under the NOPSEMA-accepted EP (Ref. 1) and connected to the existing hydrocarbon system via infrastructure described in this EP.

Each production well is fitted with a subsea Christmas tree, which includes an arrangement of valves, controls, and instrumentation to enable connection to the subsea production manifolds via jumpers and tie-in spools. Table 3-1 lists indicative locations for each proposed production well and Table 3-2 details the associated manifolds.

Table 3-1: Indicative Production Well Locations and Water Depths

Well Name	Associated Manifold	Latitude*	Longitude*	Approx. Water Depth (WD) (m)
GOR-1A	Gorgon M1 manifold	-20° 24′ 29.134″S	114° 50′ 56.000″ E	216
GOR-1B	Gorgon M1 manifold	−20° 24′ 27.694″S	114° 50’ 57.032″ E	216
GOR-1G	Gorgon M1 manifold	-20° 24′ 29.874″ S	114° 50′ 59.261″ E	216
GOR-4C	Gorgon M4 manifold	- 20° 34′ 38.616″ S	114° 46′ 38.395″ E	250
GOR-4D	Gorgon M4 manifold	−20° 34′ 38.336″ S	114° 46′ 37.543″ E	250

Well Name	Associated Manifold	Latitude*	Longitude*	Approx. Water Depth (WD) (m)
GOR-4E	Gorgon M4 manifold	- 20° 34´ 37.790˝ S:	114° 46´ 36.948˝ E	250
GOR-4F	Gorgon M4 manifold	−20° 34’ 36.94″ S	114° 46’ 36.39″ E	250
JZI-3C	Jansz DC-3 combined manifold/PTS	−19° 51’ 11.42″ S	114° 30’ 54.64″ E	1315
JZI-3D	Jansz DC-3 combined manifold/PTS	−19° 51’ 10.40″ S	114° 30’ 54.33″ E	1315
JZI-3E	Jansz DC-3 combined manifold/PTS	−19° 51’ 9.69″ S	114° 30’ 54.97″ E	1315
JZI-3F	Jansz DC-3 combined manifold/PTS	−19° 51’ 9.04″	114° 30’ 55.05″ E	1315

* *Indicative latitudes and longitudes only*

3.3.2 Subsea Production Manifolds

Production wells are connected to subsea production manifolds via jumpers. The production manifolds enable gas condensate from each wellhead to be commingled before entering the flowlines.

The existing Gorgon M1 production manifold will be used for the Gorgon M1 drill centre. A new Gorgon M4 production manifold and PTS will be installed for the Gorgon M4 drill centre. The M4 production manifold is connected to the new M4 PTS (Section 3.3.3) via tie-in jumpers, which are then connected to existing subsea facilities via tie-in spools and flowlines (Section 3.3.4).

A new Jansz DC-3 combined manifold/PTS will be installed for the Jansz DC-3 drill centre. It will tie-in to the existing Jansz infrastructure via tie-in spools and flowlines.

Mudmat foundations will be installed for all production manifolds. Table 3-2 summarises these structures and their location.

Table 3-2: Production Manifold Details

Description	Approx. Dimensions L × W × H (m)	Latitude*	Longitude*	WD (m)
Gorgon M1 manifold (existing)	25 × 18 × 7	20° 24’ 29.59″ S	114° 50’ 57.26″ E	216
Gorgon M4 manifold module (new)	19 × 15 × 6	20° 34’ 37.38″ S	114° 46′ 37.97″ E	250
Gorgon M4 manifold mudmat (new)	30 × 25 × 3	20° 34’ 37.38″ S	114° 46′ 37.97″ E	250
Jansz DC-3 combined manifold/PTS module (new)	19 × 23 × 7	19° 51′ 10.44″ S	114° 30′ 56.19″ E	1315

Description	Approx. Dimensions L × W × H (m)	Latitude*	Longitude*	WD (m)
Jansz DC-3 combined manifold/PTS mudmat (new)	30 × 25 × 3	19° 51′ 10.44″ S	114° 30′ 56.19″ E	1315

* *Indicative latitudes and longitudes only*

3.3.3 Pipeline Termination Structure

A separate PTS is planned to be installed at the Gorgon M4 drill centre to connect the Gorgon M4 manifold to the subsea hydrocarbon system. Within the Jansz field, the Jansz DC-3 combined manifold/PTS functions as a PTS to connect to the subsea hydrocarbon system. Table 3-3 summarises the dimensions and location of the Gorgon M4 PTS.

Table 3-3: Pipeline Termination Structure Details

Description	Approx. Dimensions L × W × H (m)	Latitude*	Longitude*	WD (m)
Gorgon M4 PTS module (new)	22 × 15 × 10	20° 34′ 36.47″ S	114° 46′ 40.40″ E	249
Gorgon M4 PTS mudmat (new)	30 × 25 × 3	20° 34′ 36.47″ S	114° 46′ 40.40″ E	249

* *Indicative latitudes and longitudes only*

3.3.4 Infield Flowlines, Pipelines, Jumpers, and Tie-in Spools

A number of pipelines, flowlines, jumpers, and tie-in spools are required to connect the subsea production manifolds and PTSs to the existing facilities. These are listed in Table 3-4, Table 3-5, and Table 3-6.

Table 3-4: Gorgon M1 Well Jumper Overview

Description	Name	Inlet Location	Outlet Location	Pipeline	Quantity
Jumpers	Gorgon M1 well jumpers[1]	Gorgon M1 Christmas tree	Gorgon M1 manifold	8″ Production	3
				2″ MEG	3
				2″ Utility	3

1 *The well jumpers are multibore jumpers (ie pipe "connectors") comprising an 8" production pipeline, 2" MEG pipeline, and 2" utility pipeline.*

Table 3-5: Gorgon M4 Flowline, Pipeline, Jumper, and Spool Overview

Description	Name	Inlet Location	Outlet Location	Pipeline	Quantity
Jumpers	Gorgon M4 well jumpers[1]	Gorgon M4 tree	Gorgon M4 manifold	8″ Production	4
				2″ MEG	4
				2″ Utility	4
Jumpers	Gorgon M4 manifold to Gorgon M4 PTS jumpers	Gorgon M4 manifold	Gorgon M4 PTS	20″ Production	1
				6″ MEG	1
				4″ Utility	1
Spools	Gorgon M4 PTS to pipeline end termination (PLET) spools	Gorgon M4 PTS	PLET	26″ Production	1
				8″ MEG	1
				6″ Utility	1

Description	Name	Inlet Location	Outlet Location	Pipeline	Quantity
Flowline/ Pipeline	Gorgon M4 Flowline/Pipeline[2]	M4 PLET	M3 PLET	24″ Production	1
				8″ MEG	1
				6″ Utility	1
Spools	PLET to Gorgon M3 PTS spools	M3 PLET	Gorgon M3 PTS	26″ Production	1
				8″ MEG	1
				6″ Utility	1

1 *The well jumpers are multibore jumpers comprising an 8" production pipeline, 2" MEG pipeline, and 2" utility pipeline.*

2 *The production line is classified as a flowline. The MEG and Utility lines are classified as pipelines.*

Table 3-6: Jansz DC-3 Flowline, Pipeline, Jumper, and Spool Overview

Description	Name	Inlet Location	Outlet Location	Pipeline	Quantity
Jumpers	Jansz DC-3 well jumpers[1]	Jansz DC-3 tree	Jansz DC-3 combined manifold/ PTS	8″ Production	4
				2″ MEG	4
				2″ Utility	4
Spools	Jansz DC-3 combined manifold/ PTS to PLET spools	Jansz DC-3 combined manifold/ PTS	PLET	24″ Production	1
				6″ MEG	1
				6″ Utility	1
Flowline/Pipeline	Jansz DC-3 flowline/pipeline[2]	DC-3 PLET	DC-1 PLET	18″ Production	1
				6″ MEG	1
				6″ Utility	1
Spools	PLET to Jansz DC-1 combined manifold/PTS spools	PLET	Jansz DC-1 combined manifold/PTS	24″ Production	1
				6″ MEG	1
				6″ Utility	1

1 *The well jumpers are multibore jumpers comprising an 8" production pipeline, 2" MEG pipeline, and 2" utility pipeline.*

2 *The production line is classified as a flowline. The MEG and Utility lines are classified as pipelines.*

3.3.5 Umbilicals

The fibre-optic and electrohydraulic control umbilicals provide hydraulic power, electric power, and a fibre-optic control link from the Gorgon LNG Plant to the subsea infrastructure in the Gorgon and Jansz–Io gas fields. A Central Distribution Unit (CDU) is a termination point for the main control umbilical from the Gorgon LNG Plant into which the individual drill centre umbilicals connect.

New electrohydraulic umbilicals will be installed between the existing Gorgon CDU and the new Gorgon M4 manifold and between the existing Jansz CDU and the umbilical termination assembly on the new Jansz DC-3 combined manifold/PTS (Figure 3-1 and Table 3-7).

Table 3-7: Gorgon and Jansz Umbilical Overview

Description	Name	Inlet Location	Outlet Location	Quantity
Umbilical	Gorgon M4 Umbilical	Gorgon CDU (existing)	Gorgon M4 manifold	1
Umbilical	Jansz DC-3 Umbilical	Jansz CDU (existing)	Jansz DC-3 combined manifold/PTS	1

3.3.6 Flying Leads

New electrical (EFL), steel tube (STFL), and hydraulic (HFL) flying leads will tie-in the separate components of the new infrastructure. Their role is to provide overall control of the new infrastructure being installed under this EP.

3.4 Reservoir Properties

The properties of the Gorgon and Jansz–Io fields are summarised in the following subsections.

3.4.1 Hydrocarbon Composition

Table 3-8 summarises the compositional reservoir analyses undertaken by Shell Development Australia in 1999 (Ref. 5). More recent assays conducted during well flowbacks in 2014 (Ref. 91) and ongoing analysis indicate that the initial compositional analysis is still accurate.

Table 3-8: Production Reservoir Properties

Property	Gorgon	Jansz–Io
Density	848 kg/m^3 (at 15 °C)	743.1 kg/m^3 (at 15 °C)
American Petroleum Institute (API)	35.3	47.9
Dynamic viscosity (centipoises; cP)	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
Oil property category	Group 2	Group 1
Oil persistence classification	Persistent (light)	Non-persistent

3.4.2 Flow Rate

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.

3.5 Installation of Infield Flowlines, Pipelines, and Umbilicals

3.5.1 Site Survey

Non-invasive surveys may be undertaken before and after pipelay using a combination of video, side-scan sonar (SSS), multibeam echo sounder (MBES), and obstacle avoidance sonar. The pre-lay survey will confirm the bathymetric profile along the flowline and umbilical route and identify any seabed features or obstructions that may have engineering significance.

If a significant obstruction is encountered along the flowline and umbilical route, the alignment will be rerouted around the obstruction (but still within the OA as described in this EP).

3.5.1.1 Multibeam Echo Sounders

MBES use multiple sound signals to detect the sea floor and can map a large area of seabed in a single pass, providing detailed information in a shorter time.

MBES will be mounted to a remotely operated vehicle (ROV) and deployed from a vessel. As the ROV travels along the chosen lines, the transmit transducer directs sound waves down through the water to the seabed. The reflected sound is measured by the receive transducer and provides information on the bathymetry of the seabed. Although the exact equipment is not yet known, Table 3-9 summarises the indicative MBES parameters relevant to the scope.

Table 3-9: MBES Survey Parameters

Parameter	Survey Specification
Indicative frequency	>12 kHz
Acoustic source volume (indicative only)	236–238 dB re 1 µPa (zero to peak)

3.5.1.2 Side-scan Sonar

SSS uses high-frequency sound pulses that are reflected off the sea floor to create an image of morphology and differences in seabed texture. Transmit and receive transducers are generally used in SSS surveys.

Higher-resolution SSS units (or transducers) commonly use frequencies from 36 kHz to 900 kHz. Although the exact equipment is not yet known, Table 3-10 summarises the indicative SSS parameters relevant to the geophysical scope.

Table 3-10: Side-scan Sonar Survey Parameters

Parameter	Survey Specification
Indicative frequency	36–900 kHz
Acoustic source volume (indicative only)	228 dB re 1 µPa (zero to peak)

3.5.2 Seabed and Installation Preparation

It is expected that only minimal work will be required to prepare the seabed before commencing offshore installation activities. Previous seabed surveys show a clear pipelay route and clear areas for installing infrastructure. Prior to pipelay, structure, umbilical, and jumper and spool installation, a visual site survey will be conducted by ROV to verify that installation activities will be unhindered.

The offshore installation preparation activities described in the subsections below will be carried out before pipelay, structure, umbilical, and spool and jumper installation to ensure the infrastructure is installed on a solid and supported foundation.

3.5.2.1 Anti-burial Mattresses

Concrete anti-burial mattresses will be permanently installed along the Gorgon production flowline route (see Figure 3-1), from the Gorgon M4 PLET for up to 350 m. These anti-burial mattresses are required to ensure that the flowline remains clear of the seabed, and thus help cool the production gas. Over the 350 m length, two anti-burial mattresses are required approximately every 40 m. Mattresses are ~9 m × 3 m in area.

3.5.2.2 Lateral Buckle Initiators

Lateral buckle initiators will be permanently installed along the Gorgon production flowline route (see Figure 3-1) to ensure any pipeline expansion force is relieved laterally in a controlled manner. Lateral buckle initiators are a mudmat structure ~24 m × 6 m in area, with an elevated engineered friction surface that raises the flowline ~0.5 m above the seabed. Five lateral buckle initiator locations are evenly spaced along the length of the Gorgon flowline route. Three lateral buckle initiator structures will be installed at each location, ~40 m apart.

3.5.2.3 Adjustable Pipe Support

An adjustable pipe support (APS) will be permanently installed at either end of the Gorgon production flowline and Jansz production flowline routes before pipelay. The APS connects the flowline and the PLETs, and supports and aligns the loads in the connector and the adjacent pipe. An APS is an A-frame structure on a mudmat foundation; each structure has a footprint of ~14 m × 7 m.

3.5.2.4 Initiation Anchors

A deadman anchor will be used to start installation of the flowlines and pipelines. This anchor is connected to the start of the flowline/pipeline by wire rope rigging. It will be deployed at the start of pipelay to fix the end of the pipe in place prior to laying the pipe. Initiation anchors are typically installed at a defined distance from the target box for the start of the flowline/pipeline and are recovered after pipelay. This method will be used for both Gorgon and Jansz flowlines/pipelines.

3.5.3 Pipeline End Termination Structure (PLET), Pipeline, and Flowline Installation

Gorgon and Jansz pipelines and flowlines will be installed using an S-lay technique.

S-lay installation methods involve lowering pipe off the vessel over the stinger (a support structure that extends from the stern to support the pipe as it is moved into the water) as the boat moves along the route. The stinger supports the transition of the pipe off the vessel into the water in the overbend region. After the pipe exits the stinger, it continues through the water until it reaches the sea floor. As more pipe is welded in the line and eased off the boat, the pipe forms the shape of an ‘S’ in the water (Figure 3-2).

A typical pipelaying sequence involves assembling the pipes in the firing line, where welding and non-destructive testing takes place in several stages. After acceptance of the welds, field joint coating is applied and the welded pipeline is gradually lowered over the stinger through the water column to the seabed behind the vessel. As more pipe is welded, the vessel moves along the route. Once the installation vessel move is completed, additional pipe is brought to the firing line and fabrication continues.

PLETs will be installed at each end of every pipeline and flowline. PLETs allow the transition and diverless connection from pipeline/flowline to spool. To install the production flowline PLETs, the production flowline is recovered and cut to length, then lowered where the PLET is then installed on the seabed. To install smaller utility and MEG PLETs, these lines are recovered, the PLET is installed on the vessel, then deployed to the seabed via a J-lay installation method (Figure 3-2). Any of the flowlines or pipes recovered from the seabed may require seabed

debris to be removed from the infrastructure—debris will be washed off with potable water and returned to the sea before PLET installation.

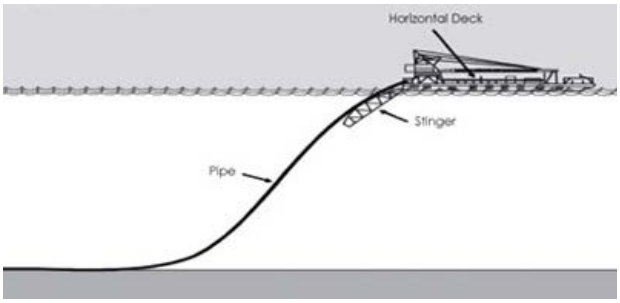
Pipeline PLETs (on the utility and MEG pipelines) have a footprint of ~15 m × 3 m. Flowline PLETs (production flowline) are installed on a mudmat foundation, with a footprint of ~18 m × 7 m.

During pipelay, the potential exists for an unplanned event, resulting in the ingress of sea water into the flowline/pipeline. For example, if the pipeline suffered a wet buckle or rupture, sea water would enter, resulting in the potential for corrosion; contingency dewatering and reflooding of treated fresh water would then be necessary. 'Treated' refers to the addition of a range of commercial chemicals including biocide, oxygen scavenger, corrosion inhibitor, clear dye, and buffering solutions.

It is anticipated that the media used for all flowlines/pipelines will be treated fresh water. The treated fresh water used to flush the lines will be discharged at the buckle location and / or from the surface before resuming pipelay.

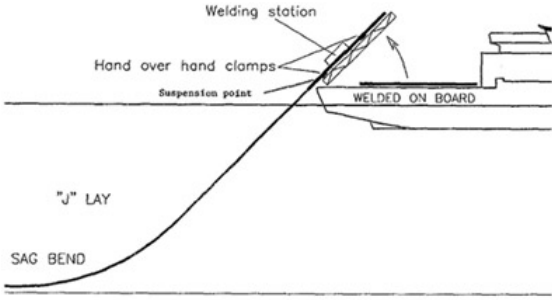
Pipelay installation may also be interrupted due to unforeseen events. In such a case, the pipeline may be stabilised by flooding it with treated fresh water before temporarily abandoning it. The treated fresh water will be discharged at the abandonment location and / or from the surface before resuming pipelay.

S-Lay Installation



(Source: www.pbjv.com.my)

J-Lay Installation



(Source: www.technip.com)

Figure 3-2: S-lay and J-lay Pipeline Installation Techniques

3.5.4 Flood, Clean, Gauge, and Hydrotest Pipelines and Flowlines

Following installation, the flowlines and pipelines undergo flood, clean, gauge, and testing (FCGT). During FCGT activities, gauge pigs preinstalled in the laydown/initiation head on one end of the pipeline/flowline are sent through the pipeline/flowline driven by the FCGT media (Table 3-11). Pigs are devices or implements that are used to perform various cleaning, clearing, maintenance, inspection, dimensioning, process, and pipeline testing activities. Pipelines and flowlines remain filled with the FCGT media after testing until commissioning, which is outside the scope of this EP (Section 2.3). The exception is the Gorgon production flowline, which is conditioned before start-up (see Section 3.9).

Gauge pigs are recovered from laydown/initiation heads on the opposite end of the pipeline/flowline. The volumes of FCGT media between pigs will be discharged to the environment from the laydown/initiation heads (Table 3-11 lists estimated volumes). Pigs may also be fitted with isotope tracking devices to enable precise monitoring of pig movement.

Note: These volumes assume the pipelines and flowlines are flooded one cycle each. If these lines need to be redesigned, reflooded, regauged and/or tested, the volumes will increase accordingly.

Note II: Throughout FCGT, pre-commissioning and leak testing operations small quantities of media containing MEG blends and treated water including biocide, oxygen scavenger, corrosion inhibitor, clear dye, and buffering solutions may be recovered to surface and discharged overboard in both planned and contingency scenarios

Table 3-11: FCGT Media for Pipelines and Flowlines

Equipment	FCGT Media	Estimated Release Volume
Gorgon M4 Production Flowline	Fresh water*	1068 m^3
Gorgon M4 Utility Pipeline	Fresh water* / MEG blend	113 m^3
Gorgon M4 MEG Pipeline	Fresh water* / MEG blend	155 m^3
Gorgon M4 Reflood Allowance (Production Pipeline)	Fresh water*	5196 m^3
Gorgon M4 Reflood Allowance (Utility Pipeline)	Fresh water* / MEG blend	200 m^3
Gorgon M4 Reflood Allowance (Utility Pipeline)	Fresh water*	232
Gorgon M4 Reflood Allowance (MEG Pipeline)	Fresh water* / MEG blend	384 m^3
Gorgon M4 Reflood Allowance (MEG Pipeline)	Fresh water*	352 m^3
Jansz DC-3 Production Flowline	Fresh water* / MEG blend	400 m^3
Jansz DC-3 Utility Pipeline	Fresh water* / MEG blend	136 m^3
Jansz DC-3 MEG Pipeline	Fresh water* / MEG blend	136 m^3
Jansz DC-3 Reflood Allowance (Production Pipeline)	Fresh water* / MEG blend	1087 m^3
Jansz DC-3 Reflood Allowance (Production Pipeline)	Fresh water*	216 m^3
Jansz DC-3 Reflood Allowance (Utility Pipeline)	Fresh water* / MEG blend	216 m^3
Jansz DC-3 Reflood Allowance (Utility Pipeline)	Fresh water*	216 m^3
Jansz DC-3 Reflood Allowance (MEG Pipeline)	Fresh water* / MEG blend	215 m^3
Jansz DC-3 Reflood Allowance (MEG Pipeline)	Fresh water*	215 m^3

** 'Fresh water' refers to water treated by a range of commercial chemicals including biocide, oxygen scavenger, corrosion inhibitor, clear dye, and buffering solutions.*

3.5.5 Umbilical Installation

Both the Gorgon and Jansz–Io umbilicals will cross the GS2 flowlines. Prior to umbilical installation, concrete mattresses will be stacked either side of the pipeline to create crossing points. Concrete mattresses will be installed from the onboard crane using an installation frame. ROVs will help with the final positioning/orientation and releasing the mattress from the frame. There will be one crossing of the Gorgon umbilical over the production, utility, and MEG flowlines, and one crossing of the Jansz umbilical over the production, utility, and MEG flowlines (Figure 3-1). Each mattress is expected to measure ~9 m × 3 m, with a submerged weight of ~10 500 kg.

The umbilicals will be installed by a lay system assisted by the auxiliary/main cranes. Umbilicals will be reeled off the vessel and connected to the CDU using

ROVs and specialist tooling. During connection to the CDU there is the potential for a small volume (<100 L) of hydraulic control fluid to be released into the environment; however, if the connection is not initially successful, a larger release of hydraulic control fluid could occur.

Following the connection, the umbilical will be leak tested. The medium for leak testing will be the hydraulic control fluid used for operating the system. On completion of the leak test, it is estimated that a small volume of this control fluid (<100 L) will be released into the environment.

3.5.6 Stabilisation

Stabilisation of the umbilical is only required at the flowline crossings. Umbilicals will be stabilised by deploying additional concrete mattresses, which will be placed over the laid umbilical using an installation frame from the onboard crane. ROVs will help with final positioning/orientation and releasing the mattress from the frame.

Post-lay pipeline and flowline stabilisation/span correction may require installing additional concrete mattresses. The nature of this activity is not yet known; the number of stabilisation points will be determined from the post-lay surveys. The methodology for installing concrete mattresses is similar to that previously discussed (Section 3.5.5).

3.6 Subsea Structure, Jumpers, and Tie-in Spool Installation

Before installing any structure, jumper, or tie-in spool, a site/seabed survey will be conducted to ensure there are no obstacles that may hinder installation activities. Previous surveys and geotechnical data indicate no obstructions are present, thus, any obstruction identified during this activity would likely be debris. In the unlikely event of encountering a significant obstruction, the debris/obstruction would be cleared. If a significant obstruction is encountered, the alignment will be rerouted (but still within the OA as described in this EP).

3.6.1 Structure Installation

The structures (M4 manifold and PTS, and DC-3 combined manifold/PTS) use standard mudmat foundations, which are installed separately (and prior) to the structure modules. Mudmat foundation skirts are engineered to self-penetrate the seabed during installation, and once fully penetrated, structures can then be lowered onto the foundations.

Subsea structures will be lifted off the installation vessel by an onboard crane, in a safe lifting area away from existing subsea facilities, and then deployed to depth. The vessel will use dynamic positioning (DP) to transit from the safe lifting area to the target location, where the structure is set down on the sea floor using heave compensation. Structure positioning will be controlled via preinstalled baseline seabed arrays.

During installation, ROV monitoring will be undertaken and, if/when required, the ROV will help with the set-down. Lifting trunnions with ROV removeable pins are planned to be used to release the structures from the lifting equipment.

3.6.2 Jumper and Tie-in Spool Installation and Tie-In

Before installing jumpers or tie-in spools, any marine growth and calcareous build-up present on existing subsea structures that will be tied into will be removed via mechanical cleaning and acid wash or similar. Only small volumes of chemicals

(10s-100s of litres per application depending on infrastructure) will be used for acid washing and these chemicals will be applied directly to infrastructure.

Jumper and tie-in spools will be individually lifted off a transportation barge by the installation vessel's onboard crane in a safe lifting area away from existing subsea facilities and then deployed to depth. The vessel will use DP to transit from the safe lifting area to the target location, where the jumper or tie-in spool is set down on the sea floor using heave compensation. Each jumper and tie-in spool will have a bespoke spreader bar and rigging. This spreader bar and rigging is recovered to the vessel deck once the jumper or tie-in spool is installed. Jumper and tie-in spool positioning will be controlled using preinstalled guideposts on the PLETs, manifolds, and trees. During installation, ROV monitoring will be undertaken and, if required, the ROV will help with the set-down.

Protection caps will be removed from the ends of the jumpers and tie-in spools (and, where relevant, Christmas trees) before deploying and landing the jumper/tie-in spool. This will release a small volume (~100 L) of preservation fluid (a treated fresh water/MEG blend is proposed) from the jumper/tie-in spool.

Similarly, caps or laydown heads will be removed from the PLET, manifold, or PTS structure being tied into, releasing a small amount of preservation fluid (treated fresh water/MEG blend) per tie-in.

Preservation fluid releases from these activities are small. The volume of release will depend on the equipment being used, but is expected to be 1–15 m^3 per connection.

Jumpers and tie-in spools will then be connected to the various structures by ROV and connected by specialised subsea ROV tooling. During this process, dissolvable chemical sticks (biocide, oxygen scavenger, dye, and buffering solutions) will be inserted into the jumpers and tie-in spools to treat any seawater ingress during connection.

Before the tie-in of newly installed infrastructure to live infrastructure (Gorgon M3 PTS and Jansz DC-1) the system will comprise single valve isolation. When the high-pressure (HP) caps are removed from the M3 PTS or DC-1 manifold PTS, a small volume of hydrocarbons may be released into the environment if they are present underneath the HP cap. This release is estimated to be small (tens of litres).

3.7 Flying Lead Installation

A flying lead is commonly used to connect subsea equipment such as a subsea control module to a subsea umbilical distribution unit. Before installing flying leads, any marine growth and calcareous build-up present on existing subsea structures that will be tied into will be removed via mechanical cleaning and acid wash or similar. The volumes of the chemicals used for acid washing will be small (10s-100s of litres per application depending on infrastructure) and these chemicals will be applied directly to the infrastructure.

Flying leads will be installed via reels (for STFLs) and deployment frames (for EFLs and HFLs) from the installation vessel. During installation, ROV monitoring will be undertaken and, if/when required, the ROV will help with the set-down. Flying leads will then be connected to the various structures by ROV.

Flying leads will be stabilised after installation, with ~20 kg sand/cement bags placed at 15 m intervals along the individual flying leads.

3.8 Leak Testing

3.8.1 System Leak Testing

After the jumpers and tie-in spools are installed, the integrity of the subsea system will be tested to ensure it is leak-free. This involves pressurising the system to a predetermined pressure via a downline from the vessel, then monitoring pressure fluctuations within the system. If unexpected pressure drops occur, ROVs will visually inspect the system to identify leaks. Pressurisation will be achieved by injecting a preservation fluid (treated fresh water and MEG blend) at appropriate points in the system. After the test, depressurisation may occur via the downline (as test fluids return to the tank on the vessel or discharged overboard) or via a stab (as test fluids are discharged into the environment). CAPL estimates the volume of preservation fluid discharged would be approximately 820 m^3. This estimated volume is calculated based on a successful, leak-free subsea system leak test—larger volumes may be discharged into the environment if there is any deviation from this assumption.

Barrier testing or leak testing of small internal pipework will also be undertaken. Barrier testing ensures the valves and caps hold pressure and demonstrates the integrity of the barriers. Testing will be done using either the downline from the vessel or a ROV-mounted fluid injection skid. Barrier testing will result in small volumes of MEG (~100 L) being discharged into the environment.

During valve actuation, a small release (a few litres for each valve) of hydraulic control fluid will be released to the marine environment from the valves and chokes on the subsea manifolds and other infrastructure.

3.9 Pre-commissioning (Conditioning)

Before commissioning starts, the Gorgon M4 flowline will be conditioned with rich (i.e. high water content) MEG preservation media. The Gorgon utility and MEG pipelines and the Jansz–Io pipelines and flowlines are not planned to be dewatered and will remain filled with the FCGT media.

A single pig will be preloaded into the Gorgon M4 26″ production tie-in spool between the PLET and M3 PTS, while a subsea pig launcher receiver (SSPLR) will be attached to Gorgon M4 PTS by removing the HP cap from the M4 PTS, deploying the SSPLR, then using the ROV to tie-in/connect the SSPLR. This activity will result in a relatively small release (~3 m^3) of PTS preservation fluid (treated fresh water and MEG) to the environment.

The conditioning pig will be driven with a rich MEG blend. Fresh water and rich MEG will be discharged subsea into the environment from the SSPLR at the Gorgon M4 PTS. Estimated volumes (contingency not included) of the larger releases are ~1271 m^3 treated fresh water/MEG blend and ~2718 m^3 treated fresh water. The flowline will be left filled with a treated fresh water/MEG blend at ambient pressure. Note: Estimated total contingency volumes, which are not expected to be released but are provided for in this EP (may be subject to change), are ~3231 m^3 treated fresh water/MEG blend and ~23 305 m^3 treated fresh water.

Once conditioning is finished, the SSPLR will be recovered, chemical sticks inserted into the PTS hub, and a HP cap installed. A small volume (~100 L) of fresh water/MEG blend will be released into the environment when the SSPLR is removed.

3.10 Equipment Suspension

Once installed and successfully tested, the subsea infrastructure may remain in suspended state until commissioning starts (commissioning is covered under a separate EP; see Section 2.3.2). During this suspension period, the infrastructure will remain at ambient seabed pressure and be full of preservation fluids until it is ready for commissioning.

3.11 Inspection, Maintenance, and Repair Before Operations Commence

IMR of subsea infrastructure may be undertaken to ensure that the integrity of the hydrocarbon system is maintained at or above acceptable standards while this EP is in force. IMR activities may occur at any time once the infrastructure is successfully installed, including during the suspension phase (if required) before operations commence.

3.11.1 Inspections

Inspections provide assurance that asset integrity is being maintained, and proactively identify maintenance or repair requirements. Inspection generally involves using a surface vessel travelling along the route of the subsea system, with an associated subsea ROV. CAPL incorporated an appropriate level of conservatism (including activity frequency) to enable risk evaluations to be undertaken for all inspection activities.

Generally, inspections will occur once a year; however, the precise frequency and timing will be informed by monitoring and previous inspection results. Typically, vessels will be on site for 55 to 155 days per year depending on the type of inspection / inspection complexity. Events such as cyclones or seismic activity that could affect the subsea infrastructure may also trigger inspections.

Inspection techniques may include:

- visual inspections (indicative frequency: two yearly), which may involve aerial surveys, ROVs or autonomous underwater vehicles (AUVs) deployed from a vessel, divers, and a dive support vessel
- marine acoustic surveys (indicative frequency: two yearly), which may use SSS and MBES, and are typically conducted from a vessel using towed acoustic instruments, ROVs, or AUVs
- non-destructive testing (indicative frequency: two yearly), which may include ultrasonic testing and electrical resistance testing, which are typically undertaken using an ROV deployed from a vessel
- cathodic protection measurements (indicative frequency: two yearly), which are completed using ROVs and conductivity probes, or by taking visual readings of anode wastage gauge readings
- escarpment fatigue monitoring/inspection (indicative frequency: twice a year), which uses fatigue monitoring equipment that is installed and retrieved by a ROV deployed from a vessel
- pigging (indicative frequency: two yearly), which uses temporary pig launchers that are deployed from a vessel and tied into the PTS. Pigging activities, including internal inspection of the pipeline, may use a combination of inhibiters, water, gel, MEG, and/or nitrogen slugs. Fluids used to drive the pig train are directed to the Gorgon LNG Plant. Pigs may be equipped with tracking transmitters.

3.11.2 Maintenance and Repairs

Maintenance and repair activities may need to be conducted during the operational life of the project including during after installation suspension phases and before commissioning to:

- prevent deterioration and/or failure of infrastructure
- maintain reliability and performance of infrastructure.

Maintenance and repair activities are expected to be rare and infrequent—the exact frequency will depend on the results of inspections. If a repair is required, a vessel may remain on site for ~20 to 60 days at a time, depending on the repair required.

Maintenance and minor repairs may include, but are not limited to:

- module/component change-out (including back testing of seals), which may include, but is not limited to, replacing subsea infrastructure such as flying leads, flow meters, or choke modules. Planned change-out is only scheduled for a few retrievable items
- stabilisation/span correction, which may involve installing grout bags or concrete mattresses
- subsea excavation alongside infrastructure, which may be required to gain access to, or enable minor repairs of, infrastructure
- cathodic protection system maintenance/additional anodes, which may involve using a vessel and ROV spread to add cathodic protection equipment, or place it adjacent to, production pipelines
- marine biological growth and calcareous deposit removal, which may be undertaken using mechanical techniques and/or chemical treatments using a vessel and ROV spread. 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; therefore, it is estimated to have the same frequency as these activities
- pipeline repair, which involves repairing pipeline defects that threaten a pipeline's structural integrity; this activity may use structural or HP repair clamps. Pipeline repair activities are generally undertaken by ROVs from a single vessel but may require support from an additional vessel.

3.12 Support Operations

Given the breadth of construction and installation activities covered by this EP, many different vessels will be required. The types of vessels that will be used include:

- pipelay vessel (PLV)
- survey vessel
- light and heavy construction vessels (LCVs and HCVs)
- transportation vessels, tugs, and barges
- platform supply vessels (PSVs).

In addition to these vessels other vessels may be utilised to conduct IMR activities throughout the life of this plan.

All vessels are collectively termed ‘installation vessels’ for this EP, and once they enter the area of operations (Section 3.2.2) are they considered to be within the scope of this EP (Section 2.3).

Larger installation vessels (e.g. PLV, HCVs, LCVs) will be serviced by helicopters, primarily for passenger transfers/crew changes; helicopter flight frequency may range between five and ten times per week for each vessel. Crew changes for smaller vessels (e.g. PSVs, tugs) will typically be conducted at port outside of the OA. All vessels will initially mobilise and demobilise at the port.

All vessels routinely discharge waste streams into the marine environmental These discharges, which are managed under maritime legislation, include sewage, greywater, food waste, brine (from freshwater makers), ballast water, and cooling water. When such discharge occurs in the OA, the vessels are subject to the management measures described in this EP.

All vessels will operate on DP—no vessel anchoring is planned for the activities within the scope of this EP.

4 Description of the Environment

The Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPPGS(E)R) detail the information that must be included in the EP. Specifically, Regulation 13(2) states that the environment plan must:

> *(a) describe the existing environment that may be affected by the activity; and*
>
> *(b) include details of the particular relevant values and sensitivities (if any) of that environment.*

To be able to provide an environment description that meets the requirements of the regulations, CAPL has split the environmental areas into the:

- Operational Area (OA); defined in Section 3.2.2
- 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.

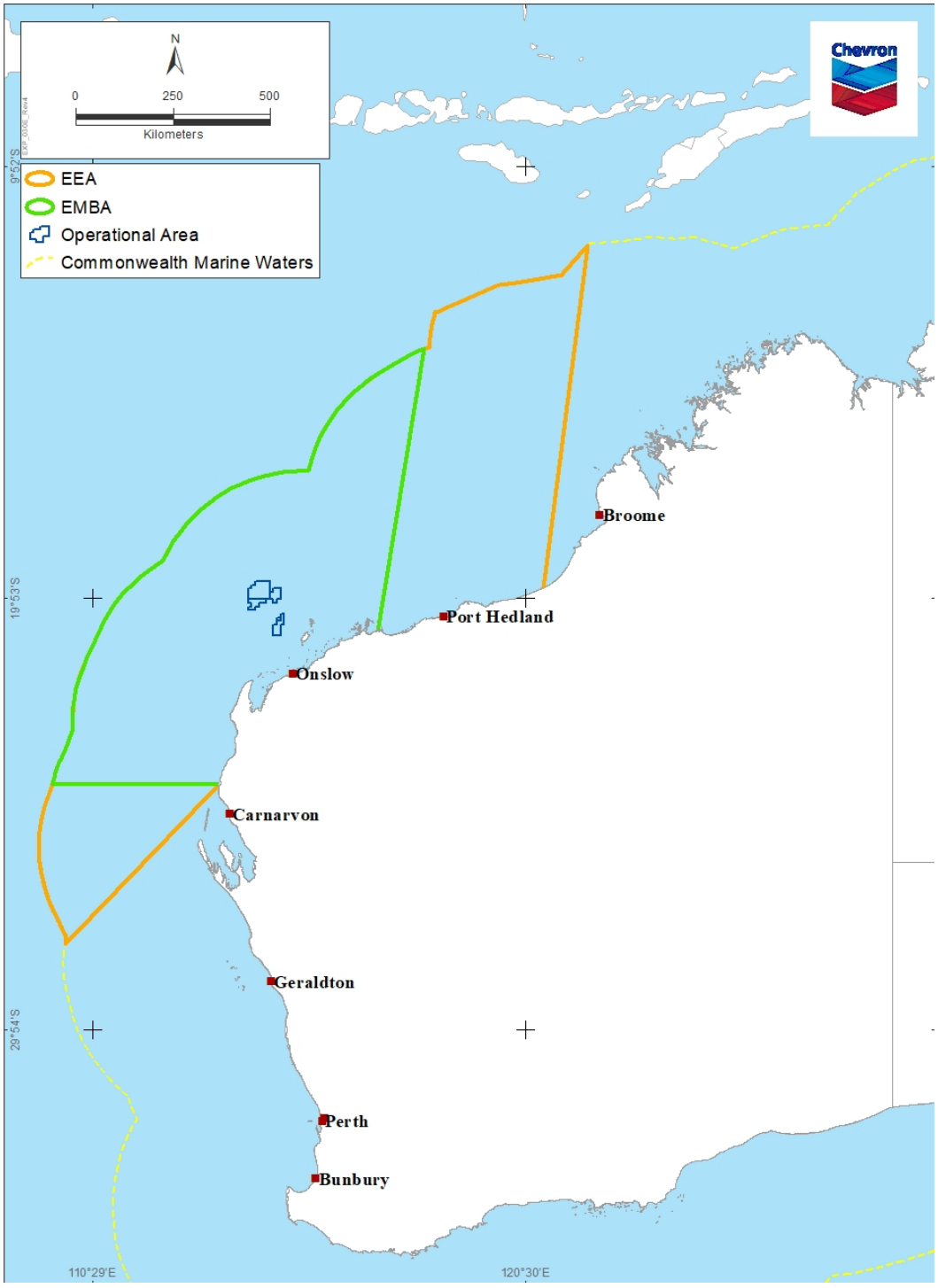


Figure 4-1: CAPL OA, EMBA, and EEA

4.1 Physical Environment

CAPL's Description of the Environment document identifies and summarises the physical environment (Appendix C; Ref. 8).

4.2 Biological Environment

CAPL's Description of the Environment document (Appendix C; Ref. 8) also identifies and summarises the biological environment. The presence of biological values and sensitivities within the OA, EMBA, and EEA is detailed in the following subsections.

4.2.1 Marine Mammals

Based on several Protected Matters searches (Ref. 6; Ref. 7; Ref. 123; Ref. 124), the list of Threatened and Migratory marine mammal species present within the OA, EMBA, and EAA is listed in Table 4-1. Biologically Important Areas (BIAs) associated with marine mammal species are listed in Table 4-2.

Table 4-1: Threatened and Migratory Marine Mammals

Common Name	OA	EMBA	EEA
Antarctic Minke Whale, Dark-shoulder Minke Whale	☐	☒	☒
Australian Snubfin Dolphin	☐	☒	☒
Blue Whale	☒	☒	☒
Bryde's Whale	☒	☒	☒
Dugong	☐	☒	☒
Fin Whale	☒	☒	☒
Humpback Whale	☒	☒	☒
Indo–Pacific Humpback Dolphin	☐	☒	☒
Killer Whale, Orca	☒	☒	☒
Sei Whale	☒	☒	☒
Southern Right Whale	☐	☒	☒
Sperm Whale	☒	☒	☒
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	☒	☒	☒

Table 4-2: BIAs for Threatened and Migratory Marine Mammals

Common Name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
Australian Snubfin Dolphin	Breeding	Year-round	☐	☒	☒
	Calving	Year-round	☐	☒	☒
	Foraging (high-density prey)	Year-round	☐	☒	☒
	Foraging likely	Year-round	☐	☐	☒
Dugong	Breeding	Apr-May	☐	☒	☒
	Calving	Apr- May	☐	☒	☒
	Foraging	Apr- May May- Sep	☐	☒	☒
	Foraging (high density seagrass beds)	Apr- May	☐	☒	☒

Common Name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
	Migration likely	Year-round	☐	☒	☒
	Nursing	April-May	☐	☒	☒
Humpback Whale	Calving	Winter	☐	☐	☒
	Migration	Northern migration, late Jul–Sep	☐	☐	☒
	Migration (north and south)	Northern peak Jul Southern peak Oct–Nov	☒	☒	☒
	Nursing	Winter	☐	☐	☒
	Resting	Winter	☐	☒	☒
Indo–Pacific Humpback Dolphin	Breeding	Year-round	☐	☒	☒
	Calving	Year-round	☐	☒	☒
	Foraging	Year-round	☐	☐	☒
	Foraging (high-density prey)	Year-round	☐	☒	☒
Indo–Pacific/Spotted Bottlenose Dolphin	Breeding	Not possible to determine yet	☐	☒	☒
	Calving	Not possible to determine yet	☐	☒	☒
	Foraging	Not possible to determine yet	☐	☒	☒
	Foraging likely	Not possible to determine yet	☐	☐	☒
	Migration likely	Not possible to determine yet	☐	☐	☒
Pygmy Blue Whale	Distribution	-	☒	☒	☒
	Foraging	-	☐	☒	☒
	Migration	Northern migration (enter Perth canyon Jan–May; pass Exmouth Apr–Aug; continue north to Indonesia) Southern migration (follow WA coastline from Oct–late Dec)	☐	☒	☒

4.2.2 Reptiles

Based on several Protected Matters searches (Ref. 6; Ref. 7; Ref. 123; Ref, 124), the list of Threatened and Migratory marine reptile species present within the OA, EMBA, and EEA is listed in Table 4-3. Habitats critical to the survival of marine turtles and BIAs associated with marine reptile species are listed in Table 4-4 and Table 4-5 respectively.

Table 4-3: Threatened and Migratory Marine Reptiles

Common Name	OA	EMBA	EEA
Flatback Turtle	☒	☒	☒
Green Turtle	☒	☒	☒
Hawksbill Turtle	☒	☒	☒
Leatherback Turtle, Leathery Turtle	☒	☒	☒

Common Name	OA	EMBA	EEA
Loggerhead Turtle	☒	☒	☒
Olive Ridley Turtle, Pacific Ridley Turtle	☐	☐	☒
Salt-water Crocodile, Estuarine Crocodile	☐	☒	☒
Short-nosed Seasnake	☐	☒	☒

Table 4-4: Critical Habitats for Marine Turtles

Common Name	Location	Seasonal Presence	OA	EMBA	EEA
Loggerhead Turtle	Exmouth Gulf and Ningaloo coast. 20 km internesting buffer	Nov–May	☐	☒	☒
	Gnaraloo Bay and beaches. 20 km internesting buffer	Nov–May	☐	☒	☒
	Shark Bay, all coastal and island beaches out to the northern tip of Dirk Hartog Island. 20 km internesting buffer	Nov–May	☐	☐	☒
Green Turtle	Browse Island. 20 km internesting buffer	Nov–Mar	☐	☐	☒
	Scott Reef. 20 km internesting buffer	Nov–Mar	☐	☐	☒
	Adele Island, Lacepede Islands	Nov–Mar	☐	☐	☒
	Dampier Archipelago. 20 km internesting buffer	Nov–Mar	☐	☒	☒
	Barrow Island, Montebello Islands, Serrurier Island, and Thevenard Island. 20 km internesting buffer	Nov–Mar	☐	☒	☒
	Exmouth Gulf and Ningaloo coast. 20 km internesting buffer	Nov–Mar	☐	☒	☒
Hawksbill Turtle	Dampier Archipelago, including Delambre Island and Rosemary Island. 20 km internesting buffer	Oct–Feb	☐	☒	☒
	Cape Preston to mouth of Exmouth Gulf including Montebello Islands and Lowendal Islands. 20 km internesting buffer	Oct–Feb	☐	☒	☒
Olive Ridley Turtle	Cape Leveque. 20 km internesting buffer	May–Jul	☐	☐	☒
Flatback Turtle	Lacepede Islands. 60 km internesting buffer	Oct–Mar	☐	☐	☒
	Eco Beach (near Broome). 60 km internesting buffer	Jul	☐	☒	☒
	Eighty Mile Beach. 60 km internesting buffer	Jul	☐	☒	☒
	Cemetery Beach, Port Hedland. 60 km internesting buffer	Oct–Mar	☐	☒	☒
	Mundabullangana Beach. 60 km internesting buffer	Oct–Mar	☐	☒	☒
	Dampier Archipelago, including Delambre Island and Hauy Island. 60 km internesting buffer	Oct–Mar	☐	☒	☒

Common Name	Location	Seasonal Presence	OA	EMBA	EEA
	Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island. 40 km internesting buffer	Oct–Mar	☐	☒	☒

Table 4-5: BIAs for Threatened and Migratory Marine Reptiles

Common Name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
Flatback Turtle	Aggregation		☐	☒	☒
	Foraging	Year-round – early summer	☐	☒	☒
	Internesting		☐	☒	☒
	Internesting buffer	Year-round – summer	☒	☒	☒
	Mating	Early summer	☐	☒	☒
	Migration corridor	Summer (nesting/internesting) year-round	☐	☒	☒
	Nesting	Short summer nesting season, predominantly Nov–Mar with peak in Jan	☐	☒	☒
Green Turtle	Aggregation	Early summer	☐	☒	☒
	Basking	Summer	☐	☒	☒
	Foraging	Mar–May, summer, year-round	☐	☒	☒
	Internesting	Dec–Feb Peak season Dec–Jan	☐	☒	☒
	Internesting buffer	Dec–Jan Peak season Dec–Jan Year-round	☐	☒	☒
	Mating	Summer	☐	☒	☒
	Migration corridor	Summer (nesting/internesting) year-round	☐	☒	☒
	Nesting	Peak season Dec–Jan	☐	☒	☒
Hawksbill Turtle	Foraging	Spring and early summer, peak nesting Oct	☐	☒	☒
	Internesting	Spring and early summer, peak nesting Oct	☐	☒	☒
	Internesting buffer	Spring and early summer, year-round	☐	☒	☒
	Mating	-	☐	☒	☒
	Migration corridor	-	☐	☒	☒
	Nesting	-	☐	☒	☒
Loggerhead Turtle	Foraging	Year-round	☒	☒	☒
	Internesting	Dec–Mar	☐	☐	☒
	Internesting buffer		☐	☒	☒
	Nesting	Dec–Mar	☐	☒	☒

4.2.3 Fishes, including Sharks and Rays

Based on several Protected Matters searches (Ref. 6; Ref. 7; Ref. 123; Ref. 124), the list of Threatened and Migratory fishes including shark and ray species present within the OA, EMBA, and EEA is listed in Table 4-6. BIAs associated with fish (including shark and ray species) are listed in Table 4-7.

Table 4-6: Threatened and Migratory Fishes, including Sharks and Rays

Common Name	OA	EMBA	EEA
Dwarf Sawfish, Queensland Sawfish	☐	☒	☒
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	☐	☒	☒
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	☒	☒	☒
Green Sawfish, Dindagubba, Narrowsnout Sawfish	☒	☒	☒
Grey Nurse Shark (west coast population)	☒	☒	☒
Longfin Mako	☒	☒	☒
Narrow Sawfish, Knifetooth Sawfish	☒	☒	☒
Northern River Shark, New Guinea River Shark	☐	☐	☒
Porbeagle, Mackerel Shark	☐	☒	☒
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray	☒	☒	☒
Shortfin Mako, Mako Shark	☒	☒	☒
Whale Shark	☒	☒	☒
White Shark, Great White Shark	☒	☒	☒

Table 4-7: BIAs for Threatened and Migratory Fishes, including Sharks and Rays

Common Name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
Dwarf Sawfish	Foraging	Habitat used in dry season to early wet (Dec) All seasons	☐	☒	☒
	Juvenile	All seasons	☐	☐	☒
	Nursing	Use in dry season to early wet (Dec) All seasons	☐	☒	☒
	Pupping	All seasons	☐	☒	☒
Freshwater Sawfish	Foraging	All seasons	☐	☒	☒
	Juvenile	Pupping occurs from Jan–May	☐	☒	☒
	Nursing	All seasons	☒	☐	☒
	Pupping	Pupping occurs from Jan–May, more prevalent during the late wet season when mature animals have more water to manoeuvre in	☐	☒	☒
Green Sawfish	Foraging	-	☐	☒	☒
	Nursing	-	☐	☒	☒

Common Name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
	Pupping	-	☐	☒	☒
Whale Shark	Foraging	Spring	☒	☒	☒
	Foraging (high-density prey)	Apr–Jun, autumn	☐	☒	☒

4.2.4 Seabirds and Shorebirds

Based on several Protected Matters searches (Ref. 6; Ref. 7; Ref. 123; Ref. 124), the list of Threatened and Migratory seabird and shorebird species present within the OA, EMBA, and EEA is listed in Table 4-8. BIAs associated with seabird and shorebird species are listed in Table 4-9.

Table 4-8: Threatened and Migratory Seabirds and Shorebirds

Common Name	OA	EMBA	EEA
Abbott's Booby	☐	☒	☒
Amsterdam Albatross	☐	☐	☒
Asian Dowitcher[2]	☐	☒	☒
Australian Fairy Tern	☒	☒	☒
Australian Lesser Noddy	☐	☐	☒
Australian Painted Snipe	☐	☒	☒
Barn Swallow[1]	☐	☒	☒
Bar-tailed Godwit[2]	☐	☒	☒
Black-browed Albatross	☐	☐	☒
Black-tailed Godwit	☐	☒	☒
Bridled Tern	☐	☒	☒
Broad-billed Sandpiper[2]	☐	☒	☒
Brown Booby	☐	☒	☒
Campbell Albatross, Campbell Black-browed Albatross	☐	☒	☒
Caspian Tern	☐	☒	☒
Common Greenshank, Greenshank[2]	☐	☒	☒
Common Noddy	☒	☒	☒
Common Redshank, Redshank[2]	☐	☒	☒
Common Sandpiper[2]	☒	☒	☒
Crested Tern[2]	☐	☒	☒
Curlew Sandpiper[2]	☒	☒	☒
Double-banded Plover[2]	☐	☐	☒
Eastern Curlew, Far Eastern Curlew[2]	☒	☒	☒
Flesh-footed Shearwater, Fleshy-footed Shearwater	☐	☒	☒
Fork-tailed Swift	☐	☒	☒

Common Name	OA	EMBA	EEA
Gouldian Finch	☐	☐	☒
Great Frigatebird, Greater Frigatebird	☐	☒	☒
Great Knot[2]	☐	☒	☒
Greater Sand Plover, Large Sand Plover[2]	☐	☒	☒
Grey Plover[2]	☐	☒	☒
Grey Wagtail[1]	☐	☒	☒
Grey-tailed Tattler[2]	☐	☒	☒
Indian Yellow-nosed Albatross	☐	☐	☒
Lesser Frigatebird, Least Frigatebird	☒	☒	☒
Lesser Sand Plover, Mongolian Plover[2]	☐	☒	☒
Little Curlew, Little Whimbrel[2]	☐	☒	☒
Little Tern	☐	☒	☒
Long-toed Stint[2]	☐	☒	☒
Malleefowl	☐	☐	☒
Marsh Sandpiper, Little Greenshank[2]	☐	☒	☒
Masked Booby	☐	☒	☒
Masked Owl (northern)	☐	☐	☒
Night Parrot	☐	☒	☒
Northern Giant Petrel	☐	☐	☒
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri)	☐	☒	☒
Oriental Cuckoo, Horsfield's Cuckoo[1]	☐	☒	☒
Oriental Plover, Oriental Dotterel[2]	☐	☒	☒
Oriental Pratincole[2]	☐	☒	☒
Osprey[2]	☒	☒	☒
Pacific Golden Plover[2]	☐	☒	☒
Pectoral Sandpiper[2]	☒	☒	☒
Pin-tailed Snipe[2]	☐	☒	☒
Princess Parrot, Alexandra's Parrot	☐	☒	☒
Red Goshawk	☐	☐	☒
Red Knot, Knot[2]	☒	☒	☒
Red-footed Booby	☐	☐	☒
Red-necked Stint[2]	☐	☒	☒
Red-rumped Swallow[1]	☐	☐	☒
Red-tailed Tropicbird	☐	☒	☒
Roseate Tern	☐	☒	☒

Common Name	OA	EMBA	EEA
Ruddy Turnstone[2]	☐	☒	☒
Ruff (Reeve) [2]	☐	☒	☒
Sanderling[2]	☐	☒	☒
Sharp-tailed Sandpiper[2]	☒	☒	☒
Shy Albatross, Tasmanian Shy Albatross	☐	☐	☒
Soft-plumaged Petrel	☐	☒	☒
Southern Giant-Petrel, Southern Giant Petrel	☒	☒	☒
Streaked Shearwater	☒	☒	☒
Swinhoe's Snipe[2]	☐	☒	☒
Terek Sandpiper[2]	☐	☒	☒
Wandering Albatross	☐	☐	☒
Wedge-tailed Shearwater	☐	☒	☒
Whimbrel[2]	☐	☒	☒
White-capped Albatross	☐	☐	☒
White-tailed Tropicbird	☐	☒	☒
White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren	☐	☒	☒
White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren	☐	☐	☒
Wood Sandpiper[2]	☐	☒	☒
Yellow Wagtail[1]	☐	☒	☒

1 Migratory terrestrial species (unlikely to be encountered in the EMBA)

2 Migratory Wetland Species (unlikely to be encountered in the EMBA)

Table 4-9: BIAs for Threatened and Migratory Seabirds and Shorebirds

Common Name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
Bridled Tern	Foraging (in high numbers)	Almost entirely a breeding visitor, arrives late Sep or Oct and leaves between late Feb and early May	☐	☐	☒
Brown Booby	Breeding	Breeding Feb–Oct (but mainly in autumn)	☐	☒	☒
Fairy Tern	Breeding	Breeding Jul to late Sep; birds from South West Marine Region (SWMR) disperse north in winter	☐	☒	☒
Greater Frigatebird	Breeding	Breeding in May–Jun and Aug	☐	☐	☒
Lesser Crested Tern	Breeding	Breeding Mar–June	☐	☒	☒
Lesser Frigatebird	Breeding	Breeding Mar–Sep	☐	☒	☒
Little Tern	Breeding	Breeding recorded in Jun, Jul, and Oct	☐	☒	☒

Common Name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
	Resting	Breeding recorded in Jun, Jul, and Oct	☐	☒	☒
Red-footed Booby	Breeding	Breeding in May-June	☐	☐	☒
Roseate Tern	Breeding	Breeding from mid-Mar–Jul; birds from SWMR disperse north in winter	☐	☒	☒
	Resting	Winter	☐	☒	☒
Sooty Tern	Foraging	Late Aug–early May	☐	☐	☒
Wedge-tailed Shearwater	Breeding	Breeding visitor; arrives in mid-Aug and leaves Pilbara in Apr and Shark Bay in mid-May	☒	☒	☒
	Foraging (in high numbers)	Mid-Aug–May	☐	☐	☒
White-tailed Tropicbird	Breeding	Breeding recorded in May and Oct	☒	☒	☒

4.2.5 Marine Habitat

Marine habitats considered to provide a specific value for matters of National Environmental Significance as described in CAPL's Description of the Environment document (Appendix C; Ref. 8) were identified within the OA, EMBA, and EEA (Table 4-10).

In addition to the broad marine habitat description provided for the EMBA, CAPL has conducted extensive surveys within the production licences to understand the nature and composition of habitat and seabed sediments, and thus provide accurate bathymetry for geohazard assessment and engineering design. These surveys comprise high-resolution geophysical surveys, predominantly supported by seabed sampling campaigns. Data from these surveys were interpreted to characterise benthic substrate; the benthic habitat within the OA comprises soft substrate (see Figure 4-2 and Figure 4-3).

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
Eighty Mile Beach[1]	☐	☒	☐	☒	☐	☐	☒	☒
Mermaid Reef – Rowley Shoals[2]	☐	☐	☒	☐	☐	☐	☐	☒
Ningaloo Coast [3]	☐	☐	☒	☐	☐	☐	☒	☒
Ningaloo Coast[4]	☐	☒	☒	☐	☐	☐	☒	☒
Oceanic Shoals[5]	☐		☒	☐	☐	☐	☐	☒
Roebuck Bay[1]	☒	☒	☐	☐	☐	☐	☒	☒
Shark Bay[4]	☒	☐	☐	☐	☐	☐	☐	☒
Shark Bay (Wooramel Seagrass Bank)[3]	☒	☐	☐	☐	☐	☐	☐	☒
Subtropical and Temperate Coastal Saltmarsh[6]	☐	☐	☐	☒	☐	☐	☒	☐
West Kimberley – National Heritage Place	☐	☒	☒	☐	☐	☐	☒	☒

1 *Ramsar Wetland*
2 *Commonwealth Heritage*
3 *National Heritage Place*
4 *World Heritage Property*
5 *Australian Marine Park*
6 *Threatened Ecological Community*

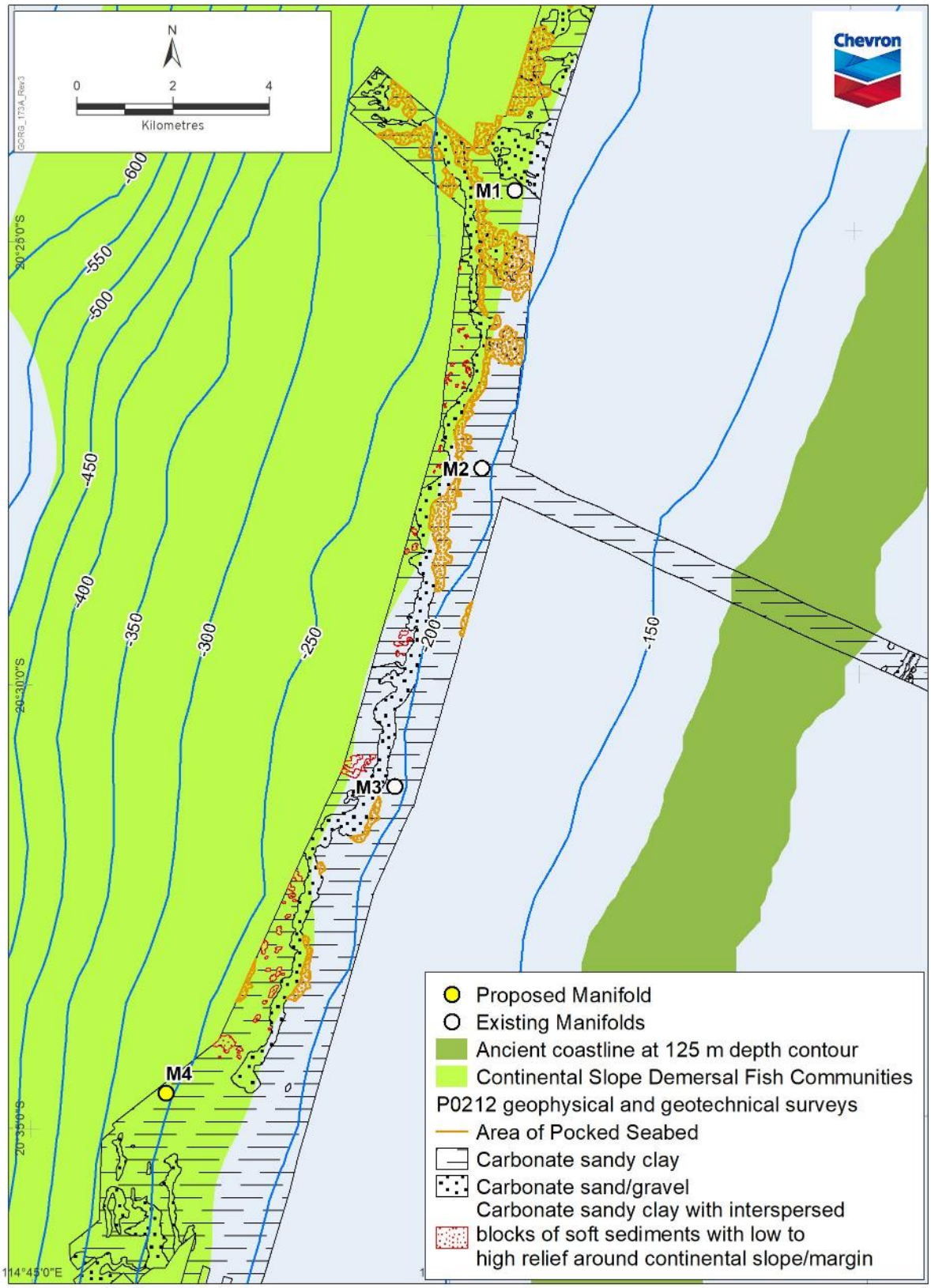


Figure 4-2: GS2 (Gorgon) Well Locations and Benthic Habitat

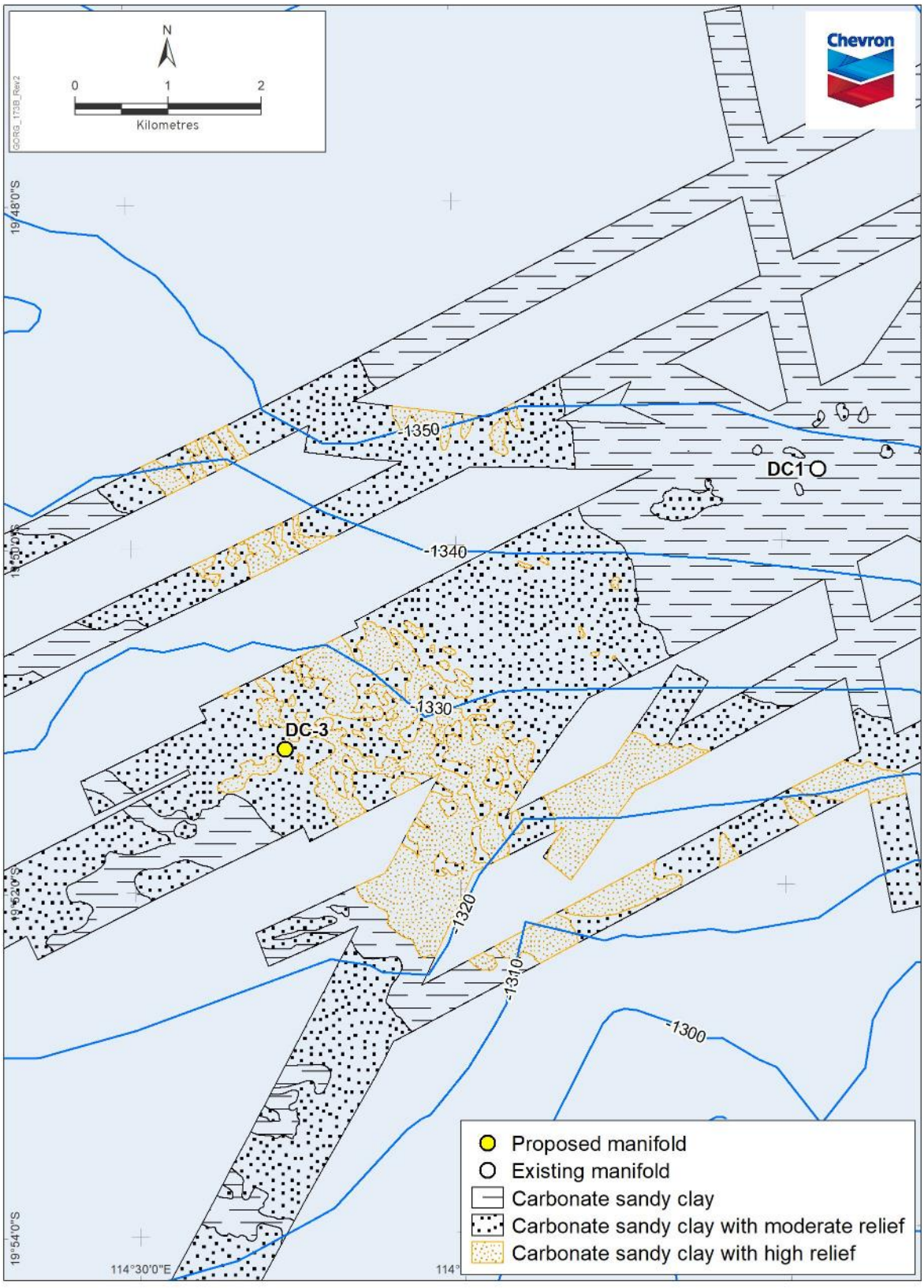


Figure 4-3: GS2 (Jansz–Io) Well Locations and Benthic Habitat

4.3 Commercial Interests

4.3.1 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 document (Appendix C; Ref. 8) identifies and summarises the commercial fisheries.

Stakeholder engagement, along with annual fishing records indicate that only two fisheries were active in the OA in 2018—the Pilbara Line Fishery and Pilbara Trap Fishery (Ref. 132). Neither of these fisheries operated more than three vessels within the OA in 2018 (Figure 4-4). No landing weights were recorded by the Pilbara Trap Fishery within the Operational Area as these are only provided where three or more vessels are active. However, the Pilbara Line Fishery recorded a catch of ~18785 kg (in 2018) near the OA by (Ref. 132). The extent and effort of these fisheries during the 2018 fishing season is shown in Figure 4-4.

As part of its Consultation Service, WAFIC confirmed:

- Pilbara Trap Fishery licence holders are not currently active in the OA.
- A single Western Tuna and Billfish Fishery (Commonwealth) licence holder is known to be active in the OA.

The commercial state and Commonwealth fisheries with licences that overlap the OA, EMBA, and EEA are listed in Table 4-11 and Table 4-12 respectively.

Table 4-11: State Managed Fisheries

State Managed Fisheries	OA	EMBA	EEA
Abalone	☒	☒	☒
Broome Prawn	☐	☒	☒
Exmouth Gulf Prawn	☐	☒	☒
Gascoyne Demersal Scalefish	☐	☒	☒
Kimberley Crab	☐	☒	☒
Kimberley Gillnet and Barramundi	☐	☒	☒
Kimberley Prawn	☐	☐	☒
Mackerel Fishery	☒	☒	☒
Marine Aquarium	☒	☒	☒
Nickol Bay Prawn	☐	☒	☒
Northern Demersal Scalefish	☐	☒	☒
Octopus	☐	☐	☒
Onslow Prawn	☒	☒	☒
Pilbara Crab	☐	☒	☒
Pilbara Fish Trawl	☒	☒	☒
Pilbara Line	☒	☒	☒
Pilbara Trap	☒	☒	☒

State Managed Fisheries	OA	EMBA	EEA
Shark Bay Beach Seine and Mesh Net	☐	☐	☒
Shark Bay Crab	☐	☐	☒
Shark Bay Prawn	☐	☐	☒
Shark Bay Scallop	☐	☐	☒
South West Coast Salmon / South Coast Salmon	☒	☒	☒
Specimen Shell	☒	☒	☒
West Coast Deep Sea Crustacean	☒	☒	☒
West Coast Demersal Gillnet and Demersal Longline	☐	☐	☒
West Coast Demersal Scalefish	☐	☐	☒
West Coast Rock Lobster	☐	☒	☒

Table 4-12: Commonwealth Managed Fisheries

Commonwealth Managed Fisheries	OA	EMBA	EEA
North-West Slope Trawl Fishery	☒	☒	☒
Southern Bluefin Tuna Fishery	☐	☒	☒
Western Deepwater Trawl Fishery	☐	☒	☒
Western Skipjack Fishery	☒	☒	☒
Western Tuna and Billfish Fishery	☒	☒	☒

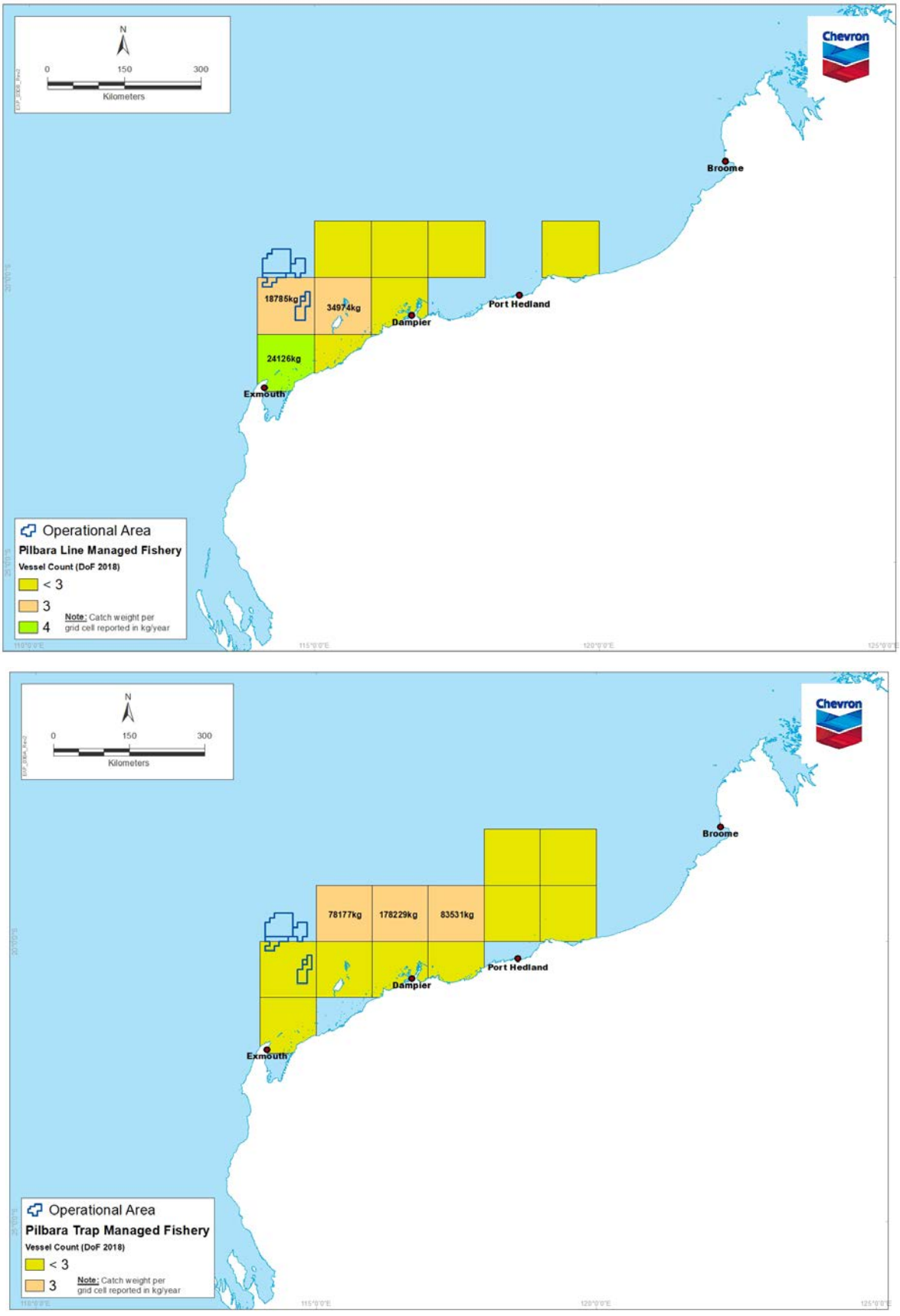


Figure 4-4: Active Fisheries and Effort in Relation to the Operational Area

4.3.2 Shipping

AMSA uses a satellite automated identification system (AIS) service that provides AIS data across the Indo–Pacific and Indonesian region. Data provided by shipborne AISs were used to build a point density map from filtered satellite AIS data collected in December 2019—the aim was to show the level of shipping activity in State and Commonwealth Waters (Ref. 135) near the OA (Figure 4-5). The figure clearly shows increased density around CAPL's existing infrastructure.

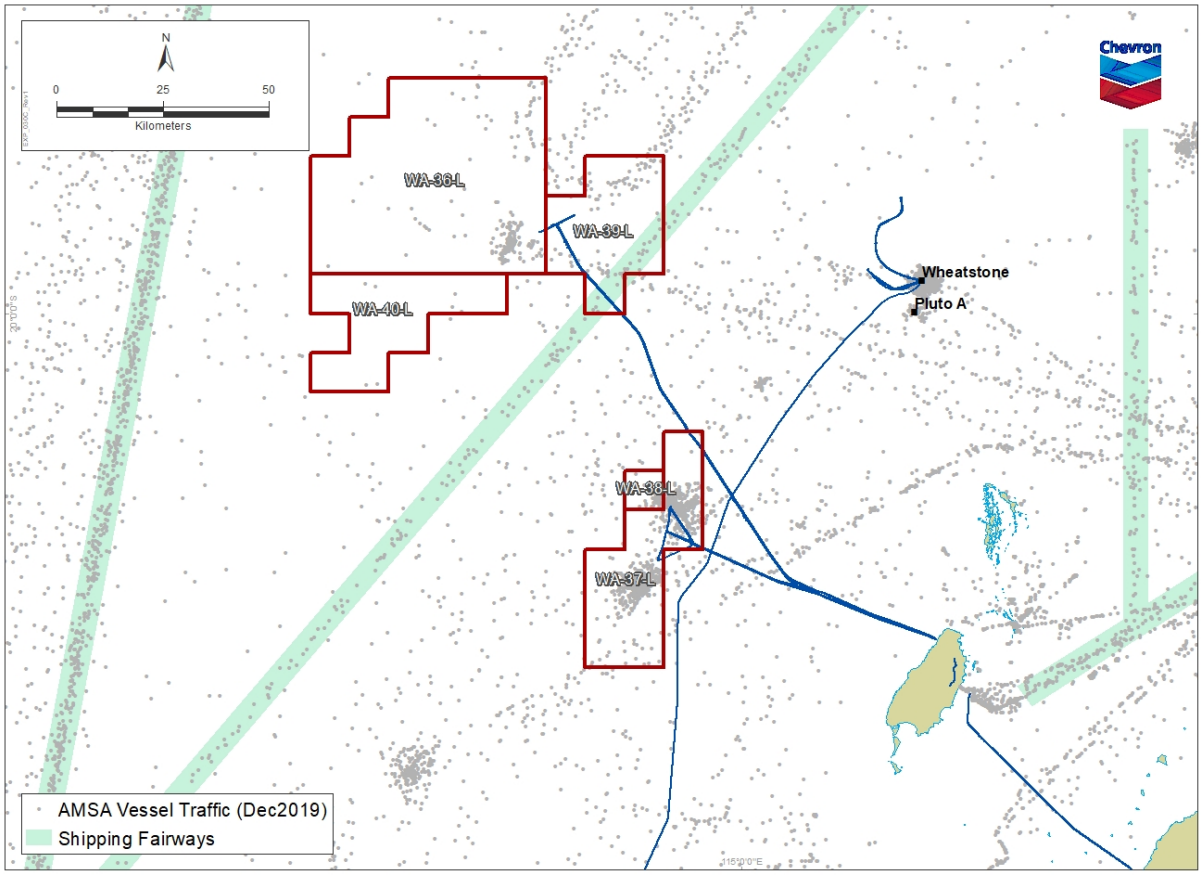


Figure 4-5: Commercial Shipping Density

4.4 Qualities and Characteristics of Locations, Places, and Areas

CAPL's Description of the Environment document (Appendix C; Ref. 8) identifies and describes the qualities and characteristics of the locations, places, and areas that CAPL considers to comprise these receptor groups:

- Ramsar Wetlands (Table 4-13)
- Threatened Ecological Communities (TECs) (Table 4-14)
- Australian Marine Parks (AMPs) (Table 4-15)
- Key Ecological Features (KEFs) (Table 4-16).

Table 4-13: Ramsar Wetlands

Wetland Name	OA	EMBA	EEA
Eighty Mile Beach	☐	☒	☒
Roebuck Bay	☐	☒	☒

Table 4-14: Summary of TECs

TEC Name	OA	EMBA	EEA
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	☐	☐	☒

Table 4-15: Summary of AMPs

AMP Name	OA	EMBA	EEA
Abrolhos	☐	☐	☒
Argo-Rowley Terrace	☐	☒	☒
Carnarvon Canyon	☐	☐	☒
Dampier	☐	☒	☒
Eighty Mile Beach	☐	☒	☒
Gascoyne	☐	☒	☒
Kimberley	☐	☒	☒
Mermaid Reef	☐	☒	☒
Montebello	☐	☒	☒
Ningaloo	☐	☒	☒
Roebuck	☐	☒	☒
Shark Bay	☐	☐	☒

Table 4-16: Summary of KEFs

KEF Name	OA	EMBA	EEA
Ancient coastline at 125 m depth contour	☒	☒	☒
Canyons linking the Argo Abyssal Plain with the Scott Plateau	☐	☐	☒
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	☐	☒	☒
Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	☐	☐	☒
Wallaby Saddle	☐	☐	☒
Western demersal slope and associated fish communities	☐	☐	☒

4.5 Heritage Value of Places

CAPL's Description of the Environment document (Appendix C; Ref. 8) identifies and describes the heritage values. The World Heritage Properties, National Heritage Places, and Commonwealth Heritage Places within the OA and EMBA are listed in Table 4-17, Table 4-18, and Table 4-19 respectively.

Historic shipwrecks and sunken aircraft (>75 years' old) are protected under the Commonwealth *Underwater Cultural Heritage Act 2018*. The Australasian Underwater Cultural Heritage Database (Ref. 17) identified that zero,100, and 258 shipwrecks (>75 years' old) were present within the OA, EMBA, and EEA respectively.

Table 4-17: World Heritage Properties

World Heritage Properties	OA	EMBA	EEA
Shark Bay	☐	☐	☒
The Ningaloo Coast	☐	☒	☒

Table 4-18: National Heritage Places

National Heritage Places	OA	EMBA	EEA
Dirk Hartog Landing Site 1616 – Cape Inscription Area	☐	☐	☒
HMAS Sydney II and *HSK Kormoran* Shipwreck Sites	☐	☐	☒
Shark Bay, Western Australia	☐	☐	☒
The Ningaloo Coast	☐	☒	☒
The West Kimberley	☐	☒	☒

Table 4-19: Commonwealth Heritage Properties

Commonwealth Heritage Properties	OA	EMBA	EEA
Learmonth Air Weapons Range Facility	☐	☒	☒
Mermaid Reef – Rowley Shoals	☐	☒	☒
Ningaloo Marine Area – Commonwealth Waters	☐	☒	☒
Scott Reef and Surrounds – Commonwealth Area	☐	☐	☒
HMAS Sydney II and *HSK Kormoran* Shipwreck Sites	☐	☐	☒

5 Environmental Risk Assessment Methodology

In accordance with Regulation 13(5) of the OPGGS(E)R, this section summarises the methods used to identify and assess the environmental impacts and risks associated with the activities described in Section 3.

The risk assessment for this EP was undertaken in accordance with CAPL's Operational Excellence (OE) Australian Business Unit's (ABU) Risk Management Procedure (Ref. 18) using the Chevron Corporation Integrated Risk Prioritization Matrix (Figure 5-1). This approach generally aligns with the processes outlined in ISO 31000:2009 Risk Management – Principles and Guidelines (Ref. 19) and Handbook 203:2012 Managing Environment-Related Risk (Ref. 20).

The risk assessment process and evaluation involved consulting with environmental, health, safety, commissioning, start-up, operations, maintenance, and engineering personnel. The 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).

RISK: The OE Risk Management Procedure (Ref. 18) defines risk as the combination of the potential consequences arising from a specified hazard, together with the likelihood of the hazard resulting in an unwanted event.

5.1 Identification and Description of the Petroleum Activity

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

5.2 Identification of Particular Environmental Values and Sensitivities

The presence of environmental values and sensitivities within the OA and wider EMBA is documented in Section 4 with the values and sensitivities described in the Description of the Environment document (Appendix C; Ref. 8). In accordance with Regulation 13(3) of the OPGGS(E)R, CAPL considers the particular values and sensitivities to be:

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

Because many protected, rare, or endangered fauna have the potential to transit through the OA and wider EMBA, 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 Environmental Aspects

ASPECT: 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 discharges, greenhouse gas emissions, 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 are outside the scope of this EP.

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

- physical presence
- light emissions
- underwater sound
- atmospheric emissions
- 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, the potential consequences were evaluated using the Integrated Risk Prioritization Matrix (Figure 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 (from Section 4) (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 the acceptability criteria.

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

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

Figure 5-1: Chevron Corporation Integrated Risk Prioritization Matrix

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. 21; GN0166), CAPL has adapted the approach developed by Oil and Gas UK (OGUK) (Ref. 22) 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 is made for lower-order impacts and risks (Table 5-2) 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.

A Type B decision is made for higher-order impacts and risks (Table 5-2) 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 typically involves sufficient complexity, higher-order impact and risks (Table 5-2), 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.

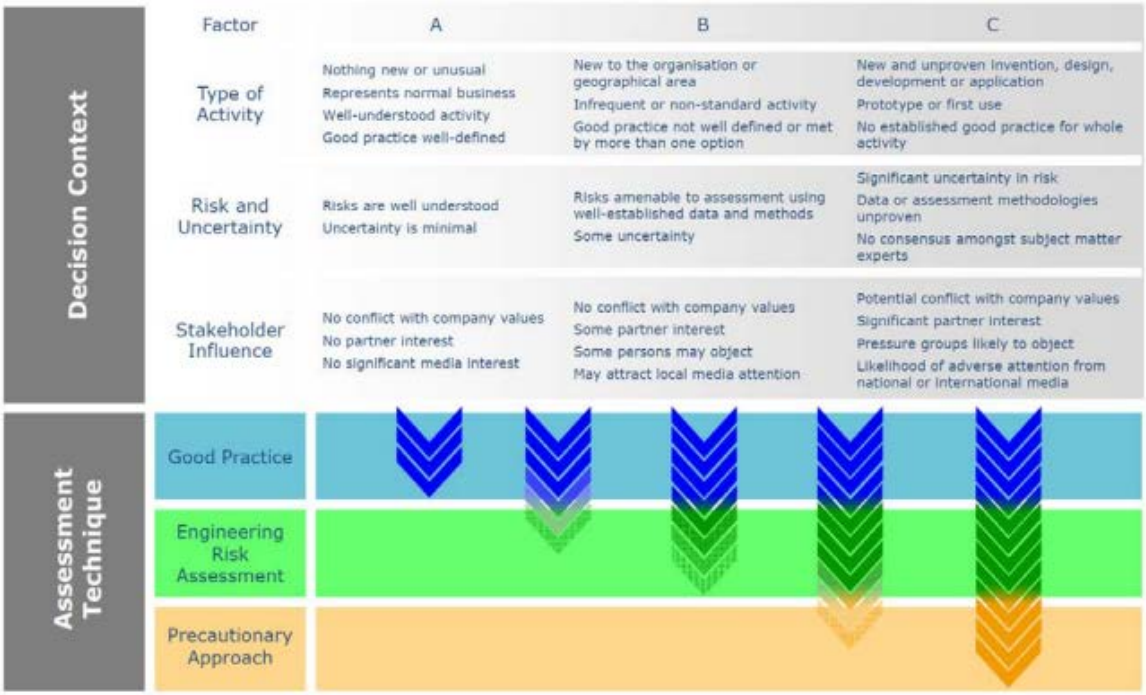


Figure 5-2: ALARP Decision Support Framework

(Source: Ref. 21)

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 Section 6.

The assessment techniques considered include:

- good practice
- engineering risk assessment
- precautionary approach.

5.5.2.2 Good Practice

OGUK (Ref. 22) 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. 22), 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. 22) 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 Figure 5-1.

5.5.4 Quantification of the Level of Risk

The Integrated Risk Prioritization Matrix (Figure 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 risk assessment to the environment (as defined under the OPGGS(E)R).

5.6 Risk and Impact Acceptance Criteria

NOPSEMA provides guidance on demonstrating that impacts and risks will be of an acceptable level (Ref. 23). 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 (e.g. consistent with titleholder policy, culture, and company standards)
- external context (the existing environment and stakeholder expectations).

5.6.1 Principles of ESD and Precautionary Principle

The principles of ESD are considered in Table 5-1 in relation to acceptability evaluations.

Table 5-1: 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 (Figure 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.

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.

5.6.2 Defining an Acceptable Level of Impact and Risk

Following NOPSEMA's ALARP Guidance Note (Ref. 21; GN0166), CAPL has applied the approach that lower-order environmental impacts or risks (Table 5-2) 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'.

Table 5-2: CAPL Definition of Lower- and Higher-order Impacts and Risks

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

Consequently, for higher-order impacts and risks, CAPL will define an acceptable level of impact or risk for each aspect. CAPL considers these types of documents when defining the acceptable level of impact or risk:

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

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

5.6.3 Summary of Acceptance Criteria

Table 5-3 outlines the criteria that CAPL used to demonstrate that impacts and risks from each identified aspect are acceptable.

Table 5-3: Acceptability Criteria

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

Acceptability Test	
Defined acceptable level	Is the impact and risk broadly acceptable (i.e. Decision Context A)?
	If no: For higher-order environmental impacts and risks (Decision Context B or C), what is the defined level of impact, and does the activity meet this level?

5.7 Environmental Performance Outcomes, Standards, and Measurement Criteria

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

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

- **Environmental Performance Outcomes**: the level of performance in managing the potential environmental impacts and environmental risks from each petroleum activity
- **Environmental Performance Standards**: 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 Environment Plan Decision-Making Guideline (A524696; Ref. 24), 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 Risk Assessment and Management Strategy – Petroleum Activity

To meet the requirements of the OPGGS(E)R, Regulation 13(5) and (6), *Evaluation of environmental impacts and risks* and Regulation 13(7) *Environmental performance outcomes and standards,* this Section evaluates the impacts and risks associated with the petroleum activity appropriate to the nature and scale of each impact and risk, and details the control measures that are used to reduce the risks to ALARP and an acceptable level. Additionally, environmental performance outcomes, performance standards, and measurement criteria have been developed and are described in the following subsections.

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

Table 6-1: Impact and Risk Overview

Ref.	Aspect	Impact	Risk			Decision Context (A/B/C)	ALARP	Acceptable
		C[1]	C	L	R			
6.1	Physical Presence (Marine Users and Marine Fauna)	-	6	2	7	A	Yes	Yes
6.2	Light Emissions	6	6	3	8	A	Yes	Yes
6.3	Underwater Sound	5	5	3	7	A	Yes	Yes
6.4	Physical Presence – Seabed	4	-	-	-	A	Yes	Yes
6.5	Atmospheric Emissions	6	-	-	-	A	Yes	Yes
6.6.16.6	Planned Discharge – Cooling and Brine Water	6	-	-	-	A	Yes	Yes
6.6.2	Planned Discharge – Ballast Water (and Biofouling)	-	2	6	7	A	Yes	Yes
6.6.3	Planned Discharge – Sewage, Greywater, and Food Wastes	6	6	5	10	A	Yes	Yes
6.6.4.4	Mechanical Completion and Pre-commissioning Discharges – Risk Assessment	6	5	5	9	A	Yes	Yes
6.7.1	Waste	-	6	5	10	A	Yes	Yes
6.7.2	Loss of Containment	-	5	5	9	A	Yes	Yes
6.7.3	Vessel Collision	-	2	6	7	A	Yes	Yes
6.8.4.1	Ground Disturbance – Shoreline Spill Response	-	5	5	9	A	Yes	Yes
6.8.4.2	Physical Presence – Oiled Wildlife Response	-	5	5	9	A	Yes	Yes

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

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

6.1 Physical Presence (Marine Users and Marine Fauna)

Source

The physical presence of the installation vessels was identified as having the potential to result in an interaction with either marine fauna or other marine users within the OA.

Potential Impacts and Risks

Impacts	C	Risks	C
N/A	-	Unplanned interactions with receptors have the potential to cause: • injury or death of marine fauna	6

Consequence Evaluation

Injury or death of marine fauna

Surface-dwelling fauna are the species most at risk from this aspect and thus are the focus of this evaluation. As identified in Section 4.2, several whale species listed as Threatened and/or Migratory under the EPBC Act have the potential to occur within the OA. In total, five BIAs overlap the OA. These are:

- Pygmy Blue Whale (migration)
- Pygmy Blue Whale (presence)
- Humpback Whale (migration)
- Whale Shark (foraging)
- Flatback Turtle (internesting).

The Recovery Plan for Marine Turtles in Australia (Ref. 13) and Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (Ref. 14) identify vessel disturbance as a key threat. However, the recovery plan notes that this is only an issue in shallow coastal foraging habitats (Ref. 13, Ref. 14), which are not present in the OA. As such, Whale Sharks and cetaceans were the focus of this evaluation as they provide a representative case to enable an indicative consequence evaluation to be undertaken.

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. 25).

Collisions between larger vessels with reduced manoeuvrability and large, slow-moving cetaceans occur more frequently where high vessel traffic and cetacean habitat occurs (Ref. 26). Laist *et al.* (Ref. 27) found that larger vessels with reduced manoeuvrability moving >10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling faster than 14 knots. The fastest lay rates for flowlines and pipelines within the scope of this EP is expected to be ~2 km per day (or 0.4 knots), while installation of subsea infrastructure would occur from stationary / slow-moving vessels. Consequently, the installation vessels covered by this EP would not be moving at these higher speeds (i.e. >10 knots) when conducting activities within the scope of this EP.

There have been recorded instances of cetacean deaths in Australian waters (e.g. a Bryde's Whale in Bass Strait in 1992) (Ref. 26), although the data indicates deaths are more likely to be associated with container ships and fast ferries. Mackay *et al.* (Ref. 28) 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.

The duration of fauna exposure to vessel strike depends on the duration of installation activities completed under this EP. As described in Section 3.2.1, the scope of this activity is expected to occur over 24 months.

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.

Disruption to commercial activities

As identified in Table 4-11 and Table 4-12, several commercial fisheries have licences that overlap the OA associated with this EP.

Annual fishing records, indicate that only two fisheries were active in the OA during the 2018 season with no more than three vessels for each fishery potentially operating within the OA each year (Ref. 132). Although CAPL notes that these records may not be complete, they provide sufficient information to indicate the level of fishing effort near the activities covered by this EP is expected to be low. This is confirmed through engagement with WAFIC who indicates very limited current commercial fishing activity occurs in the OA and engagement with licence holders has not indicated any projected increase in the near term. Consequently, the

proposed activities or presence of the additional production wells are not expected to result in an impact to commercial operations (via loss of catches or damage to fishing equipment).

However, small numbers of fishing vessels or commercial shipping vessels may be encountered near the OA. As such, the most credible impact to other marine users would be the minor deviation of these vessels around the installation vessels. Any required deviation is not expected to impact on the functions, interests, or activities of other marine users (as confirmed by stakeholder consultation records).

Any impacts arising from the physical presence of the installation vessels is expected to be limited, thus is evaluated as having the potential to have 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 and other marine user interactions during vessel operations are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL.

Although the OA is located adjacent to high-density shipping channels, commercial fishing activities near the OA are limited (Ref. 132) as confirmed by WAFIC who indicate very limited commercial fishing activity currently occurs in the OA and engagement with licence holders has not indicated any projected increase in the near term.

The risks arising from the physical presence of installation vessels are lower-order risks (see Table 5-2).

As such, CAPL applied ALARP Decision Context A for this aspect.

Control Measure	Source of Good Practice Control Measure
• 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 (Ref. 29). These regulations describe strategies to ensure whales and dolphins are not harmed during offshore interactions with people, and include requirements for • vessel masters • fauna observation actions • fauna interaction management actions.
• Pre-start notifications	Under the Commonwealth *Navigation Act 2012*, the AHO is responsible for maintaining and disseminating hydrographic and other nautical information and nautical publications including: • Notices to Mariners • Auscoast warnings. Details of offshore activities are published in Notices to Mariners, thus enabling other marine users to plan their activities, and minimising disruption from these activities. Relevant details will be provided to the JRCC to enable Auscoast warnings to be disseminated.
• CAPL Marine Safety Reliability and Efficiency Process	CAPL's Marine Safety Reliability and Efficiency (MSRE) Standardised OE Process (Ref. 88) 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 information is available to commercial fishers operating in this area to enable ease of communication in highlighting risks and nearby exclusion zones.

Likelihood and Risk Level Summary	
Likelihood	Due to the nature and scale of this petroleum activity, the slow-moving nature of vessels within the OA, the limited area of operation, and the limited duration of this program, the likelihood of interaction with other marine users or a vessel collision with marine fauna is considered low. However, conditions may occur where interactions with smaller marine fauna (such as fish and turtles) are more likely, thus the likelihood of the consequence occurring was conservatively ranked as Occasional (2).
Risk Level	Low (7)

Determination of Acceptability			
Principles of ESD	The risks associated with this aspect are associated with unplanned interactions causing individual fauna death / incidental disruption to other marine users, which is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.		
Relevant Environmental Legislation and Other Requirements	Legislation and other requirements considered relevant for this aspect include: • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans – The Australian Guidelines for Whale and Dolphin Watching (Ref. 29) • Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 10) • Conservation Advice for the Humpback Whale 2015–2020 (Ref. 9) • Conservation Advice *Balaenoptera borealis* Sei Whale (Ref. 11) • Conservation Advice *Balaenoptera physalus* Fin Whale (Ref. 12) • Conservation Advice for the Whale Shark 2015-2020 (Ref. 15) • Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (Ref. 14) • Recovery Plan for Marine Turtles in Australia (Ref. 13) • Commonwealth *Navigation Act 2012*.		
Internal Context	These CAPL environmental performance standards / procedures were deemed relevant for this aspect: • MSRE process (OE-03.09.01) (Ref. 88)		
External Context	Engagement with WAFIC indicate very limited commercial fishing activity currently occurs in the OA and engagement with licence holders has not indicated any projected increase in the near term.		
Defined Acceptable Level	In accordance with Section 5.6, these risks are inherently acceptable as they are lower-order risks. In addition, these potential risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
Prevent injury or death to listed fauna from a fauna strike within the OA	**Vessel Master** Vessel Masters will be briefed on caution and 'no approach zones' and interaction management actions as defined in the EPBC Regulations 2000 – Part 8 Division 8.1.	Training records confirm vessel masters were briefed on caution and 'no approach zones' and interaction management actions as defined in the EPBC Regulations 2000 – Part 8 Division 8.1	Vessel Master
	Vessel Master A Vessel Master (or delegate) will be on duty at all times.	Bridge watch records confirm a vessel master (or delegate) was on duty at all times	Vessel Master
	Fauna interaction management actions Vessels will implement, where practicable: • Caution zone (300 m either side of whales; 150 m either side of dolphins): vessels must operate at no wake speed in this zone. • No approach zone (100 m either side of whales; 300 m for whale calves; 50 m either side of	Installation vessel daily reports note when cetaceans were sighted, and the guidelines were implemented	Vessel Master

	dolphins): vessels should not enter this zone and should not wait in front of the direction of travel of an animal or pod.		
Prevent physical interaction with other marine users during this activity	**Pre-start notifications** The AHO will be notified at least four working weeks before operations commence to enable Notices to Mariners to be published.	Email records confirm the AHO were notified via email to datacentre@hydro.gov.au at least four working weeks before operations commenced	ABU GS2 Construction Superintendent
	Pre-start notifications AMSA's JRCC will be notified 24–48 hours before operations commence to enable AMSA to distribute an Auscoast warning.	Email records confirm that information to distribute an Auscoast warning was provided to the JRCC via email (rccaus@amsa.gov.au)	ABU GS2 Construction Superintendent
	Vessel Crew and Navigational Equipment 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.	ABU GS2 Construction Superintendent

6.2 Light Emissions

Cause of Aspect

This activity was identified as having the potential to result in the generation of light emissions:

- support operations (installation vessels).

Monitoring undertaken by Woodside (Ref. 30) indicates that light density (navigational lighting) attenuated to below 1.00 lux and 0.03 lux at distances of 300 m and 1.4 km, respectively, from a Mobile Offshore Drilling Unit (MODU). Navigational lighting is expected to be the same on installation vessels and MODU thus (Ref. 30) is considered appropriate to inform the analysis if this assessment. Light densities of 1.00 and 0.03 lux are comparable to natural light densities experienced during deep twilight and during a quarter moon. For this assessment, it is conservatively assumed that within 1.4 km, there is the potential for light emissions to attract marine species.

Potential Impacts and Risks

Impacts	C	Risks	C
Light emissions will cause a change in ambient light levels resulting in a localised light glow.	6	A change in ambient light levels resulting in a localised light glow may impact receptors by: • acting as an attractant to light-sensitive species (e.g. seabirds, fish), in turn affecting predator–prey dynamics.	6

Consequence Evaluation

Based on modelling undertaken by Woodside (Ref. 30), CAPL expects that its activities will result in temporary changes to ambient light emissions extending to a radius of ~1.4 km from the installation vessel. 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).

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. 31), so light is not considered to be a significant factor in cetacean behaviour or survival.

Light can attract many species of fish, reptiles, and seabirds. Within the OA, the particular values and sensitivities with the potential to be exposed to light emissions include:

- Wedge-tailed Shearwater (breeding / foraging)
- Flatback Turtle (internesting).

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. 32) and that lighting can attract birds from large catchment areas (Ref. 33). 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. 34). The Draft National Light Pollution Guidelines (Ref. 116) 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. 117; Ref. 118) and fledgling seabirds grounded in response to artificial light 15 km away (Ref. 119).

As the OA is (at its closest) 65 km from coastline habitats, no turtle hatchlings or seabird fledglings would be exposed to changes in ambient light levels. Only a small number of Threatened or Migratory listed seabird 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.

The Recovery Plan for Marine Turtles in Australia (Ref. 13) 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 behaviours (near coast), as well as disrupting hatchling orientation and sea-finding behaviours of hatchlings. Given the distance offshore and limited exposure associated with this activity, light emissions are not expected to affect critical behaviours discussed in the turtle recovery plan. If individual internesting turtles were attracted to the light, it is not expected that this would significantly alter critical behaviours that would lead to individual or greater population impacts due to the distance offshore.

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 to be lower-order impacts and risks in accordance with this EP (Table 5-2). As such, CAPL applied ALARP Decision Context A for this aspect.			
Control Measure	**Source of Good Practice Control Measure**		
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.		
Likelihood and Risk Level Summary			
Likelihood	Due to the nature and scale of this petroleum activity and its offshore location, the likelihood of light emissions from the activity acting as an attractant to light-sensitive species was ranked as Seldom (3).		
Risk Level	Low (8)		
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: • Draft National Light Pollution Guidelines (Ref. 116) • Recovery Plan for Marine Turtles in Australia (Ref. 13)		
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.		
Defined Acceptable Level	In accordance with Section 5.6, these impacts and risks are inherently acceptable as they are lower-order impacts and risks. In addition, these potential impacts and risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
N/A	N/A	N/A	N/A

6.3 Underwater Sound

Cause of Aspect

These activities were identified as having the potential to result in the generation of underwater sound emissions:

- site survey (SSS / MBES)
- support operations (installation vessels)
- support operations (helicopters).

Site Survey (SSS / MBES)

Site surveys may use various survey techniques as described in Section 3.5.1. The indicative frequencies and sound levels associated with these techniques are also listed in Section 3.5.1. In summary, survey techniques are expected to emit various frequencies between 12 and 500 kHz; maximum at-source sound levels are ~238 dB re 1 µPa (zero to peak) (Ref. 35).

Support Operations – Installation Vessels

Studies of underwater noise generated from propellers of offshore installation vessels when holding position indicate highest measured levels up to 182 dB re 1 µPa, with levels of 120 dB re 1 µPa recorded at 3–4 km (Ref. 36).

Support Operations – Helicopter Operations

Sound emitted from helicopter operations is typically below 500 Hz (Ref. 37). The peak-received level diminishes with increasing helicopter altitude, but the duration of audibility often increases with increasing altitude. Richardson *et al.* (Ref. 25) 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.

Potential Impacts and Risks

Impacts	C	Risks	C
Sound emissions will cause a change in ambient sound levels.	5	The generation of underwater sound has the potential to affect marine fauna through: • localised and temporary behavioural disturbance • auditory impairment, permanent threshold shift.	5

Consequence Evaluation

The change in sound levels will be temporary and limited to the duration of the activity. The particular values and sensitivities with the potential to be exposed to sound emissions include:

- Humpback Whale (migration)
- Pygmy Blue Whale (migration)
- Whale Shark (foraging)
- fish communities (associated with the various KEFs)
- Flatback Turtle (internesting).

Localised and Temporary Behavioural Disturbance – Continuous (Support Operations)

Whales

Using the United States (US) National Marine Fisheries Service (NMFS) guidance for non-pulsed sound, such as vessel noise, a behavioural disturbance limit of 120 dB re 1 µPa was adopted (Ref. 38). Richardson *et al.* (Ref. 25) and Southall *et al.* (Ref. 40) indicate that behavioural avoidance of baleen whales may onset from 140 to 160 dB re 1 µPa or possibly higher.

McCauley (Ref. 36; Ref. 41) indicates that continuous noise sources from vessel operations are expected to fall below 120 dB re 1 µPa within 4 km of the vessel.

Hearing damage in marine mammals from shipping noise has not been widely reported (Ref. 42). Although there is the potential for a larger number of cetaceans to be present within 4 km of the OA during migration periods, given the sparse open-water environment, it is not expected that exposure to these sound levels would result in a significant change to migration behaviours that would result in further impact at either individual or local population levels. Therefore, the only potential impacts expected would be short-term Minor (5) effects to individuals.

Turtles

McCauley *et al.* (Ref. 43) reported that exposure to airgun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa rms, with turtles observed to increase their swimming activity at received sound levels of ~166 dB re 1 µPa rms. Although pulsed sounds are expected to result in different impacts to that of continuous sounds, in lieu of appropriate information for continuous sound emissions, CAPL used 166 dB re 1 µPa rms as a conservative threshold to inform the evaluation for this potential impact. Because noise levels generated from vessel operations have the potential to be ~182 dB re 1 µPa, it can be expected that continuous noise emissions have the potential to result in behavioural impacts.

The OA is 65 km away from sensitive coastline and is on the outer limits of the Flatback Turtle internesting BIA (60 km buffer of critical breeding habitat associated with the Montebello Islands and Barrow Island).

Because sound levels from vessel operations are known to be well below impact thresholds 4 km from the vessel (120 dB re 1 µPa recorded at 3–4 km; Ref. 36) exposure to the BIA above levels that are expected to result in behavioural changes are not expected. Consequently, any potential disturbance would only be expected to result in short-term Minor (5) effects to species.

Fish

Due to a lack of observational data on impacts to fish from continuous sources, Popper *et al.* (Ref. 44) proposed qualitative indicators of relative risk of effects indicating that peak sound pressure level (SPL) (~207 dB re 1 µPa) has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity. Behavioural impacts in fish are expected to be limited to an initial startle reaction before behaviours either return to normal, or result in fish moving away from the area (Ref. 45).

Vessel thrusters were identified as being the highest continuous sound source for offshore operations (measured to have a peak output of ~182 dB re 1 µPa). As the sound levels are below the thresholds at which recoverable injuries could occur, and as any behavioural impacts are expected to be short term, the consequence was evaluated as Minor (5).

Auditory Impairment, Permanent Threshold Shift – Continuous (Support Operations)

Whales

The criteria set by Southall *et al.* (Ref. 40) suggests that to cause an instantaneous injury to cetaceans resulting in a permanent loss in hearing, the sound must exceed 230 dB re 1 µPa (peak SPL). Given the sound levels of continuous noise sources are below this, it is not expected that vessel operations result in auditory impairment or permanent threshold shift to whales; therefore, this is not discussed further.

Turtles

Sound levels that could cause auditory impairment or permanent threshold shift onset are considered possible at an SPL of 180 dB re 1 µPa (Ref. 96). Studies have identified that avoidance behaviours are expected to occur before exceeding the levels that would be expected to result in auditory impairment or permanent threshold shift (Ref. 46). Consequently, it is not expected that vessel operations result in auditory impairment to turtles; therefore, this is not discussed further.

Fish

Popper *et al.* (Ref. 44) propose qualitative indicators of relative risk of effects indicating that peak SPL (~207 dB re 1 µPa) has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity; thus, peak levels would need to be above this to result in auditory impairment. Due to the nature of the proposed activities and sound monitoring completed from similar offshore vessel operations, CAPL does not expect its activities to exceed the thresholds described above that could result in auditory impairment or permanent injury.

Therefore, this potential impact is not considered further.

Localised and Temporary Behavioural Disturbance – Pulsed (Site Survey)

Taking a zero to peak source level of 238 dB re 1 µPa, received levels of sound were estimated (Table 6-2) for various distances from the source, using a sound propagation algorithm based on Richardson *et al.* (Ref. 25).

Table 6-2: Estimated Received Sound Levels with Distance from the Source

Horizontal distance from source (m)	Received sound levels (dB re 1 µPa)
0	238
3	228
50	204
100	198

500	184
794	180
1000	178
7000	161

Whales

Richardson *et al.* (Ref. 25) and Southall *et al.* (Ref. 40) indicate that behavioural avoidance of baleen whales may onset from 140 to 160 dB re 1 µPa or possibly higher. The NMFS guidance for pulsed sound indicates disturbance to cetaceans is likely at 160 dB re 1 µPa rms (Ref. 39)

Although there is the potential for a larger number of cetaceans to be present during migration periods, any adverse impact would have to occur close to the source; Table 6-2 shows that exposures above impact thresholds are expected ~7 km from the vessel. As such, given the distance offshore and the lack of behaviours that may result in sedentary behaviour, it would only ever be expected that a small number of whales would be close enough to the acoustic source to result in changes to behaviours.

If migrating cetaceans were present, it is not expected that exposure to these sound levels would result in a significant change to migratory behaviours that would result in further impacts at both individual or local population levels. As such, the only potential impacts expected would be short-term effects to individuals, which were ranked as Minor (5).

Turtles

McCauley *et al.* (Ref. 43) reported that exposure to airgun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa rms, with turtles observed to increase their swimming activity at received sound levels of ~166 dB re 1 µPa rms. The OA overlaps a BIA for Flatback Turtles displaying internesting behaviours, but it is at the outer limit of this area (identified as a 60 km buffer). Sound levels generated from the site survey are anticipated to be below this threshold within 7 km of the sound source (Table 6-2). Given the distance offshore and because species present in this area are expected to be limited to transient individuals, exposure would only be expected to a small number of individuals (based on exposure to 0.4% of the BIA assuming a 7 km exposure footprint [49 km^2] and a BIA of 11 309 km^2). Thus, any potential disturbance would result in short-term effects to species, which were ranked as Minor (5).

Fish

Given a lack of observational data for impacts to fish from SSS/MBES sources, Popper *et al.* (Ref. 44) proposed qualitative indicators of relative risk of effects indicating that peak SPL (~207 dB re 1 µPa) has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity. The sound levels that are expected to be produced by the site survey indicate potential for some localised and temporary disturbance. Recoverable injuries are considered a temporary disturbance; therefore, the resulting 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. 45). Thus, any potential impacts are expected to be limited, with short-term effects to species, which were ranked as Minor (5).

Auditory Impairment, Permanent Threshold Shift – Pulsed (Site Survey)

Whales

The criteria set by Southall *et al.* (Ref. 40) suggests that to cause an instantaneous injury to cetaceans resulting in a permanent loss in hearing, the sound must exceed 230 dB re 1 µPa (peak SPL). Sound levels generated from the site survey are anticipated to be below this threshold within 3 m of the sound source (Table 6-2). Consequently, for auditory impairment or permanent threshold shift to occur, whales would need to be extremely close to the sound source, which, given common behavioural traits (avoidance) is not expected to occur. Thus, no permanent or temporary physical impacts to whales are expected.

Turtles

Sound levels that could cause auditory impairment or permanent threshold shift onset are considered possible at an SPL of 180 dB re 1 µPa (Ref. 96). Sound levels are expected to be below this threshold within 800 m of the sound source (Table 6-2). However, studies have indicated that avoidance behaviours are expected to occur before exceeding the levels that may result in auditory impairment or permanent threshold shift (Ref. 46).

Consequently, it is not expected that site surveys would result in any auditory impairment to turtles; therefore, this is not discussed further.

Fish

Popper *et al.* (Ref. 44) propose qualitative indicators of relative risk of effects indicating that peak SPL (~207 dB re 1 µPa) has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity; thus, peak levels would need to be above this to result in auditory impairment. Sound levels are

expected to be below this threshold within 50 m of the sound source (Table 6-2). The site survey is expected to result in an initial startle reaction before behaviours return to normal or result in fish moving away from the area (Ref. 45). Consequently, due to the nature of the proposed activities, CAPL does not expect these activities to result in exposures to values and sensitivities above thresholds that could result in auditory impairment or permanent injury. Therefore, this potential impact is not considered further.	
ALARP Decision Context Justification	
Offshore commercial vessel operations and site 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 and 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 these activities, the impacts and risks arising from underwater sound emissions are considered lower-order impacts and risks in accordance with Table 5-2. As such, CAPL applied ALARP Decision Context A for this aspect.	
Control Measure	**Source of Good Practice Control Measure**
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 (Ref. 29). These regulations describe strategies to ensure whales and dolphins are not harmed during offshore interactions with people, and include requirements for: • vessel masters • fauna observation actions • fauna interaction management actions. By implementing these control measures and managing interactions with cetaceans near the installation vessels or any site surveys, the potential impacts from underwater sound are limited.
Likelihood and Risk Level Summary	
Likelihood	Baleen whales may exhibit behavioural avoidance when sound levels are 140 to 160 dB re 1 µPa or possibly higher (Ref. 25; Ref. 40). Baleen whales display a gradation of behavioural responses to seismic activities, suggesting that seismic 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. 47), 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. 45; Ref 46). 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. It is reasonable to expect that impacts such as these will not occur during this project with the identified controls in place. Therefore, the likelihood is considered Seldom (3).
Risk Level	Low (7)
Acceptability Summary	
Principles of ESD	The impacts and risks associated with this aspect are limited to localised, short-term behavioural changes. On the assumption that this potential impact occurs during a sensitive life stage (such as migration), CAPL would not expect these activities to affect migration, internesting, or foraging behaviours, nor impact on individuals or the wider population. As such, this aspect is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no further evaluation against the Principles of ESD is required.
Relevant Environmental	Legislation and other requirements considered applicable for this aspect include:

Legislation and Other Requirements	• EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans (Ref. 29). • Conservation Advice for the Humpback Whale 2015–2020 (Ref. 9) • Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 11) • Recovery Plan for Marine Turtles in Australia (Ref. 13) • Conservation Advice for the Whale Shark 2015–2020 (Ref. 15)		
Internal Context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.		
External context	During stakeholder consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity.		
Defined Acceptable Level	In accordance with Section 5.6, these impacts and risks are considered inherently acceptable as they are lower-order impacts and risks. In addition, the potential impacts and risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
CAPL will conduct the activity in a manner that prevents the displacement of Humpback Whales and Pygmy Blue Whales from their respective BIAs	**Vessel Master** Vessel Masters will be briefed on caution and 'no approach zones' and interaction management actions as defined in the EPBC Regulations 2000 – Part 8 Division 8.1.	Training records confirm vessel masters were briefed on caution and 'no approach zones' and interaction management actions as defined in the EPBC Regulations 2000 – Part 8 Division 8.1.	Vessel Master
	Vessel Master A Vessel Master (or delegate) will be on duty at all times.	Bridge watch records confirm a vessel master (or delegate) was on duty at all times.	Vessel Master
	Fauna interaction management actions Vessels will implement, where practicable: • Caution zone (300 m either side of whales; 150 m either side of dolphins): vessels must operate at no wake speed in this zone. • No approach zone (100 m either side of whales; 300 m for whale calves; 50 m either side of dolphins): vessels should not enter this zone and should not wait in front of the direction of travel of an animal or pod.	Installation vessel daily reports note when cetaceans were sighted, and the guidelines were implemented.	Vessel Master

6.4 Physical Presence – Seabed

Cause of Aspect

These activities were identified as causing seabed disturbance:

- installation of infield flowlines and umbilicals
- subsea structure installation and tie-in
- inspection, maintenance, and repair (IMR).

Potential Impacts and Risks

Impacts	C	Risks	C
Seabed disturbance will cause impacts to benthic receptors via: • alteration of benthic habitat	4	None identified	-

Consequence Evaluation

Alteration of Benthic Habitat

The area of benthic habitat disturbed for the GS2 Program is relatively small (~15 000 m^2), and is used for temporarily storing infrastructure during installation and the permanent infrastructure footprint (described in Section 3). The disturbance footprint is expected to be within (or close to) three KEFs:

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

Although KEFs were identified as having the potential to be exposed, as described in Section 4.4, benthic habitat is known to comprise soft sediment infauna communities that are widespread and homogenous in the region.

Any impact will be limited to the immediate vicinity of the disturbance, and thus the extent of potential impact is localised. Even though soft sediment habitats are not known to be sensitive to disturbance, the infrastructure will be in place for a long time; therefore, the impact was determined as Moderate (4).

ALARP Decision Context Justification

Seabed disturbance from offshore 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. The level of controls implemented generally depend on the receiving environment, which, for this EP, are expected to be soft sediment communities on flat featureless seabed.

Although this activity will occur within a spatially defined KEF, benthic surveys undertaken in the area indicate that marine habitat is expected to be limited to soft sediment communities.

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 (Table 5-2).

As such, CAPL applied ALARP Decision Context A for this aspect.

Control Measure	Source of Good Practice Control Measure
Pre-lay survey	CAPL conducts pre-lay surveys to ensure that any uncertainty is removed before installing subsea infrastructure. These surveys detect obstructions such as emergent features, and where such obstructions are identified, the proposed location is amended.

Likelihood and Risk Level Summary

Likelihood	N/A (see Section 5.5.3)
Risk Level	N/A

Acceptability Summary			
Principles of ESD	The impact associated with this aspect is limited to localised disturbance of well-represented soft sediment communities over a long time; consequently, this aspect is not considered as having the potential to affect biological diversity and ecological integrity. The impact associated with this aspect is Moderate (4). Therefore, no further evaluation against the Principles of ESD is required.		
Relevant Environmental Legislation and Other Requirements	No environmental legislation or other requirements were deemed relevant.		
Internal Context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.		
External context	During stakeholder consultation, no objections or claims were raised regarding seabed disturbance arising from the activity.		
Defined Acceptable Level	In accordance with Section 5.6, these impacts are considered inherently acceptable as they are lower-order impacts. In addition, the potential impacts associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
Prevent any impacts to emergent sensitive benthic features	**Pre-lay survey** CAPL will conduct benthic / pre-lay surveys to verify that no emergent seabed features / obstacles are present. Where these features are identified, infrastructure will be repositioned.	Pre-lay surveys verify no obstacles are present at infrastructure locations	ABU GS2 Construction Superintendent

6.5 Atmospheric Emissions

Cause of Aspect

These activities were identified as having the potential to result in air emissions:

- support operations (installation vessels)

Potential Impacts and Risks

Impacts	C	Risks	C
Generation of atmospheric emissions will result in: • a localised and temporary reduction in air quality.	6	N/A	-

Consequence Evaluation

A reduction in localised air quality

Modelling was undertaken for nitrogen dioxide (NO_2) emissions from MODU power generation for another offshore project (Ref. 48). 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 Australian Ambient Air Quality National Environmental Protection (Air Quality) Measures (NEPM; Ref. 136) recommends that hourly exposure to NO_2 is <0.12 ppm with annual average exposure <0.03 ppm.

Given that the modelling above is overly conservative as the volume of fuel required for power generation is expected to be significantly less for installation vessels when compared to MODU operations, and as the highest hourly averages (0.00039 ppm or 0.74 µg/m^3) were restricted to a distance ~5 km from the MODU (Ref. 48), exposures from activities covered under this EP would be 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 atmospheric emissions arising from the activity.

The impacts arising from atmospheric emissions constitute lower-order impacts (Table 5-2).

As such, CAPL applied ALARP Decision Context A for this aspect.

Control Measure	Source of Good Practice Control Measure
Reduced sulfur content fuel	Sulfur content of diesel/fuel oil complies with Marine Order 97 and Regulation 14 of MARPOL 73/78 Annex VI
Marine Order 97: Marine Pollution Prevention – Air Pollution	All vessels will 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 NO_x emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI. • Operation and ongoing maintenance of engines, generators, and deck equipment will be in accordance with manufacturers' instructions to ensure efficient operation.

Likelihood and Risk Level Summary			
Likelihood	N/A (see Section 5.5.3)		
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 • Regulation 14 of MARPOL 73/78		
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 atmospheric emissions arising from the activity.		
Defined Acceptable Level	In accordance with Section 5.6, these impacts are inherently acceptable as they are lower-order impacts. In addition, the potential impacts associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
Atmospheric emissions associated with activities described in this EP will comply with Marine Order 97 to minimise emissions to those necessary to perform the activity	**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	Vessel Master
	Marine Order 97: Marine Pollution Prevention – Air Pollution All combustion equipment is maintained in accordance with the planned maintenance system (PMS) (or equivalent).	PMS records verify that combustion equipment is maintained to schedule	Vessel Master
	Marine Order 97: Marine Pollution Prevention – Air Pollution Vessels with diesel engines >130 kW must be certified to emission standards (e.g. Engine International Air Pollution Prevention (EIAPP).	Certification documentation	Vessel Master
	Marine Order 97: Marine Pollution Prevention – Air Pollution Vessels implement their SEEMP to monitor and reduce air emissions (as appropriate to vessel class).	SEEMP records verify energy efficiency records were adopted	Vessel Master
	Marine Order 97: Marine Pollution Prevention – Air Pollution Fuel consumption is monitored on vessels (and portable back-deck equipment) and abnormally high consumption is investigated.	Fuel use is recorded in the daily operations reports	Vessel Master

6.6 Planned Discharge

The activities covered under this EP were assessed to identify all planned discharges, which are:

- cooling and brine water
- ballast water
- sewage, greywater, and food wastes
- mechanical completion / pre-commissioning discharges.

The impacts and risks associated with each of these discharges are evaluated in the subsections below.

6.6.1 Planned Discharge – Cooling and Brine Water

Cause of Aspect			
These activities have the potential to result in planned discharges of cooling and brine waters: • support operations (installation vessels) • mechanical completion (brine discharge).			
Potential Impacts and Risks			
Impacts	**C**	**Risks**	**C**
Planned discharges of cooling water and brine will result in: • a localised and temporary reduction in water quality.	6	None identified	-
Consequence Evaluation			
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. 30). Monitoring indicates that the change in water quality is limited to a localised area and returns to ambient following completion of the discharge; therefore, any impacts are Incidental (6).			
ALARP Decision Context Justification			
Offshore commercial vessel operations, and subsequent planned discharges, are commonplace and well-practised locally, nationally, and internationally. The control measures to manage the risk associated with offshore vessel discharges are well defined via legislative requirements that are considered standard industry practice. Given the limited environmental impacts of these discharges, there are no good practice control measures that are required to be implemented. During stakeholder consultation, no objections or claims were raised regarding discharges arising from the activity. The impacts associated with these discharges are lower-order impacts in accordance with Table 5-2. As such, CAPL applied ALARP Decision Context A for this aspect.			
Control Measure	**Source of Good Practice Control Measure**		
None identified.	No controls were applied for these impacts and risks. Impacts and risks associated with cooling water and brine discharges are lower-order impacts and no industry standard controls have been identified for these discharges.		
Likelihood and Risk Level Summary			
Likelihood	N/A (see Section 5.5.3)		
Risk Level	N/A		

Determination of Acceptability			
Principles of ESD	The potential impact associated with this aspect is limited to a short-term direct reduction in water quality in a localised area, which is not considered as having the potential to affect biological diversity and ecological integrity. Accordingly, the consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.		
Relevant Environmental Legislation and Other Requirements	No legislation or other requirements were considered relevant to this aspect.		
Internal Context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.		
External Context	During stakeholder consultation, no objections or claims were raised regarding discharges arising from the activity.		
Defined Acceptable Level	In accordance with Section 5.6, these impacts are inherently acceptable as they are lower-order impacts. In addition, the potential impacts associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
N/A	N/A	N/A	N/A

6.6.2 Planned Discharge – Ballast Water (and Biofouling)

Cause of Aspect

This activity has the potential to result in planned discharges of ballast waters:

- support operations (installation vessels).

Note: This activity also has the potential to result in biofouling, resulting in the same potential impacts. Consequently, both biofouling and ballast water discharge are evaluated below.

Potential Impacts and Risks

Impacts	C	Risks	C
None identified	-	Planned discharge of ballast water or biofouling has the potential to introduce a marine pest (one identified) that has the potential to destroy the ecology of marine habitats by outcompeting native species.	2

Consequence Evaluation

Invasive marine pests (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 established marine pests, and that approximately one in six introduced marine species becomes a pest (Ref. 49).

The marine habitat values and sensitivities with the potential to be impacted by the introduction of an IMP within the OA include:

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

Although three KEFs were identified as having the potential to be exposed, as described in Section 4.4, their benthic habitat is expected to comprise soft sediment infauna communities.

Once established, some pests can be difficult to eradicate (Ref. 50) 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. 51; Ref. 120; Ref. 121; Ref. 122)

The nature of the marine habitats within the OA indicate that establishment would be difficult due to the water depths, lack of hard substrates, and the presence of soft sediment communities.

If an IMP was introduced, and if it did colonise an area, there is the potential for that colony to spread outside the OA resulting in a widespread long-term impact, therefore resulting in a Severe (2) consequence.

ALARP Decision Context Justification

Offshore commercial vessel operations, and subsequent planned discharges, are commonplace and well-practised locally, nationally, and internationally.

The causes resulting in an introduction of IMPs 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 these production licences for the past 10 years while constructing and operating the GFP, 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 5-2.

As such, CAPL applied ALARP Decision Context A for this aspect.

Control Measure	Source of Good Practice Control Measure
CAPL Quarantine Procedure – Marine Vessels (OE-07.08.1010; Ref. 126)	CAPL's Quarantine Procedure (Ref. 126) provides information about quarantine compliance to CAPL, contractors, and others associated with marine vessels. Specifically, this procedure details the quarantine requirements detailed in the below control measures and requires that premobilisation biofouling information is provided to enable suitable risk assessments to be completed.

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.
Ballast water management	The Australian Ballast Water Management Requirements (Ref. 53) describes the management requirements for ballast water exchange.
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 requires that an antifouling certificate is in place for installation vessels.
Biofouling management plan Biofouling record book	The guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) MPEC.207(62) 2011 (Ref. 52) specifically requires a biofouling management plan and record book to be available and maintained.
Biofouling Risk Assessment	In accordance with the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Ref. 99), a biofouling risk assessment must be undertaken for all installation vessels covered under this EP. This risk assessment will consider evidence of recent wetsides cleaning, application of antifoul coating (and its status, if present), and recent transit history (including time in known high-risk waters). If there is a history of uncertainty or a moderate risk of IMP presence, an inspection will be undertaken in accordance with the National Biofouling Management Guidance (Ref. 99); additional actions will be undertaken (such as dry dock / hull cleaning) if the risk is considered high. As per the Western Australian Vessel Check biofouling risk assessment tool, if a vessel's risk is determined to be low then the biofouling risk is deemed to be acceptable and no further management actions will be implemented. However, if the risk is determined to be above the defined acceptable level (low), then additional management requirements will be implemented. This includes, but is not limited to, inspections to validate the assessed risk, in-water inspections, and/or cleaning (including spot cleaning if achievable).
Likelihood and Risk Level Summary	
Likelihood	Given the nature and scale of this activity, the expected absence of sensitive benthic habitats, water depths of the OA, ocean currents associated with the physical environment, the requirement to achieve low-risk status for biofouling, and that only low-risk ballast will be discharged within the OA, it is considered Rare (6) that this aspect would result in the introduction of an IMP and any subsequent impact to the ecological functions of the KEFs.
Risk Level	Low (7)
Acceptability Summary	
Principles of ESD	The potential impact associated with this aspect is a widespread long-term impact to benthic communities, which are expected to comprise soft sediment communities. The introduction of an IMP to these communities has the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Severe (2). Therefore, further evaluation against the remaining Principles of ESD is required. There is little uncertainty associated with this aspect as the activities and cause pathways are well known and the activities are well regulated and managed. The specific locations for the proposed infrastructure are well defined, and subsequently, the understanding of benthic habitat at these locations is well understood (Section 4.2.5). As such, there is no significant scientific uncertainty associated with this aspect; because pre-lay surveys will be undertaken to verify this understanding, 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. 53)

	• Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) MPEC.207(62)) 2011 (Ref. 52)		
Internal Context	This CAPL environmental performance standard / procedure was deemed relevant for this aspect: • CAPL Quarantine Procedure – Marine Vessels (Ref. 126)		
External Context	During stakeholder consultation, no objections or claims were raised regarding underwater ballast water discharges or biofouling.		
Defined Acceptable Level	In accordance with Section 5.6, these risks are inherently acceptable as they are lower-order risks. In addition, the potential risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
Prevent the introduction and establishment of invasive marine species into the OA as a result of the activities managed under this EP	**CAPL Quarantine Procedure – Marine Vessels (Ref. 126)** CAPL will complete a premobilisation questionnaire for every installation vessel before conducting activities under the scope of this EP.	Premobilisation risk assessment was competed for all installation vessels before conducting activities under the scope of this EP	ABU GS2 HES Specialist
	MARS Commonwealth Department of Agriculture, Water and Environment (DAWE) clearance is obtained to enter Australian waters through pre-arrival information reported through MARS.	Records confirm pre-arrival report submitted to DAWE	Vessel Master
	Biofouling Risk Assessment CAPL undertakes an IMP risk assessment for each installation vessel to ensure biofouling-related risks are managed to a low level before entering the OA.	Records verify that an IMP risk assessment was undertaken for each vessel and that additional management requirements were completed	ABU GS2 Health, Environment, and Safety (HES) Specialist
	Exchange of ballast water outside Australian waters Ballast water exchange was undertaken by vessels in accordance with the requirements of the Australian Ballast Water Management Requirements (Ref. 53) before entry into Commonwealth Waters.	Reports of ballast water discharges and the ballast water record system demonstrate that Australian Ballast Water Management Requirements were met	Vessel Master
	Report ballast water discharges All ballast water discharges from the vessels will be reported.	Records confirm all ballast water discharges were reported	Vessel Master
	Maintain a ballast water record system A ballast water record system will be maintained by vessels.	Ballast water record system completed	Vessel Master
	Ballast Water Management Certificate International vessels entering Australian waters will have a Ballast Water Management Certificate	Records confirm Ballast Water Management Certificate is in place, where required	Vessel Master
	Antifouling certificate	The vessel's antifouling certificates are valid	Vessel Master

	The vessel's antifouling certification is current in accordance with Marine Order 98 (Anti-fouling systems)		
	Biofouling management plan A biofouling management plan (or equivalent information) will be available for all vessels	A review of the biofouling management plans confirm they are in place and maintained	Vessel Master
	Biofouling record book A biofouling record book (or equivalent information) will be maintained separately for all vessels	A review of the biofouling record books confirm they are in place and maintained	Vessel Master

6.6.3 Planned Discharge – Sewage, Greywater, and Food Wastes

Cause of Aspect

This activity has the potential to result in planned discharges of sewage, greywater, and food wastes:

- support operations (installation vessels).

Potential Impacts and Risks

Impacts	C	Risks	C
Planned discharges of sewage, greywater, and food wastes will result in: • a localised and temporary reduction in water quality.	6	Planned discharges of sewage, greywater, and food wastes have the potential to result in: • changes to predator / prey dynamics.	6

Consequence Evaluation

Changes to the water quality

The main environmental impact associated with disposal of sewage and greywater is eutrophication (Ref. 92). However, 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 sewage discharges may occur (Ref. 92). Therefore, nutrients from sewage discharge will not accumulate or lead to eutrophication due to the highly dispersive environment (Ref. 92). This outcome was verified by sewage discharge monitoring for another offshore project (Ref. 30), 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, 100, and 200 m downstream of the platform 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.

Black *et al.* (Ref. 55) state that BOD of treated effluent is not expected to lead to oxygen depletion in the receiving waters.

Due to the rapid rate of mixing and dispersion identified during modelling of sewage releases (Ref. 30), the impacts associated with this discharge are limited to a localised area around the release point, with impacts evaluated to be 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 with the potential to be affected by changes in predator–prey dynamics include:

- Whale Shark (foraging)
- Wedge-tailed Shearwater (foraging / breeding)
- 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 deep open waters (Ref. 92).

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. 54) 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. 93; Ref. 94; Ref. 95).

Given the distance from shore, these incidental discharges are not expected to influence foraging behaviours of seabirds (specifically the Wedge-tailed Shearwater), and thus are not considered further.

As described above, plankton communities are not affected by sewage discharges, but if they are, such effects would be highly localised (expected to return to background conditions within tens to a few hundred metres of the discharge location). Consequently, impacts to Whale Shark foraging behaviours are not expected, and thus are not considered further.

Although fish 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-practised 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 discharges arising from the activity. As supported by findings of previous offshore monitoring programs, these activities are expected to result in lower-order impacts and risks in accordance with Table 5-2. As such, CAPL applied ALARP Decision Context A for this aspect.	
Control Measure	**Good Practice Control Purpose**
MARPOL sewage discharge conditions	Marine Order 96 (Sewage) gives effect to MARPOL Annex IV. MARPOL is the International Convention for the Prevention of Pollution from Ships and is aimed at preventing both accidental pollution and pollution from routine operations.
Food waste macerated	Marine Order 95 (Marine pollution prevention – garbage) gives effect to MARPOL Annex V, which requires that food waste is macerated or ground to particle size <25 mm.
Likelihood and Risk Level Summary	
Likelihood	Given the nature and scale of this activity, the absence of sedentary pelagic fauna, 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 continental slope demersal fish communities (KEF) or other values and sensitivities.
Risk Level	Low (10)
Acceptability Summary	
Principles of ESD	The potential impact associated with this aspect is a localised short-term effect to species and thus 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 • Marine Order 96 • MARPOL Annex IV and V
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 discharges arising from the activity.
Defined Acceptable Level	In accordance with Section 5.6, these impacts and risks are inherently acceptable as they are lower-order impacts and risks. In addition, the potential impacts and risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.

Environmental Performance Outcomes	Performance Standards / Control Measures	Measurement Criteria	Responsibility
Prevent impacts and risks greater than a localised and temporary reduction in water quality arising from sewage, greywater, and food wastes	**Food waste macerated** Food waste will be macerated to a particle size of <25 mm when discharged >3 NM and <12 NM from land.	Records show discharges of food waste comply with the distances specified in Marine Order 95	Vessel Master
	MARPOL discharge conditions Sewage will be discharged where it meets these conditions: • sewage is treated via a sewage treatment plant (before discharge >3 NM from land) • vessel is moving at a speed >4 knots Or • sewage remains untreated (>12 NM from land) • vessel is moving at a speed >4 knots.	Records show discharges of sewage comply with Marine Order 96 conditions	Vessel Master
		Valid International Sewage Pollution Prevention certificate	Vessel Master

6.6.4 Planned Discharge – IMR, Mechanical Completion, and Precommissioning Discharges

Planned operational discharges are required during these activities:

- tie-ins of spools and jumpers
- connector openings
- mechanical completions / FCGT of flowline and pipelines
- precommissioning (dewatering) flowlines (Gorgon only)
- IMR
- infield pigging (from field to Gorgon LNG Plant)
- module and component change-out
- residual grout arising from grout-bag filling / hose flushing
- connection, leak, diagnostic, barrier, pressure, flushing, and back-seal testing of newly replaced modules and components
- applying treatments for biological growth, calcareous deposits, or external corrosion.

All planned discharges are described in Section 3.

The types of releases from these activities include:

- chemically inhibited water (biocide, oxygen scavenger, dye, and buffering solutions)
- pigging fluids slugs (MEG, fresh water)
- fugitive releases during tie-ins (fresh water / MEG preservation fluid, hydraulic fluid, umbilical control fluid)
- marine growth removal fluids.

Pre-commissioning discharges are the focus of this evaluation as they represent the discharges with the highest potential for adverse effects. This determination was based on the nature and scale of the releases and the type of chemicals discharged.

Given the discharge volume and associated chemicals, the extent and duration of exposure to sensitive receptors is much larger than for any other discharge covered in this EP. CAPL acknowledges that each chemical discharged under this EP will cause varying levels of impact; however, because precommissioning discharges include chemicals such as biocide, these discharges are considered to have the highest potential for impact.

Therefore, using precommissioning discharges to infer the level of impact associated with all operational discharges under this EP ensures that the most conservative impact and risk level were assessed.

6.6.4.1 Dilution Modelling – Precommissioning Discharges

Modelling associated with the discharges from the GFP was completed using precommissioning volumes of 120 000 m^3 and 220 000 m^3, which are the full volumes of the Gorgon and Jansz pipelines respectively (Ref. 56). Outputs from this modelling were used to inform the extent and duration of exposure for both hydrotest and precommissioning discharges in this EP. These modelling outputs are considered appropriate because:

- the modelled release location is near (~13 km) the proposed release locations for the discharges as described in Section 3
- the volumes required for the GS2 Program are significantly less that that previously modelled, with the contingency discharges estimated to be ~23 305 m^3 of treated sea water (Section 3.9) and thus modelling provides an overly conservative estimate of the EMBA by these discharges
- the release durations are expected to be much smaller, with the release anticipated to be completed within ~72 hours
- the model duration is much larger than the anticipated residence time (~13 hours)
- the release locations are within similar water depths and thus are subject to similar subsea currents / oceanographic processes.

CAPL engaged Asia–Pacific Applied Science Associates (APASA) to conduct modelling to assess and quantify the mixing and dispersion from a precommissioning discharge, by considering the discharge characteristics and physical conditions of the receiving waters. The aim of this study was to understand the dilution and resulting concentration of the discharge plume under a range of predicted ambient conditions.

The four key components of the modelling undertaken by APASA (Ref. 56) were:

- Three-dimensional (3D) hydrodynamic modelling of tidal current flows was undertaken for the area using the ASA HYDROMAP model.
- HYCOM oceanographic hindcasts were used to represent the mesoscale circulation patterns with assimilation of observed meteorological oceanographic data.
- Near-field mixing and dispersion of the hydrotest water was predicted using the fully 3D flow model, Updated Merge (UM3).

- Far-field mixing and dispersion of the hydrotest water discharge was predicted using the 3D discharge and plume behaviour model, MUDMAP.

Table 6-3 summarises the model parameters.

Table 6-3: Modelled Discharge Parameters

Parameter	Details	
Release location	Gorgon Midline PTS	Jansz Midline PTS
Water depth (m)	130 m	1340 m
Volume	120 000 m^3	220 000 m^3
Discharge duration	133 hours	244 hours
Model duration	168 hours	360 hours
Discharge rate	0.25 m^3/s (corresponds to a pig speed of ~0.5 m/s through pipe)	
Outlet pipe diameter	0.15 m	
Pipe orientation (degrees)	90 (upwards)	

At the time of writing this EP, the exact biocide / water treatment chemicals were not known. However, to support a quantitative evaluation, CAPL has indicated that cocodiamine biocide (XC24302), OSW24081, and Roemex RX9026E will likely be used as the proposed biocide, oxygen scavenger, and dye chemicals for water treatment along with buffering solutions such as sodium bicarbonate and sodium carbonate.

Based on ecotoxicity information sourced for each of these chemicals, a predicted no-effect concentration (PNEC) was determined to help assess the potential environmental impacts (Table 6-4).

Table 6-4: Predicted No-effect Concentration for Treatment Chemicals

Species	Ecotoxicity Information		
	XC24302	OSW24081	Roemex RX9026E
Species 1	**Marine algae** (*Skeletonema costatum*) EC50 (72-hour) 0.1 mg/L	**Freshwater algae** (*Pseudokirchneriella subcapitata*) EC50 (72-hour) 7.8 mg/L	**Algae** undisclosed EC50 (72-hour) >200 mg/L
Species 2	**Marine invertebrate** (*Acartia tonsa*) LC50 (48-hour) 0.3 mg/L	**Freshwater invertebrate** (*Daphnia magna*) LC50 (48-hour) 9.8 mg/L	**Crustacean** undisclosed LC50 (48-hour) >200 mg/L
Species 3	**Marine fish**[1] *(Cyprinodon variegatus)* LC50 (96-hour) 1.3 mg/L	**Freshwater fish** (*Oncorhynchus mykiss*) LC50 (96-hour) 33.2 mg/L	**Fish** undisclosed LC50 (96-hour) >200 mg/L
PNEC assessment	Given the nature of the release (subsea location) where marine algae and invertebrates are not expected to be prevalent, a safety factor was applied to the fish species as this represents the species that will likely be affected by the release. A safety factor of 10 was applied because the residence time of the plume once the discharge has ceased is less than that used to derive the LC50 (<96 hours), and because the discharge is a single non-continuous release of limited volume.		
PNEC (ppm)	0.13	3.32	20
Initial concentration (ppm)	200	850	80

Species	Ecotoxicity Information		
	XC24302	OSW24081	Roemex RX9026E
Safe dilution factor	2000	256	4

DC *Although the species identified are not local to the north-west of Western Australia, their physiology is similar, and therefore their response is expected to be representative of species present within the EMBA, for which no data are available.*

6.6.4.2 Modelling Outputs

In general, the modelling results predicted that the plume will rise upward immediately after release due to the plume momentum and pipe configuration, creating a turbulent mixing zone with the receiving waters. Once the hydrotest water plume loses all its upward momentum, the ambient currents will further mix and disperse this wastewater (Ref. 56).

The modelling results indicate that exposures from these discharges that are above impact thresholds are predicted to occur conservatively up to 10 km away from the Gorgon release location (Figure 6-1). Using average current speeds of 0.22 m/s (Ref. 114), it is expected it will take <13 hours to return to below-impact thresholds.

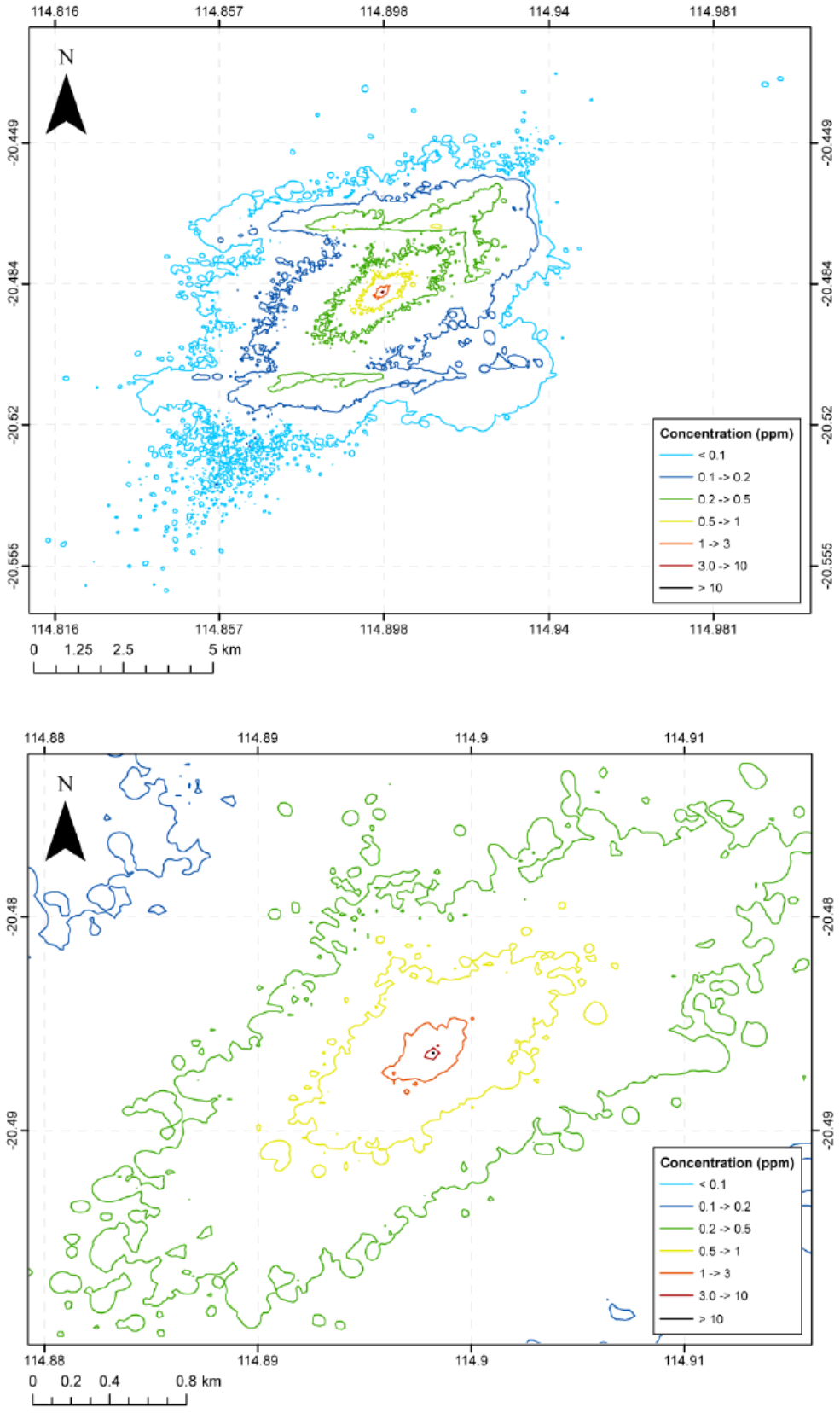


Figure 6-1: Predicted Concentrations for a Pre-commissioning Discharge at a Fixed Location

6.6.4.3 Modelling – MEG Discharges

Modelling discharges of 40 m^3 MEG slugs were completed for the GFP. Although these volumes are higher than expected for the GS2 Project, the outputs were used to inform the extent and duration of exposure in this EP. They are considered appropriate because:

- the modelled release location is near (~13 km) the proposed release locations for these discharges
- the volumes required for this activity are significantly less and thus modelling provides an overly conservative estimation of the EMBA by these discharges
- release locations are within similar water depths and thus subject to similar subsea currents / oceanographic processes.

MEG is not considered harmful or toxic to aquatic organisms and readily biodegrades. It is also miscible in water and will rapidly disperse into the water column upon release into the marine environment.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Ref. 57) specify a marine low reliability trigger value of 50 000 µg/L (50 mg/L) for MEG in sea water. The World Health Organization (WHO) has reported a no observed effect concentration (NOEC) of 24 000 ppm for MEG (Ref. 58). In accordance with the Organisation for Economic Co-operation and Development (Ref. 59) because three NOECs are described for three separate taxonomic groups, a safety factor of 10 was adopted for the protection of marine fauna and benthic habitats. Based on the NOEC provided by WHO (Ref. 58), a PNEC of 2400 ppm (or 2400 mg/L) was used to inform the concentration level above which has the potential to result in an environmental impact.

Modelling the release of ~40 m^3 of MEG at 40 m water depth predicted that the peak concentration of MEG would be 320 mg/L, well below the PNEC toxicity value of 2400 mg/L.

6.6.4.4 Mechanical Completion and Pre-commissioning Discharges – Risk Assessment

Cause of Aspect

These activities have the potential to result in planned discharges of treated and inhibited waters, as well as MEG:

- mechanical completion
- pre-commissioning (dewatering)
- fugitive releases during tie-ins (ME/preservation fluid, hydraulic fluid, umbilical control fluid).

Potential Impacts and Risks

Impacts	C	Risks	C
Planned mechanical completion and pre-commissioning discharges will result in: • a localised and temporary reduction in water quality	6	Planned mechanical completion and pre-commissioning discharges have the potential to result in: • indirect impacts to fauna arising from chemical toxicity impacts.	5

Consequence Evaluation

Localised and temporary reduction in water quality

Modelling indicates that the planned discharges associated with mechanical completion and pre-commissioning activities would result in a plume where potential environmental impacts may be expected (conservatively) within 5 km of the release location (Section 6.6.4.2).

The residence time of the plume (once the discharge has finished) is expected to be ~13 hours. Any fugitive emissions would be significantly less than this.

Consequently, all planned discharges are expected to result in a limited environmental impact, thus the consequence level was determined as Incidental (6).

Potential chemical toxicity

As described above, these discharges are conservatively expected to result in reduced water quality for short durations within 5 km of the release location.

The values and sensitivities with the potential to be exposed to chemical toxicity in the water column include:

- Humpback Whale (migration)
- Pygmy Blue Whale (migration and presence)
- Whale Shark (foraging)
- Flatback Turtle (91nteresting)
- fish communities (associated with the various KEFs)
- commercial fisheries.

Impact thresholds used for this evaluation are based on species that are most sensitive to changes in water quality but are unlikely to be present within the OA. These species are more likely to be entrained within a plume and exposed to decreased water quality for an extended period. Based on these impact thresholds, conservatively, there is the potential for impacts to occur within 5 km of the release location.

Modelling indicates that no exposures above MEG impact thresholds are expected (Section 6.6.4.3) and thus are not considered further.

As described by the modelling, the residence time of the plume (once the discharge has finished) is expected to be ~13 hours. Note: The duration of the discharge is anticipated to be ~3 days with a residence time of ~13 hours, therefore exposure is not expected to occur for the time period on which the impact threshold is based (i.e. 96-hour exposure durations).

Consequently, to be impacted, the particular values and sensitivities would need to pass directly through any fluid almost immediately upon release and remain within the plume for almost the entire duration of the residence time. Based on the values and sensitivities that have the potential to occur within this area, it is not expected that they would be exposed to concentrations above impact thresholds for an extended time. The identified values and sensitivities are mobile and transient and can actively avoid entrainment within any release plume.

Although several commercial fisheries overlap the OA, no known important spawning areas were identified that have the potential to be impacted (Appendix C; Ref. 8). Consequently, acute impacts are expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Impacts from these discharges are not expected to manifest at a fish population viability level.

As such, any potential impact from these discharges is expected to result in localised temporary environmental impact to species, thus the consequence level was determined as Minor (5).

ALARP Decision Context Justification

Operational discharges (including those from mechanical completion and pre-commissioning activities) are required to ensure integrity of subsea systems and prevent accidental release of production fluids. These are commonplace in offshore environments both nationally and internationally.

Control measures to manage the risks associated with these discharges are well defined with the focus on evaluating the chemicals associated with the discharges. The processes for selecting and evaluating chemicals are well understood. CAPL has operated in these titles for >10 years, and the chemical selection process used for all offshore discharges has been refined over this time and is the subject of multiple regulator inspections.

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

Because dilution modelling was undertaken in a similar location for a volume that is 45 times larger than expected under this EP, there is suitable conservatism in the evaluation and thus no significant uncertainty exists for this aspect. Even using conservative modelling, the impacts and risks arising from these discharges are lower-order impacts and risks in accordance with Table 5-2.

As such, CAPL applied ALARP Decision Context A for this aspect.

Control Measure	Good Practice Control Purpose
Chemical selection process	CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 60) is used to evaluate and approve all chemicals that may end up in the environment.

Chemical concentrations	CAPL's Hydrotest Water Quality for Corrosion Prevention Combined Project Addendum and PPL-SC-5252B (Specification) (Ref. 61) describes the maximum concentrations required for dosing hydrotest waters to ensure corrosion risk to infrastructure is minimised.		
Likelihood and Risk Level Summary			
Likelihood	Previous similar discharges by CAPL for both its Gorgon and Wheatstone assets have not identified any impacts attributable to these types of discharges. Given the nature and scale of this activity, and with the control measures in place, it is considered Remote (5) that this discharge would result in any minor impacts to the identified values and sensitivities.		
Risk Level	Low (9)		
Acceptability Summary			
Principles of ESD	This aspect is considered to result in a limited environmental 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 legislative or other industry requirements were deemed relevant for this aspect.		
Internal Context	These CAPL environmental performance standards / procedures are considered relevant to this aspect: • CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 60) • CAPL's Hydrotest Water Quality for Corrosion Prevention Combined Project Addendum and PPL-SC-5252B (Specification) (Ref. 61)		
External Context	During stakeholder consultation, no objections or claims were raised regarding discharges arising from the activity.		
Defined Acceptable Level	In accordance with Section 5.6, these impacts and risks are inherently acceptable as they are lower-order impacts and risks. In addition, the potential impacts and risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
Prevent impacts and risks greater than a localised and temporary reduction in water quality arising from mechanical completion and pre-commissioning discharges	**Chemical selection process** All planned chemical discharges must be assessed and deemed acceptable before use, in accordance with CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 60)	Current database of assessed chemicals will identify chemicals that are acceptable for use for these activities.	ABU GS2 HES Specialist
	Chemical concentrations Hydrotest chemicals will be dosed at concentrations such that the calculated discharge concentration does not exceed the concentration described in the Hydrotest Water Quality Combined Project Addendum and PPL-SU-5252-B Specification (Ref. 61)	Records confirm volumes of chemicals used during mechanical completion and pre-commissioning activities (versus volume of waters dosed) do not exceed those described in the Hydrotest Water Quality Combined Project Addendum and PPL-SU-5252-B Specification (Ref. 61).	Vessel Master

6.7 Unplanned Release Aspects

The activities covered in this EP were assessed to identify each potential spill source. This included identifying any activities that involved the potential use, transfer, or storage of hydrocarbons and other materials that had the potential to be accidentally lost to the environment. Following this assessment, spill sources were grouped by type to identify credible spill scenarios associated with the program; two credible spill scenarios were identified:

- loss of containment (LOC) (minor)
- vessel collision.

In addition to these liquid spill scenarios, an additional scenario was included—the accidental release of waste (hazardous or non-hazardous) due to human error or inappropriate waste storage.

6.7.1 Waste

Cause of Aspect

This activity has the potential to result in an unplanned release of waste to the environment:

- support operations (installation vessels).

Because waste is generated on board installation vessels, inappropriate management and storage has the potential to result in release to the environment.

Potential Impacts and Risks

Impacts	C	Risks	C
N/A	-	An accidental release of waste has the potential to cause: • marine pollution resulting in injury and entanglement of marine fauna (turtles) and seabirds.	6

Consequence Evaluation

Marine pollution resulting in injury and entanglement of marine fauna (turtles) and seabirds

If hazardous / non-hazardous waste is lost overboard, the extent of exposure to the environment is limited.

Marine fauna most at risk from marine pollution include marine reptiles and seabirds, through ingestion or entanglement (Ref. 13; Ref. 16). Ingestion or entanglement has the potential to limit feeding or foraging behaviours and thus can result in marine fauna injury or death.

However, given the restricted exposures and the limited quantity of waste with the potential to cause marine pollution that is expected to be generated from this program, it is expected that any impacts from marine pollution would result in limited impacts to individuals. Thus, CAPL ranked this consequence as Incidental (6).

ALARP Decision Context Justification

The management of waste offshore is a commonplace and well-practised activity.

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 accidental release of waste is a lower-order risk in accordance with Table 5-2.

As such, CAPL applied ALARP Decision Context A for this aspect.

Good Practice Control Measure	Source of Good Practice Control Measure		
Marine Order 95 (Marine pollution prevention – garbage)	MARPOL 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 Annex V requires that a garbage / waste 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 Annex V.		
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	Low (10)		
Acceptability Summary			
Principles of ESD	The potential impact associated with this aspect is limited to individuals and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no additional evaluation against the Principles of ESD is required.		
Relevant Environmental Legislation and Other Requirements	Legislation and other requirements considered relevant for this aspect include: • AMSA Marine Order 95 • MARPOL • Recovery Plan for Marine Turtles in Australia (Ref. 13) • Conservation Advice for the Whale Shark 2015–2020 (Ref. 15) • National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016 (Ref. 16)		
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	In accordance with Section 5.6, these risks are inherently acceptable as they are lower order risks. The activities associated with these risks are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
No overboard release of waste to the environment from activities under this EP	**Marine Order 95 (Marine pollution prevention – garbage)** A garbage management plan will be in place and implemented by the vessels.	Garbage management plan is in place and maintained	Vessel Master
	Marine Order 95 A garbage record book / log will be in place and maintained for the vessels	Garbage record book / log is in place and maintained	Vessel Master

6.7.2 Loss of Containment

Cause of Aspect

The operation of installation vessels includes handling, using, and transferring hazardous materials. Based on these activities (including lifting and installing subsea equipment), these potential LOC scenarios were identified:

- using, handling, and transferring hazardous materials and chemicals on board (<1 m^3)[1]
- hydraulic line failure from equipment (<1 m^3)[1]
- transferring hazardous materials between installation vessels and supply vessel (50 m^3)[2]
- dropped objects (and interaction with the GS2 Project subsea infrastructure) resulting in a loss of various fluids including treated sea water, hydraulic fluids, or MEG[3].
- tie-in or interaction with GFP subsea infrastructure resulting in a small loss of hydrocarbons.

[1] A range of hydrocarbons and other hazardous chemicals / materials are likely to be present during pipelay 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. 62) 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 during installation of subsea infrastructure on subsea trees may damage previously installed subsea infrastructure resulting in a release of hydrocarbons, treated sea water, hydraulic fluid, or MEG. To understand the volumes associated with this type of event, a conservative worst-case scenario was identified. CAPL defined this scenario as a release from one of the larger subsea valves (1" valve) caused by damage during tie-in activities or via a dropped object. CAPL's modelling indicated that, when under pressure, a volume of 50 m^3 of hydrocarbon could be released over a 24-hour period until the release is controlled (Ref. 63).

During tie-in of MEG and Utility flowlines, small volumes of preservation fluid (which may include inhibited sea water, MEG, or hydraulic fluid) may be released at depth. The estimated volumes for these types of releases are anticipated to be ~1 m^3 to 6 m^3 per connection.

Potential Impacts and Risks

Impacts	C	Risks	C
N/A	-	A surface or subsurface release of hydrocarbons, chemicals, MEG, or other hazardous materials has the potential to affect marine fauna through: • potential chemical toxicity in the water column.	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 hydrocarbons (Marine Diesel Oil [MDO] or Heavy Fuel Oil [HFO]) or other hazardous materials are expected to be much less than those associated with a loss of hydrocarbons from a vessel collision (Section 6.7.3), 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. 63).

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

- Humpback Whale (migration)
- Blue and Pygmy Blue Whale (migration)
- Whale Shark (foraging)
- Flatback Turtle (95nteresting)
- Fish communities (associated with the various KEFs).

Based on the nature of these accidental 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 subsea infrastructure installation and subsea tie-ins are commonplace and well-practised offshore 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 5-2.

As such, CAPL applied ALARP Decision Context A for this aspect.

Good Practice Control Measure	Good Practice Control Purpose
Permit system	It is considered good industry practice to implement a permit system that controls the isolation of overboard drainage to contain spills on deck when bulk chemical handling activities are being undertaken.
• Bulk transfer process • Hoses and connections • Planned Maintenance System (PMS)	GOMO 0611-1401 (Ref. 64) provides guidance that should be adopted to ensure the safety of personnel on board all vessels servicing and supporting offshore facilities, and to reduce the risks associated with such operations. Specifically, this guideline indicates: • an appropriate procedure is in place for the discharging operation • hoses must remain afloat at all times through the use of sufficient floating devices • use of self-sealing weak-link couplings in the mid-section of the hose string is recommended • hoses must be maintained, and sections changed out in accordance manufacturer guidance (PMS).
Hazardous material and chemical storage	Contractors have procedures/systems in place for safely handling and storing materials such as waste oil and chemicals. Spilled flammable liquids and chemicals should be cleaned up immediately. Proper storage for paint and chemicals should be provided. Inductions for all vessel crew make personnel aware of the housekeeping requirements when implementing the activity.
CAPL MSRE Process	CAPL's Marine Safety Reliability and Efficiency (MSRE) Standardised OE Process (Ref. 88) details the requirements for lifting and installing heavy equipment near offshore infrastructure. Specifically, installation risk is minimised by ensuring lifting plans are in place for complicated / heavy lifts, which are defined under the MSRE process as: • Heavy lift: Any lift >75% of the rated capacity (per load chart) of the crane or hoist used for a specific lifting activity • Complicated lift: Lifts that are difficult because of the nature of the load (e.g. awkward shape, offset or high centre of gravity, fragile, containing liquids, no lifting attachments/difficult to sling, and other unique characteristics), and/or because lifting operations/handling of the lift is also difficult (e.g. requires rotation, cross-hauled involving two or more sets of rigging, and/or tandem lifting with cranes).

SOPEP/ Shipboard Marine Pollution Emergency Plan	MARPOL 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.		
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	Low (9)		
Acceptability Summary			
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.		
Relevant Environmental Legislation and Other Requirements	Legislation and other requirements considered relevant for this aspect include: • Guidelines for Offshore Marine Operations (GOMO 0611-1401; Ref. 64) • Marine Order 91, Marine pollution prevention – oil		
Internal Context	CAPLs environmental performance standards / procedures considered relevant to this aspect include: • Marine Safety Reliability and Efficiency (MSRE) Standardised OE Process (Ref. 88)		
External Context	During stakeholder consultation, no objections or claims were raised regarding LOC management arising from the activity.		
Defined Acceptable Level	In accordance with Section 5.6, these risks are inherently acceptable as they are lower-order impacts and risks. In addition, the potential impacts and risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
No spill of hydrocarbons or hazardous liquids to the environment from activities under this EP	**Permit system** Implement a permit system to control the isolation of overboard drainage aboard the vessel where there is potential for unplanned discharge of hazardous chemicals	Records demonstrate a permit system was implemented for isolating overboard drainage	Vessel Master
	Hazardous material and chemical storage Hazardous liquids to be stored within secondary containment or	Weekly environmental inspections confirm hydrocarbons and hazardous liquids are	Vessel Master

	purpose-built bulk tanks aboard the vessels	stored within secondary containment or purpose-built bulk tanks	
	CAPL MSRE Procedure Lifting operations using the vessel's crane, which are non-routine, complicated, and/or heavy lifts, must comply with the CAPL's Managing Safe Work (MSW) OE Standard – Lifting and Rigging (Ref. 137). Specifically, a CAPL-accepted lifting plan will be in place and implemented	Before lifts occur, lifting plans (developed by the contractor) are reviewed and accepted by the ABU GS2 Construction Superintendent and Vessel Master	ABU GS2 Construction Superintendent
	SOPEP Maintain chemical spill kits aboard vessels, in accordance with the approved SOPEP	MSRE inspection records (or similar) show vessels have spill kits and an approved SOPEP	Vessel Master
	SOPEP Undertake oil spill training exercises, in accordance with the vessel operator's emergency response exercise program	Records confirm oil spill training exercises were undertaken in accordance with the Vessel Operator's emergency response exercise program	Vessel Master
	Bulk fluid transfer process The Vessel Operator will have a bulk fluid transfer procedure in place before commencing operations	Vessel Operator's bulk fluid transfer procedure	Vessel Master
	Bulk fluid transfer process Implement bulk fluid transfers, in accordance with Vessel Operator's bulk fluid transfer procedures, including: • vessel-to-vessel communication protocols • transfer hose pressure testing • continuous visual monitoring • tank volume monitoring	Records demonstrate Vessel Operator's bulk fluid transfer procedures were implemented	Vessel Master
	Hoses and connections Transfer hoses must have sufficient floating devices and self-sealing couplings	Records demonstrate transfer hoses have sufficient floating devices and self-sealing couplings	Vessel Master
	Planned Maintenance System Maintain bulk fluid transfer hoses, in accordance with the vessel PMS	Records confirm bulk fluid transfer hoses were maintained in accordance with the vessel PMS	Vessel Master

6.7.3 Vessel Collision

After evaluating threats associated with the activities covered under this EP, a vessel collision event is considered credible (but unlikely). A major marine spill because of vessel collision is only likely to occur under exceptional circumstances (e.g. loss of DP, navigational error, floundering due to weather).

6.7.3.1 Spill Modelling

CAPL conducted spill modelling to inform the impacts and risks associated with a vessel collision event.

The model, a 3D oil spill trajectory and weathering model—SIMAP—is designed to simulate the transport, spread, and weathering of specific oil types under the influence of changing meteorological and oceanographic forces.

Table 6-5 summarises the model inputs, parameters, and predetermined concentration and exposure assessment thresholds. Table 6-6 summarises the hydrocarbon properties for both MDO and HFO. Environmental exposure and impact thresholds are described in Table 6-7 and Table 6-8 respectively.

Table 6-5: Vessel Collision Credible Spill Scenario Inputs

Parameter	Details		Jansz
Release Location	Gorgon		Jansz
Latitude	20° 34′ 38.60″ S		19° 51′ 10.44″ S
Longitude	114° 46′ 38.39″ E		114° 30′ 56.20″ E
Oil type	MDO	HFO	HFO
Simulation duration	50 days	60 days	60 days
Maximum indicative volumes	1500 m^3	1500 m^3	1500 m^3
Number of randomly selected spill simulations per season	100 (300 in total)	100 (300 in total)	100 (300 in total)
Seasons assessed	Summer (Oct–Mar); Transitional (Apr and Sep); Winter (May–Aug)		

Table 6-6: Hydrocarbon Properties

Characteristics	Volatiles (%)	Semi-volatiles (%)	Low volatiles (%)	Residual (%)	Density (kg/m^3) at 25 °C	Dynamic Viscosity (cP) at 25 °C
Boiling point (BP) (°C)	<180	180–265	265–380	>380		
MDO	6.0	34.6	54.4	5.0	829	4
HFO	1.0	4.9	11.3	82.8	975	3180

Table 6-7: Justification for Hydrocarbon Environmental Exposure Thresholds

Environmental Exposure Threshold	Justification
Surface (>1 g/m^2)	In accordance with NOPSEMA's Oil Spill Modelling Bulletin #1 (Ref. 115), CAPL has set the surface exposure threshold at 1 g/m^2, which is establishes the planning area for scientific monitoring.
In-water (dissolved) (>10 ppb)	In accordance with NOPSEMA's Oil Spill Modelling Bulletin #1 (Ref. 115), CAPL has set the in-water (dissolved) exposure threshold at 10 ppb. This concentration is considered too low for ecological impact assessment, but is used for oil spill planning and scientific monitoring purposes (water quality)

Environmental Exposure Threshold	Justification
In-water (entrained) (>100 ppb)	In accordance with NOPSEMA's Oil Spill Modelling Bulletin #1 (Ref. 115), CAPL has set the in-water (entrained) exposure threshold at 100 ppb, which is establishes the planning area for scientific monitoring.

Table 6-8: Justification for Hydrocarbon Impact Thresholds

Environmental Impact Threshold	Justification
Surface (>1 g/m^2)	In accordance with the Bonn Agreement Oil Appearance Code (Ref. 98), oil layers in the range of 0.3 to 5.0 microns in thickness appear to be rainbow-coloured (bands of individual colours of the rainbow—red, orange, yellow, green, blue, indigo, and violet) because of the constructive and destructive interference of the wavelengths of white light caused by the presence of the oil film. At this concentration, oil on water is expected to be noticeable, and thus has the potential to impact nature-based activities (such as tourism) given the potential reduction in aesthetics. Consequently, CAPL has set >1 g/m^2 as the threshold for defining potential socioeconomic impacts in the event of a hydrocarbon spill event.
Surface (>10 g/m^2)	Scholten *et al.* (Ref. 65) indicate that a hydrocarbon layer 25 g/m^2 thick would be harmful for seabirds that contact a surface hydrocarbon slick. Engelhardt (Ref. 66), Clark (Ref. 67), Geraci and St. Aubin (Ref. 68), and Jenssen (Ref. 69) indicate that a hydrocarbon layer >10 g/m^2 would impart a lethal dose to an intersecting wildlife individual (i.e. marine reptiles / marine mammals). Peakall *et al.* (Ref. 70) state that oil concentration <1 g/m^2 was not harmful to seabirds. Therefore, CAPL has set the environmental impact threshold for marine fauna at >10 g/m^2.
In-water (dissolved) (>576 ppb.hr)	Potential effects from exposure to dissolved aromatic hydrocarbons included damage to the lining of the stomach and intestine, as well as effects to motility and digestion. French-McCay (Ref. 71) indicates that an average 96-hour LC50 of 50 ppb (or 4800 ppb.hr) has the potential to result in an acute lethal threshold to 5% of biota. A review of scientific literature indicates that a minimum threshold of six ppb over 96 hours (or 576 ppb.hr) has the potential to result in an acute lethal threshold to 1% of biota (Ref. 66; Ref. 67; Ref. 68; Ref. 69; Ref. 72). Therefore, there is the potential for acute impacts to 1% of species where dissolved exposures of 576 ppb.hr are encountered.
In-water (entrained) (>11 760 ppb.hr)	OSPAR (Ref. 73) describes the PNEC for dispersed oil as being 70.5 ppb, based on exposure times exceeding seven days. As the PNEC is based on prolonged exposures (>7 days), concentrations of 11 760ppb.hr (70.5 ppb × 168 hours) are considered as having potential for chronic impacts to juvenile fish, larvae, and planktonic organisms that might be entrained (or otherwise moving) within the plumes. Consequently, impact thresholds were defined as concentrations >11 760 ppb.hr.
Shoreline (>100 g/m^2)	Lin and Mendelssohn (Ref. 74) indicate that hydrocarbon volumes greater than 1000 g/m^2 that come ashore during the growing season have the potential to significantly impact salt marsh or mangrove plants. Owens and Sergy (Ref. 75) indicate that volumes ashore >100–1000 g/m^2, have the potential to coat shoreline habitats. For benthic epifaunal invertebrates living in intertidal habitats on hard substrates, a threshold of 100 g/m^2 oil thickness would be enough to coat the animal and likely impact its survival and reproductive capacity (Ref. 76). Thus, where concentrations ashore are >100 g/m^2, there is the potential for acute exposures to marine fauna. In addition, concentrations ashore >1000 g/m^2 are considered to have negative impacts on sensitive habitats such as mangrove communities.

6.7.3.1.1 Weathering and Fate – MDO

MDO is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3 (API of 37.6) and a low pour point (−14 °C). The low viscosity (4 cP) indicates that this oil will spread quickly when released and will form a thin film on the sea surface, increasing the evaporation rate.

Generally, about 6.0% of the MDO mass should evaporate within the first 12 hours (BP <180 °C); a further 34.6% should evaporate within the first 24 hours (BP180 °C-265 °C); and an additional 54.4% should evaporate over several days (BP 265 °C-380 °C). Approximately 5% (by mass) of MDO will not evaporate at atmospheric temperatures. These compounds will persist in the environment.

Typically, <50% of the slick volume, and potentially far less, will remain on the water surface after ~3 days (Figure 6-2).

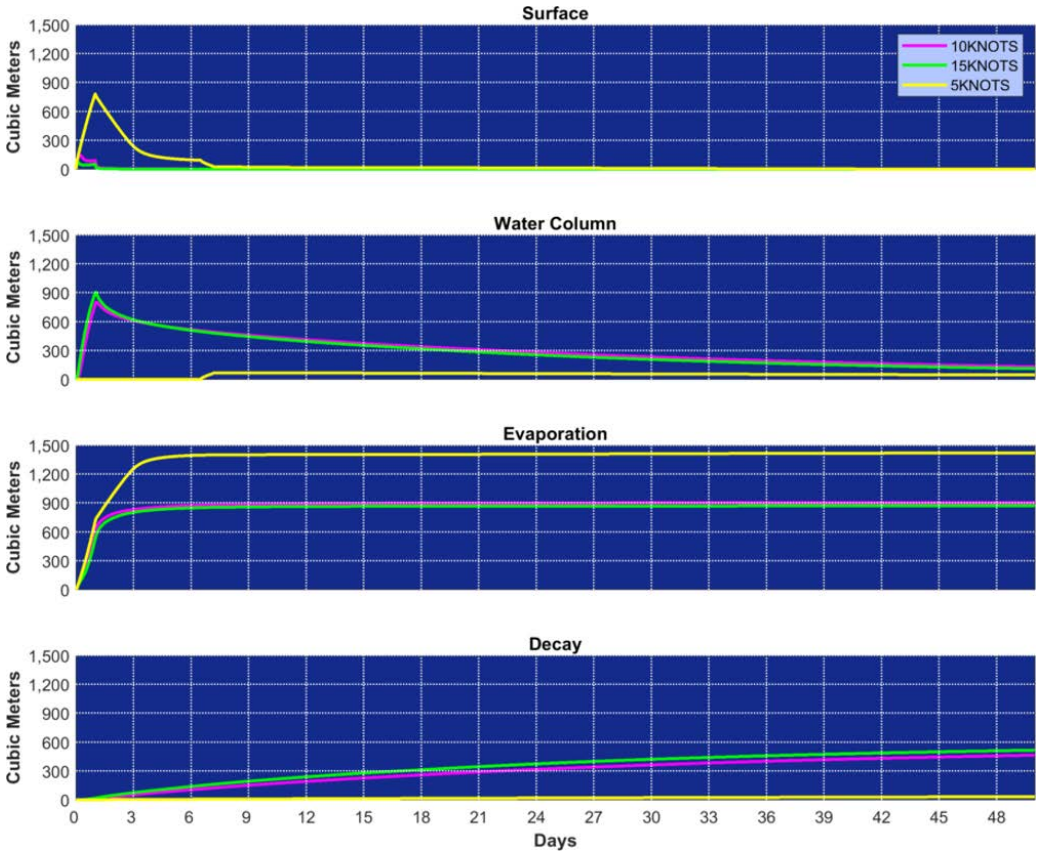


Figure 6-2: Predicted Weathering Graph: MDO

6.7.3.1.2 Weathering and Fate – HFO

HFO has a high density of 947.9 kg/m^3 (API of 12.3) and a relatively high pour point (7 °C). The high viscosity (3180 cP) indicates that this oil will not readily spread when released and will form a thick film on the sea surface, decreasing the evaporation rate.

Generally, about 1.0% of the HFO mass should evaporate within the first 12 hours (BP <180 °C); a further 4.9% should evaporate within the first 24 hours (180 °C < BP <265 °C); and an additional 11.3% should evaporate over several days (265 °C < BP <380 °C). Approximately 82.8% (by mass) of HFO will not evaporate at atmospheric temperatures. These compounds will persist in the environment. As a result of the high persistent compounds content, in combination

with the high dynamic viscosity of this oil once released into the environment, the HFO is likely to break into small masses of tar-like consistency and not spread or entrain readily. Additionally, the high water content of the HFO (up to 30%) will cause it to emulsify.

Importantly, the density of some HFOs means that they may also sink when they are released into water. This heavy fraction will assume a tar-like consistency and adhere to exposed substrates or suspended particulates (Ref. 77). In the open sea where the concentrations of suspended material are low, this effect may be less important, but in the surf zone, grains of sand become mixed into the oil. The longer-term fate of oil sunk in this way is likely to be burial under fresh sediment in nearshore waters or stranding by waves casting the oil onto shore (Ref. 78).

HFO also tends to solidify into tar balls, which can widely disperse. Tar balls are oil fragments that can have a solid to semi-solid consistency and tar ball formation mechanisms are not entirely known. They form when oil adheres to sediment or sand, when thick oil slicks partially oxidise, or when stable water-in-oil emulsions form and persist submerged in the environment (Ref. 79). Tar balls commonly wash up on shorelines and can originate from natural oil seeps or petroleum spills (Ref. 80). In general, tar balls are subject to extreme weathering and lose most of their n-alkanes and lower molecular weight poly aromatic hydrocarbons (PAHs) (Ref. 80). However, little research has been done on whether tar balls lose their toxic constituents (i.e. PAH) to water at rates sufficient to cause toxicity.

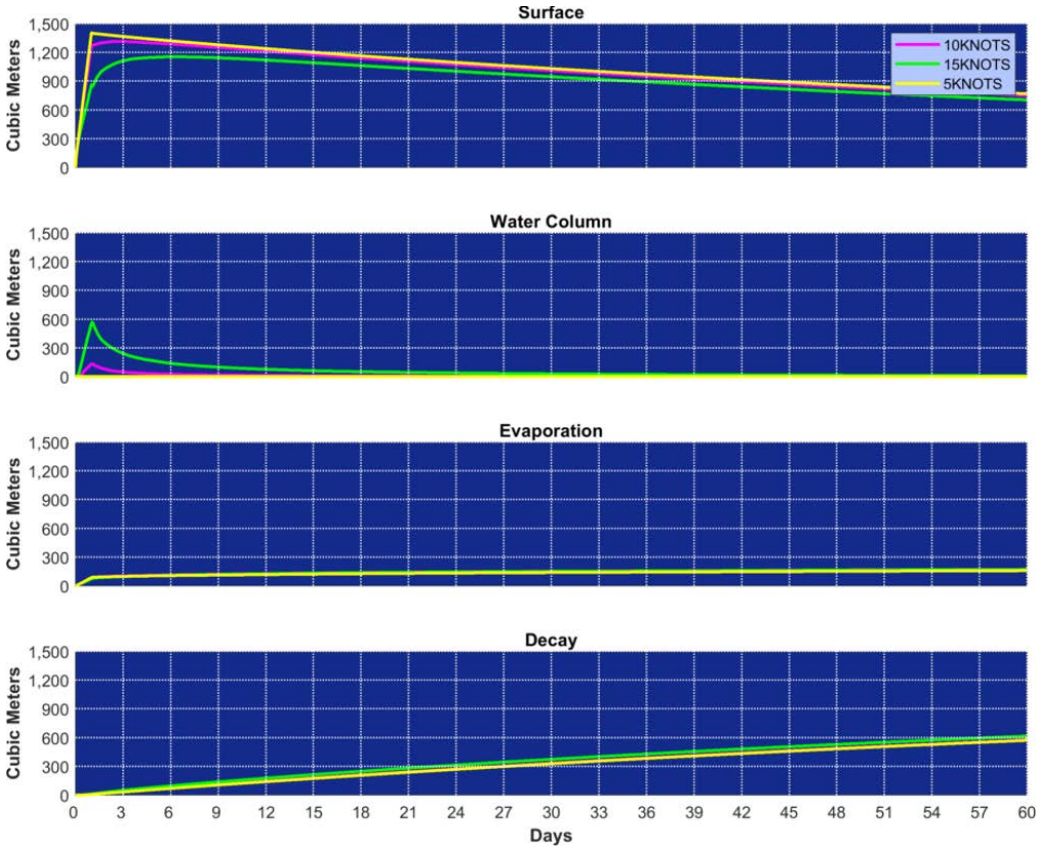


Figure 6-3: Predicted Weathering Graph: HFO

6.7.3.1.3 Modelling Outputs

Modelling outputs from RPS (Ref. 114) are summarised in Table 6-9.

Table 6-9: Vessel Collision Spill Modelling Output Summary

Model Parameter	Gorgon MDO Spill	Gorgon HFO Spill	Jansz HFO Spill
Surface Environmental Exposures	• Hydrocarbon exposures >1 g/m^2 are restricted to within 277 km of the source	• Hydrocarbon exposures >1 g/m^2 have the potential to occur up to 1609 km from the source	• Hydrocarbon exposures >1 g/m^2 have the potential to occur up to 1935 km from the source
Surface Environmental Impact	• Hydrocarbon exposures >10 g/m^2 are restricted to within 65.5 km of the source	• Hydrocarbon exposures >10 g/m^2 have the potential to occur up to 1300 km from the source	• Hydrocarbon exposures >10 g/m^2 have the potential to occur up to 1530 km from the source
Entrained Environmental Exposure	• Hydrocarbon exposures >100 ppb have the potential to occur up to ~366 km from the release point • Low probability (<14%) of the Gascoyne, Montebello, and Ningaloo AMPs being exposed to concentrations >100 ppb	• Hydrocarbon exposures >100 ppb have the potential to occur up to 90 km from the source	• Hydrocarbon exposures >100 ppb have the potential to occur up to 118 km from the source
Entrained Environmental Impact	• Hydrocarbon exposures >11 760 ppb.hr have the potential to occur up to 250 km from the release point	• Hydrocarbon exposures >11 760 ppb.hr have the potential to occur up to 20 km from the source	• Hydrocarbon exposures >11 760 ppb.hr have the potential to occur up to 26 km from the source
Dissolved Environmental Exposure	• Low probability (1%) of the Gascoyne and Ningaloo AMPs being exposed to concentrations between 10 and 13 ppb	• No hydrocarbon exposures greater than exposure thresholds were predicted to occur	• No hydrocarbon exposures greater than exposure thresholds were predicted to occur
Dissolved Environmental Impact	• No hydrocarbon exposures greater than impact thresholds were predicted to occur	• No hydrocarbon exposures greater than impact thresholds were predicted to occur	• No hydrocarbon exposures greater than impact thresholds were predicted to occur
Shoreline	• Modelling indicates only a 3% probability of shoreline contact in summer (>10 g/m^2) • Predicted minimum time before shoreline exposure: 3.3 days • Predicted maximum volumes ashore: 2.7 m^3 • Predicted maximum shoreline loading: <100 g/m^2	• Modelling indicates a 22% probability of shoreline contact >100 g/m^2 • Predicted minimum time before shoreline exposure: 4.8 days • Predicted maximum volumes ashore: 1260.2 m^3 • Predicted maximum shoreline loading: >1000 g/m^2 during the Summer and Transitional months	• Modelling indicates a 15% probability of shoreline contact >100 g/m^2 • Predicted minimum time before shoreline exposure: 2.1 days • Predicted maximum volumes ashore: 1084.7 m^3 • Predicted maximum shoreline loading: >1000 g/m^2 during the Summer and Transitional months

Model Parameter	Gorgon MDO Spill	Gorgon HFO Spill	Jansz HFO Spill
	• Exposures are below environmental impact thresholds and thus are not considered further	• Predicted maximum length of shoreline exposed to concentrations >100 g/m^2: 154 km.	• Predicted maximum length of shoreline exposed to concentrations >100 g/m^2: 109 km.

6.7.3.2 Emergency Condition – Risk Assessment

Cause of Aspect

A vessel collision typically occurs as a result of:

- loss of DP
- navigational error
- floundering due to weather.

Grounding is not considered to be credible due to the water depths associated with the OA, and the lack of submerged features in this area.

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.	4
		• smothering of subtidal and intertidal habitats	2
		• indirect impacts to commercial fisheries	5
		• reduction in amenity resulting in impacts to tourism and recreation.	3

Consequence Evaluation

Marine pollution resulting in acute and chronic impacts to marine fauna

Marine Mammals – Whales, Dolphins, and Dugongs

Marine mammals are sensitive to surface exposures. When they pass through surface hydrocarbon slicks they can be physically impacted through contact, ingestion, and inhalation (Ref. 62; Ref. 81). Baleen whales skim the surface to feed and may ingest hydrocarbons or hydrocarbon-contaminated prey, potentially fouling baleen fibres and thereby impairing food-gathering efficiency (Ref. 82).

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. 68). Marine mammals are vulnerable if they inhale evaporated volatiles when they surface in the 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. 68).

Although marine mammals will also be exposed to elevated hydrocarbons in the water column, they are expected to be less sensitive to temporary in-water exposures than by surface exposures. 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. 68; Ref. 66).

BIAs for marine mammals that may be exposed to hydrocarbon concentrations greater than impact thresholds include:

- Humpback and Pygmy Blue Whales (distribution, migration, foraging, and resting)
- Dugong (breeding, calving, foraging, and nursing)
- Dolphins (breeding, calving, and foraging).

Deterministic spill analysis indicates that where hydrocarbons track into nearshore environments that are important for marine mammals, the duration of any offshore surface exposure is limited, with surface hydrocarbons present for seven days and weathered product washes up on the shore.

Therefore, the potential for environmental impacts would be limited to a relatively short period following the release. Given the short exposure times, only a small portion of the population would likely be exposed to surface hydrocarbons, resulting in short-term and localised consequences, with no expected long-term population viability effects. Therefore, the potential impacts of hydrocarbon exposure to whales was ranked as Minor (5).

Turtles

Turtles can be exposed to hydrocarbons as they surface, resulting in direct contact with the skin, eyes, and other membranes, as well as inhaling vapours or ingesting the hydrocarbons (Ref. 83).

Shoreline hydrocarbons can impact turtles coming ashore at nesting beaches, with exposure to skin and cavities such as eyes, nostrils, and mouth. 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. 83).

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. 84). Oil effects on turtles can include impacts to the skin, blood, digestive, and immune systems, and increased mortality due to oiling.

BIAs for the Flatback Turtle, Loggerhead Turtle, Green Turtle, and Hawksbill Turtle may be exposed to hydrocarbon concentrations greater than impact thresholds. These BIAs are associated with these behaviours:

- foraging
- internesting
- mating
- aggregation
- internesting buffer
- nesting
- basking.

Deterministic spill analysis indicates that where hydrocarbons track into nearshore environments that are important for marine turtles, the duration of any offshore surface exposure is limited, with surface hydrocarbons present for seven days and weathered product washes up on the shore.

Consequently, any marine exposure is expected to cause less of an impact than shoreline exposure. Modelling predicts that known nesting areas—including the Cape Range National Park (Ningaloo Coast), Barrow and Montebello Islands, and Exmouth Gulf—have the potential to be exposed to concentrations above impact thresholds. If a catastrophic spill event occurred during the nesting season, nesting adult turtles and hatchlings may be exposed as they traverse the intertidal area, resulting in potential smothering and acute impacts to some hatchlings during that nesting season. This has the potential to cause a longer-term impact for local population recruitment but is not expected to impact the wider population.

Given the potential for localised, long-term impacts, the consequence was ranked as Moderate (4).

Fishes, including sharks and rays

Whale Sharks, sharks, and fish have the potential for exposure to hydrocarbons through entrained and dissolved fractions. 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. 127).

BIAs for fishes including sharks and rays that may be exposed to hydrocarbon concentrations greater than impact thresholds include:

- Dwarf, Freshwater, and Green Sawfish (foraging, nursing, pupping)
- Juvenile and Pygmy Blue Whales (distribution, migration, foraging, and resting)
- Whale Shark (foraging).

Deterministic spill analysis indicates that where hydrocarbons track into nearshore environments (associated with high-density prey foraging), the duration of any offshore surface exposure is limited, with surface hydrocarbons present for seven days and weathered product washes up on the shore. However, where a HFO hydrocarbon plume tracks into offshore waters, there is the potential for a longer exposure until the hydrocarbons are recovered.

If a catastrophic spill event occurred during the foraging season (for Whale Sharks) or breeding and pupping season (for sawfish) there is the potential for a larger number of individuals to be exposed, resulting in chronic and acute impacts. This has the potential to cause a longer-term impact to local populations until hydrocarbons are recovered or they wash up onshore.

Given the potential for localised, long-term impacts, the consequence was ranked as Moderate (4).

Seabirds

Birds that rest at the water's surface or surface-plunging birds are particularly vulnerable to surface hydrocarbons (Ref. 67; Ref. 84). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 70). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 70).

BIAs for the Brown Booby, Fairy Tern, Lesser Crested Tern, Lesser Frigatebird, Little Tern, Roseate Tern, Wedge-tailed Shearwater, and White-tailed Tropicbird may be exposed to hydrocarbon concentrations greater than impact thresholds. These BIAs are associated with these behaviours:

- breeding
- resting.

Deterministic spill analysis indicates that where hydrocarbons track into nearshore environments where seabird habitat for behaviours such as foraging is most likely to occur, the duration of any offshore surface exposure is limited, with surface hydrocarbons present for seven days and weathered product washes up on the shore.

Consequently, any marine exposure is expected to cause less of an impact than shoreline exposure. Modelling predicts that known nesting areas—including the Cape Range National Park (Ningaloo Coast), Barrow and Montebello Islands, and Exmouth Gulf—have the potential to be exposed to concentrations above impact thresholds.

Consequently, if a catastrophic spill event occurred during the nesting season, nesting adult seabirds and chicks have the potential to be exposed, which may result in shoreline smothering and acute impacts. This has the potential to cause a longer-term impact for local population recruitment, but would not be expected to impact the wider species population.

Given the potential for localised, long-term impacts, the consequence was ranked as Moderate (4).

Smothering of subtidal and intertidal habitats

Seagrass

Seagrass grows mostly on sandy/sandy-muddy sediments from the intertidal zone down to a depth of 30 m. Seagrass is most likely to be impacted by surface slicks from a large spill, which would decrease the amount of light that can penetrate through the water column. Studies of photosynthetic impacts on seagrass with concentrations ranging from 3 to 522 mg/L, found minimal or no negative impacts (Ref. 131).

Smothering of seagrass communities may occur if the slick occurs in the intertidal or shallow subtidal habitat, and these communities may be exposed to oil on the falling tide; however, the slick would generally be lifted off by the returning tide—particularly in the case of light oils—thereby reducing the period of exposure.

Modelling predicted seagrass habitat associated with this key value or sensitivity has the potential to be exposed to hydrocarbon concentrations above impact thresholds:

- Roebuck Bay – Ramsar Wetland.

If seagrass in this location is impacted, there is the potential for regionally significant habitat to be impacted, resulting in widespread and long-term effects.

Based on the potential for a widespread long-term impact, CAPL has ranked this consequence as Severe (2).

Coral

Direct contact of hydrocarbons to intertidal 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. 85; Ref. 86).

Modelling predicted coral reefs associated with these key values or sensitivities have the potential to be exposed to hydrocarbon concentrations above impact thresholds:

- Ningaloo Coast – World Heritage Property
- Ningaloo Coast – National Heritage Place
- The West Kimberley – National Heritage Place.

If coral habitat in these locations is impacted, there is the potential for regionally significant habitat to be impacted, resulting in widespread and long-term effects.

Based on the potential for a widespread long-term impact, CAPL has ranked this consequence as Severe (2).

Mangroves and intertidal mudflats

Modelling from a HFO spill event indicates that the maximum length of shoreline exposed to hydrocarbon concentrations above impact thresholds is ~154 km.

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. 87). 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. 87).

Modelling predicted mangroves and intertidal mudflats associated with these key values or sensitivities have the potential to be exposed to hydrocarbon concentrations above impact thresholds:

- Ningaloo Coast – World Heritage Property
- The West Kimberley – National Heritage Place
- Eighty Mile Beach – Ramsar Wetland
- Roebuck Bay – Ramsar Wetland.

If mangroves and intertidal mud habitats in these locations are impacted, there is the potential for regionally significant habitat to be impacted, resulting in widespread and long-term effects. Based on the potential for up to 154 km of shoreline to be exposed to hydrocarbons above impact thresholds, a spill event such as this has the potential to cause a widespread long-term impact. Based on the potential for a widespread long-term impact, CAPL has ranked this consequence as Severe (2).

Saltmarsh

Modelling from a HFO spill event indicates that the maximum length of shoreline exposed to hydrocarbon concentrations above impact thresholds is ~154 km.

Shoreline hydrocarbons can have smothering and toxic effects on saltmarsh habitat. Saltmarshes play a large role in the aquatic food web and the delivery of nutrients to coastal waters. They also support terrestrial animals and provide coastal protection. A long-term study of saltmarshes that were extensively coated with HFO (in Wales) and light crude (in Chile), in which neither site was cleaned, showed that smothered vegetation was killed, and that natural recovery of heavily impacted areas may take decades (Ref. 129). This finding is supported by a study of a site impacted by Prudehoe crude oil in Washington, in which recovery was still not observed at heavily oiled sites 17 months after the spill (Ref. 130). Modelling predicted saltmarsh associated with these key values or sensitivities have the potential to be exposed to hydrocarbon concentrations above impact thresholds:

- Eighty Mile Beach – Ramsar Wetland
- Subtropical and Temperate Coastal Saltmarsh – TECs.

If saltmarsh habitats (especially the TEC) are impacted, there is the potential for regionally significant habitat to be impacted, resulting in widespread and long-term effects. Based on the potential for up to 154 km of shoreline to be exposed to hydrocarbons above impact thresholds, a spill event such as this has the potential to cause a widespread long-term impact. Based on the potential for a widespread long-term impact, CAPL has ranked this consequence as Severe (2).

Indirect impacts to commercial fisheries

As identified in Table 4-11 and Table 4-12, several commercial fisheries have licences that overlap the EMBA associated with this EP. Although exposures >11 760 ppb.hr 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. Any hydrocarbon plume and subsequent impact will depend on environmental conditions. Modelling predicts that inshore exposure would be limited in duration, with hydrocarbons either washing ashore rapidly (resulting in limited time exposure or diluting over a longer term in deeper offshore waters). In both instances, it is expected that any impact from this type of event may have a localised impact directly to targeted species and indirectly through recruitment, with recovery expected in the short term.

As such, 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 has the potential to occur along the coast from Ningaloo to Broome depending on the environmental conditions at the time of the event. Deterministic analysis indicates that up to 183 km of shoreline may be exposed to shoreline hydrocarbon concentrations >10 g/m^2.

Shoreline loading can impact the visual amenity of coastal areas and limit beach access for users, impacting tourism and recreation activities. Given the potential for a short-term but potentially widespread disturbance to marine tourism and recreation activities, CAPL has ranked the consequence as Major (3).

ALARP Decision Context Justification

Installation vessels commonly operate near each other during offshore construction, bunkering, cargo loading, and unloading. 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 these production licences for the past 10 years while constructing and operating the GFP, 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 5-2. CAPL evaluates the likelihood of a vessel collision occurring, which results in a release volume and impact, as extremely low; therefore, ALARP Decision Context A has been applied for this aspect.	
Good Practice Control Measure	**Source of Good Practice Control Measure**
CAPL MSRE Process	CAPL's MSRE Standardised OE Process (Ref. 88) ensures that various legislated requirements are met. These include: • crew meet the minimum Standards of Training, Certification and Watchkeeping standards for safely operating a vessel, including watchkeeping requirements • navigation, radar equipment, and lighting meets industry standards.
SIMOPs Plan	A Simultaneous Operations (SIMOPs) plan provides information on: • responsible parties, and their roles and responsibilities • identifying and managing hazards arising from GS2 Operations SIMOPS • emergency response plans. The plan details the requirements and frequency for conflict meetings that will be chaired with the purpose of: • reviewing SIMOPS controls and mitigation plans • resolving conflicts and issues • reviewing new activity requests.
Contractor premobilisation inspections	All vessels contracted to CAPL will be subject to a premobilisation inspection where various compliance aspects can be inspected.
SOPEP	In accordance with MARPOL Annex I and Marine Order 91 (Marine Pollution Prevention – oil), a SOPEP must be developed based on the Guidelines for the Development of Shipboard Oil Pollution Emergency Plans, adopted by IMO as Resolution MEPC.54(32) (Ref. 138). 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 OPGGS€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's has developed an OPEP to support all spill response activities across all its assets. The OPEP is attached to this EP as Appendix D.
OSMP	The OSMP details the arrangements and capability in place for: • operational monitoring of a hydrocarbon spill to inform response activities • scientific monitoring of environmental impacts of the spill and response activities. Operational monitoring allows adequate information to be provided to aid decision-making to ensure response activities are timely, safe, and appropriate. Scientific monitoring identifies if potential longer-term remediation activities may be required. This NOPSEMA-accepted OSMP is attached as Appendix E.
Pre-start notifications	Under the Commonwealth *Navigation Act 2012*, AHO are responsible for maintaining and disseminating hydrographic and other nautical information and nautical publications including: • Notices to Mariners

	• Auscoast warnings. Details of the activities will be published in Notices to Mariners, thus enabling other marine users to plan their activities, and minimising disruption to exclusion zones. Relevant details will be provided to the JRCC to enable Auscoast warnings to be disseminated.
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 Rare (6).
Risk Level	Low (7)
Acceptability Summary	
Principles of ESD	The worst-case potential impact associated with this event is considered to result in a widespread and long-term impact, thus the worst-case consequence associated with this event is Severe (2). Therefore, further evaluation against the remaining Principles of ESD is required. There is little uncertainty associated with this event as the activities and cause pathways are well known, and the activities are well regulated and managed. Using conservative inputs, spill modelling was undertaken to inform the extent of potential impact associated with this type of event. Stochastic modelling was undertaken to remove uncertainty associated with environmental conditions and provide a suitable understanding of what may happen in such an event. Evaluation of consequences assumes no barriers are in place, thus with the consideration of industry best practice barriers, the potential impacts are likely much less than those considered in this evaluation.
Relevant Environmental Legislation and Other Requirements	Legislation and other requirements relevant for this aspect include: • Commonwealth *Navigation Act 2012* (pre-start notifications) • Marine Order 91, Marine Pollution Prevention – oil • Marine Order 3, Seagoing qualifications • Marine Order 30, Prevention of collisions
Internal Context	CAPLs environmental performance standards / procedures considered relevant to this aspect include: • MSRE Standardised OE Process (Ref. 88) • CAPL OPEP – (Ref. 90; Appendix D) • CAPL OSMP (Ref. 89; Appendix E)
External Context	During stakeholder consultation, no objections or claims were raised regarding vessel collision scenarios arising from the activity.
Defined Acceptable Level	In accordance with Section 5.6, these risks are inherently acceptable as they are lower-order risks. In addition, the potential impacts and risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.

Environmental Performance Outcomes	Performance Standards / Control Measures	Measurement Criteria	Responsibility
No spill of hydrocarbons or hazardous liquids to the environment from activities under this EP	**CAPL MSRE process** Vessels will meet the crew competency and navigation equipment requirements of the MSRE process	Records indicate that vessels meet the crew competency and navigation equipment requirements of the MSRE process	ABU GS2 Construction Superintendent
	SIMOPS Plan CAPL will develop and implement SIMOPs Plan(s) to manage its fleet of installation vessels for the duration of the Activity.	Records indicate that activities have been assessed for SIMOPs implications in accordance with the SIMOPs Plan(s) before approval and execution	ABU GS2 Construction Superintendent
	Contractor premobilisation inspection CAPL undertakes a premobilisation inspection of the installation vessels to confirm vessel certifications are current	Premobilisation inspection report / record verifies that vessels are certified	ABU GS2 Construction Superintendent
	SOPEP All vessels will have a SOPEP (or equivalent) in place before commencing activities under this EP	Records confirm all vessels have a SOPEP (or equivalent) in place before commencing activities under this EP	ABU GS2 Construction Superintendent
	SOPEP In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill	Vessel Master
	OPEP In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the OPEP (Ref. 90; Appendix D)	Records confirm that emergency response activities were implemented in accordance with the OPEP in the event of a vessel-based spill	ABU Perth Emergency Management Team (PEMT) Incident Commander
	OSMP In the event of a vessel-based spill event, operational and scientific monitoring will be implemented in accordance with the OSMP (Ref. 89;Appendix E)	Records confirm that operational and scientific monitoring was implemented in accordance with the OSMP in the event of a vessel-based spill	ABU PEMT Incident Commander
	Pre-start notifications The AHO will be notified at least four working weeks before operations commence to enable Notices to Mariners to be published	Email records confirm the AHO were notified via email datacentre@hydro.gov.au at least four working weeks before operations commenced	ABU GS2 Construction Superintendent

	Pre-start notifications AMSA's JRCC will be notified 24–48 hours before operations commence to enable AMSA to distribute an Auscoast warning	Email records confirm that information to distribute an Auscoast warning was emailed to the JRCC (rccaus@amsa.gov.au)	ABU GS2 Construction Superintendent

6.8 Spill Response

6.8.1 Response Option Selection

CAPL has developed a series of Strategic Net Environmental Benefit Analysis (NEBAs) (Ref. 139) 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 ¾ – 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. 128). 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.

6.8.2 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 2 – MDO
- Group ¾ – HFO.

The outcomes of the Strategic NEBA are outlined in Table 6-1 of the OPEP (Ref. 90; Appendix D); these determined that the primary response options proposed to be used for spill scenarios associated with this EP include:

- Monitoring, Evaluation, and Surveillance (MES)
- Containment and Recovery (CAR) (for Group ¾ only)
- Shoreline Protection and Deflection (SPD)
- Shoreline Clean-up (SHC).

6.8.3 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 (Appendix D; Ref. 90).

6.8.3.1 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. 139) to understand the planned response to an event (Section 6.8.3.2).
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 (Section 6.8.3.2).
3. Review the number of response packages available to determine if the capability exists.

6.8.3.2 CAPL Planned Response Vessel Collision (HFO)

In accordance with the Strategic NEBA (Ref. 139), the primary response strategies proposed to be used for this spill scenario and response package calculations are described below.

Implement MES response

A MES response will commence for every spill to water as soon as the spill is identified. MES activities may range from very simplistic visual observation only, through to more involved monitoring and evaluating tactics. Appendix C of the OPEP (Appendix D; Ref. 90) has documented the arrangements that CAPL have in place to implement all the required MES tactics and consequently this technique is not discussed further.

Implement a CAR response

Deterministic analysis for the largest sea surface swept area indicate that actionable surface hydrocarbons (concentrations >10 g/m^2) are present until day 26 following the spill event. This analysis also indicates that the maximum area of actionable surface oil was 59 km^2 on day 2, reducing, on average, ~25 km^2 between day 10 and 20 assuming no physical recovery has occurred. Despite the reduction in surface oil with time, CAPL has taken a conservative approach in identifying the number of teams required by using the maximum area of actionable oil on the surface (59 km^2)

Based on Appendix C of the OPEP (Appendix D; Ref. 90), each CAR team is expected to cover 0.558 km^2 per day. Assuming that the response starts on day 3

and finishes on day 20, each team can cover an area of ~10.04 km^2 over the duration of the response. Consequently a maximum of six teams over this duration are expected to be sufficient to cover the largest sea surface swept area. Confirmation that CAPL has the arrangements in place to implement the required number of packages is provided in Table 6-10.

Implement an SPD response

Deterministic analysis for the largest volume of oil ashore indicates that up to 1261 m^3 may wash ashore between days four and six following the spill event. 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.

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.

Based on Appendix C of the OPEP (Appendix D; Ref. 90), each protection team is expected to recover 15.6 m^3 of hydrocarbon per day. On the assumption that 420 m^3 washes ashore each day for three days, CAPL would need up to 27 teams available each day to recover the hydrocarbon as it washed ashore. Confirmation that CAPL has the arrangements in place to implement the required number of packages is provided in Table 6-10.

Implement an SHC response

Deterministic analysis for the largest volume of oil ashore indicates that up to 1261 m^3 may wash ashore between days four and six following the spill event. 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.

Based on Appendix C of the OPEP (Appendix D; Ref. 90), each SHC team is expected to recover 1.6 m^3 of hydrocarbon per day. If 50 clean-up teams are mobilised and used, all hydrocarbons can be recovered within 16 days. Consequently, if such an event occurred, after modelling and monitoring activities were completed, CAPL would aim to mobilise 10 teams within the first 3 days and ramp up to 50 teams by day 5 as directed and informed by MES activities.

Table 6-10: Vessel Collision (HFO) Response Package Deployment Timeline

Response Technique	Days Following Event							Weeks Following Event				
	1	2	3	4	5	6	7	2	3	4	5	6
No. packages – planned MES	1	1	1	1	1	1	1	1	1	1	0	0
Does CAPL have the required capability?–	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
No. packages – planned CAR	0	0	6	6	6	6	6	6	6	0	0	0
Does CAPL have the required capability?			Y	Y	Y	Y	Y	Y	Y			

Response Technique	Days Following Event							Weeks Following Event				
	1	2	3	4	5	6	7	2	3	4	5	6
No. packages – planned SPD	0	0	27	27	27	27	27	27	27	0	0	0
Does CAPL have the required capability?			Y	Y	Y	Y	Y	Y	Y			

No. packages – planned SHC	0	0	10	30	50	50	50	50	50	0	0	0
Does CAPL have the required capability?			Y	Y	Y	Y	Y	Y	Y			

6.8.3.3 Vessel Collision (MDO)

No shoreline contact is predicted for this scenario, therefore there is no need to implement SPD and SHC responses. Offshore CAR would not be effective because of the hydrocarbon properties (Group 2). Consequently, in accordance with the Strategic NEBA (Ref. 139), the primary response CAPL proposes for this spill scenario 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 (Appendix D; Ref. 90) has documented the arrangements that CAPL have in place to implement all the required MES tactics; therefore, this technique is not discussed further.

6.8.4 Spill Response Environmental Risk Assessment

6.8.4.1 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.

Cause of Aspect

In the event of a worst-case spill event (vessel collision resulting in a release of HFO), 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 or 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 5-2. As such, CAPL considers ALARP Decision Context A should be applied for this aspect.			
Control Measure	**Source of Good Practice Control Measure**		
OSMP (Ref. 89; Appendix E)	Operational monitoring allows adequate information to be provided to aid decision-making to ensure response activities are timely, safe, and appropriate. Scientific monitoring identifies if potential longer-term remediation activities may be required. 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	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. 89; Appendix E).		
External Context	During stakeholder consultation, no objections or claims were raised regarding spill response activities.		
Defined Acceptable Level	In accordance with Section 5.6, these risks are inherently acceptable as they are lower-order risks. In addition, the potential risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
Reduce the risk of impacts to the onshore environment during event response	**OSMP** Operational and scientific monitoring will be implemented in accordance with the OSMP, specifically OPS5 – Rapid (oiled) Shoreline Assessment (Ref. 89; Appendix E)	Records confirm that operational and scientific monitoring was implemented in accordance with the OSMP	Emergency Management Team (EMT) Incident Commander (IC)

6.8.4.2 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.

Cause of Aspect			
In the event of a worst-case spill event (vessel collision resulting in a release of HFO), 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 5-2. As such, CAPL considers ALARP Decision Context A should be applied to this aspect.			
Control Measure	**Source of Good Practice Control Measure**		
OSMP (Ref. 89; Appendix E)	Operational monitoring allows adequate information to be provided to aid decision-making to ensure response activities are timely, safe, and appropriate. Scientific monitoring identifies if potential longer-term remediation activities may be required. 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	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. 89; Appendix E).		
External Context	During stakeholder consultation, no objections or claims were raised regarding spill response activities.		
Defined Acceptable Level	In accordance with Section 5.6, these risks are inherently acceptable as they are lower-order magnitude risks. In addition, the potential risks associated with the activity are consistent with any recovery plan, conservation advice, or relevant bioregional plan.		
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**	**Responsibility**
Reduce the risk of impacts to the onshore environment during event response	**OSMP** Operational and scientific monitoring will be implemented in accordance with the OSMP, specifically OPS5 – Rapid (oiled) Shoreline Assessment (Ref. 89; Appendix E)	Records confirm that operational and scientific monitoring was implemented in accordance with the OSMP	EMT IC

7 Implementation Strategy

To meet the requirements of the OPGGS€R, Division 2.3, Regulation 14, *Implementation strategy for the environment plan*, this Section describes the implementation strategy, which identifies the systems, practices, and procedures used to ensure the environmental impacts and risks of the activities are continuously reduced to ALARP and the environmental performance outcomes and standards detailed in Section 6 are achieved.

7.1 Systems, Practices, and Procedures

CAPL's operations are managed in accordance with the OEMS, which is a comprehensive management framework that supports the corporate commitment to protect the safety and health of people and the environment. This framework ensures a systematic approach to environmental management, with the environmental aspects of each project addressed from project conception, throughout project planning, and as an integral component of implementation, as shown in Figure 7-1.

Figure 7-1: CAPL OEMS Process Overview

Under the OEMS are 13 elements that enable CAPL to implement activities in a manner that is consistent with its Operational Excellence Policy 530 (Appendix A). Of the elements described under the OEMS, those relevant to this EP are detailed in Table 7-1. The following subsections summarise the key processes that help demonstrate how CAPL is effective in reducing environmental impacts and risks to ALARP and an acceptable level.

Under the OEMS, records (including compliance records to demonstrate environmental performance and compliance with this EP) will be retained in accordance with Regulation 27 of the OPGGS€R.

Table 7-1: OEMS Elements Relevant to this Activity

OEMS Element	Element Description	Key Processes Relevant to this Activity
Safe Operations (OE-03)	Operate and maintain facilities to prevent injuries, illness, and incidents	• (OE-03.01.01) ABU HES Risk Management (Ref. 18) • (OE-03.09.01) Marine Safety Reliability and Efficiency – ABU Standardised OE Process (Ref. 88) • (OE-03.06.02) Managing Safe Work (MSW) – ABU Standardised OE Process (Ref. 101) • (OE-03.16.13) Hazardous Communication Process (Ref. 102) • (ABU151100648) Hazardous Materials Environmental Assessment Tool (Ref. 60)
Management of Change (OE-04)	Manage both permanent and temporary changes to prevent incidents	• (OE-04.00.01) Management of Change for Facilities and Operations – ABU Standardised OE Process (Ref. 104)
Incident Investigation (OE-09)	Investigate and identify root causes of incidents to reduce or eliminate systemic causes to prevent future incidents	• (OE-09.00.01) Incident Investigation and Reporting – ABU Standardised OE Process (Ref. 105)
Community and Stakeholder Engagement (OE-10)	Reach out to the community and engage in open dialogue to build trust	• (OE-10.00.01) Community and Stakeholder Engagement – ABU Standardised OE Process (Ref. 106)
Emergency Management (OE-11.01)	Prevention is the first priority, but be prepared to respond immediately and effectively to all emergencies involving wholly owned or operated CAPL assets	• (OE-11.01.01) Emergency Management Process (Ref. 107) • OSMP (Ref. 89)
Compliance Assurance (OE-12)	Verify conformance with OE requirements in applicable company policy and government laws and regulations	• (OE-12.01.19) Compliance Assurance Audit Program ABU Standardised OE Procedure (Ref. 108) • (OE-12.01.18) Compliance Assurance Management of Instances of Potential Noncompliance (Ref. 109)

7.1.1 Safe Operations (OE-03)

7.1.1.1 (OE-03.01.01) ABU HES Risk Management

The HES Risk Management Process (Ref. 18) provides a corporate-level framework for managing HES risks and is designed to be consistent with the environmental risk management requirements of ISO 14001 Environmental Management System (Ref. 110) and ISO 31000:2009 Risk Management Standard (Ref. 19).

This process is summarised in Section 5 of this EP. Additional risk assessments must be undertaken if the MOC process (Section 7.1.2) is triggered. Risk assessments are undertaken in accordance with this process.

The HES Risk Management Process and the MOC process (Section 7.1.2) are the key systems CAPL use to ensure, that in accordance with Regulation 14(3)(a), the impacts and risks of the petroleum activity continue to be identified and reduced to ALARP.

7.1.1.2 (OE-03.09.01) Marine Safety Reliability and Efficiency – ABU Standardised OE Process

The MSRE Process (Ref. 88) identifies the requirements and activities necessary to deliver safety, reliability, and efficiency in marine services. This process applies to marine vessels chartered by CAPL as well as those vessels contracted by an affiliate or contractor that provide marine support or services to CAPL. The MSRE Process includes both prevention and mitigation measures, ensuring minimum standards are met for vessel operations.

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) are available and that minimum standards are met for navigation equipment, lighting, waste systems, and other marine safety protocols including Marine Order 30 (Prevention of Collisions Issue 8).
- 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 / 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 and Installation 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.

7.1.1.3 (OE-03.06.02) Managing Safe Work (MSW) – ABU Standardised OE Process

The MSW Process (Ref. 101) identifies, assesses, and eliminates, mitigates, or controls the hazards associated with work. The MSW Process identifies and evaluates job task hazards, specifies control measures, manages those measures, controls the work, and manages behaviours to support safe work. Standards and procedures relating to MSW are appended to this process, including:

- Permit to Work Procedure, which contains the requirements and procedures for developing, approving, and applying work permits and/or work plans for managing HES risks associated with work activities.
- Simultaneous Operations (SIMOPS) Standard, which contains requirements that apply to SIMOPS (two or more activities that may affect each other when carried out simultaneously, including operations and maintenance activities taking place in the same area and heavy lifting over subsea infrastructure).

7.1.1.4 (OE-03.16.01) Hazardous Communication Process

The Hazardous Communication Process (Ref. 102) provides a framework for managing hazardous materials within CAPL. Specifically, CAPL's Hazardous Material Approval Process (HMAP) (Ref. 103) outlines the chemical selection process, which includes the steps required for selecting and managing materials/products that are classified as Hazardous Materials or Dangerous Goods.

The HMAP is designed to:

- assess Hazardous Materials requested for procurement for their HES risks, and provide an opportunity for selecting and procuring less-hazardous chemicals (substitution) while maintaining technical performance, where reasonably practicable
- 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 chemical selection process, certain chemicals that will be discharged to the environment undergo a detailed environmental assessment. The assessment comprises a semi-quantitative assessment method (Table 7-2), which considers three components that influence the potential risk associated with the use/discharge of a chemical to the marine environment. These components are:

- inherent chemical properties
- environmental sensitivities within the receiving environment
- chemical application.

The chemical environmental risk assessment generates a chemical application profile. Offshore Chemical Notification Scheme (OCNS) (Ref. 133) substitution warnings are also considered when assessing chemicals.

Each component uses criteria against which the chemical and its application are scored to determine acceptability. The selection of the criteria and associated scoring scales were informed by several sources, including the WA Drilling Fluids Management Guidelines (Ref. 125) and the OCNS.

The chemical risk profile is a replicable and transparent method to identify chemicals (and applications) that may carry a higher potential risk. Risk profiles for each chemical are stored and maintained as necessary for the duration of the drilling activities to ensure that potential changes to the chemical inventory are assessed and acceptable. The chemical risk profiles are also used to compare alternative chemicals and application strategies (thus helping inform opportunities for improvement), and ensure that where chemical use is necessary, the environmental risks associated with their use/discharge are reduced to ALARP.

Table 7-2: Chemical Risk Assessment Criteria

<table>
<tr><th>Assessment Criteria</th><th>Selection Rationale</th></tr>
<tr><td colspan="2">Assessment Component – Chemical Environmental Properties
This component considers the chemical's inherent properties, including three key criteria (persistence, bioaccumulation, and toxicity) that determine possible effect and fate with respect to marine flora and/or fauna.</td></tr>
<tr><td>Toxicity</td><td>The toxicity of a chemical reflects the OCNS, 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 the former WA Department of Mines and Petroleum, (now Department of Mines, Industry Regulation and Safety) from Hinwood et al. (Ref. 111).</td></tr>
<tr><td>Biodegradation rate (Persistence)</td><td>The biodegradation rate indicates the potential persistence of the chemical within the environment, and therefore the potential duration of exposure for environmental sensitivities.
The biodegradation scale is based on adjustment criteria used by the UK Centre for Environment, Fisheries and Aquaculture Science (Cefas) for chemical hazard assessments under the OCNS.</td></tr>
<tr><td>Bioaccumulation potential / Bioconcentration factors</td><td>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 which 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 bioaccumulation scale is based on adjustment criteria used by Cefas for chemical hazard assessments under the OCNS.</td></tr>
<tr><td colspan="2">Assessment Component – Environmental Sensitivities
The potential consequence of a chemical discharge is considered to be greater the more sensitive the receiving environment. In the context of potential biological effects from chemical discharges, sensitive factors may include species endemism/uniqueness, species diversity, biological productivity including benthic primary productivity, and the social/cultural value of an area.</td></tr>
<tr><td>Use/discharge environment (environmental designations)</td><td>For this assessment, environmental designations (e.g. International Union for Conservation of Nature [IUCN] for protected area categories for marine areas) are used as a proxy for the presence of sensitive factors.
Note: These IUCN categories relate to the Australian Marine Park designations.
<table>
<tr><th>Type</th><th>IUCN Category</th><th>Description</th></tr>
<tr><td rowspan="2">Sanctuary</td><td>Ia</td><td>Strict Nature Reserve: Protected Area managed mainly for science</td></tr>
<tr><td>Ib</td><td>Wilderness Area: Protected Area managed mainly for wilderness protection</td></tr>
<tr><td>Marine National Park</td><td>II</td><td>Protected Area managed mainly for ecosystem conservation and recreation</td></tr>
<tr><td>Habitat Protection</td><td>IV</td><td>Habitat/Species Management Area: Protected Area managed mainly for conservation through management intervention.</td></tr>
<tr><td>Multiple Use</td><td>VI</td><td>Managed Resource Protected Areas: Protected Area managed mainly for the sustainable use of natural ecosystems.</td></tr>
</table>
Other values identified within this EP (e.g. active fishing areas, or KEFs that are not encompassed within marine parks are also factored into the assessment.</td></tr>
</table>

Assessment Criteria	Selection Rationale
Assessment Component – Chemical Application Application-specific considerations relate to how the chemical is discharged—discharge parameters can have a major influence on a chemical's potential for adverse effect within the receiving environment.	
Dosage	The dosage of a chemical indicates the potential for toxic impact—greater dilution of a chemical before it is discharged reduces the potential for adverse effects.
Quantity discharged	The total quantity of chemical discharged indicates the potential scale of effect—larger volumes may pose a greater risk across a greater area of the receiving environment and expose a greater number of sensitivities to possible adverse effects. Larger volumes may also require a greater buffering capacity (i.e. dilution) within the receiving environment to moderate the chemical's inherent properties (particularly toxicity).
Discharge frequency	Discharge frequency considers how often the chemical will be introduced into a particular environment—the more frequent the discharge, the greater the potential for adverse acute and/or chronic effects within the receiving environment.

7.1.2 Management of Change (OE-04)

7.1.2.1 (OE-04.00.01) Management of Change for Facilities and Operations

The Management of Change for Facilities and Operations Process (Ref. 104) manages changes to facilities, operations, products, and the organisation so as to prevent incidents, support reliable and efficient operations, and keep unacceptable risks from being introduced into CAPL's business.

In conjunction with the HES Risk Management Process (Section 7.1.1.1), this process is followed to document and assess the impact of changes to activities described in Section 6. 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.

This EP must be resubmitted to NOPSEMA for acceptance/approval before:

- commencing any new activity, or significantly modifying, changing, or adding a new stage of an existing activity, not provided for in this EP
- changing the instrument holder for, or operator of, the activity
- a significant new environmental impact or risk, or significant increase in an existing environmental impact or risk, occurs that is not provided for in this EP
- 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.

7.1.3 Incident Investigation (OE-09)

7.1.3.1 (OE-09.00.01) Incident Investigation and Reporting – ABU Standardised OE Process

The Incident Investigation and Reporting Process (Ref. 105) describes how CAPL reports and investigates incidents. In accordance with this process, environmental incidents will be reported by CAPL as per Section 7.4.

The process is designed to implement the OE expectations of Element 9 – Incident Reporting, which requires investigation and identification of root causes of incidents to reduce or eliminate systemic causes and to prevent future incidents. This includes incidents resulting in injury, operational impact, near miss, occupational illness, environmental, reliability, business disruption, and community concerns.

The process includes:

- incident notification
- incident investigation, reporting, and documentation
- incident investigation competency model
- competency management for investigators
- leveraging and institutionalising lessons learned across the organisation.

The objective of the process is to determine the root causes of an incident, which results in the generation of actions that can be implemented to directly stop or control the current incident or reduce the risk of future incidents.

A CAPL software program and database is used to input incident data directly from the field, as well as access data including root cause information, action tracking, progress reporting, and escalation. All identified non-conformances, corrective, and preventive actions will be added to the database, and assigned to personnel for timely closure.

7.1.4 Community and Stakeholder Engagement (OE-10)

7.1.4.1 (OE-10.00.01) Community and Stakeholder Engagement – ABU Standardised OE Process

The Community and Stakeholder Engagement process (Ref. 106) systematically identifies stakeholders and plans and executes engagement to foster mutual understanding, dialogue, and trust.

In accordance with Regulation 14(9) of the OPGGS€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 2.6.4.

7.1.5 Emergency Management (OE-11)

7.1.5.1 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 is compatible with the Australasian Inter-service Incident Management System (AIIMS). This system is compatible with the National Plan for Maritime Environmental Emergencies (National Plan; Ref. 100), with an incident management system consistent with the AIIMS.

The ERO comprises the groups listed in Table 7-3; this table also describes the major functions of teams during an emergency.

Figure 7-2 to Figure 7-5 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 Crisis Management Plan (Ref. 112).

Table 7-3: CAPL Emergency Management Teams

Type of Team	Membership	Description
On-site Response Teams (ORTs)	Site personnel who work at the facility or operation where a spill may occur	• Conducts and coordinates response tasks on site • Establishes staging areas and field command posts • Communicates site conditions and resource needs to the EMT.
Emergency Management Teams (EMTs)	Personnel with senior or specialist roles: • Installation EMT (Level 2) • Asset EMT (Level 3)	• Provides incident management for emergency events • Performs major spill management functions • Sets strategic goals for the incident • Sets tactical objectives for ORTs • Acquires resources to supplement ORTs • Briefs and liaises with government • Operates from the EMT command centre.
Crisis Management Teams (CMTs)	CAPL ABU Management personnel.	• Manages business continuity for Level 3 incidents • Does not directly manage emergency response strategies or tactics • Liaises between EMT and Chevron Corporation • Provides assistance with media outreach, shareholder issues, and corporate concerns.

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 in Table 3-1 of the OPEP (Ref. 90; Appendix D).

7.1.5.2 (OE-11.01.01) Emergency Management Process

The Emergency Management Process (Ref. 107) provides organisational structures, management processes, and the tools necessary to:

- respond to emergencies and prevent or mitigate emergency and/or crisis situations
- respond to incidents safely, rapidly and effectively
- restore or resume affected operations of strategic importance.

The OPEP (Ref. 90; Appendix D) 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.

7.1.5.3 Chain of Command for Emergency Response

A well-delineated EMT chain of command has been established for emergency response (Figure 7-2 to Figure 7-5). As incidents grow in size or complexity, command may transfer several times. Within the response structure, command may transfer between On-scene Commanders (Ocs) at the tactical level. For a major incident, incident command may transfer to a designated Control Agency or to the PEMT, 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.

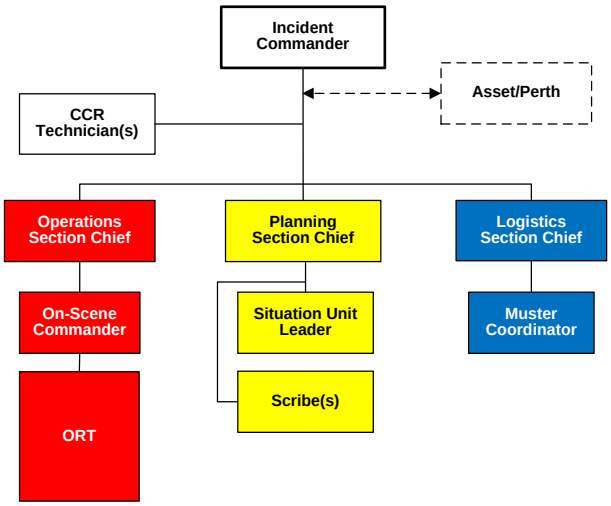


Figure 7-2: Basic EMT Organisation Chart – Emergency Response Chain of Command

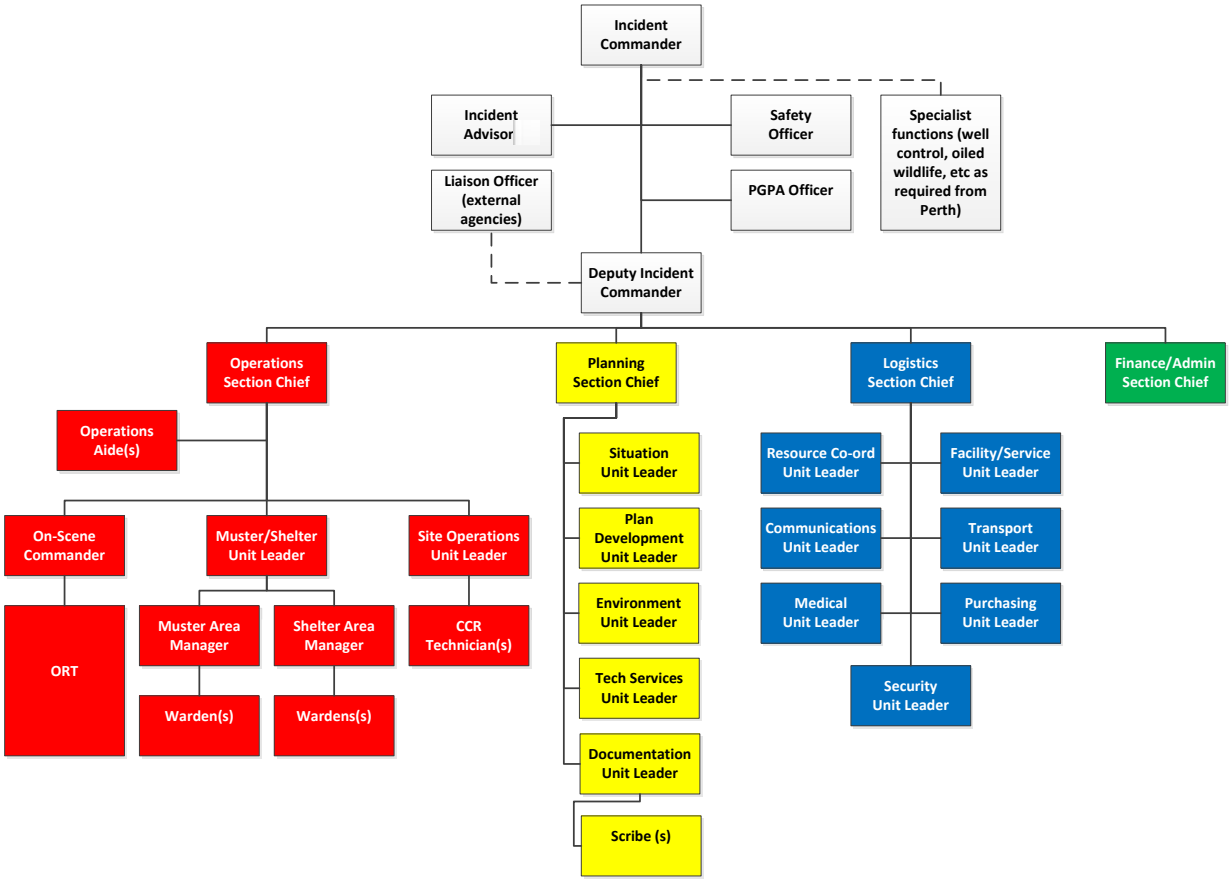


Figure 7-3: Expanded EMT Organisation Chart – Emergency Response Chain of Command

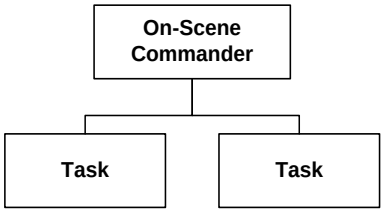
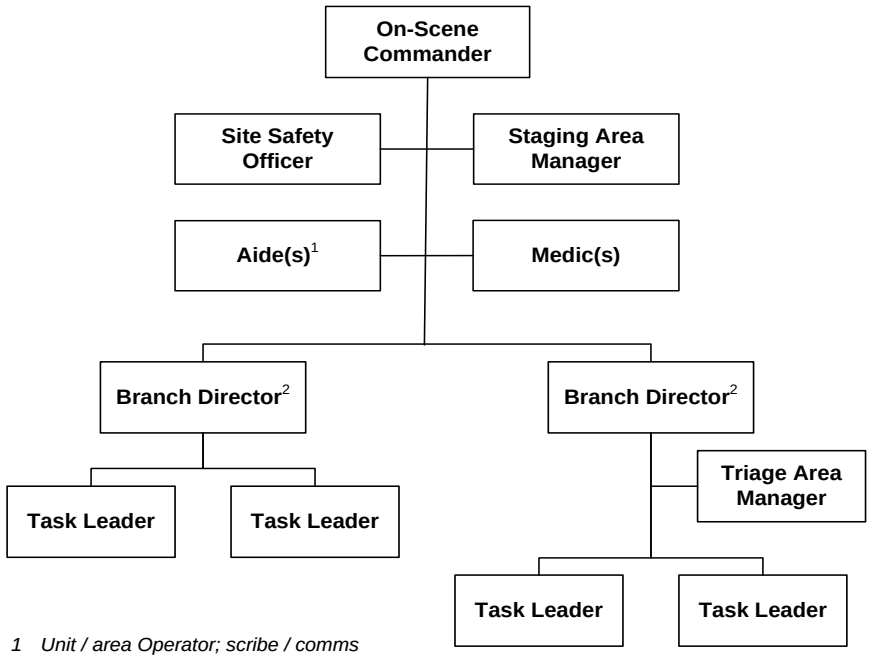


Figure 7-4: Basic ORT Organisation Chart – Emergency Response Chain of Command



1 Unit / area Operator; scribe / comms

2 e.g. Source Control, Response, Shoreline Cleanup, Medical, Environmental, etc.

Figure 7-5: Expanded ORT Organisation Chart – Emergency Response Chain of Command

7.1.5.4 Roles and Responsibilities for Emergency Response

Table 7-4 provides additional information about the structure of these teams and individual roles and responsibilities during emergency response.

Table 7-4: Roles and Responsibilities – Emergency Events and Response

Role	Responsibilities
On-Site Response Team	
On-Scene Commander (OC)	• 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	• 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.

Role	Responsibilities
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.

7.1.5.5 Training and Competencies for Emergency Response

Competencies and training requirements for the EMT, ORT, and other personnel during implementation of the OPEP (Ref. 90; Appendix D) are outlined in Table 7-5. Competency and training records for personnel, including contractors and subcontractors, are maintained.

Table 7-5: Competency and Training Requirements for Emergency Response

Role	Summary
Note: Personnel with no specialist emergency response duties should undergo training in line with their responsibilities as indicated below for 'All personnel'.	
All personnel	• Provide basic first response to an incident, including, but not limited to: conducting a quick assessment; making safe; notifying anyone else in danger; and raising the alarm. • Complete basic procedures in response to an alarm and evacuate to a muster point (as necessary). • Frequency: Every 3 years if not involved in response or drills/exercises.
In addition to the above, personnel responsible for roles with specialist oil spill response duties should undergo further training and practice in line with the responsibilities set out below.	
IC	• Roles may include full-time contracted services personnel or part-time operations personnel with an identified role in emergency management. • 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).
EMT	• Roles may include full-time contracted services personnel or part-time operations personnel with an identified role in emergency management. Typically based on Barrow Island, Onslow, or Perth; fulfils senior roles within the EMT for oil spill response or management. • 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).
OC	• Roles may include full-time contracted services personnel or part-time operations personnel with an identified role in emergency response. • Competencies: Safely and effectively organises and manages on-scene tactical response operations and provides field reporting. • Frequency: Once a year (maintenance of competencies may be through response or training/drills/exercises).

7.1.5.6 Oil Spill Exercise Schedule

CAPL's multi-year exercise schedule (MYES) describes the schedule of training and exercise required for all emergency events. The MYES incorporates CAPL's Oil Spill Exercise Schedule (ABU151100455) (Ref. 153) for oil spill training, drills, and exercises.

The MYES 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 MYES outlines the proposed testing arrangements to be completed, including the exercise types (listed in Table 7-6) and proposed level of response to be tested (Table 7-7) that may be used to meet the defined objectives. A minimum of one test for each level will be conducted each year.

Table 7-6: Exercise Types

Exercise 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 7-7: Exercise Levels

Exercise Level	Details
Level 1 – ORT	• Each ORT must hold at least two exercises per year per shift. • 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 multi-year 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. 90; Appendix D) 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
- if a facility becomes operational after the response arrangements have been tested and before the next test is conducted: test the response arrangements in relation to the facility when it becomes operational.

7.1.6 Compliance Assurance (OE-12.01)

7.1.6.1 (OE-12.01.19) Compliance Assurance Audit Program Procedure

The Compliance Assurance Audit Program Procedure (Ref. 108) addresses the establishment of audit programs to verify the effectiveness of controls and the extent to which CAPL meets the requirements.

Routine audits and inspections of activities in the scope of this EP will be undertaken in accordance with the audit program/schedule, which will be regularly reviewed and updated to ensure effective verification of environmental compliance requirements. The audit program/schedule will include the time frames, location, and scope of the audits.

Typically, routine inspections will be worksite-based (such as HES inspections) and conducted regularly, with the frequency and scope determined by the risk profile of individual sites and activities. Audits will focus on infield activities (such as site audits) and/or administrative processes (such as desktop audits of relevant information), and a single audit of this activity per year is planned (given its nature and scale).

Audit protocols and inspection checklists will be followed for all audits and inspections, and actions will be tracked until closure. Audit findings and corrective actions are recorded and tracked, as described in Section 7.1.6.2.

Additionally, continual monitoring of HES legislation is conducted, including new or updated legislation, which can include plans of management (or similar) under the EPBC Act. Legislative changes are proactively assessed based on their nature and scale to ensure that potential business impacts are understood and effectively managed, and that HES permits and controls remain fit-for-purpose.

7.1.6.2 (OE-12.01.18) Compliance Assurance Management of Instances of Potential Noncompliance

The Compliance Assurance Management of Instances of Potential Noncompliance Procedure (Ref. 109) 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 stated 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.

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 7.1.2.

7.2 Chain of Command and Roles and Responsibilities

7.2.1 Chain of Command

In accordance with Regulation 14(4) of the OPGGS€R, a clear chain of command for implementing the petroleum activity is outlined in Figure 7-6. More detailed roles and responsibilities are described in Section 7.2.2.

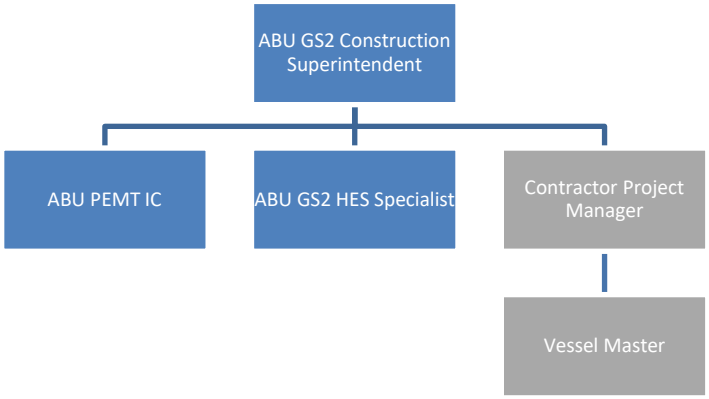


Figure 7-6: Chain of Command

7.2.2 Roles and Responsibilities

The roles and responsibilities for implementing task-specific control measures are detailed in Section 6, and are summarised in Table 7-8.

Table 7-8: Roles and Responsibilities

Roles	Responsibilities
ABU GS2 Construction Superintendent	• Ensure that this EP is implemented according to the commitments made within it • Ensure the activities implemented are consistent with those described in Section 3

Roles	Responsibilities
	• Ensure impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Sections 6 and 7 • Ensure ongoing stakeholder consultation is conducted in accordance with Section 2.6.4 • Ensure incidents are reported and investigated in accordance with Sections 7.4 Section 7.1.3 respectively • Ensure this EP is maintained and reviewed in accordance with Section 7.5
ABU GS2 HES Specialist	• Ensure personnel are made aware of their requirements under this EP in accordance with Section 7.2.3 • Ensure compliance with this EP is verified in accordance with Section 7.1.6 • Ensure impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Sections 6 and 7 • Ensure all changes to this EP are subject to a Management of Change assessment as described in Section 7.1.2
Vessel Master	• Ensure impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Sections 6 and 7 • Ensure all incidents are reported to CAPL • Ensure all emissions and discharges are monitored and recorded in accordance with Sections 6 and 7.3
ABU PEMT IC	• Implement CAPL's OPEP and OSMP in the event of a vessel-based spill event in accordance with Section 7.1.5.

7.2.3 Environmental Awareness

In accordance with Regulation 14 (5) of the OPGGS€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.

The responsibilities identified in this EP are summarised in Section 7.2.2. Personnel with specific responsibilities under this EP were included during the internal review of this EP and are made aware of their role-specific responsibilities under this EP.

Table 7-9: Inductions

Induction	Required Personnel	Induction Scope
Environment Plan Roll-out	Those with specific responsibilities under this EP (Table 7-8)	EP-specific environmental roll-out covering requirements in this EP, including the roles and responsibilities outlined in Table 7-8.
Program Induction	Survey personnel	Before commencing operations, all personnel, including subcontractors, must attend an induction that includes an overview 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 risks from the activity • cetacean observation techniques

Induction	Required Personnel	Induction Scope
		• an outline of the control measures in this EP to achieve the environmental performance outcomes • incident reporting requirements • incident response arrangements.

7.3 Monitoring

Regulation 14(7) of OPGGS€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 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. Specifically, planned discharges to the marine environment associated with this petroleum activity are assessed in Section 6.6—the impacts and risks associated with these are considered to be minimal.

If a vessel collision results in a LOC event, CAPL will implement the OSMP (Ref. 89), which is identified as a control measure in Section 6.7. 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 Incident Reporting

In accordance with CAPL's Incident Investigation and Reporting process (Ref. 105), all 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 As a minimum, the written incident report must describe: • the incidents and all material facts and circumstances concerning the incidents • any actions taken to avoid or mitigate any adverse environmental impacts • any corrective actions already taken, or that may be taken, to prevent a repeat of similar incidents. If no recordable incidents occur during the reporting month, a 'nil report' will be submitted.	Submit written report to NOPSEMA by the 15th of each month
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 6.6.2)
- Accidental Release – Vessel Collision (Section 6.7.3).

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 effected) • 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 a 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 marine pest or disease within 24 hours	DPIRD: • Email: biosecurity@fish.wa.gov.au • Phone: FishWatch 24-hour hotline: 1800 815 507

7.4.1 Routine Reporting

Regulation 26C of the OPGGS€R requires environmental performance reporting for the activity described in this EP, as summarised 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 and end of activity	CAPL must complete Form FM1405 and submit to NOPSEMA 10 days before activity commencement	NOPSEMA Submissions NOPSEMA GPO Box 2568 Perth 6001 Western Australia https://securefile.nopsema.gov.au/filedrop/submissions	Once
End of EP notification	CAPL must complete Form FM1405 and submit to NOPSEMA within 10 days of activity completion		Once

7.5 Environment Plan Review

Revisions and/or resubmission of this EP to NOPSEMA will be undertaken in accordance with Regulation 17 of the OPGGS€R. The decision to revise or resubmit the EP will be made in accordance with CAPL's OEMS, particularly Element 4 – Management of Change Process, as detailed in Section 7.1.2.

Additional triggers for reviewing this EP include:

- premobilisation review – before starting any activity under this EP
- changes to listings, status, and/or management instruments communicated via EPBC Act Species Information and Policy updates

Where a change to this EP from one of these reviews is identified, it will be evaluated in accordance with Section 7.1.2, and, if required by Regulation 17 of the OPGGS€R, resubmitted to NOPSEMA for assessment, or revised and re-issued for use accordingly.

The Description of the Environment document (Appendix C; Ref. 8) will be reviewed annually to include any relevant changes to source documents, such as State/Commonwealth management plans, threatened species recovery instruments (recovery plans / conservation advice), EPBC status, or new published research. Any suggested changes to the description of the environment or risk assessment arising from this review will be subject to a MOC process in accordance with Section 7.1.2.

Specific OPEP review requirements are described in Section 9 of the OPEP (Ref. 90; Appendix D).

8 Abbreviations and Definitions

Table 8-1: Abbreviations and Definitions

Abbreviation/Acronym	Definition
@	At
~	Approximately
″	Inch
<	Less than / fewer than
>	Greater than / more than
°C	Degrees Celsius
µg	Microgram
3D	Three dimensions, three-dimensional
ABU	Australian Business Units
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
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
APASA	Asia–Pacific Applied Science Associates
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
APS	Adjustable Pipe Support
Auscoast	Australian Coastal (weather warning)
AUV	Autonomous Underwater Vehicle
bbl	Barrel
BIA	Biologically Important Area
BOD	Biological Oxygen Demand
BP	Boiling Point
CAPL	Chevron Australia Pty Ltd
CAR	Containment and Recovery
CCR	Central Control Room
CDU	Central Distribution Unit
Cefas	UK Centre for Environment, Fisheries and Aquaculture Science
CMT	Crisis Management Teams
Commonwealth	Commonwealth of Australia
Commonwealth Waters	Waters stretching from three to 200 nautical miles from the Australian coast.
cP	Centipoise
DAWE	Commonwealth Department of Agriculture, Water and the Environment

Abbreviation/Acronym	Definition
dB re 1 µPa	Decibels relative to one micropascal; the unit used to measure the intensity of an underwater sound
dB re 1 µPa rms	Decibels relative to one micropascal root mean squared; the unit used to measure the intensity of an underwater sound
DC-1, DC-2, etc.	Drill Centre name
DMIRS	Western Australian Department of Mines, Industry Regulation and Safety
DNP	Commonwealth Director of National Parks
DoT	Western Australian Department of Transport
DP	Dynamic Positioning
DPIRD	Western Australian Department of Primary Industries and Regional Development (formerly Department of Fisheries)
EC50	A concentration or dose that yields biological effects in 50% of test animals/species
EEA	Environmental Exposure Area
EFL	Electrical Flying Lead
EIAPP	Engine International Air Pollution Prevention
EMBA	Environment that May Be Affected
EMT	Emergency Management Team
EP	Environment Plan
EPBC 2003/1294	Commonwealth Ministerial Approval (for the Gorgon Gas Development) as amended or replaced from time to time.
EPBC 2005/2184	Commonwealth Ministerial Approval (for the Jansz Feed Gas Pipeline) as amended or replaced from time to time.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ERO	Emergency Response Organisation
ESD	Ecologically Sustainable Development
FCGT	Flood, Clean, Gauge, and Test
GFP	Gorgon Foundation Project
GOMO	Guidelines for Offshore Marine Operations
GOR-1A, etc.	Well name in the Gorgon field
GS2	Gorgon Stage 2
h	Hour
HCV	Heavy Construction Vessel
HES	Health, Environment, and Safety
HFL	Hydraulic Flying Lead
HFO	Heavy Fuel Oil
HMAP	Hazardous Material Approval Process
HP	High pressure
Hz	Hertz
IAPP	International Air Pollution Prevention
IC	Incident Commander

Abbreviation/Acronym	Definition
IEE	International Energy Efficiency
IFO	Intermediate Fuel Oil
IMO	International Maritime Organization
IMP	Invasive Marine Pest
IMR	Inspection, Maintenance, and Repair
ITOPF	International Tanker Owners Pollution Federation Ltd
IUCN	International Union for Conservation of Nature
JRCC	Joint Rescue Coordination Centre
JZI-1, etc.	Well name in the Jansz–Io field
KEF	Key Ecological Feature
kg	Kilogram
kHz	Kilohertz
km	Kilometre
kW	Kilowatt
L	Litre
LC50	A concentration or dose found to be lethal in 50% of a group of test species
LCV	Light Construction Vessel
LNG	Liquified Natural Gas
LOC	Loss of Containment
lux	A standard for measuring light; equal to the amount of visible light per square metre incident upon a surface
m	Metre
m/m	Mass percent
m/s	Metres per second
M1, M2, etc.	Manifold name
m^2	Square metre
m^3	Cubic metre
MARPOL	The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978
MARS	Maritime Arrivals Reporting System
MBES	Multibeam Echo Sounder
MDO	Marine Diesel Oil
MEG	Monoethylene glycol
MES	Monitoring, Evaluation, and Surveillance
mg	Milligram
mm	Millimetre
MMscf	Million standard cubic feet
MMscfd	Million standard cubic feet per day
MOC	Management of Change

Abbreviation/Acronym	Definition
MODU	Mobile Offshore Drilling Unit
MSRE	Marine Safety Reliability and Efficiency
MSW	Managing Safe Work
MYES	Multi-Year Exercise Schedule
N/A	Not Applicable
NEBA	Net Environmental Benefit Analysis
NEPM	National Environmental Protection (Air Quality) Measure
NM	Nautical Mile
NMFS	National Marine Fisheries Service (US)
NO_2	Nitrogen dioxide
NOEC	No Observed Effect Concentration
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NO_x	Oxides of nitrogen
OA	Operational Area
OC	On-scene Commander
OCNS	Offshore Chemical Notification Scheme
OE	Operational Excellence
OEMS	Operational Excellence Management System
OGUK	Oil and Gas UK
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
OSRC	Oil Spill Response Coordination
OWR	Oiled Wildlife Response
PAH	Polyaromatic Hydrocarbon
PEMT	Perth Emergency Management Team
PGPA	Policy, Government and Public Affairs (CAPL)
PLET	Pipeline End Termination
PLV	Pipelay Vessel
PMS	Planned Maintenance System
PNEC	Predicted No-effect Concentration
ppb	Parts per billion
ppb.hr	Parts per billion per hour
ppm	Parts per million
PSV	Platform Supply Vessel
PTS	Pipeline Termination Structure

Abbreviation/Acronym	Definition
Q1, Q2, etc.	Three-month quarter of a calendar year
Ramsar	A wetland of international importance, recognised globally under the Ramsar Convention. The Ramsar Convention is an international treaty for the conservation and sustainable use of wetlands; it recognises the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.
rms	Root Mean Square
ROV	Remotely Operated Vehicle
s	Second (time)
SEEMP	Ship Energy Efficiency Management Plan
SHC	Shoreline Clean-up
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous Operations
SOPEP	Shipboard Oil Pollution Emergency Plan
SO_x	Sulfur oxides
SPD	Shoreline Protection and Deflection
SPL	Sound Pressure Level
SSPLR	Subsea Pig Launcher Receiver
SSS	Side-scan Sonar
State Waters	The marine environment within three nautical miles of the mainland of Western Australia or its islands
STFL	Steel Tube Flying Lead
SWMR	South West Marine Region
TAPL	Texaco Australia Pty. Ltd.
TEC	Threatened Ecological Community
UK	United Kingdom
US	United States
WA	Western Australia
WAFIC	Western Australian Fisheries Industry Council
WD	Water Depth
WHO	World Health Organization

9 References

Ref. No.	Document	Document Number
1.	Chevron Australia. 2018. *Gorgon and Jansz–Io Drilling, Completions and Well Maintenance Program. Environment Plan*. Perth, Western Australia.	ABU140800133
2.	Chevron Australia. 2016. *Gorgon and Jansz Feed Gas Pipeline and Wells Operations Environment Plan*. Perth, Western Australia.	GOR-COP-0902
3.	National Offshore Petroleum Safety and Environmental Management Authority. 2017. *Decision-Making Guideline – Criterion-10A(g) Consultation Requirements*. Available from: https://www.nopsema.gov.au/assets/Corporate/Decision-making-guidelines-consultation-package-November-2016.pdf [Accessed 01 December 2019]	
4.	APPEA. 2017. *Stakeholder Consultation and Engagement Principles and Methodology – Draft*.	
5.	Shell Developments (Australia) Pty Ltd. 1999. *Gorgon Assay*.	
6.	Department of the Environment and Energy. 2020. *Protected Matters Search Report for the Gorgon Production Licences*. Available from: http://www.environment.gov.au/epbc/pmst/index.html [Report created 2 January 2020].	
7.	Department of the Environment and Energy. 2020. *Protected Matters Search Report for the Jansz–Io Production Licences*. Available from: http://www.environment.gov.au/epbc/pmst/index.html [Report created 2 January 2020].	
8.	Chevron Australia. 2020. *Description of the Environment*. Perth, Western Australia.	
9.	Threatened Species Scientific Committee. 2015. *Approved Conservation Advice for Megaptera novaeangliae (humpback whale)*. Canberra, Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/38-conservation-advice-10102015.pdf [Accessed 01 December 2019]	
10.	Department of the Environment. 2015. *Blue Whale Conservation Management Plan*. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/blue-whale-conservation-management-plan. [Accessed 01 December 2019]	
11.	Threatened Species Scientific Committee. 2015. *Approved Conservation Advice for Balaenoptera borealis (sei whale)*. Canberra, Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/34-conservation-advice-01102015.pdf. [Accessed 01 December 2019]	
12.	Threatened Species Scientific Committee. 2015. *Approved Conservation Advice for Balaenoptera physalus (fin whale)*. Canberra, Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/37-conservation-advice-01102015.pdf. [Accessed 01 December 2019]	
13.	Environment Australia. 2017. *Recovery Plan for Marine Turtles in Australia – July 2017–2027*. Canberra, Environment Australia. Available from: http://www.environment.gov.au/system/files/resources/46eedcfc-204b-43de-99c5-4d6f6e72704f/files/recovery-plan-marine-turtles-2017.pdf. [Accessed 01 December 2019]	
14.	Threatened Species Scientific Committee. 2008. *Commonwealth Conservation Advice on Dermochelys coriacea*. Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1768-conservation-advice.pdf. [Accessed 01 December 2019]	

Ref. No.	Document	Document Number
15.	Threatened Species Scientific Committee. 2015. *Approved Conservation Advice for Rhincodon typus (Whale Shark)*. Canberra, Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/66680-conservation-advice-01102015.pdf. [Accessed 01 December 2019]	
16.	Department of Environment, Water Heritage and the Arts. 2011. *National recovery plan for threatened albatrosses and giant petrels 2011–2016*, Commonwealth of Australia. Available from: http://www.environment.gov.au/system/files/resources/bb2cf120-0945-420e-bdfa-d370cf90085e/files/albatrosses-and-giant-petrels-recovery-plan.pdf. [Accessed 01 December 2019]	
17.	Department of Agriculture, Water and the Environment. [n.d.] *Australasian Underwater Cultural Heritage Database*. Available from: https://www.environment.gov.au/heritage/underwater-heritage/auchd [Accessed 23 Mar 2020]	
18.	Chevron Australia. 2016. *Health, Environment, and Safety (HES) Risk Management Procedure*. Perth, Western Australia.	OE-03.01.01
19.	Standards Australia/Standards New Zealand. 2009. *ISO 31000:2009 Risk Management – Principles and Guidelines*. Sydney, Australia/Wellington, New Zealand.	
20.	Standards Australia/Standards New Zealand. 2012. *Handbook 203:2012. Managing Environment-Related Risk*. Sydney, Australia/Wellington, New Zealand.	
21.	National Offshore Petroleum Safety and Environmental Management Authority. 2015. *ALARP Guidance Note.* N-04300-GN0166 Revision 6 June 2015. Available from: https://www.nopsema.gov.au/assets/Guidance-notes/A138249.pdf. [Accessed 01 December 2019]	
22.	Oil and Gas United Kingdom. 2014. *Guidance on Risk Related Decision Making Issue* 2 July 2014	
23.	National Offshore Petroleum Safety and Environmental Management Authority. 2016. *Decision-making – Criterion 10A(c) Acceptable level*. N-04750-GL1637 Rev 0 November 2016. Available from: https://www.nopsema.gov.au/assets/Corporate/Decision-making-guidelines-consultation-package-November-2016.pdf [Accessed 01 December 2019]	
24.	National Offshore Petroleum Safety and Environmental Management Authority. 2017. *Environment Plan Decision Making – Guideline*. A524696-GL1721. Revision No. 3. May 2017. Available from: https://www.nopsema.gov.au/assets/Guidelines/A524696.pdf	
25.	Richardson, W.J., Greene, C.R., Malme, C.I and Thomson, D.H. 1995. *Marine Mammals and Noise*. Academic Press, San Diego.	
26.	Whale and Dolphin Conservation Society. 2006. *Vessel Collisions and Cetaceans: What happens when they don't miss the boat*. Whale and Dolphin Society. United Kingdom. Available from: au.whales.org/wp-content/uploads/sites/3/2018/08/whales-and-ship-strikes.pdf [Accessed 01 December 2019]	
27.	Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. 2001. Collisions between ships and whales. *Marine Mammal Science*, 17(1), 35–75.	
28.	Mackay, A.I., Bailluel, F., Childerhouse, S., Donnelly, D., Harcourt, R., Parra, G.J. and Goldsworthy, S.D. 2015. *Offshore migratory movement of southern right whales: addressing critical conservation and management needs*. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2015/000526-1. SARDI Research Report Series No. 859.	
29.	Commonwealth of Australia. 2000. *EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans. The Australian Guidelines for Whale and Dolphin Watching*. Available from: https://www.legislation.gov.au/Details/F2016C00914 [Accessed 01 December 2019]	

Ref. No.	Document	Document Number
30.	Woodside Energy Ltd. 2014. *Browse FLNG Development, Draft Environmental Impact Statement*. EPBC 2013/7079. November 2014. Woodside Energy, Perth WA.	
31.	Simmonds, M., Dolman, S. and Weilgart, L. 2004. *Oceans of Noise*. Whale and Dolphin Conservation Society, Wiltshire, United Kingdom.	
32.	Marquenie, J., Donners, M., Poot, H., Steckel, W. and de Wit, B. 2008. Adapting the spectral composition of artificial lighting to safeguard the environment. *Petroleum and Chemical Industry Conference Europe –Electrical and Instrumentation Applications*, pp 1–6.	
33.	Wiese, F.K., Montevecci, W.A., Davoren, G.K., Huettmann, F., Diamond, A.W. and Linke, J. 2001. Seabirds at risk around off shore oil platforms in the northwest Atlantic. *Marine Pollution Bulletin.* 42:1285–1290.	
34.	Shell. 2010. *Prelude Floating LNG Project EIS Supplement—Response to Submissions*	
35.	Scientific Committee of Antarctic Research. 2002. *Impacts of Marine Acoustic Technology on the Antarctic Environment*. Version 1.2. Geoscience Australia. Available from: http://www.geoscience.scar.org/geophysics/acoustics_1_2.pdf	
36.	McCauley, R.D. 1998. *Radiated underwater noise measured from the drilling rig ocean general, rig tenders Pacific Ariki and Pacific Frontier, fishing vessel Reef Venture and natural sources in the Timor Sea, Northern Australia*. Prepared by Rob McCauley for Shell Australia.	
37.	Richardson W.J., Fraker, M.A., Wursig, B. and Wills, R.S. 1985. Behaviour of bowhead whales (*Balaena mysticetus*), summering in the Beaufort Sea: Reactions to industrial activities. *Biological Conservation*. 32. 195–230.	
38.	National Marine Fisheries Service. 2014. *Marine Mammal Acoustic Thresholds*. U.S. Department of Commerce, NOAA. Available online at: https://archive.fisheries.noaa.gov/wcr/protected_species/marine_mammals/threshold_guidance.html Accessed 22 February 2020	
39.	National Marine Fisheries Service. 2016. *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset Permanent and Temporary Threshold Shifts*. U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55. 178pp. Available from: http://www.nmfs.noaa.gov/pr/acoustics/Acoustic%20Guidance%20Files/opr-55_acoustic_guidance_tech_memo.pdf [Accessed 01 December 2019]	
40.	Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr, C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals*, 33(4): 411–414.	
41.	McCauley, R.D. 2004. *Underwater sea noise in the Otway Basin – drilling, seismic and blue whales*. Report prepared by Centre for Marine Science and Technology, Curtin University, for Santos Ltd	
42.	OSPAR Commission. 2009. *Overview of Impacts of Anthropogenic Underwater Sound in the Marine Environment*. London. UK.	
43.	McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adihyta, A., Murdoch, J. *et al.* 2000. Marine seismic surveys: A study of environmental implications. *Australian Petroleum Production Exploration Association (APPEA) Journal* 40: 692-708.	
44.	Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T. and Gentry, R.L. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. SpringerBriefs in Oceanography, Volume ASA S3/SC1.4 TR-2014. ASA Press. 87 pp.	

Ref. No.	Document	Document Number
45.	Wardle, C.S., Carter, T.J., Urquhart, G.G., Johnstone, A.D.F., Ziolkowski, A.M., Hampson, G. and Mackie, D. 2001. Effects of seismic air guns on marine fish, *Continental Shelf Research* 21 (2001) 1005–1027	
46.	Weir, C. 2007. Observations of marine turtles in relation to seismic airgun sound off Angola. *Marine Turtle Newsletter*, 116: 17–20.	
47.	McCauley, R.D. 1994. Seismic Survey. In: *Environmental Implications of Offshore Oil and Gas Developments in Australia – the Findings of an Independent Scientific Review*. Edited by Swan J.M., Neff J.M. and Young P.C. Australian Petroleum Production and Exploration Association. Sydney	
48.	BP. 2013. Shah Deniz 2 Project. *Environmental & Socio-Economic Impact Assessment*. BP Development Pty Ltd. Available from: https://www.bp.com/en_az/azerbaijan/home/news/environmental-and-social-documentation/shah-deniz-.html [Accessed 01 December 2019]	
49.	Department of the Environment. 2015. *The introduction of Marine Pests to the Australian Environment via Shipping*. Available from: http://www.environment.gov.au/biodiversity/threatened/nominations/ineligible-ktp/introduction-marine-pests-via-shipping [Accessed 01 December 2019]	
50.	Hewitt, C.L., Martin, R.B., Sliwa, C., McEnnulty, F.R., Murphy, N.E., Jones, T. and Cooper, S. (eds). 2002. *National introduced marine pest information system*. Available from: https://publications.csiro.au/rpr/download?pid=procite:e774e447-ccc4-4d0c-b189-bd1b40faf214&dsid=DS1 [Accessed 01 December 2019]	
51.	Paulay, G. Kirkendale, L. Lambert, G. and Meyer, C. 2002. Anthropogenic biotic interchange in a coral reef ecosystem: A case study from Guam. *Pacific Science* 56(4): 403–422	
52.	International Maritime Organization. 2011. *Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) MPEC.207(62))*. Available from: http://www.imo.org/en/OurWork/Environment/Biofouling/Pages/default.aspx [Accessed 01 December 2019]	
53.	Department of Agriculture, Water and the Environment. 2020. *Australian Ballast Water Management Requirements.* Version 8. Department of Agriculture and Water Resources, Canberra, Australian Capital Territory. Available from: https://www.agriculture.gov.au/sites/default/files/documents/australian-ballast-water-management-requirements.pdf [Accessed 23 Mar 2020]	
54.	McIntyre, A.D. and Johnson, R. 1975. Effects of nutrient enrichment from sewage in the sea. In: ALH Gameson, ed. *Discharge of sewage from sea outfalls*. New York, Pergamon Press. pp. 131–141	
55.	Black, K.P., Brand, G.W., Grynberg, H., Gwyther, D., Hammond, L.S., Mourtikas, S., Richardson, B.J. and Wardrop, J.A. 1994. Production facilities. In: *Environmental implications of offshore oil and gas development in Australia – the findings of an independent scientific review*. Swan, J.M., Neff, J.M. and Young, P.C. (eds) Australian Petroleum and Production Exploration Association. Sydney. pp 209–407	
56.	Asia–Pacific Applied Science Associates. 2012. *Hydrotest Discharge Water Simulation Study*. Prepared for Gorgon Upstream Joint Venture, Perth, Western Australia.	
57.	Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand. 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. National Water Quality Management Strategy Paper No. 4. Environment Australia, Canberra, Australian Capital Territory.	
58.	World Health Organization. 2000. *Ethylene Glycol: environmental aspects*. Concise International Chemical Assessment Document 22. Geneva, Switzerland. Viewed online on Accessed 01 December 2019 at http://www.who.int/ipcs/publications/cicad/en/cicad22.pdf.	

Ref. No.	Document	Document Number
59.	Organisation for Economic Co-operation and Development. 1992. *Guidance for initial hazard assessment of high production volume (HPV) chemicals (aquatic effects assessment)*. Organisation for Economic Co-operation and Development, Paris.	
60.	Chevron Australia. 2015. *ABU Hazardous Materials Environmental Assessment Tool*. CAPL, Perth, Western Australia.	ABU151100648
61.	Chevron Australia. 2018. *Hydrotest Water Quality for Corrosion Prevention Combined Project Addendum and PPL-SC-5252B (Specification)*. Chevron Australia, Perth, Western Australia.	G6-TE-R-US00-SPCX001
62.	Australian Maritime Safety Authority. 2015. *Technical guideline for preparing contingency plans for marine and coastal facilities*. Canberra, Australia	
63.	RPS APASA. 2017. *Quantitative Subsea Release Modelling*. Unpublished report prepared for Chevron Australia Pty Ltd.	G6-NT-REPX0000141
64.	[No author]. 2013. *Guidelines for Offshore Marine Operations*. Revision 0611-1401. Available from: http://www.g-omo.info/wp-content/uploads/2016/06/201311-GOMOfinal.pdf [Accessed 01 December 2019]	
65.	Scholten, M.C., Kaag, N.H.B.M., van Dokkum, H.P., Jak, R.G., Schobben, H.P.M., and Slob, W., 1996. *Toxische effecten van olie in het aquatische milieu*, TNO report TNO-MEP – R96/230, Den Helder, The Netherlands.	
66.	Engelhardt, F. 1983. Petroleum effects on marine mammals. *Aquatic Toxicology*, 4: 199–217.	
67.	Clark R. 1984. Impacts of oil pollution on seabirds. *Environmental Pollution Series: Ecology and Biology*. 33: 1–22.	
68.	Geraci, J.R. and St. Aubin, D.J. 1988. *Synthesis of Effects of Oil on Marine Mammals*. Report to U.S. Department of the Interior, Minerals Management Service, Atlantic OCS Region, OCS Study. Ventura, California.	
69.	Jenssen, B.M. 1994. Effects of Oil Pollution, Chemically Treated Oil, and Cleaning on the Thermal Balance of Birds. *Environmental Pollution*, 86.	
70.	Peakall, D.B., Wells, P.G. and Mackay, D. 1987. A hazard assessment of chemically dispersed oil spills and seabirds. *Marine Environmental Research* 22(2):91–106.	
71.	French-McCay, D.P. 2002. Development and Application of an Oil Toxicity and Exposure Model, OilToxEx, *Environmental Toxicology and Chemistry*, 21(10), 2080–2094.	
72.	Tsvetnenko, Y. 1998. Derivation of Australian tropical marine water quality criteria for the protection of aquatic life from adverse effects of petroleum hydrocarbons. *Environmental Toxicology and Water Quality* 13: 273–284	
73.	OSPAR. 2014. *Establishment of a list of Predicted No Effect Concentrations (PNECs) for naturally occurring substances in produced water*. OSPAR Commission. OSPAR Agreement: 2014–05	
74.	Lin, Q. and Mendelssohn, I.A. 1996. A comparative investigation of the effect of South Louisiana crude oil on the vegetation of freshwater, brackish, and salt marshes. *Marine Pollution Bulletin*, 32: 202–209.	
75.	Owens, E.H. and Sergy, G.A. 1994. *Field guide to the documentation and description of oiled shorelines*. Environment Canada, Edmonton, Alberta.	
76.	French, D.P. 2009. State-of-the-art and research needs for oil spill impact assessment modelling. In: *Proceedings of 32nd Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*. Ottawa, Ontario, Canada. (pp. 601–653)	
77.	Concawe Petroleum Produces and Heath Manage Group. 1998. *Heavy Fuel Oils*. Product Dossier no. 98/109. Brussels, Belguim	

Ref. No.	Document	Document Number
78.	International Tanker Owners Pollution Federation. 2001. *A Review of the Problems Posed by Spill of Heavy Fuel Oils*. Paper presented at: 2001 International Oil Spill Conference, March 26‑29 2001, Tampa Florida.	
79.	Goodman, R. 2003. Tar balls: The end state. *Spill Sci Tech Bull*, 8.	
80.	Wang, Z., Fingas, M., Landriault, M., Sigouin, L., Castle, W., Hoestetter, D., Zhang, D. and Spencer, B. 1998. Identification and Linkage of Tar balls from the Coasts of Vancouver Island and Northern California Using GC/MS and Isotopic Techniques. *J High Res Chromatog*, 21.	
81.	International Petroleum Industry Environmental Conservation Association. 1995. *Biological Impacts of Oil Pollution: Rocky Shores*, International Petroleum Industry Environmental Conservation Association, No. 7. 209–215 Blackfriars Road, London, SE1 8NL, United Kingdom	
82.	Australian Maritime Safety Authority. 2013. *The Effects of Maritime Oil Spills on Wildlife Including Non-avian Marine Life, Vol. 2013*. Australian Maritime Safety Authority, Canberra, Australian Capital Territory.	
83.	National Oceanic and Atmospheric Administration. 2010. *Oil and sea turtles: biology planning and response*. US Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of Response and Restoration.	
84.	Australian Maritime Safety Authority. 2015. *The Effects of Maritime Oil Spills on Wildlife including Non-avian Marine Life*. Available from: http://www.amsa.gov.au/environment/maritime-environmental-emergencies/national-plan/general-information/oiled-wildlife/marine-life/index.asp [Accessed 01 December 2019].	
85.	Shigenaka, G. 2001. *Toxicity of oil to reef building corals: a spill response perspective*. National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum, National Ocean Service, Office of Research and Restoration 8, Seattle, USA.	
86.	Negri, A.P. and Heyward, A.J. 2000. Inhibition of fertilization and larval metamorphosis of the coral Acropora millepora (Ehrenberg, 1834) by petroleum products. *Marine Pollution Bulletin* 41(7-12): 420–427.	
87.	Baca, B., Rosch, E., DeMicco, E.D. and Schuler, P.A. 2014. TROPICS: 30-year Follow-up and Analysis of Mangroves, Invertebrates, and Hydrocarbons. *International Oil Spill Conference Proceedings: May 2014*, Vol. 2014, No. 1, pp. 1734–1748.	
88.	Chevron Australia. 2015. *Marine Safety Reliability and Efficiency. ABU Standardised OE Process*. Chevron Australia, Perth, Western Australia.	OE-03.09.01
89.	Chevron Australia. 2017. *Operation and Scientific Monitoring Plan – Environmental Monitoring in the Event of an Oil Spill to Marine Coastal Waters*. Chevron Australia, Perth, Western Australia	ABU130700448
90.	Chevron Australia. 2020. *Chevron ABU Consolidated Oil Pollution Emergency Plan (OPEP)*. Chevron Australia, Perth, Western Australia.	ABU-COP-02788
91.	Chevron Australia. 2014. *Perforation and flowback Field Report – Gorgon 3C: Perforation & Flowback Report #3.* Chevron Australia, Perth, Western Australia.	
92.	NERA. 2017. *Environment Plan Reference Case – Planned discharge of sewage, putrescible waste and grey-water*. Available from https://referencecases.nopsema.gov.au/assets/reference-case-project/2017-1001-Sewage-grey-water-and-putrescible-waste-discharges.pdf Accessed [Accessed 01 December 2019]	
93.	Abdellatif, E.M., Ali, O.M., Khalil, I.F., and Nyonje, B.M. 1993. Effects of Sewage Disposal into the White Nile on the Plankton Community. *Hydrobiologia*, Vol 259, pp 195-201.	

Ref. No.	Document	Document Number
94.	Axelrad, D.M., Poore, G.C.B., Arnott, G.H., Bault, J., Brown, V., Edwards, R.R.C, and Hickman, N. 1981. T*he Effects of Treated Sewage Discharge on the Biota of Port Phillip Bay, Victoria, Australia*. Estuaries and Nutrients, Contemporary Issues in Science and Society. The Human Press Inc.	
95.	Parnell, P.E. 2003. The effects of sewage discharge on water quality and phytoplankton of Hawai'ian Coastal Waters. *Marine Environmental Research*, Vol. 44, pp 293-311.	
96.	National Science Foundation (U.S.), U.S. Geological Survey, and [NOAA] National Oceanic and Atmospheric Administration (U.S.). 2011. *Final Programmatic Environmental Impact Statement/Overseas*. Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey. National Science Foundation, Arlington, VA.	
97.	Kegley, S.E., Hill, B.R., Orme S., Choi A.H., 2011. *PAN Pesticide Database*, Pesticide Action Network, North America (San Francisco, CA, 2011), Available from http://www.pesticideinfo.org [Accessed 01 December 2019]	
98.	Lewis, A. 2007. *Current Status of the BAOAC (Bonn agreement oil appearance code)*. Published report developed for the Netherlands North Sea Agency Directie Noordzee. Available from https://www.bonnagreement.org/site/assets/files/3952/current-status-report-final-19jan07.pdf [Accessed 01 December 2019]	
99.	Marine Pest Sectoral Committee 2018, *National biofouling management guidelines for the petroleum production and exploration industry*, Department of Agriculture and Water Resources, Canberra, December. CC BY 4.0. Document modified in 2018 to meet accessibility requirements. Available from https://www.marinepests.gov.au/sites/default/files/Documents/petroleum-exploration-biofouling-guidelines.pdf [Accessed 01 December 2019]	
100.	*National Plan for Maritime Environmental Emergencies*. Available from https://www.amsa.gov.au/sites/default/files/amsa-496-national-plan.pdf [Accessed 01 December 2019]	
101.	Chevron Australia. *Managing Safe Work (MSW) – ABU Standardised OE Process*. Perth, Western Australia	OE-03.06.02
102.	Chevron Australia. 2015. *Hazardous Communication: ABU Standardised OE Process*. Rev. 6.0. Chevron Australia, Perth, Western Australia	OE-03.16.01
103.	Chevron Australia. 2018. *ABU Hazardous Materials Approval Process: ABU Standardised OE Procedure*. Rev. 13.0. Chevron Australia, Perth, Western Australia	OE-03.16.13
104.	Chevron Australia. 2013. *Management of Change for Facilities and Operations: ABU Standardised OE Process*. Chevron Australia, Perth, Western Australia	OE-04.00.01
105.	Chevron Australia. 2017. *Incident Investigation and Reporting – ABU Standardised OE Process*. Chevron Australia, Perth, Western Australia	OE-09.00.01
106.	Chevron Australia. 2015. *Community and Stakeholder Engagement– ABU Standardised OE Process*. Rev. 6.0. Chevron Australia, Perth, Western Australia	OE-10.00.01
107.	Chevron Australia. 2012. *Emergency Management Process*. Chevron Australia, Perth, Western Australia	OE-11.01.01
108.	Chevron Australia. 2016. *Compliance Assurance Audit Program – ABU Standardised OE Process*. Rev. 5.0. Chevron Australia, Perth, Western Australia	OE-12.01.19
109.	Chevron Australia. 2013. ABU – *Compliance Assurance Management of Instances of Potential Noncompliance*. Rev. 5.0 Chevron Australia, Perth, Western Australia	OE-12.01.18
110.	Standards Australia/Standards New Zealand. 2016. *AS/NZS ISO 14001:2004 Environmental Management Systems – Requirements with Guidance for Use*. Sydney, Australia/Wellington, New Zealand	

Ref. No.	Document	Document Number
111.	Hinwood J.B., Poots, A.E., Dennis, L.R., Carey, J.M., Houridis, H., Bell, R., Thomson, J.R., Boudreau, P. and Ayling, A.M. Australian Marine and Offshore Group Pty Ltd, 1994. The Environmental Implication of Drilling activities. In: Swan, J.M., Neff, J.M. and Young, P.C. (Eds) *Environmental Implications of Offshore Oil and Gas Development in Australia – The Findings of an Independent Scientific Revie*w. Australian Petroleum Exploration Association, Sydney, pp 123–207	
112.	Chevron Australia. 2013. *ABU – Crisis Management Plan*. Rev. 18.0. Chevron Australia, Perth, Western Australia	OE-11.01.10
113.	Australian Marine Oil Spill Centre. 2017. *AMOSPlan Section III. Australian Industry Cooperative Oil Spill Response Arrangements*. Available from: https://amosc.com.au/wp-content/uploads/2018/01/AMOSPlan-2017.pdf [Accessed 01 December 2019]	
114.	RPS. 2019. *Gorgon Stage 2 Development Project. Oil Spill Modelling*. Unpublished report. Prepared on behalf of CAPL.	
115.	NOPSEMA. 2019. *Oil Spill Modelling Bulletin #1 – Oil Spill Modelling*. Available from: https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf [Accessed 01 December 2019]	
116.	Commonwealth of Australia. 2019. *National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds*, Commonwealth of Australia 2019. Available online from: https://www.environment.gov.au/system/files/consultations/f9d7b873-29a3-4ae6-8278-3c3b64ee5a9f/files/draft-light-pollution-guidelines.pdf	
117.	Kamrowski, R.L., Limpus, C.J., Pendoley, K. and Hamann, M. 2014. Influence of industrial light pollution on the sea-finding behaviour of flatback turtle hatchlings. *Wildlife Research* 41:421–434	
118.	Hodge, W., Limpus, C.J. and Smissen, P. 2007. *Queensland turtle conservation project: Hummock Hill Island Nesting Turtle Study December 2006 Conservation Technical and Data Report* Environmental Protection Agency, Queensland.	
119.	Rodríguez, A., Burgan, G., Dann, P., Jessop, R., Negro, J.J. and Chiaradia, A. 2014. Fatal attraction of short-tailed shearwaters to artificial lights. *PLoS ONE* 9(10):e110114	
120.	Glasby, T.M., Connell, S.D., Holloway, M.G. and Hewitt, C.L., 2007. Nonindigenous biota on artificial structures: could habitat creation facilitate biological invasions. *Marine Biology* 151: 887–895	
121.	Dafforn, K.A., Glasby, T.M., and Johnston, E.L., 2009. Links between estuarine condition and spatial distributions of marine invaders. *Diversity and Distributions* 15(5): 807–821.	
122.	Dafforn, K.A., Johnston, E.L. and Glasby, T.M., 2009. Shallow moving structures promote marine invader dominance. *Biofouling* 25:3, 277-287.	
123.	Department of the Environment and Energy. 2019. *Protected Matters Search Report for the EMBA*. Available from: http://www.environment.gov.au/epbc/pmst/index.html [Report created 22 December 2019].	
124.	Department of the Environment and Energy. 2018. *Protected Matters Search Report for the EEA*. Available from: http://www.environment.gov.au/epbc/pmst/index.html [Report created 22 December 2019].	
125.	Department of Mines and Petroleum. 2011. *Drilling Fluids Management Guidelines*. Department of Mines and Petroleum, Perth, Western Australia.	
126.	Chevron Australia. 2019. *Quarantine Procedure Marine Vessels. ABU Standardised OE Process*. Chevron Australia, Perth, Western Australia.	OE-07.08.1010

Ref. No.	Document	Document Number
127.	Lee, K., King, T.L., Robinson, B., Li, Z., Burridge, L., Lyons, M., Wong, D., MacKeigan, K., Courtenay, S., Johnson, S., Boudreau, M., Hodson, P., Greer, C. and Venosa, A.D. 2011. Toxicity Effects of Chemically Dispersed Crude Oil on Fish. In: *International Oil Spill Conference Proceedings: March 2011*, 2011(1): 163. [DOI: https://doi.org/10.7901/2169-3358-2011-1-163]	
128.	International Petroleum Industry Environmental Conservation Association. 2017. *Guidelines on implementing spill impact mitigation assessment (SIMA), International Association of Oil and Gas Producers*. IOGP Report 593. Available online from: C:/Users/Ash%20Work/Downloads/guidelines_on_implementing_spill_impact_mitigation_assessment_sima_2017.pdf	
129.	Baker Hughes. 2013. *EcoTox Report: OSW24514*. Baker Hughes, Perth, Western Australia.	
130.	Hoff, R.Z., Shigenaka, G. and Henry, C.B. 1993. Salt Marsh Recovery from a Crude Oil Spill: Vegetation, Oil Weathering, and Response. *International Oil Spill Conference Proceedings*, 1993(1): 307–311.	
131.	Wilson, K.G. and Ralph, P.J. 2012. Laboratory Testing Protocol for the Impact of Dispersed Petrochemicals on Seagrass. *Marine Pollution Bulletin*, 64(11): 2421–2427.	
132.	DPIRD. 2019. *Fish Cube WA Data Extract*. Available by request from DPIRD.	
133.	Centre for Environment, Fisheries and Aquaculture Science. 2020. *Offshore Chemical Notification Scheme – Lists of Notified and Ranked Products*. Available online from https://www.cefas.co.uk/data-and-publications/ocns/.	
134.	NOPSEMA. 2019. *Bulletin #2 – Clarifying statutory requirements and good practice*. Available online at: https://www.nopsema.gov.au/assets/Bulletins/A696998.pdf. [Accessed 22 February 2020]	
135.	Australian Maritime Safety Authority (AMSA). 2017. *Automated Identification System (AIS) Point Density Map*. Department of Sustainability, Environment, Water, Population and Communities. Canberra, Australian Capital Territory.	
136.	National Environment Protection Council (NEPC), 2015, National Environment Protection Measure for Ambient Air Quality. *Ambient Air Quality. Available online at:* http://www.nepc.gov.au/resource/variation-ambient-air-quality-nepm-%E2%80%93-particles-standards	
137.	Chevron Australia. 2018. *ABU – Lifting and Rigging: MSW Manual*. Rev. 2.0. Chevron Australia, Perth, Western Australia.	OE-03.06.1074
138.	*Guidelines for the Development of Shipboard Oil Pollution Emergency Plans*, adopted by IMO as Resolution MEPC.54(32)	
139.	Chevron Australia. 2020. *Strategic Net Environmental Benefit Analysis*. Chevron Australia, Perth, Western Australia.	ABU 19080 1382
140.	Chevron Australia. 2015. *Oil Spill Response Multi-Year Exercise and Drill Schedule 2015-2020.* Chevron Australia, Perth, Western Australia	ABU 15110 0455

Appendix A Operational Excellence Policy 530

policy 530

operational excellence: achieving world-class performance

human energy®

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.

Al Williams
Managing Director, Australasia Business Unit

Appendix B Stakeholder Consultation Records

Appendix B.1 Engagement Material

From: ABU Environment Plan Information <ABUEnvPlanInfo@chevron.com>
Sent: Friday, 20 December 2019 9:23 AM
To: Undisclosed recipients:
Subject: Chevron-operated Gorgon Stage 2 Program - Stakeholder Consultation
Attachments: GS2 Fact Sheet - Pipeline and Subsea Installation.pdf

Dear Stakeholder,

Chevron Australia is the operator of the Gorgon Gas Development (Gorgon Project) in the north-west of Australia.

As part of Gorgon Stage 2 program, the operator plans to add new wells and subsea infrastructure to the existing Gorgon and Jansz-Io gas fields so future gas supply to the Gorgon Project's existing LNG processing trains on Barrow Island can be maintained. This was always envisaged as part of the original field development plans.

To accommodate this campaign, Chevron Australia is preparing a new Environment Plan to address the pipeline, subsea infrastructure installation and pre-commissioning components. The Environment Plan is expected to be submitted for approval to the National Offshore Petroleum Safety and Environmental Management Authority in Q2 2020.

The attached fact sheet outlines the planned activities and associated control measures. To fully identify all potential risks and effects of the proposed operations on the existing natural, social and economic environment, and as part of its commitment to effective consultation, Chevron Australia is seeking feedback from relevant stakeholders. This feedback will help identify and manage any aspects arising from the program and may form part of the Environment Plan.

Should you wish to provide feedback or obtain more information about the proposed activities please reply to this email.

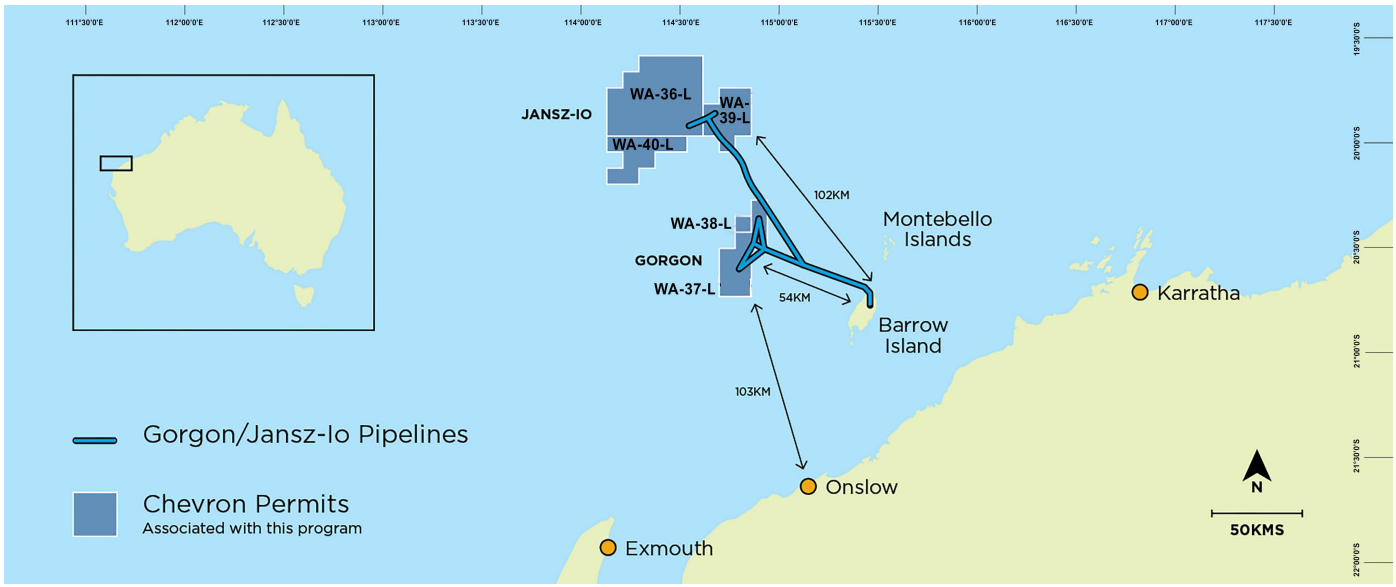
Regards

James Bowie
Senior Advisor
Operations - Corporate Affairs

Chevron Australia Pty Ltd
250 St George's Tce
Perth WA 6000
james.bowie@chevron.com

fact sheet

gorgon stage 2 pipeline, subsea infrastructure installation and pre-commissioning program



background

Chevron Australia, on behalf of the Gorgon Joint Venture, is the operator for the Gorgon Gas Development (also known as the Gorgon Project).

The Gorgon Project comprises offshore production wells and pipeline infrastructure associated with the Jansz–Io and Gorgon gas fields that gather and transport gas to the Gorgon Gas Treatment Plant (GTP) on Barrow Island, where it is processed.

Chevron Australia is planning to submit an Environment Plan (EP) for the installation of pipeline and subsea infrastructure in the Gorgon and Jansz-Io fields for the Gorgon Stage 2 (GS2) Project.

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

activity overview

To maintain gas supply for the GTP, the Gorgon Stage 2 (GS2) Project will expand the subsea gathering network in the Gorgon and Jansz–Io gas fields. Currently Chevron Australia is in the process of constructing the wells, with these activities being managed under the

Gorgon and Jansz-Io Drilling Completion and Well Maintenance Program EP already accepted by NOPSEMA. The next phase for the GS2 project involves the installation of additional subsea manifolds to accommodate the new wells, and installation of infield flowlines to tie into the existing subsea infrastructure. These activities will be covered under a separate EP proposed to be submitted to NOPSEMA in Q2 2020.

identified environmental hazards and control measures

Potential environmental impacts or risks and relevant control measures associated with these activities are summarised below.

Physical Presence

Potential Environmental Impacts	
• injury or death of marine fauna • a disruption to commercial activities	
Control measures	**What does this control measure do**
EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	These regulations describe requirements for ensuring animals are not harmed during interaction with whales and dolphins.
Pre-start notifications	Pre-start notifications enable other marine users to plan their activities such that their disruption from activities are minimized.
Chevron Australia MSRE Process	The Marine, Safety, Reliability and Efficiency (MSRE) process ensures that various legislated requirements are met. These include: • Crew meet the minimum standards for safely operating a vessel, including Watchkeeping requirements (MSA Marine Orders Part 3 [Seagoing qualifications]). • Navigation, radar equipment and lighting meet industry standards (AMSA Marine Orders Part 30 [Prevention of collisions]).

Physical Presence (Seabed)

Potential Environmental Impacts	
• Alteration of benthic habitat	
Control measures	**What does this control measure do**
Benthic surveys	Benthic surveys (including pre-lay surveys) can be used to verify that no sensitive features (such as hard substrate) are present with the potential to be disturbed.

Light Emissions

Potential Environmental Impacts	
• Change in ambient light levels resulting in a localised light glow. • Impacts to predator-prey dynamics • Localised and temporary fauna disturbance	
Control measures	**What does this control measure do**
Minimise light spill	These measures ensure that light glow and changes in ambient light levels are reduced to ALARP levels whilst maintaining appropriate light levels for safe operations offshore.

Underwater Sound

Potential Environmental Impacts	
• Auditory impairment • Permanent threshold shift	
Control measures	**What does this control measure do**
EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	These regulations describe requirements for ensuring animals are not harmed during interaction with whales and dolphins.
Planned maintenance system	Planned maintenance systems ensure that equipment including noise emitting equipment such as thrusters are maintained in accordance with manufacturer specifications.

Atmospheric Emissions

Potential Environmental Impacts	
• A localised and temporary reduction in air quality	
Control measures	**What does this control measure do**
Marine Orders – Part 97: Marine Pollution Prevention – Air Pollution	Marine order 97 sets out the requirements for the prevention of air pollution by vessels.

Planned Discharges (Operational)

Potential Environmental Impacts
• Introduction of an IMP • A localised and temporary reduction in water quality • Impacts to predator-prey dynamics |

Control measures	What does this control measure do
Chemical selection process	Defines the process in which Chevron Australia assess chemicals for acceptance and use.
AMSA Marine Order Part 96: (Sewage)	Marine order 96 sets out the requirements for the prevention of marine pollution by sewage from ships including: • certification requirements • reporting of incidents • discharge of untreated sewage • discharge in special areas.
AMSA Marine Order 95: (Marine Pollution Prevention – Garbage)	Marine order 95 sets out the requirements for: • management of cargo residues • garbage management plans • garbage record books.
Chevron Australia Quarantine Procedure (marine vessels)	Defines the procedure for marine vessels intending to approach or access Barrow Island (BWI) or undertaking activities in title areas outside the boundaries of the Montebello/BWI Marine Management. This incorporates legislative requirements for managing • Ballast water discharges; and • Biofouling.

Planned Discharges (Mechanical Completion and Pre-commissioning)

Potential Environmental Impacts
• A localised and temporary reduction in water quality • Fauna injury / mortality

Control measures	What does this control measure do
Chemical selection process	Defines the process in which Chevron Australia assess chemicals for acceptance and use.

Accidental Release - Waste

Potential Environmental Impacts
• Marine pollution resulting in injury and entanglement of marine fauna (turtles) and seabirds

Control measures	What does this control measure do
AMSA Marine Order 95: (Marine Pollution Prevention – Garbage)	Marine order 95 sets out the requirements for: • management of cargo residues • garbage management plans • garbage record books.

Accidental Release – Loss of Containment & Vessel Collision

Potential Environmental Impacts
• Injury or death of marine fauna • A localised and temporary reduction in water quality

Control measures	What does this control measure do
Pre-start notifications process	Pre-start notifications enable other marine users to plan their activities such that their disruption from activities are minimized.
Guidelines for Offshore Marine operations 0611-1401	This guideline recommends that: • An appropriate procedure is in place for fuel transfer operations • Hoses must remain afloat at all times through use of sufficient floating devices • Use of self-sealing weak link couplings • Hoses maintained and sections changed out in accordance with manufacturer guidance (Planned maintenance systems).
MARPOL Annex I (enacted by AMSA Marine Order Part 91, Marine pollution prevention – oil) requirement for an approved SOPEP.	This requires that each vessel will have an AMSA approved Shipboard Oil Pollution Emergency Plan (SOPEP) or equivalent under MARPOL Annex I and AMSA's Marine Order Part 91, Marine pollution prevention – oil. • The SOPEP ensures the crew is prepared to respond to a spill and provides activities to be undertaken to control the spill.
Oil Pollution Emergency plan	Chevron Australia's Oil Pollution Emergency plan describes the response arrangements to be implemented in the event of an oil spill event.
Operational and Scientific Monitoring Plan	Chevron Australia's Operational and Scientific Monitoring Plan describes the various monitoring arrangements to be implemented in the event of an oil spill event.
Chevron Australia MSRE process	The Marine, Safety, Reliability and Efficiency (MSRE) process ensures that various legislated requirements are met. These include: • Crew meet the minimum standards for safely operating a vessel, including Watchkeeping requirements (MSA Marine Orders Part 3 [Seagoing qualifications]). • Navigation, radar equipment and lighting meet industry standards (AMSA Marine Orders Part 30 [Prevention of collisions]).

environmental approvals

Chevron Australia will submit an Environment Plan (EP) for the activities described above for acceptance under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

The EP will include an environmental risk assessment of the activities associated with the Pipeline, Subsea Infrastructure Installation and Pre-commissioning program. To fully identify all potential impacts or risks of the proposed activities on the existing natural, social and economic environment, feedback is sought from relevant stakeholders.

Feedback provided assists Chevron Australia to identify and manage any aspects arising from the program and may form part of the EP.

Once submitted for assessment, the full text EP will be available on the NOPSEMA website:

http://www.nopsema.gov.au/environmental-management/environment-plans/environment-plan-summaries/

For more information regarding the planned Pipeline, Subsea Infrastructure Installation and Pre-commissioning activities, or to provide feedback, please contact:

Chevron Australia Pty Ltd
Email: abuenvplaninfo@chevron.com

fact sheet

commercial fishing consultation

gorgon stage two pipeline, subsea infrastructure and pre-commissioning program

overview

Chevron Australia is planning to expand the subsea infrastructure and flowlines associated with the existing Gorgon and Jansz gas fields. The new infrastructure and flowlines, which are part of the Gorgon Stage 2 Project, will connect 11 wells drilled between 2019 – 2020 and help maintain gas supply to the Gorgon Project's Gas Treatment Plant located on Barrow Island.

activity program summary

Installation of flowlines and subsea infrastructure (manifolds and pipeline termination structures) in Commonwealth waters to connect existing wells to the existing Gorgon and Jansz-Io trunklines.

The length of the flowline in the Gorgon Gas field is 9 km and 6.6 km in the Jansz-Io field.

The infrastructure includes:

- 24-inch (Gorgon field) and 18-inch (Jansz-Io) production pipelines
- 8-inch (Gorgon) and 6-inch (Jansz-Io field) mono-ethylene glycol (MEG) pipelines. MEG is used to prevent hydrate (ie frozen ice) formation in undersea infrastructure
- 6-inch utility pipelines for both Gorgon and Jansz-Io fields

Umbilicals along both flowlines which will be used to provide hydraulic and electric power and control from Barrow Island

Purpose

Expand the existing Gorgon and Jansz gas field development to link 11 wells drilled in 2019 - 2020.

The 11 wells are subject to a separate and approved Gorgon and Jansz-Io Drilling,

Completions and Well Maintenance Program Environment Plan

Location
Approximately 130 km off the north-west coast of Western Australia. The Jansz-Io gas fields are located within production licences WA-36-L, WA-39-L and WA-40-L approximately 200 km off the north-west coast of Western Australia.

See location map on page 3.

Approximate water depth
Gorgon field; 200m – 250m, Jansz field: 1315m – 1350m

Earliest expected commencement dates
Q4 2020, subject to approvals, vessel availability and weather constraints.

Estimated duration
Duration will run approximately two years over multiple campaigns.

Operational Area
The operational area associated with the installation of subsea infrastructure as described in this EP, is defined as a 1500 m corridor centred over this infrastructure (i.e. 750 m either side of infrastructure) and any initiation anchors, wires and abandonment wires.

See location map for more details.

Seabed and installation preparation
Minimal work will be required for the preparation of the seabed prior to offshore installation activities.

Previous seabed surveys show a clear pipelay route and clear areas for structure installation.

Prior to pipelay, structure, umbilical and jumper and spool installation, a visual site survey will be conducted to verify that installation activities will be unhindered.

Vessels
A range of construction, survey and support vessels will be utilised.

All discharges will be managed as per existing maritime legislation.

Recreational fishing will not be permitted from Chevron, contractor or sub-contractor vessels as per Chevron contractual requirements.

Commercial fishing
Proactive engagement between project and fishing vessels is an important means for all parties to understand planned activities and manage risks.

Proactive engagement between project and fishing vessels is an important means for all parties to understand planned activities and manage risks.

Project support vessels will be encouraged to proactively communicate with commercial fishing vessels approaching the operational area.

Fishing vessels will be encouraged to also proactively communicate with project support vessels ahead of entering the operational area.

Where possible, project support vessels will endeavour to divert around active fishing activity.

Exclusion zones/cautionary area
Pre-existing Gorgon exclusion zones are in place. There are no planned additional exclusion zones.

Project vessels will be made aware of the difference between an exclusion zone and a cautionary area (CA).

Commercial fishers can transit, anchor and/or fish in a CA if safe to do so.

Project vessels will proactively and positively communicate with commercial fishing vessels as they enter a CA to highlight risks and highlight nearby exclusion zones.

Conducting fishing operations within exclusion zones (or above pipelines or well heads) poses an unacceptable risk and must be avoided.

A Notice to Mariners will be formally issued prior to the execution of the activities.

stakeholders

Chevron 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 program.

As well as consulting commercial fishing and other relevant stakeholders, Chevron will keep informed stakeholders who identify an interest in our planned activities.

potential hazards and control measures

Chevron has undertaken an assessment to identify potential hazards and control measures. These have been highlighted in the "*Gorgon Stage 2 Pipeline, Subsea Infrastructure and Pre-Commissioning Program Fact Sheet*" (circulated in December 2019 and January 2020). Please advise if you would like this information re-sent to you.

providing feedback

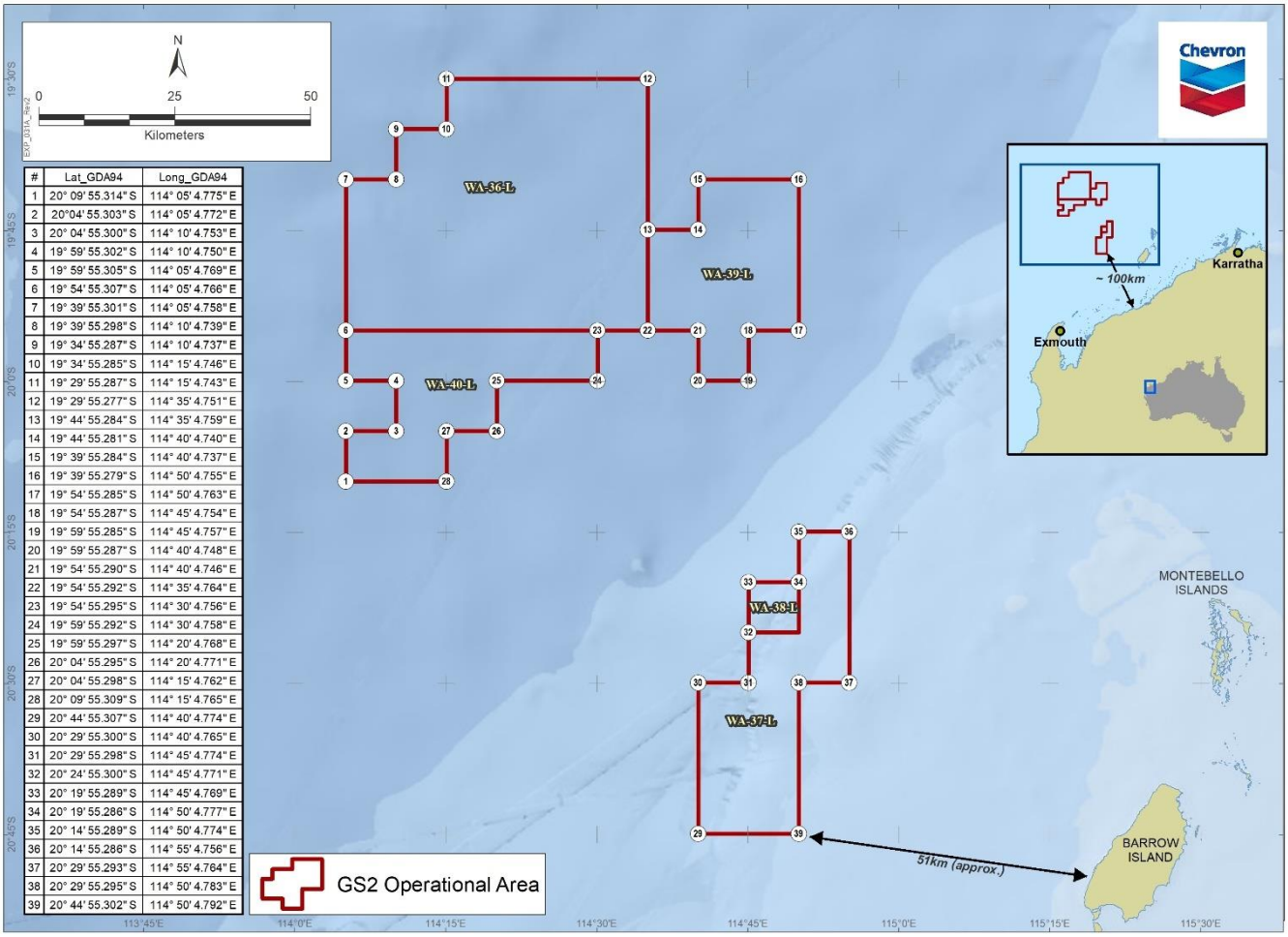
Chevron is seeking comment on the proposed activities from relevant and interested stakeholders. In particular from the commercial fishing sector.

Please note that stakeholder feedback and Chevron's response will be included in the Environment Plan which is planned for submission to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in Q2 2020 for acceptance in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

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

Feedback can be directed to:

James Bowie
Senior Corporate Affairs Advisor (Operations)
abuenvplaninfo@chevron.com



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2	20°04' 55.303" S	114° 05' 4.772" E
3	20° 04' 55.300" S	114° 10' 4.753" E
4	19° 59' 55.302" S	114° 10' 4.750" E
5	19° 59' 55.305" S	114° 05' 4.769" E
6	19° 54' 55.307" S	114° 05' 4.766" E
7	19° 39' 55.301" S	114° 05' 4.758" E
8	19° 39' 55.298" S	114° 10' 4.739" E
9	19° 34' 55.287" S	114° 10' 4.737" E
10	19° 34' 55.285" S	114° 15' 4.746" E
11	19° 29' 55.287" S	114° 15' 4.743" E
12	19° 29' 55.277" S	114° 35' 4.751" E
13	19° 44' 55.284" S	114° 35' 4.759" E
14	19° 44' 55.281" S	114° 40' 4.740" E
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
20	19° 59' 55.287" S	114° 40' 4.748" E
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
24	19° 59' 55.292" S	114° 30' 4.758" E
25	19° 59' 55.297" S	114° 20' 4.768" E
26	20° 04' 55.295" S	114° 20' 4.771" E
27	20° 04' 55.298" S	114° 15' 4.762" E
28	20° 09' 55.309" S	114° 15' 4.765" E
29	20° 44' 55.307" S	114° 40' 4.774" E
30	20° 29' 55.300" S	114° 40' 4.765" E
31	20° 29' 55.298" S	114° 45' 4.774" E
32	20° 24' 55.300" S	114° 45' 4.771" E
33	20° 19' 55.289" S	114° 45' 4.769" E
34	20° 19' 55.286" S	114° 50' 4.777" E
35	20° 14' 55.289" S	114° 50' 4.774" E
36	20° 14' 55.286" S	114° 55' 4.756" E
37	20° 29' 55.293" S	114° 55' 4.764" E
38	20° 29' 55.295" S	114° 50' 4.783" E
39	20° 44' 55.302" S	114° 50' 4.792" E

Appendix B.2 Sensitive Information Report

The Stakeholder Engagement Log and consultation records have been withheld because they contain sensitive information.

Sensitive Information Document

Stakeholder Engagement Log

Appendix C Description of the Environment

Appendix D Oil Pollution Emergency Plan

Appendix E Operational and Scientific Monitoring Plan