Cliff Head Field State Offshore Environment Plan Summary

Triangle Energy (Operations) Pty Ltd Controlled Document

10HSEQENVPL11SUM

Revision: 7

Issue date: 07/07/2025

Document Control and Revisions

This Cliff Head Field Offshore Environment Plan shall be revised in the following circumstances:

- A new activity is proposed which is not provided for in the EP
- Any significant modification of, change in, or new stage of an activity is proposed to commence which is not provided for in the EP.
- There is a change in the instrument holder or operator of the Activity.
- New or increased environmental risks or impacts associated with the Activity have been identified.
- A formal request from DEMIRS for a revised EP from the operator.
- The EP has been in place for five years.

Table of Contents

1 Operator Details

Triangle Energy (Operations) Pty Ltd (TEO) is the designated Operator (commenced 17th June 2018) of the Cliff Head Oil Field Development (CHD) which is in Production Licence Area WA-31-L.

TEO operates these facilities on behalf of the Cliff Head Oil Field Joint Venture which comprises:

- Triangle Energy (Global) Ltd 78.75%
- Pilot Energy Pty Ltd 21.25%

1.1 Registered Office

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2 Introduction

TEO is required to develop and implement an Environment Plan (EP) under the *Petroleum (Submerged Lands) (Environment) Regulations 2012* for the series of subsea production (no longer in production) and water injection wells within State Waters.

Following a review of pipeline licenses by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) in 2020, DEMIRS identified that the State Offshore Pipeline as needing a regulatory change from being licenced under the *Petroleum (Submerged Lands) Act 1972* (PSLA) to an Access Authority under the PSLA.

On 18th March 2021, Pipeline Licence TPL/18 for the offshore pipeline, was replaced by Access Authority (AA3T) under the PSLA.

The location map for the ASP Cliff Head Development is provided in Figure 2-1. The EP applies to the Cliff Head infrastructure located in State waters only, which covers the pipelines traversing State waters.

The EP addresses the requirement for a 5-year revision under the PSLA and Regulation 8 of the *Petroleum (Submerged Lands) (Environment) Regulations 2012,* which requires an Operator to submit a revision of the EP when it has been in place for five years. The EP is also supported by an Oil Spill Contingency Plan (OSCP) for State waters activities only.

The scope of the EP includes the operation of the pipelines within State waters during the Non-Production Phase and Care and Maintenance Phase, including the associated inspection, maintenance and repair (IMR) activities within a 1km wide pipeline corridor. The Non-Production Phase is defined as commencing at the cease of production and ending after the offshore production and injection wells have been successfully plugged and abandoned. The pipelines are required to support the well management during this phase. The Care & Maintenance Phase commences immediately after the Non-Production Phase.

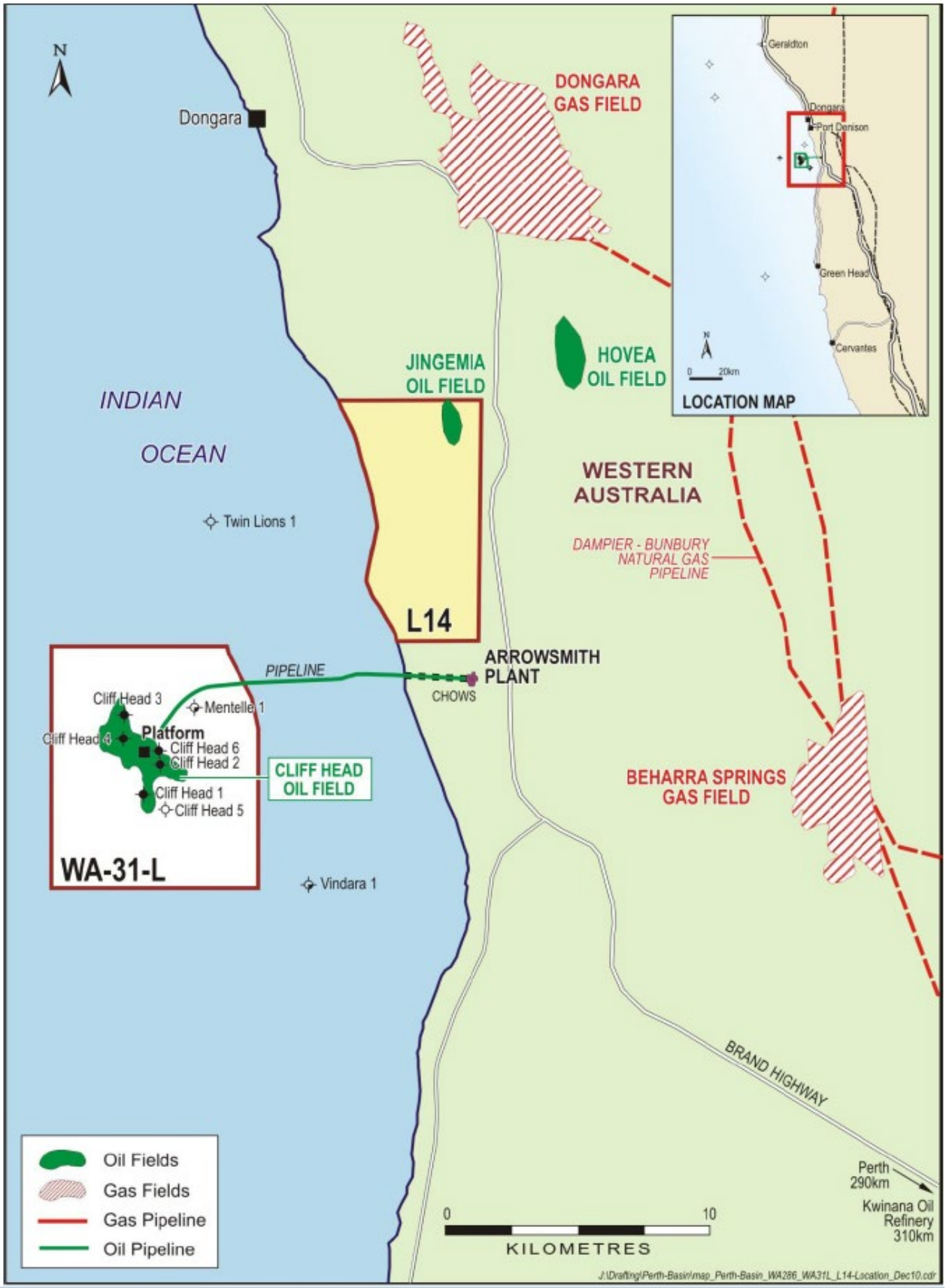


Figure 2-1: Regional Location of Cliff Head Development

3 Description of the Activity

3.1 Project Overview

The Cliff Head Oil Field facilities comprise production wells (currently shut-in and secure), injection wells and an unmanned offshore wellhead platform, located in Commonwealth waters. The CHA wellhead platform is connected to the ASP via twin 14 km production and injection pipelines. The two pipelines are connected via a pigging loop on CHA such that they form a single pipeline system when pigging. The pipelines extend from the offshore field facilities, through State waters and an onshore pipeline easement, to the ASP (Figure 2-1).

The pipeline system includes an offshore and onshore component. The offshore component of the pipeline system runs 10.4 km from the CHA in Commonwealth waters, along the seabed in Commonwealth and State waters, to the horizontal directional drilled (HDD) shore crossing located approximately 500 m seaward of the shoreline. The State waters component is 5.9 km. The offshore component of the pipelines is unburied and uses the concrete coating weight and grout bags/rock dumps to provide stability. The pipelines cross beneath the shoreline and the frontal dune system via the HDD shore crossing.

The pipeline system facilities located in State waters that are in the scope of the EP are:

- An insulated subsea production pipeline.
- An insulated subsea water injection pipeline.
- A subsea power and control cable, and chemical supply umbilical, which are strapped to the production pipeline.

The production pipeline is designed to transport produced fluids from the CHA to the ASP where oil can be separated from the produced water. The water injection pipeline is designed to return treated produced water to the injection wells in Commonwealth waters, for injection into the geological formation.

3.2 Current Project Status

In July 2024 a decision was made to shut-in the field. Production ceased from the wells on 4 August 2024. The production and injection pipeline system was subsequently pigged, flushed to <10 ppm Oil-in-Water (OIW) concentration and treated.

The facilities are currently in a Non-Production Phase (NPP) state. The NPP is the nominal period between completion of NPP transition and the offshore wells on CHA being plugged and abandoned (P&A). This phase involves a substantial reduction in overall activity and will mostly consist of maintenance activities to ensure all infrastructure and equipment remain in a suitable condition for well management operations, safe decommissioning and removal. The P&A of the wells is expected to commence in late 2026 and completed in the first half of 2027, at which time the NPP will end.

The project is expected to enter the Care and Maintenance (C&M) phase in mid-2027. The C&M phase is the nominal period between the successful P&A of the offshore wells on CHA and eventual removal of the facilities, where inspections and monitoring are still undertaken and ongoing environmental obligations are to be met.

3.3 Location

The pipelines, cable and umbilical that lie within State waters extend from the shoreline crossing to the State waters limit, which is 6.9 km long. A 1 km corridor centred on the pipelines (i.e. 500 m either side of the pipelines) constitutes the area in which project activities will be carried out in State waters, referred to as the Operational Area. The nearest towns to the pipeline shoreline crossing are Dongara (19.5 km north) and Leeman (57 km south). No formal exclusion zone applies around the pipelines

or IMR vessels. Coordinates for the Operational Area are provided in Table 3-1 and shown in Figure 3-1.

Table 3-1: Operational Area Centre Points (GDA94/MGA50)

Point	Easting	Northing
1	297179	6742771
2	300842	6742894
3	302145	6743082
4	303071	6743091

3.4 Cliff Head Non-Production Phase

Following Cessation of Production (CoP), the Cliff Head Development transitioned to the NPP. Activities will be completed in Q3 2025 and involved significantly reducing and/or eliminating risks associated with the processing of produced fluids e.g. where practicable hazardous substances such as remnant produced oil, hydrocarbon gas and hydrogen sulphide gas, were removed, followed by the implementation of mothballing programs for the equipment that was not to remain in-service and/or available during the NPP phase.

The NPP phase involves a substantial reduction in overall activity; however the EP covers activities to keep the pipelines in-service and/or available during the NPP period.

The following “key” Cliff Head facility capabilities and operations are essential and necessary during the NPP;

- Access to Operational Area via helicopter for inspection tasks.
- Ability to execute well integrity and control activities using injection water (IW) stored in the IW tank at ASP and pipeline to be “available”.
- Effectiveness of critical controls.

Following the successful P&A of the offshore wells (planned for first half 2027), the operations will enter a C&M phase.

3.5 Cliff Head Care and Maintenance Phase

The C&M phase involves a further substantial reduction in overall activity, however ongoing IMR activities for the State waters pipelines will remain in order to ensure they are in suitable condition for decommissioning and removal.

The IW system at ASP will be kept intact and available to maintain the ability to flush the pipeline prior to final removal.

Decommissioning planning will be ongoing throughout the NPP and C&M phase.

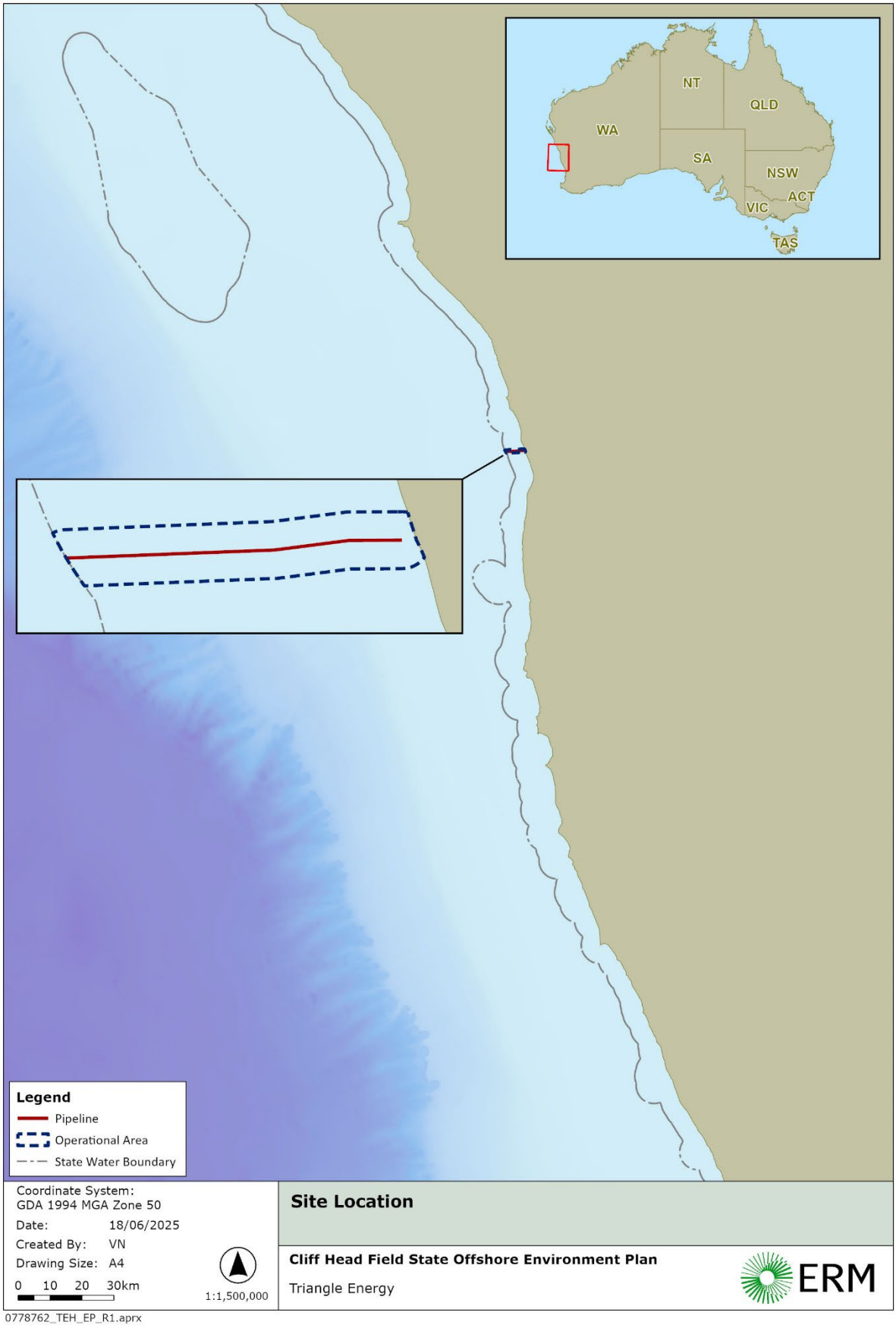


Figure 3-1: Project Location

3.6 Overview of the Offshore Pipeline Infrastructure

The Cliff Head development includes the operation and maintenance of the two pipeline system:

- The insulated subsea production pipeline, which carried the well stream fluids from the CHA wellhead platform to the ASP.
- The insulated subsea water injection pipeline, which transported produced formation water (PFW) and additional make-up injection water from the ASP to the CHA (indicative added chemicals are outlined in Section 8.7).

The two pipelines are identical in size (273.1 millimetres (mm), i.e. 10") and design, they are constructed from steel (design wall thickness is 14.3 mm) and insulated with special high-density polyurethane foam and encased in concrete (concrete thickness is 25-40 mm). There are no valves or other pathways for routine discharge in State waters. Both pipelines have been stabilised on the seabed via the weight of concrete coating and via grout bags and rock dumping in certain areas (i.e. not buried). In addition, there is an 80 mm integrated power cable complete with fibre optic cables and a 60 mm umbilical flat pack for the chemical injection fluids. Both the power cable and the umbilical are strapped to the production line.

External corrosion mitigation is provided by a combination of corrosion coatings and cathodic protection (CP). The CP system for the offshore pipeline consists of standard aluminium-zinc-indium (Al-Zn-In) half shell bracelet anodes spaced approximately every 300 m along the length of the submerged section of the pipeline.

Both pipelines will be maintained and remain available throughout NPP to retain the ability to execute well integrity and control activities. Throughout the C&M phase, the pipelines will be maintained to facilitate complete removal, including maintaining the capability for flushing operations.

The NPP steady state pipeline system will be a closed system. The total fluid in the system is estimated to be 2,540 m^3 with a maximum oil component of 125 litres (assuming up to 50 ppm OIW concentration). Typically, OIW will be significantly less.

3.7 Pipeline operations, inspection, maintenance and repair activities

TEO may undertake a variety of pipeline operation and IMR activities under the EP, as outlined in Table 3-2. These activities are considered essential for the safe operation of the pipelines and cannot reasonably be avoided. Both pipelines and power control and supply cable will be maintained and remain available throughout NPP to retain the ability to execute well integrity and control activities at ASP. The chemical supply umbilical will be mothballed along with the chemical injection package at ASP.

IMR activities that may be conducted within the pipeline at the HDD shore crossing, including below the low water line, will be undertaken from above the low water line and are covered by the Cliff Head Field Onshore Operations EP (10HSEQENVPL09) subject to approval by DEMIRS. Pipeline IMR activities will predominately be performed during daylight hours. However, support vessels may mobilise and demobilise from the Operational Area during hours of darkness. Emergency repairs may be required on a 24-hour basis.

There are non-routine operations (outside steady state) that may occur from time to time. These include:

- Regular pigging operations of the pipelines (including, PitBoss, SmartBall, intelligent pigging, etc.).
- Unplanned well control operations involving the pumping of IW from ASP to CHA via the IW pipeline, down the well bore and into the reservoir.
- Unplanned production well bore flushing operations requirements (due to oil migrating into the production well bore within the production well tubing and needing to be removed).

An aerial inspection is conducted periodically, and a vessel will conduct an inspection along the pipeline every two years. In the unlikely event that any significant maintenance or repair work is required to the pipelines, a vessel may be moored on site. An additional support vessel may then be required to transit to and from the site to service the works. A summary of potential IMR activities is provided in Table 3-2, with further details provided in the sections below. The base-case is to maintain the current frequency of inspections and maintenance throughout NPP and C&M, however the frequency of activities are likely to be reduced. Any reduction in inspection frequencies will be determined through an engineering risk assessment and assessed when appropriate through the Management of Change (MOC) procedure (refer to Section 8.5.1).

An inventory of equipment and property is maintained via a Computerised Maintenance Management System (CMMS). The CMMS includes a detailed record of infrastructure, equipment, property and the associated status to support the NPP and planning for decommissioning. The CMMS will be reconfigured based on the review of maintenance regimes and will continue to capture the status of property throughout future phases. CMMS is used to manage the inspection program.

Table 3-2: Pipeline IMR Activities in State Waters, with Indicative Frequencies and Durations

Activity	Frequency	Approx. durations (days)
Pigging with a biocide train	Weekly	1 day
Aerial survey	Periodically	1 day
Smartball inspection	Every 3 months	1 day
Intelligent pig	Every 2 years	5 days
Visual / Remote operated vehicle (ROV) surveys	Every 2 years	5 days
Free span rectification	As needed, typically less than once every 5 years	10-25 days
Time-of-flight diffraction (ToFD) ultrasonic inspection (subsea)	As needed, typically once every 2-3 years	10 days
Marine growth removal	As needed, less than once every 10 years	10-25 days
CP inspection and rectification - Field Gradient Survey	Every 2 years (as part of ROV surveys) - Every 3 years	5 days
Emergency clamping	As needed	10 days
Subsea cable repair	As needed	10-25 days
Pipeline repair / replacement	As needed	Up to 2 months.

3.7.1 Chemical Selection

Indicative added chemicals are outlined in Section 8.7.

TEO has a Chemical Management Procedure (Document Ref: 10OPGOPC06) in place which sets out the section, assessment and on-site controls of downhole and process chemicals for the Project and also defines the duties and responsibilities of site and Perth-based personnel. The assessment involves consideration for the toxicity, bioaccumulation and persistence of chemicals in the marine environment consistent with the Department of Mines and Petroleum (DMP) Chemical Assessment Guide: Environmental Risk Assessment of Chemicals used in WA Petroleum Activities Guideline.

3.8 IMR Vessels

IMR vessels will be contracted on an as needed basis and will be selected based on the Activity that will be undertaken. All IMR vessels will be commercial vessels with a suitable survey class for operations in the Operational Area.

All IMR vessels will run on marine diesel (or lighter) grade fuel; no intermediate or heavy fuel oils will be used. The largest fuel tank volume size would be <500 m^3, for a large pipelaying/ construction vessel. This has been used to determine the maximum credible marine diesel spill scenario. It is expected that other vessels will have considerably smaller maximum credible spill scenarios than this.

Support vessels will support pipeline IMR activities where required. The vessels will either be holding station or moored during activities, depending on the operational requirements of the Activity. For major works, temporary moorings will be installed for up to two months and when required for short periods, will be in place for 2 to 3 weeks. Moorings will be installed prior to commencing activities and recovered following completion of an activity. The size of the mooring is dependent on the load that it is required to hold, which is a function of vessel size and weather conditions. Given that IMR activities will require calm weather conditions, and the relatively small size of the potential vessels, temporary moorings are expected to be relatively small in size.

There is no formal exclusion zone around the pipelines or IMR vessels. This means that other vessels and fishing activities can occur as normal. The location of the pipelines are marked on nautical charts with the general advice that vessels should not anchor or trawl in the vicinity of the pipelines. However, TEO has a memorandum of understanding (MOU) in place with the West Coast Rock Lobster Managed Fishery that agrees that traps can be placed along the pipelines for rock lobster fishing.

3.9 Helicopters

A helicopter will undertake aerial surveys periodically. The helicopter will originate from Dongara airport, where all refuelling will occur (i.e. no offshore refuelling) Helicopter flight altitude will range from 150 feet (ft) onshore and 500 to 1000 ft offshore.

3.10 Other Support

IMR vessels may be equipped with a Remotely Operated Underwater Vehicle (ROV) system. Visual inspection will typically be carried out by an observation or micro class ROV deployed from a vessel.

3.11 Refuelling

Bunkering at sea is unlikely to be required given the nature of the activities and the close proximity of the ports of Dongara and Geraldton. However, bunkering at sea is included in the scope of the EP and has been included in the environmental risk assessment.

4 Description of the Environment

4.1 EMBA

The EMBA encompasses the area that could be affected by unplanned events and is derived from modelling the worst case hydrocarbon spill scenario, that is the summary of all the locations where hydrocarbon exposure values could be exceeded by any of the simulations modelled.

The worst-case hydrocarbon spill scenario used to inform the EMBA is outlined in Table 4-1. The EMBA boundaries have been defined based on hydrocarbon modelling results. One boundary represents the potential extent of ecological effects (ecological EMBA). The socio-cultural EMBA represents where hydrocarbons may be visible on the sea surface and is therefore representative of the area where the public and stakeholders may perceive impacts to be, as well as potential area closures as a precautionary measure. As the ecological EMBA is the larger of the two EMBAs, this has been used to identify the physical, biological, socio-economic and cultural values described in this section.

Table 4-1: Worst Case Credible Hydrocarbon Spill Scenario Associated with Operational Activities Used to Define the EMBA

Incident	Substance Type	Worst Case Release	Location	Section
Vessel spills				
Vessel tank rupture due to a vessel collision (e.g. support vessels or other marine users)	Diesel	~500m^3 (approximately 167 m^3/hour for 3 hours)	29° 27’ 00.4” S 114° 52’ 12.1” E	7.1.1

4.2 Natural Environment – Physical

4.2.1 Bathymetry and Geomorphology

4.2.1.1 Bathymetry and Seabed Morphology

The Operational Area is situated within the inner continental shelf waters of the northern Perth basin, in shallow, gradually sloping coastal waters up to approximately 15 m water depth at the State waters limit. The bathymetry and morphology of the inner-shelf region (<100 m water depth), in which the Operational Area is situated, is generally flat, although interspersed by exposed areas of lithified dunes, which form a series of islands and reefs along the mainland coastline throughout the region.

4.2.1.2 Islands, Reefs, Banks and Shoals

While there are no islands, reefs, banks or shoals within the Operational Area, there are a number of such features distributed more broadly throughout the EMBA (distance to Operational Area in brackets), including:

- Big Horseshoe Reef (2.5 km south)
- Little Horseshoe Reef (6.5 km south)
- Leander Reef (8.5 km northwest)
- Cliff Head Break (14 km south)
- Beagle Island (42 km south)
- Lipfert and Milligan Islands (65 km south)
- Clio Bank (68 km west)
- Fisherman Island (80 km south)
- Sandland Islands (90 km south)
- Essex Rocks (100 km south)
- Houtman Abrolhos Islands

4.2.2 Climate

The Operational Area and wider EMBA is located in a region that experiences a Mediterranean climate, characterised by seasonal patterns of hot, dry summers and mild, wet winters, with a low number of rain days. The highest temperatures occur in January and February (19.2 to 32.4 ºC) while the lowest temperatures occur in August (8 to 19.5 ºC). There is a dominant winter rainfall with approximately 86% of annual rainfall occurring between April and September; the wettest month is June where over 100 mm can be expected to fall. During summer months, rainfall is uncommon with only 70 mm expected between October and March (Pearce, 1997).

4.2.3 Wind

Winds over the region are relatively strong (mean 12–16 knots; maximum 30–35 knots) and are most frequently from the northwest during the summer months (September to February) and from the southeast during the winter months (May to July). March, April and August are transitional months where the wind can be from either the northwest or southeast.

4.2.4 Oceanography

Water circulation in the Operational Area and surrounding EMBA is primarily influenced by wind-driven currents, although localised wave-forced currents may occur around the shallow reefs within the surrounding areas, particularly during large swell events. The currents at the surface to mid-depth have typical mean speeds of 0.08 to 0.15ms-1 and near the seabed this is reduced to 0.06 to 0.1ms-1. They run mostly parallel to the local bathymetry/shoreline (WNI, 2000).

The Leeuwin Current is the dominant oceanic current in the region. It draws warm, low salinity water of tropical origin southwards along the coast of Western Australia.

4.2.5 Water and Sediment Quality

Water and sediment quality monitoring within and surrounding the Operational Area indicates that water and sediment quality is high. Water and sediment quality at monitoring sites adjacent to the pipeline were found to be high, with results below the relevant ANZECC & ARMCANZ (2000) trigger levels for all tested analytes, including metals and hydrocarbons (BMT Oceanica, 2016).

4.2.6 Air Quality

The closest air quality data available is measured in Geraldton, approximately 70 km north of Dongara. According to the Air Quality index for Western Australia, air quality in Geraldton is classified as 'Good'.

4.3 Natural Environment – Biological

4.3.1 Protected Areas

The Operational Area does not overlap with any State or Commonwealth designated protected areas. The EMBA overlaps the State-managed Jurien Bay Marine Park (approximately 73 km south of Operational Area) and the Abrolhos Islands Fish Habitat Protection Area (approximately 96 km north-west of Operational Area), declared under the WA Fish Resources Management Act.

Onshore, State Nature Reserves are located along the coast and islands to the south of the Operational Area and overlapping the EMBA, including at the Beagle Islands (42 km south of Operational Area), the Lipfert and Milligan Islands (65 km south of Operational Area), Fisherman Islands (80 km south of Operational Area), Sandland Islands (90 km south of Operational Area), and Essex Rocks (100 km south of Operational Area).

Additionally, the EMBA overlaps the Commonwealth-managed Abrolhos Australian Marine Park (AMP) (58 km north-west of Operational Area) and the Jurien Bay AMP (86 km south of Operational Area).

4.3.2 Threatened and Priority Ecological Communities

No Commonwealth or State designated Threatened Ecological Communities (TECs) occur in the Operational Area. One Commonwealth designated TEC, Subtropical and Temperate Coastal Saltmarsh, was identified in the EPBC Act Protected Matters Search Tool (PMST) search as being likely to occur within the EMBA. The community is listed as Vulnerable due to its small and declining distribution throughout Australia.

Subtropical and Temperate Coastal Saltmarsh is recognised in WA as a Priority Ecological Community (PEC); ecological communities with insufficient information available to be considered a TEC, or which are rare but not currently threatened). No other State-listed PECs are formally identified as occurring within the Operational Area or wider EMBA.

4.4 Key Ecological Features

There are no Key Ecological Features (KEFs) identified within the Operational Area as this area is within State waters only and governed by State legislation. There are however, two KEFs located adjacent to the Operational Area, the 'Commonwealth marine environment within and adjacent to the west coast inshore lagoons' and the 'Western Rock Lobster'. There are two additional KEFs overlapping the wider EMBA, the 'Commonwealth marine environment surrounding the Houtman Abrolhos Islands' and the 'Ancient Coastline at 90 – 120 m depth' (DSEWPAC, 2012a).

4.4.1 Benthic Habitats and Communities

4.4.1.1 Operational Area Characterisation

The habitats within the Operational Area in State waters are described as bare sands, high density seagrass meadow, low density seagrass, and sand with algae and seagrass. The seagrass species are well represented throughout the WA region and there are no identified areas of significance in the Operational Area.

4.4.1.2 Sandy Seafloor Habitat

Sandy seafloor habitat occurs in sub-tidal areas where the sand forms a thick layer over the underlying limestone pavement. Bare sand is present shoreward of the HDD emergence site, between the shoreline and to a depth of approximately 3 – 5 m. The sands are often shifting, and as a consequence the density of epibiota is low. In deeper areas, small-scattered patches of seaweeds, mostly *Sargassum* and *Dictyales* species, and *Halophila* seagrasses, can be found.

4.4.1.3 Seagrass Habitats

Seagrasses occur in varying density throughout the Operational Area, with two identifiably distinct habitat types. The first type, located within the Operational Area, comprises of high-density seagrass meadows. The second type, located further west, has lower density meadows of ephemeral species, such as *Syringodium* and *Halophila*.

4.4.1.4 Limestone Pavement Habitat

Limestone pavement habitat has not been surveyed along the pipeline route, within the Operational Area, however it is a widely distributed habitat type throughout the region.

4.4.1.5 Emergent Reef Habitat

There are no Emergent reefs located within the Operational Area itself, however, there are numerous located in the wider EMBA. A series of broken ribbon reefs lie approximately 3 to 5 km offshore, which lie to the north and south of the Operational Area.

The Houtman Abrolhos Islands, located approximately 100 km from the Operational Area (within the wider EMBA) have a high diversity of hermatypic coral compared with other reefs at similar latitude.

4.4.1.6 Limestone Patch Reef Habitat

Major Patch reefs are located further west of the Operational Area, within the wider EMBA. These reefs are high profile structures, with steep reef faces typically rising 1 to 4 m above the surrounding seabed with extensive horizontal ledges.

4.4.2 Intertidal Habitats and Communities

The main intertidal habitats on the shoreline comprise long narrow sandy beaches separated by limestone platforms and exposed beach rock. The platforms and beach rock, support turf algae and molluscs with a range of small fish and crabs present in rock pools.

4.4.2.1 Sandy Beaches

The coastline closest to the Operational Area (between Leeman and Geraldton) is almost entirely made up of sandy beaches. Intertidal platforms and reefs located offshore, dissipate wave energy and reduce erosion of the beach.

4.4.2.2 Subtropical and Temperate Coastal Saltmarsh

Subtropical and temperate coastal saltmarsh occurs in the Irwin river estuary (approximately 25 km north of Operational Area) near Dongara, and the Chapman river estuary (approximately 95 km north

of Operational Area) near Geraldton. The saltmarsh communities are recognised as an *EPBC Act* TEC and State PEC (refer to Section 4.3.2).

4.5 Marine Fauna

A search of the EPBC Act Protected Matters Database was undertaken to identify listed marine species under the EPBC Act that may occur within the Operational Area and EMBA. Where available, the status of species protected under the WA *Biodiversity Conservation Act 2016* has also been included. The species relevant to the Operational Area and EMBA are summarised in Table 4-2.

Table 4-2: Environmental Values and Sensitivities Under the EPBC Act

Common Name	Scientific Name	EPBC Act Status	State Status	Operational Area	EMBA
Marine Mammals					
Blue Whale	*Balaenoptera musculus*	Endangered Migratory	Endangered	✓	✓
Southern Right Whale	*Eubalaena australis*	Endangered Migratory	Vulnerable	✓	✓
Humpback Whale	*Megaptera novaeangliae*	Migratory	Conservation Dependent	✓	✓
Australian Sea lion	*Neophoca cinerea*	Endangered	Endangered	✓	✓
Bryde's Whale	*Balaenoptera edeni*	Migratory	N/A	✓	✓
Killer Whale	*Orcinus orca*	Migratory	N/A	✓	✓
Sei Whale	*Balaenoptera borealis*	Migratory	Endangered	x	✓
Fin Whale	*Balaenoptera physalus*	Migratory	Endangered	x	✓
Sperm Whale	*Physeter microcephalus*	Migratory	Vulnerable	x	✓
Antarctic Minke Whale	*Balaenoptera bonaerensis*	Migratory	Migratory	x	✓
Marine Reptiles					
Loggerhead Turtle	*Caretta caretta*	Endangered Migratory	Endangered	✓	✓
Green Turtle	*Chelonia mydas*	Vulnerable Migratory	Vulnerable	✓	✓
Leatherback Turtle	*Dermochelys coriacea*	Endangered Migratory	Vulnerable	✓	✓
Flatback Turtle	*Natator depressus*	Vulnerable Migratory	Vulnerable	✓	✓
Shark, Fish and Rays					
Grey Nurse Shark	*Carcharias taurus*	Vulnerable	Vulnerable	✓	✓
White Shark	*Carcharodon carcharias*	Vulnerable Migratory	Vulnerable	✓	✓
Whale Shark	*Phincodon typus*	Vulnerable Migratory	Other Specially	✓	✓
Mackerel Shark, Porbeagle	*Lamna nasus*	Migratory	N/A	✓	✓
Reef Manta Ray	*Manta alfredi*	Migratory	N/A	✓	✓
Giant Manta Ray	*Manta birostris*	Migratory	N/A	✓	✓
Shortfin Mako	*Isurus oxyrinchus*	Migratory	N/A	x	✓
Longfin Mako	*Isurus paucus*	Migratory	N/A	x	✓
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Migratory	N/A	✓	✓
Freshwater Sawfish	*Pristis pristis*	Vulnerable Migratory	N/A	✓	✓

Common Name	Scientific Name	EPBC Act Status	State Status	Operational Area	EMBA
Birds					
Amsterdam Albatross	*Diomedea amsterdamensis*	Endangered Migratory	Critically Endangered	✓	✓
Southern Royal Albatross	*Diomedea epomophora*	Vulnerable Migratory	Vulnerable	✓	✓
Wandering Albatross	*Diomedea exulans*	Vulnerable Migratory	Vulnerable	✓	✓
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Vulnerable Migratory	Endangered	✓	✓
Black-browed Albatross	*Thalassarche melanophris*	Vulnerable Migratory	Endangered	✓	✓
Campbell Albatross	*Thalassarche impavida*	Vulnerable Migratory	Vulnerable	✓	✓
Shy Albatross	*Thalassarche cauta*	Endangered Migratory	Vulnerable	✓	✓
White-capped Albatross	*Thalassarche cauta steadi*	Vulnerable Migratory	Vulerable	✓	✓
Australian Lesser Noddy	*Anous tenuirostris melanops*	Vulnerable	Endangered	✓	✓
Australian Fairy Tern	*Sternula nereis*	Vulnerable	Vulnerable	✓	✓
Common Noddy	*Anous stolidus*	Migratory	Migratory	✓	✓
Caspian Tern	*Hydroprogne caspia*	Migratory	Migratory	✓	✓
Bridled Tern	*Onychoprion anaethetus*	Migratory	Migratory	x	✓
Roseate Tern	*Sterna dougallii*	Migratory	Migratory	x	✓
Little Tern	*Sternula albifrons*	Vulnerable Migratory	Migratory	✓	✓
Greater Crested Tern	*Thalasseus bergii*	Migratory	N/A	x	✓
Australian Painted Snipe	*Rostratula australis*	Endangered Migratory	Endangered	✓	✓
Northern Siberian Bar-tailed Godwit	*Limosa lapponica*	Migratory	Migratory	✓	✓
Red Knot	*Calidris canutus*	Vulnerable Migratory	Endangered	✓	✓
Curlew Sandpiper	*Calidris ferruginea*	Critically Endangered	Critically Endangered	✓	✓
Common Sandpiper	*Actitis hypoleucos*	Migratory	Migratory	✓	✓
Pectoral Sandpiper	*Calidris melanotos*	Migratory	Migratory	✓	✓
Sharp-tailed Sandpiper	*Calidris acuminata*	Vulnerable Migratory	Migratory	✓	✓
Eastern Curlew	*Numenius madagascariensis*	Critically Endangered Migratory	Critically Endangered	✓	✓

Common Name	Scientific Name	EPBC Act Status	State Status	Operational Area	EMBA
Red-tailed Tropicbird (Indian Ocean)	*Phaethon rubricauda westralis*	Endangered	Migratory	✓	✓
White-tailed Tropicbird	*Phaethon lepturus*	Migratory	Migratory	x	✓
Fork-tailed Swift	*Apus pacificus*	Migratory	Migratory	✓	✓
Northern Giant Petrel	*Macronectes halli*	Vulnerable Migratory	Migratory	✓	✓
Southern Giant Petrel	*Macronectes giganteus*	Endangered Migratory	Migratory	✓	✓
Soft-plumaged Petrel	*Pterodroma mollis*	Vulnerable	N/A	✓	✓
Blue Petrel	*Halobaena caerulea*	Vulnerable	N/A	x	✓
Fairy Prion (Southern)	*Pachyptila turtur subantarctica*	Vulnerable	N/A	x	✓
Lesser Frigatebird	*Fregata ariel*	Migratory	Migratory	x	✓
Common Greenshank	*Tringa nebularia*	Endangered Migratory	Migratory	x	✓
Greater Sand Plover	*Charadrius leschenaultii*	Vulnerable Migratory	Vulnerable	x	✓
Sooty Albatross	*Phoebetria fusca*	Vulnerable Migratory	Endangered	x	✓
Osprey	*Pandion haliaetus*	Migratory	Migratory	x	✓
Grey Wagtail	*Motacilla cinerea*	Migratory	Migratory	✓	✓
Wedge-tailed Shearwater[1]	*Ardenna pacifica*	Migratory	Migratory	✓	✓
Flesh-footed Shearwater	*Ardenna carneipes*	Migratory	Vulnerable	✓	✓
Sooty Shearwater	*Ardenna grisea*	Vulnerable Migratory	Migratory	x	✓
Pacific Gull [2]	*Larus pacificus*	N/A	N/A	✓	✓
Sooty Tern[3]	*Onychoprion fuscatus*	N/A	N/A	✓	✓
White-faced Storm Petrel[4]	*Pelagodroma marina*	N/A	N/A	✓	✓
Little Shearwater[5]	*Puffinus assimilis*	N/A	N/A	✓	✓
Australian Pied Cormorant[6]	*Phalacrocorax varius*	N/A	N/A	✓	✓

[1] Wedge-tailed shearwater not detected in Operational Area PMST search, but overlapping BIA would suggest foraging may occur within this area.
[2] Pacific gull not detected in PMST search, but overlapping BIA would suggest foraging may occur within this area.
[3] Sooty tern not detected in PMST search, but overlapping BIA would suggest foraging may occur within this area.
[4] White-faced storm petrel not detected in PMST search, but overlapping BIA would suggest that foraging may occur within this area.
[5] Little shearwater not detected in PMST search, but overlapping BIA would suggest foraging may occur within this area.
[6] Australian Pied Cormorant not detected in PMST search, but overlapping BIA would suggest foraging may occur within this area

4.6 Biologically Important Areas

Table 4-3 identifies the Biologically Important areas (BIAs) overlapping the Operational Area and the EMBA.

Table 4-3: BIAs Overlapping or in The Vicinity of the Operational Area

Species	BIA (category)	Direction and distance from Operational Area (km)
Mammals		
Humpback Whale	Migration	0 (overlaps)
Pygmy Blue Whale	Migration	50 (West)
	Foraging	43 (West)
Southern Right Whale	Migration	0 (overlaps)
Australian Sea lion	Foraging (male and female)	0 (overlaps)
	Numerous other foraging BIAs	Varied (surrounding Houtman Abrolhos Islands)
	Breeding sites	42, 78 and 136 (South)
	Haul-out sites	90 and 121 (South)
Birds		
Australian Lesser Noddy	Foraging	93 (Northwest)
Bridled Tern	Foraging	4 (West)
Caspian Tern	Foraging	0 (overlaps)
Common Noddy	Foraging	74 (Northwest and south)
Fairy Tern	Foraging	0 (overlaps)
Little Shearwater	Foraging	0 (overlaps)
Pacific Gull	Foraging	0 (overlaps)
Roseate Tern	Foraging	10 (South) and 75 (Northwest)
Soft-plumaged Petrel	Foraging	73 (West)
Sooty Tern	Foraging	62 (West)
Wedge-tailed Shearwater	Foraging	0 (overlaps)
White-faced Storm Petrel	Foraging	34.5 (West)
Sharks		
White Shark	Foraging	13 (South)

4.7 Marine Mammals

Several species of marine mammals are known to occur in the region and have wide distributions that are associated with feeding and migration patterns linked to reproductive cycles. Pursuant to the PMST, there were six species of protected or migratory marine mammals located within the Operational Area and wider EMBA. An additional four species were identified in the EMBA only.

There are several marine mammal BIAs either overlapping the Operational Area of in the wider EMBA. These are:

- Foraging, breeding and haul-out BIAs for the Australian sea lion.
- Migration BIA for the humpback whale.
- Migration and foraging BIAs for the pygmy blue whale.
- Migration BIA for the southern right whale.

Additional species not identified in the PMST but likely to transit the Operational Area include several species of baleen whales and coastal dolphin species such as the bottlenose.

4.8 Marine Reptiles

Pursuant to the PMST, there were four species of protected or migratory marine turtles located within the Operational Area. No additional species were identified within the EMBA. Although marine turtles may occur, it is considered unlikely that they will be present in significant numbers. Accordingly, no nesting or breeding areas are within the vicinity of the Operational Area. Further, there are no BIAs overlapping or located in the vicinity of the Operational Area.

4.9 Marine Birds

Many migratory shorebirds (including those frequenting offshore islands) and seabird species are known to occur in the region. Pursuant to the PMST, there were 30 species of protected or migratory birds located within the Operational Area. An additional 12 species were identified in the EMBA.

There are 12 seabird foraging BIAs either overlapping or within the vicinity of the Operational Area and within the wider EMBA. Foraging BIAs are allocated where known foraging behaviour occurs.

4.10 Sharks, Fishes and Rays

Pursuant to the PMST, there were eight species of protected or migratory sharks, fish or rays located within the Operational Area. An additional two species were identified in the EMBA.

The closest foraging BIA for the white shark is located approximately 13 km (south) of the Operational Area. Further, accordingly to the PMST, there was 12 species of pipefish, three species of seahorse, two species of seadragon and three species of pipehorse identified as potentially occurring in the wider EMBA.

4.11 Important Habitats

Habitats used by key fish species for spawning, feeding, and as nursery areas are particularly vulnerable to disturbances. The following key fish species may undertake spawning, aggregating or pupping within the Operational Area and EMBA:

- Bass groper (*Polyprion americanus*) (March – June)
- Blue-eye trevalla (*Hyperoglyphe antarctica*) (April – June*)
- Greybanded grouper (*Hyporthodus griseofasciatus*) (October – February)
- Redthroat Emperor *(Lethrinus miniatus*) (November – February)
- Pink snapper (*Chrysophrys auratus*) (June – August)
- Baldchin groper (*Choerodon rubescens*) (September – January)
- Samson fish *(Seriola hippos*) (November – January)
- West Australian dhufish (*Glaucosoma hebraicum*) (December – March)
- Western rock lobster (*Panulirus cygnus*) (August – February)
- Sandbar shark (*Carcharhinus plumbeus*) (October – April)
- Western Rock Octopus (*Octopus djinda*) (March – May, September – November **)

** The spawning period of H. antarctica on the west coast of WA is not certain but likely to be similar to New South Wales populations.*

** *Western Rock Octopus spawning occurs year-round with peaks during Autumn and Spring*

4.12 Commercially Significant Populations

Bony fish assemblages identified in the Operational Area and EMBA are characterised by temperate and subtropical species, including a number of species that are targeted by commercial and recreational fishers. Demersal fish species include highly sought commercial and recreational species such as blue groper (*Achoerodus gouldii*), baldchin groper (*Choerodon rubescens*), snapper (*Pagrus auratus*), goldband snapper (*Pristipomoides multidens*) and dhufish (*Glaucosoma hebraicum*). Some tropical species, such as goldband snapper, occurs in the Central West Coast bioregion. Some demersal fishes are largely dependent on a single habitat while others occupy a wide range, or live in several different habitats throughout the stages of the lifecycle. Many juvenile demersal fishes utilise inshore, seagrass-lined estuaries, or sandy/muddy bay habitats for feeding and protection, and then migrate offshore as adults, to reefs or other habitats.

Pelagic teleost fishes in the EMBA are typically highly mobile (although may be associated with particular habitats or oceanographic features) and include large predatory species such as tailor, Australian salmon, large carangids (e.g. *Seriola* spp.), mackerels and tunas (family Scombridae). Also present are smaller pelagic species such as pilchards (family Clupeidae), Australian herring (*Arripis georgianus*) and garfish (*Hyporhamphus melanochir*).

4.13 Socio-Economic Environment

4.13.1 Commercial Fisheries

The principal fishery that operates within the vicinity of the Operational Area is the WA West Coast Managed Rock Lobster Fishery, with whom TEO have a memorandum of understanding (MOU) allowing fishing activities to continue to occur in the vicinity of the pipelines and other project infrastructure.

Fishing effort has also been reported within the Operational Area for the following State fisheries:

- West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery
- West Coast Demersal Scalefish (Interim) Managed Fishery
- Octopus Interim Managed Fishery

In addition, the following coastal wading and diving collection fisheries have been active in coastal waters to the north and south of the Operational Area.

- Marine Aquarium Fish Managed Fishery
- Specimen Shell Managed Fishery

Given that the level and location of activity for these collection fisheries along this stretch of coast is variable, it is assumed that some collectors in these fisheries could fish along the coast near the pipeline.

No Commonwealth-managed fisheries have been historically active in the Operational Area.

4.13.1.1 State Fisheries

WA State commercial fisheries are managed by the Department of Primary Industries and Regional Development (Fisheries) under the *Fish Resources Management Act 1994*, Fisheries Resources Management Regulations 1995, relevant gazetted notices and licence conditions and applicable Fishery Management Plans.

4.13.1.2 Commonwealth Fisheries

The Australian Fisheries Management Authority (AFMA) manages more than 20 fisheries on behalf of the Commonwealth Government and is bound by objectives under the *Fisheries Management Act 1991*.

Commonwealth managed commercial fisheries with the licence to operate within the Operational Area and EMBA include:

- Western Skipjack Fishery
- Western Tuna and Billfish Fishery
- Southern Bluefin Tuna Fishery
- Western Deepwater Trawl Fishery
- Small Pelagic Fishery.

4.13.1.3 Recreational Fishing

Recreational fishing in the region consists of both shore- and boat-based angling, with recreational fishing concentrated around access nodes such as the boat ramps at Dongara and Geraldton, from which recreational vessels may launch. Consultation with Recfishwest during the preparation of the EP confirmed that the beaches and coastal waters in proximity to the Operational Area are frequented by both beach and boat-based anglers. A number of targeted recreational fishing interests exist in the area including (but not limited to):

- Demersal fish species including West Australian Dhufish, Snapper, Baldchin groper, and Redthroat emperor.
- Pelagic fish species, including Mackerel, Samsonfish, Tuna species and Trevally.
- Western rock lobster (DPIRD, pers. comm).

4.13.2 Ports and Shipping

Given the coastal location of the Operational Area, commercial shipping is located in deeper waters to the west of pipeline. The main shipping traffic in the region passes approximately 80 km west of the Operational Area, between Fremantle and Asia and other international ports. No commercial freight traffic is expected in the Operational Area, with vessel movements expected to consist of low levels of commercial fishers transiting the area and recreational boating.

4.14 Cultural Environment

4.14.1 International and National Heritage Sites

A search of the Australian Marine Spatial Information System (AMSIS) and the Protected Matters Search Tool (PMST) determined there are no World Heritage Areas (WHA), National Heritage Places or Commonwealth Heritage Places occurring within the Operational Area or the EMBA.

4.14.2 State Register of Heritage Places

A search of the inHerit and PlanWA tools determined that there are no places on the WA State Register of Heritage Places that occur within the Operational Area or EMBA.

4.14.3 Indigenous Heritage

A search of the Aboriginal Cultural Heritage Inquiry System (ACHIS) determined that there are no registered Aboriginal sites protected under the *Aboriginal Heritage Act 1972* located within the Operational Area. The closest registered site on the boundary of the EMBA, Irwin River (18907), is located approximately 17 km north of the Operational Area. The site is registered for its historical, creation / dreaming narrative, camp, landscape / seascape features and water source features. The area of Eneabba West (15297), located on the coast within the EMBA is classified as an ‘Other Heritage Place’ under the Act (information has been received by the Heritage Council in relation to the place, but an assessment has not been completed to determine if it meets criteria for registration under the Act).

4.14.4 Non-Indigenous Heritage Sites

There are no known sites of European cultural heritage significance within the vicinity of the Operational Area and no non-Indigenous heritage values have been identified within the EMBA.

4.14.5 Native Title

The Operational Area is within the determined Yamatji Nation Claim (WC2019/008) boundary. The Yamatji People are the traditional owners within the Operational Area. The Operational Area overlaps with the Yamatji National Native Title area and the Yamatji Indigenous Land Use Agreement Area. The Yamatji Nation claim is made up of five claimant groups – Hutt River, Southern Yamatji, Yamatji Nation, Mullewa Wadjari and Widi Mob.

The Yamatji People are represented by the Bundi Yamatji Aboriginal Corporation, Yamatji Southern Regional Corporation and the Yamatji Marlpa Aboriginal Corporation. A Yamatji Proponent Standard Heritage Agreement (YPSHA) is in place between TEO and Yamatji Southern Regional Corporation as of February 2021. Under this agreement the importance of early exchange of information between both parties was acknowledged, to ensure that the Yamatji Nation are aware of proposed activities for the Site, to avoid misunderstandings and to enable informed decisions to be made and desired outcomes to be achieved (TEO, 2021). The agreement commits TEO to communicate upcoming activities at the site on a biannual basis including outlining the nature of the activities, location and associated timing. Condition 16 of the agreement also stipulates the requirement to rehabilitate all areas of disturbance at the Site.

The southern portion of the EMBA overlaps with the South West Settlement NNT area. The Noongar People are the traditional owners of the southern area of the EMBA. The Noongar people are divided into six dialectal groups. The EMBA overlaps with the Yued region and the Yued ILUA area. The South West Aboriginal Land and Sea Council represents the Noongar Traditional Owners within the EMBA.

4.14.6 Maritime Archaeology

A number of historic shipwrecks protected under the Commonwealth *Underwater Cultural Heritage Act 2018* and recorded in the Australasian Underwater Cultural Heritage Database are found in the EMBA, however none occur within the Operational Area.

5 Assessment of Environmental Impacts and Risks

Environmental activities with the potential for impact from the project activities are summarised in Table 5-1. These activities and events have the potential to result in adverse effects on the physical, socio-economic and biological environment.

Table 5-1: Project Activities with the Potential for Impact

Event / Aspect	Activities / unplanned event details
Planned	
Physical Presence: Interaction with Other Users	• Presence of pipelines. • Vessels undertaking IMR activities.
Physical Presence: Seabed Disturbance	• Visual / ROV surveys. • Free span rectification. • Marine growth removal. • Temporary mooring during IMR activities.
Routine Light Emissions	• External light emissions on board the IMR vessels.
Routine Acoustic Emissions	• Vessels and helicopters undertaking IMR activities.
Routine Atmospheric Emissions	• Internal combustion engines and incinerators on IMR vessels.
Routine Discharges	• Routine discharge of sewage, grey water and putrescible wastes to the marine environment from IMR vessels. • Routine discharge of deck and bilge water to the marine environment from IMR vessels. • Routine discharge of cooling water or brine to the marine environment from IMR vessels.
Unplanned	
Accidental Hydrocarbon Release – Vessel Collision	• Loss of hydrocarbons to the marine environment due to a vessel collision (e.g. support vessels or other marine users).
Accidental Hydrocarbon Release – Pipeline Leak	• Loss of hydrocarbons to the marine environment from the produced fluids pipeline due to corrosion, materials fatigue or physical damage (e.g. during IMR activities). • Loss of hydrocarbons to the marine environment from the produced fluids pipeline due to physical damage arising from objects being dropped on the pipeline, vessel interaction (e.g. anchor drag) or equipment (e.g. fishing) being dragged across the pipeline.
Accidental Hydrocarbon Release - Refuelling	• Accidental discharge of marine diesel into the marine environment during refuelling.
Accidental Release of Produced Formation Water	• Accidental discharge to the ocean of produced formation water (PFW)/ chemicals due to a pipeline leak or rupture.
Unplanned Discharges: Deck and Subsea Spills	• Accidental discharge to the ocean of other hydrocarbons/ chemicals from project vessel deck activities and equipment (e.g. cranes), including subsea spills from subsea equipment including the ROV.
Unplanned Discharges: Loss of Solid Hazardous and non-hazardous Wastes	• Accidental loss of hazardous or non-hazardous wastes/ equipment to the marine environment.

Event / Aspect	Activities / unplanned event details
Physical Presence: Vessel Collision with Marine Fauna	• Accidental collision between IMR vessels and protected marine fauna.
Physical Presence: Dropped Object	• Dropped objects resulting in seabed disturbance.
Physical Presence: Accidental Introduction and Establishment of IMS	• Accidental introduction of IMS.

5.1 Risk Assessment Methodology

The risk assessment approach used within the EP is consistent with the approach outlined in AS14001, ISO31000:2018 Risk Management Principles and Guidelines on Implementation and HB203: 2012 Environmental Risk Management. Qualitative environmental risk is assessed as follows for identified environmental aspects/activities which could result in an environmental impact.

The environmental impact identification and risk assessment process comprised the following components:

- Impact and Risk Identification
  - The impact and risk identification process considered all the potential environmental consequences that may credibly arise from the identified aspects/events.
- Risk Analysis

Risk analysis determines the credible worst case environmental consequence for impacts and risks, and the likelihood of the consequence occurring. The Risk Matrix found in the TEO Risk Management Procedure [10HSEQGENPC27], given in Appendix A, was used to assess the consequence and likelihood of impacts and risks from identified aspects/events.

- Risk Treatment and Evaluation
  - The TEO Environmental Risk Matrix (Appendix A) was applied following the detailed evaluation of potential impacts and risks from activities. This matrix uses consequence and likelihood rankings, which when combined, result in a risk level between Extreme and Low. Risk assessment outcomes are based solely on risk assessment to the environment.

5.2 Risk Acceptance Criteria and ALARP Considerations

5.2.1 Determination of ALARP

All potential risks identified during the risk assessment process are required to be reduced to ALARP.

ALARP will be considered to be achieved when the following criteria are met:

- There are no reasonably practicable alternatives to the Activity, or
- There are no additional reasonably practicable measures available to further reduce the impact or risk, or
- The cost of implementing further measures is disproportionate to the reduction in impact or risk.

5.2.2 Determination of Acceptable

The determination that impacts and risks associated with the Activity are of an acceptable level requires operators to set limits where the impacts and risks associated with activities are not considered to be acceptable.

The environmental impacts and risks associated with the Activity were determined to be acceptable if the following criteria are met:

- The residual risk of impact is ranked low to high.
- An assessment has been made to determine if further information/studies are required to support or validate the consequence assessment.
- Performance standards are consistent with industry standards, legal and regulatory requirements.
- Performance standards are consistent with stakeholder expectations.
- The activity complies with Legal Requirements/Laws/Standards.
- The activity is in accordance with the TEO HSE Policy.
- The activity being conducted, including assessment of risks, is consistent with the principles of Ecological Sustainable Development (ESD).
- Performance standards are such that the impact or risk is considered to be ALARP.

5.3 Risk Assessment Workshops

A Risk analysis workshop was undertaken for all environmental aspects of project activities, consistent with the Australian and New Zealand Standards AS/NZS ISO 31000:2018 (Risk management – principles and guidelines) and the DMP Guidelines for the Development of Petroleum and Geothermal environment plans in Western Australia (November 2016). A risk assessment workshop was conducted on 8 April 2025 to review the proposed Risk Register and to confirm risk ranking and risk identification. The attendees included key senior representative from TEO and Environmental Resources Management (ERM).

6 Planned Activities: Environmental Risk Assessment, Performance Objectives, Standards and Measurement Criteria

This section describes the environmental impacts, mitigation measures, performance objectives, performance standards and measurement criteria developed by TEO to address the environmental impacts associated with planned project activities, in accordance with Regulation 14(4) of the Petroleum (Submerged Lands) (Environment) Regulations 2012.

The sub- sections below contain the following details:

- The planned activities identified that may pose a risk of environmental impact.
- Potential nature and scale of environmental impacts.
- Impact assessment summary (derived from an Environmental Risk Assessment / Identification workshop held on 12 February 2020).
- EPOs, EPSs and Measurement Criteria.
- Assessment of ALARP and acceptability to identify if further impact reduction measures are required.

6.1 Physical Presence: Interaction with Other Marine Users

Physical Presence: Interaction with Other Marine Users				
Aspects / Events	Interaction with other marine users from the physical presence of pipelines and IMR vessels within the Operational Area			
Receptors	Socio-economic (commercial and recreational fishing/boating)			
Inherent Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Presence of pipelines interacting with the activities of other marine users.	Potential inconvenience to fishing practices, or damage to fishing/vessel gear.	C	2	Medium (6)
Vessels conducting IMR activities.	Displacement of other marine users - loss of fishing area, potential inconvenience to fishing practices, or damage to fishing gear, minor navigational hazard to shipping.	C	2	Medium (6)
Aspect/event Details				
The presence of the pipelines may cause minor interference with the activities of other marine users (i.e. snagging of anchors or fishing gear). The presence of vessels during routine IMR activities (approximately every two years) could present a minor navigational hazard to commercial and recreational fishing activities.				
Impact Assessment				
Potential Impacts to Socio-economic Receptors				
No formal exclusion zone applies around the pipelines, and IMR vessels and fishing activities can occur in the Operational Area. The location of the pipelines is marked on nautical charts available from the Australian Hydrographic Office (AHO) with the general advice that vessels should not anchor or trawl in the vicinity of the pipeline. Given the coastal location of the Operational Area, commercial shipping is predominantly located in deeper waters to the west of pipeline. No commercial freight traffic is expected within the Operational Area, with vessel movements expected to consist of low levels of commercial fishers transiting the area and recreational boating. The Operational Area overlaps the management boundary of eight WA State managed fisheries (Section 4.13.1). Of these fisheries, only the West Coast Demersal Gillnet and Demersal Longline (Interim) Management Fishery, Octopus Interim Managed Fishery, West Coast Rock Lobster Managed Fishery, West Coast Demersal Scalefish (Interim) Managed Fishery, West Coast Deep Sea Crustacean Managed Fishery, and Open Access in the North Coast, Gascoyne Coast and West Coast Bioregions are considered to be active within the Operational Area. The pipelines have been in place for several years and fishers are aware of their presence through consultation and marking on nautical charts. It is therefore considered that the continued physical presence of the pipelines will not interfere with the activities of these fisheries, other than creating habitat for their target species. The Operational Area is located within an important rock lobster fishing ground. TEO has a memorandum of understanding (MOU) in place with the West Coast Rock Lobster Managed Fishery that agrees that traps can be placed along the Operational Area for rock lobster fishing. The pipelines have been designed to allow for lobster fishing activities to take place unaffected throughout the area traversed by the pipelines, except when workover, construction or maintenance operations are active.				

Physical Presence: Interaction with Other Marine Users

The MOU contains a number of requirements, those relevant are provided below with how TEO meets those requirements:

(1) The President of the association is provided sufficient time to allow them to advise members of the fishing area.

(2) Marine buoys will be deployed around the area where maintenance activities are being undertaken.

(3) TEO will use reasonable endeavours not to conduct significant maintenance activities on the pipelines during the “whites” season (mid-November to end December).

(4) TEO will endeavour to meet this commitment to fishers, although there may be times it is not possible such as due to weather delays, regulatory approvals or vessel availability. In the event of this occurring, consultation with fishers is undertaken ahead of the Activity to ascertain if there are any concerns.

Normal pipeline operations do not involve vessels or any on-the-water activities. However, vessels may be required to traverse the pipeline route infrequently (approximately every two years) for the purpose of IMR. In the unlikely event that any significant maintenance or repair work is required to the pipelines, a vessel may be moored on site and there is potential for another vessel to transit to and from the site to service the works. This may potentially cause minor and temporary disruption to other users such as commercial fishing, recreational fishing and boating as they avoid IMR vessels and moorings. The presence of temporary moorings during IMR activities may create fishing snags, during the short period (typically no greater than 25 days) the moorings are installed. All consultation with stakeholders is logged in the register along with any merits or objections. It is noted that no objections have been raised as a result of the most recent consultation. Due to the anticipated frequency of IMR and relatively small impact area, the potential displacement of commercial and recreational fishers in the Operational Area is considered to be negligible.

Mitigation Measures

Legislation, Codes and Standards

- IMR vessels to comply with Marine Orders 21 (Safety of navigation and emergency procedures), specifically:
  - adherence to minimum safe manning levels
  - emergency management plan to be on board vessels.
- IMR vessels to comply with Marine Order 27 (Radio equipment), specifically:
  - radio and navigational systems of IMR vessels are in accordance with Regulations 7 to 11, 19 and 20 of Safety of Life at Sea (SOLAS)
  - automatic identification system (AIS) provides other users with information about the vessel's identity, type, position, course, speed, navigational status and other safety-related data
  - maintenance of radio navigation equipment in efficient working order (compass/radar).
- IMR vessels to comply with Marine Order 30 (Prevention of collisions), specifically adherence to the requirements of the International Regulations for Preventing Collisions at Sea 1972 (COLREGS):
  - adherence to steering and sailing rules including maintaining lookouts (e.g. visual, hearing, radar), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar)
  - adherence to navigation light display requirements, including visibility, light position/shape appropriate to activity
  - adherence to navigation noise signals as required.

Industry Good Practice

- Pipeline is present on marine charts to reduce potential for third party interference.
- Temporary moorings to be clearly marked with high visibility floats to facilitate identification of mooring location by other users.
- Notification to be made to key stakeholders prior to commencing vessel-based IMR activities.

Demonstration of ALARP

In addition to the above mitigation measures / controls, the below mitigation / controls were also identified.

Mitigation	Benefit	Adopt	Justification

Physical Presence: Interaction with Other Marine Users			
Alternatives/Substitutes Considered			
No alternatives/substitutes identified.			
Additional Measures Considered			
Rock lobster fishers consulted to ensure they are aware of upcoming activities in the scope of the EP and MOU remains valid; limit IMR activities to avoid peak rock lobster fishing activities.	Consultation and limiting IMR activities to avoid peak rock lobster fishing activities will ensure rock lobster fishers are aware of activities and reduces the potential for interaction.	✓	Consultation will ensure the requirements within the MOU with rock lobster fishers are met.

ALARP Statement

The pipelines are required to remain available during the NPP phase to retain the ability to execute well integrity and control activities at ASP. The pipelines are also required to be maintained for complete removal during the C&M phase including the ability for flushing activities. It is considered that the control measures and industry standards in place reduce the potential impacts of the physical presence of the pipelines and IMR vessels to ALARP. The additional controls adopted through the ALARP evaluation further reduces the potential for impact of displacement to other marine users.

Residual Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Residual Risk
Presence of pipelines causing interference with the activities of other marine users.	Loss of fishing area, and a potential inconvenience to fishing practices, or damage to fishing gear.	C	1	Low (3)
Displacement of other marine users while IMR vessels are conducting activities.	Loss of fishing area, and a potential inconvenience to fishing practices, or damage to fishing gear, minor navigational hazard to shipping.	C	1	Low (3)

Measurement of Environmental Performance

Performance Objective:	Environmental Performance Standards	Measurement Criteria
Undertake IMR activities in a manner that will not interfere or displace other marine users to a greater extent than is necessary	IMR vessels maintain compliance with Marine Order 21 for the duration of the EP, specifically: • Vessels adhere to minimum safe manning levels. • emergency management plan is on board vessels.	TEO vessel audit or third party inspection document demonstrate that: • All IMR vessels have adhered to minimum safe manning levels. • The emergency management plan was on board all IMR vessels.

	IMR vessels maintain compliance with Marine Order 27 for the duration of the EP, specifically: • Radio and navigational systems of IMR vessels are in accordance with Regulations 7 to 11, 19 and 20 of SOLAS. • AIS is in place and functioning. • Radio navigation equipment is maintained in efficient working order (compass/radar).	TEO vessel audit or third party inspection document demonstrate that: • Radio and navigational systems of IMR vessels are in accordance with Regulations 7 to 11, 19 and 20 of SOLAS. • AIS was in place and functioning on all relevant IMR vessels. • Maintenance of radio navigation equipment completed.
	IMR vessels maintain compliance with Marine Order 30 for the duration of the EP, specifically: • Adherence to steering and sailing rules including maintaining lookouts (e.g. visual, hearing, radar), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar). • Adherence to navigation light display requirements, including visibility, light position/shape appropriate to activity • Adherence to navigation noise signals as required.	TEO vessel audit or third party inspection document demonstrate that: • All IMR vessels have adhered to steering and sailing rules including maintaining lookouts (e.g. visual, hearing, radar), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar). • All IMR vessels have adhered to navigation light display requirements, including visibility, light position/shape appropriate to activity • All IMR vessels have adhered to navigation noise signals as required.
	The pipeline route is provided on marine charts.	Marine charts verify pipeline route.
	Temporary moorings are clearly marked and visible to other marine users while deployed.	Documented inspection records during activity confirm that temporary moorings are marked in accordance with the Activity-specific Mooring Plan.
	Key stakeholders are notified prior to commencing vessel-based IMR activities.	Stakeholder notification records confirm key stakeholders were notified prior to commencing vessel-based IMR activities.

	In accordance with the rock lobster MOU, prior to any maintenance activities, TEO will: • Advise the President of the Dongara Professional Fishing Association (DPFA) in sufficient time. • Mark the area of use with temporary marine buoys. • Avoid the "whites" season (mid-November to end December) unless otherwise agreed with DPFA and rock lobster fishery through consultation prior to activity commencement. • Consider any additional requests that arise through ongoing consultation, and update MOU accordingly.	Consultation records with DPFA and rock lobster fishery maintained. Signed and valid MOU with DPFA in place.

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact ranked low to high?	Yes, residual risk is Low for: Presence of pipelines causing interference with the activities of other marine users. Displacement of other marine users while IMR vessels are conducting activities.
Is further information required in the consequence assessment?	No – potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy.
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the physical presence of the pipelines and associated IMR activities and respective assessment and management of risks has addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see demonstration of ALARP above.
Acceptability Statement	

The residual risk of displacing or interfering with the activities of other marine users is considered to be Low (3), which has been determined as acceptable, in accordance with the TEO acceptability criteria. Eliminating the impact would require stopping IMR activities and increase the risk of an unplanned hydrocarbon leak from the pipeline. IMR activities are also required to ensure the umbilical, cable and pipelines are in suitable condition for decommissioning and removal. Controls and performance standards applied to the impact are standard industry practice and and meet requirements of Australian Marine Orders and AMSA/AHS expectations. Additional controls were adopted through the ALARP evaluation that further reduce the potential for impacts of displacement to other marine users. Therefore, the impact from physical presence displacing or interfering with the activities of other marine users has been determined to be ALARP and acceptable.

6.2 Physical Presence: Benthic Disturbance

Physical Presence: Benthic Disturbance				
Aspects / Events	Disturbance to seabed by physical presence of activities and infrastructure e.g. ROV surveys, free span rectification, marine growth removal, or temporary mooring during IMR activities.			
Receptors	Water quality Benthic habitat and communities			
Inherent Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Visual / ROV surveys	Localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.	D	1	Medium (4)
Free span rectification	Localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.	D	1	Medium (4)
Marine growth removal	Localised disturbance to, or loss of, benthic habitat (both on the pipeline and seabed) and temporary reduction in water quality due to sediment resuspension.	D	1	Medium (4)
Temporary mooring during IMR activities	Localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.	D	1	Medium (4)
Vessel anchoring in an emergency situation	Localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.	D	1	Medium (4)

Aspect/event Details

Visual / ROV Surveys

Visual / ROV surveys will be undertaken approximately every two years to visually inspect the pipelines. When operating close to the seabed, water propulsion from the ROV thrusters may cause localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.

Free Span Rectification

Free span rectification works are undertaken by placing support below, around and above the pipelines to fill spans and provide stabilisation. Industry standard techniques include rock dumping or grout bagging. Free span rectification is undertaken on an as needed basis, typically less than once every five years. The installation of stabilisation materials may result in disturbance to, or loss of, benthic habitats and temporary reduction in water quality due to sediment resuspension.

Marine Growth Removal

Physical Presence: Benthic Disturbance

High pressure water jetting to remove marine growth on the exterior of the pipelines is carried out by ROV equipped with a water jet. Marine growth removal is undertaken on an as needed basis, typically less than once every 10 years. High pressure water jetting can result in very minor localised disturbance to, or loss of, benthic habitat (both on the pipeline and seabed) and temporary reduction in water quality due to sediment resuspension.

Temporary Moorings

The installation of temporary moorings may be undertaken to facilitate IMR activities. Temporary moorings may be installed prior to undertaking an IMR activity, and removed following completion of the Activity, which may result in disturbance to, or loss of, benthic habitats within the footprint of the mooring, and temporary reduction in water quality due to sediment resuspension.

Vessel Anchoring in an Emergency

In an emergency situation, anchoring might be required, which may result in disturbance to, or loss of, benthic habitats within the footprint of the anchor and temporary reduction in water quality due to sediment resuspension.

Impact Assessment

Potential Impacts to Water Quality and Benthic Habitat and Communities

Visual / ROV Surveys

The use of ROV may result in temporary seabed disturbance and suspension of sediment causing increased turbidity as a result of working close to, or occasionally on, the seabed. Visual inspection will typically be carried out by an observation or micro class ROV deployed from a vessel. Visual inspections may also be carried out by divers. The pipeline is then surveyed at a designated speed with all footage recorded. The footprint of an observation or micro class ROV is very small in size and weight and any benthic disturbance will be very minor. ROV use close to the seabed will be limited to that required to complete visual inspection activities.

Free Span Rectification

The Operational Area generally consists of unconsolidated sandy sediments and exposed limestone pavement, along with macroalgae and seagrass assemblages, which support a range of marine fauna (Section 4.4.1). These benthic habitats are well represented throughout the Operational Area and wider region. Installation of stabilisation material is expected to alter the benthic habitat where the material is installed, by providing hard substrate in the marine environment and acting as an artificial reef. This may provide habitat for species such as the western rock lobster, however, given the small, localised areas requiring installation of stabilisation materials the effects of this are considered to be negligible. The existing habitat in the footprint of areas to be stabilised will be eliminated, however, the footprint is small and highly localised (approximately 8 m^2 of seabed disturbed per linear meter of span). The installation of stabilisation material will not alter the structure or function of the coastal marine ecosystem, nor interrupt coastal processes such as sediment transport. As such, the impacts from the installation of stabilisation material are considered to be minor.

The installation of stabilisation materials may also result in a temporary reduction in water quality due to sediment resuspension. However, given the nature of sediments in the region (typically medium to coarse sand) and the highly localised disturbance footprint, resuspension is expected to be short lived and highly localised. As such, impacts from sediment resuspension are considered to be negligible.

Marine Growth Removal

High pressure water jetting to remove marine growth is carried out on the pipelines to reduce the force resulting from drag and maintain the structural integrity of the pipelines. High pressure water jetting is also used to remove insulation for pipeline inspection and to create temporary spans to facilitate inspection (e.g. using equipment that envelops the pipeline).

As described above, benthic habitat within the Operational Area generally consists of unconsolidated sandy sediments and exposed limestone pavement, along with macroalgae and seagrass assemblages, which support a range of marine fauna (Section 4.4.1). High pressure water jetting can result in very minor localised disturbance to, or loss of, benthic habitat. Such disturbance occurs when biota attached to a section of pipeline, or the seabed in the immediate vicinity of the pipeline, are removed by water jetting. Such removal affects a highly localised area (several metres) and is of short duration (water jetting typically

Physical Presence: Benthic Disturbance

occurs for several hours). The removal of marine growth includes sessile fauna such as ascidians and sponges, and macroalgae.

Water jetting may result in a localised, temporary decrease in water quality due to the resuspension of sediments, detritus and insulation material. Such decreases are localised to the immediate vicinity of water jetting operations and temporary in nature (i.e. occurs only while water jetting operations are undertaken), and impacts are considered to be negligible.

Temporary Moorings

Mooring installations typically consist of a series of three moorings (clump weights or stingray anchors) that allow the vessel to pull up on moorings to maintain position as required. The installation of temporary moorings may result in disturbance to, or loss of, benthic habitats within the footprint of the mooring (i.e. within the arc through which the mooring chain rotates). The size of the mooring is dependent on the load that it is required to hold, which is a function of vessel size and weather conditions. Given that IMR activities will require calm weather conditions, and the relatively small size of the planned IMR vessels, temporary moorings are expected to be relatively small in size (clump weights up to 1.5 m in diameter, <3 t in weight).

Where moorings are installed for long periods of time (up to 2 months for major works), the mooring footprint typically becomes bare sediment as the chain results in disturbance to benthic biota such as seagrasses and macroalgae. Where moorings are installed for short periods of time (e.g. 2-3 weeks) and then removed, the potential for disturbance to benthic habitats is considerably reduced. Recovery is also facilitated as habitat forming species (e.g. seagrass species) are still present and may regrow or recolonise the disturbed area. Given the short duration of IMR activities, the installation of temporary moorings is not expected to result in habitat loss beyond the footprint of the clump weight. Given the relatively small size and temporary nature of the mooring used to facilitate IMR activities, the impacts and risks to benthic habitats are considered to be relatively small and temporary in nature.

Vessel Anchoring in an Emergency

The typical anchor for support vessels (e.g. *Southern Spirit*) is a CQR/Plow style anchor weighing approximately 80 kg. If utilised in an emergency situation, the anchor will only be deployed for a short period and then removed, thereby reducing the potential disturbance to the seabed. Given the short duration, the temporary nature of emergency anchoring and relatively small size of the anchor, the event is not expected to result in habitat loss beyond the footprint of the anchor. Potential impacts and risks to benthic habitats are considered to be relatively small and temporary in nature.

Non-Routine Emergency Repairs and Replacements

Where inspections have indicated that repair or replacement of a section of cable or pipeline is in need, TEO will carry out such activities. TEO may utilise ROV and/or divers to undertake any required repairs or replacements of the cable or pipelines.

Pipeline repair will depend on the nature of the damage, however a single section of pipeline is likely to be 12 m in length. Works associated with the installation of the pipeline, including rock dumping will result in seabed disturbance and alteration to the benthic habitat where the pipeline is installed. Given the disturbance will be within the footprint of the replaced pipeline, impacts are expected to be minor and localised.

Mitigation Measures

Legislation, Codes and Standards

- Unexpected finds will be managed in accordance with an Unexpected Finds Protocol and reported to relevant authorities in accordance with the *Underwater Cultural Heritage Act 2018*.

Industry Good Practice

- IMR activities undertaken in accordance with Cliff Head Pipeline and Umbilical Integrity Management Plan.
- Use existing pipeline CP and TOFD inspection locations where possible to minimise need for additional marine growth removal and potential for seabed disturbance.
- Locations requiring pipeline stabilisation to be re-confirmed by ROV or diver visual surveillance prior to free span rectification or stabilisation activities so that works do not disturb areas where they are not required.

Physical Presence: Benthic Disturbance

- Lifting activities will be undertaken in accordance with Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24), which requires:
  - the security of loads to be checked prior to commencing lifts
  - loads to be covered if there is a risk of losing loose materials
  - all lifting equipment is rated for intended activities and maintained
- Personnel involved in lifting operations are competent as per requirements within the Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24).
- CHA crane, rigging and lifting connections (designed, constructed and installed to appropriate standards and codes) are inspected and maintained fit-for-purpose.
- Cliff Head Lift Plan (10HSEQGENPC24FM01) is implemented for all lifting operations detailing load ratings of lifting equipment, intended loads, operational limits (e.g. weather) and procedures.
- Temporary mooring locations to be installed in accordance with activity-specific Mooring Plan and where practicable, the substrate checked onsite for a suitable location (e.g. bare substrate), by either ROV or visual check from the sea surface.
- ROV footage from previous pipeline IMR activities will be reviewed to inform future work and avoid any identified sensitive seabed features.
- Temporary moorings to be recovered following completion of IMR activities. All moorings used during pipeline IMR activities to be temporary in nature. Moorings will be installed immediately prior to commencing IMR activities and recovered as soon as practicable, following completion (within two weeks).
- Marine operations undertaken as per Cliff Head Marine Operations Procedure (10OPGOPC04).
- No anchoring of vessels during routine operation except in case of emergency.
- Pipeline repairs and replacement undertaken in accordance with Cliff Head Offshore Pipeline Repair Plan.
- Pipeline repairs and replacement undertaken using ROV or diver visual surveillance.
- Activity notices are issued prior to all major seabed disturbance activities in accordance with the terms of the YPSHA

Demonstration of ALARP

In addition to the above mitigation measures / controls, the below mitigation / controls were also considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation Measures	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
Use divers instead of an ROV for survey inspections.	Eliminate benthic disturbance resulting from water propulsion from the ROV thrusters during scheduled surveys.	X	Surveys will be completed along the entire length of the pipelines; due to duration and depth, it is not feasible for a diver to complete the inspection.
No removal of marine growth.	Prevent benthic disturbance resulting water jetting activities.	X	Failure to remove marine growth introduces unacceptable risk to the safe operation of the pipelines. Removal of marine growth is considered necessary to reduce the drag the pipeline is subjected to in order to maintain the structural integrity of the pipelines, and to allow for routine inspection.

Physical Presence: Benthic Disturbance			
No pipeline stabilisation activities.	Prevent benthic disturbance resulting from stabilisation activities.	X	Failure to ensure the pipelines are stabilised introduces unacceptable risk to the safe operation of the pipelines. Pipeline stabilisation is considered critical in order to maintain the structural integrity of the pipelines.
Use of IMR vessels with dynamic positioning (DP) systems.	Prevent benthic disturbance resulting from temporary mooring activities.	X	The use of a vessel equipped with DP may eliminate the need to install moorings. However, the requirement for DP would significantly constrain vessel selection. DP systems generate high intensity broadband underwater noise, increasing the environmental risks and impacts associated with increased underwater noise. DP thrusters may also resuspend sediments in shallow areas, leading to a temporary, localised decrease in water quality. As such, the net environmental benefit when compared to the use of temporary moorings is negligible.
Additional Measures Considered			
No additional measures identified.			
ALARP Statement			
The pipelines are required to remain available during the NPP phase to retain the ability to execute well integrity and control activities at ASP. The pipelines are also required to be maintained for complete removal during the C&M phase including the ability for flushing activities. It is considered that the control measures and industry standards in place reduce the potential impacts of IMR activities resulting in benthic disturbance to ALARP. Additional control measures were considered but not adopted on the basis of not being practicable as described above.			
Residual Risk Analysis and Ranking			

Aspect / Event	Environmental Impact	Likelihood	Consequence	Inherent Risk
Visual / ROV surveys	Localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.	C	1	Low (3)
Free span rectification	Localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.	C	1	Low (3)
Marine growth removal	Localised disturbance to, or loss of, benthic habitat (both on the pipeline and seabed) and temporary reduction in water quality due to sediment resuspension.	C	1	Low (3)

Physical Presence: Benthic Disturbance				
Temporary mooring during IMR activities	Localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.	C	1	Low (3)
Vessel anchoring in an emergency situation	Localised disturbance to, or loss of, benthic habitat and temporary reduction in water quality due to sediment resuspension.	C	1	Low (3)

Measurement of Environmental Performance		
Performance Objective	**Environmental Performance Standards**	**Measurement Criteria**
Disturbance to benthic habitat from IMR activities is limited to that required to safely and adequately perform the Activity. No impact to underwater cultural heritage without a permit.	All IMR activities are performed to ensure adequate safety and environmental management in accordance with the Cliff Head Pipeline and Umbilical Integrity Management Plan, specifically: • The recommended inspection, maintenance and monitoring activities are identified and applied to ensure the integrity risk of the system is as ALARP and pipelines are in suitable condition for decommissioning and removal. • Maximum inspection intervals are met based on the risk levels identified. • Acceptance criteria when evaluating the results of the IMR activities are met.	Maintenance/inspection records demonstrate that: • The recommended inspection, maintenance and monitoring activities have been identified and applied to ensure the integrity risk of the system is as ALARP and pipelines are in suitable condition for decommissioning and removal. • Maximum inspection intervals have been met based on the risk levels identified. • Acceptance criteria when evaluating the results of the IMR activities have been met.
	Pipeline inspections utilise existing CP and TOFD inspection locations when used for establishment of corrosion loss trends (note that the safety and structural integrity of the pipeline is the prime consideration when undertaking inspections and maintenance).	Pipeline inspection documentation verifies the CP and TOFD inspection location status (i.e. whether previously cleared of insulation).
		Pipeline inspection documentation verifies the CP and TOFD inspection location status to confirm that IMR activities are restricted to Operational Area where benthic habitat type is known.
	Visual inspection (e.g. ROV survey) is conducted at locations requiring pipeline stabilisation prior to free span rectification or stabilisation activities.	Vendor report confirms visual inspection (e.g. ROV survey) of locations requiring pipeline stabilisation prior to free span rectification or stabilisation activities.
	Lifting activities are undertaken in accordance with Cliff Head Lifting Operations and Lifting	Permit to Work (PTW) and Job Safety Analysis (JSA) records demonstrate that the

Physical Presence: Benthic Disturbance		
	Equipment Procedure (10HSEQGENPC24), which requires: • The security of loads to be checked prior to commencing lifts. • Loads to be covered if there is a risk of losing loose materials. • All lifting equipment is rated for intended activities and maintained.	following requirements were followed: • The security of loads were checked prior to commencing lifts • Loads were covered if there is a risk of losing loose materials. • All lifting equipment was rated for intended activities and maintained.
	Personnel involved in lifting operations are competent as per requirements within the Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24). • Competency of equipment operators meets Australian legislative standards and all equipment operators hold a Certificate of Competency issued by a recognised State Authority or a National License issued in accordance with the National Standard NOHSC-1006-2001 - Lifting Competency Requirements. • Lifting Equipment Maintenance Personnel hold current Certificates of Competency and Licenses.	Training/certification records demonstrate all personnel involved in lifting operations have the appropriate training/certifications.
	CHA crane, rigging and lifting connections (designed, constructed and installed to appropriate standards and codes) are inspected and maintained fit-for-purpose.	Maintenance records verify CHA crane, rigging and lifting connections were inspected and are fit-for-purpose. Certification records are maintained for lifting equipment.
	Cliff Head Lift Plan (10HSEQGENPC24FM01) is implemented for all lifting operations detailing load ratings of lifting equipment, intended loads, operational limits (e.g. weather) and procedures.	Documented lifting plan verifies all lifting operations considered load ratings of lifting equipment, intended loads and operational limits (e.g. weather).
	All temporary moorings are installed within the Operational Area in accordance with the activity-specific Mooring Plan which specifies the coordinates, vessel bearing and angle for the mooring location.	Documented inspection records during activity confirm that temporary moorings were installed in accordance with the activity-specific Mooring Plan.
	ROV footage of any activities undertaken under the EP is reviewed to capture any relevant environmental data including: • Location of footage. • Habitat type in the area. • General notes on flora/fauna observed. This information is then used to inform future mooring locations to ensure locations of least environmental sensitivity are selected.	ROV report confirms a review of the ROV footage was undertaken and relevant environmental data was documented, including habitat type, location of ROV footage and flora/fauna observed. Environmental data from previous ROV reports are included in and used to inform future Mooring Plan.

Physical Presence: Benthic Disturbance		
	All temporary moorings are removed within two weeks following completion of maintenance activity.	Documented inspection records following IMR activities confirm temporary moorings were removed within two weeks.
	Vessel Master to monitor meteorological forecasts at least once daily as per operating conditions in Cliff Head Marine Operations Procedure (10OPGOPC04).	Vessel logs record timing and weather conditions/sea state for operations on a daily basis.
	No anchoring of vessels occurs other than in an emergency situation.	Vessel log records anchoring events.
	Recommended procedures for the repair of the pipeline are performed to ensure safety and environmental management in accordance with the Cliff Head Offshore Pipeline Repair Plan. As per the Plan, the following methodology will be applied depending on the scenario: • Subsea Clamp Strategy, or • Offshore Welding Strategy.	Commissioning inspections and/or close out reports demonstrate that the Cliff Head Offshore Pipeline Repair Plan was followed.
	Pipeline repairs and replacement are undertaken with ROV or diver visual surveillance.	Vendor report confirms that pipeline repairs and replacement were undertaken using ROV or diver visual surveillance.
	Activity notices are issued prior to all major seabed disturbance activities in accordance with the terms of the YPSHA	Records confirm Activity Notices were issued in accordance with the YPSHA.
	In the event of an unexpected find of suspected underwater cultural heritage, an Unexpected Finds Protocol is implemented and reports are made to relevant authorities in accordance with the *Underwater Cultural Heritage Act 2018*.	Records of suspected underwater cultural heritage reports to relevant authorities.

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact ranked low to high?	Yes, residual risk is Low for: • Visual / ROV surveys • Free span rectification • Marine growth removal • Temporary mooring during IMR activities • Vessel Anchoring in an Emergency
Is further information required in the consequence assessment?	No – potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.

Physical Presence: Benthic Disturbance	
Does the activity comply with Legal Requirements/Laws/Standards?	Yes.
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy.
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the IMR activities, inclusive of disturbance to benthic habitat, and the respective assessment and management of risks has addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.
Acceptability Statement	
The residual risk of benthic disturbance resulting from IMR activities is considered to be Low (3), which has been determined as acceptable, in accordance with the TEO acceptability criteria. Eliminating the impact would require stopping IMR activities and increase the risk of an unplanned hydrocarbon leak from the pipeline. IMR activities are also required to ensure the umbilical, cable and pipelines are in suitable condition for decommissioning and removal. Controls and performance standards applied to the impact are standard industry practice. Further opportunities to reduce the impacts have been investigated above and no additional controls were identified that could practicably further reduce impacts based on the cost or effort being disproportional to the environmental benefit. Therefore, the impact from benthic disturbance resulting from IMR activities has been determined to be ALARP and acceptable.	

6.3 Physical Presence: Routine Light Emissions

Routine Light Emissions				
Aspects / Events	Routine external light emissions on board the IMR vessels			
Receptors	Marine Fauna			
Inherent Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Routine external light emissions on board the IMR vessels	Change in fauna behaviour, disorientation of marine fauna	C	1	Low (3)

Aspect/event Details

Normal pipeline operations do not involve vessels or any on-the-water activities. However the inspection, maintenance and/or repair activities as described in Section 3 require IMR vessels which occur infrequently (approximately every two years). IMR vessels and associated maintenance equipment and machinery will have external lighting to facilitate navigation and safe operations at night. External light emissions from the IMR vessels are typically managed to maintain good night vision for crew members. Maintenance activities along the pipelines will predominately be performed during daylight hours, however vessels may mobilise and demobilise from the Operational Area during hours of darkness. Emergency repairs may be required on a 24-hour basis.

Lighting on the IMR vessels is used to allow safe operations during night hours, as well as to communicate the vessel's presence and activities to other marine users (i.e. navigation lights). Lighting is required for operations and cannot reasonably be eliminated.

The highest point on an IMR vessel which is routinely lit are the bridge lights, which are about 3 m above sea level. The distance to the horizon at which a vessel will be directly visible can be estimated using the formula of:

$$horizon\ distance = 3.57 \times \sqrt{Height}$$

Where 'horizon distance' is the distance to the horizon at sea level in kilometres and 'height' is the height above sea level of the light source in metres. Using this formula, the approximate distance at which the bridge lights will be visible at sea level are about 5 km from the vessel.

Impact Assessment

Potential Impacts to Marine Fauna

Light emissions can affect fauna in two main ways:

- Behaviour: Many organisms are adapted to natural levels of lighting and the natural changes associated with the day and night cycle as well as the night time phase of the moon. Artificial lighting has the potential to create a constant level of light at night that can override these natural levels and cycles.
- Orientation: Organisms such as marine turtles and birds may also use lighting from natural sources to orient themselves in a certain direction at night. In instances where an artificial light source is brighter than a natural source, the artificial light may act to override natural cues, leading to disorientation.

Fauna within the Operational Area are predominantly pelagic fish and zooplankton, with a low abundance of transient species such as marine turtles, whales, migratory sea birds and foraging seabirds transiting through the Operational Area. Relevant to the project location, birds are the most likely species to be impacted by artificial light.

Marine Mammals

Sea lions, humpback whales, southern right whales and pygmy blue whales are not expected to be impacted by above surface light emissions. Given the fauna expected to occur within the Operational Area, impacts from light emissions are considered to be extremely unlikely.

Routine Light Emissions

Marine Turtles

The Operational Area does not overlap with any marine turtle BIAs, there are no nesting beaches in proximity to the Operational Area and marine turtles are highly unlikely to be foraging in the vicinity of the Operational Area. However, it is acknowledged that marine turtles may transit the Operational Area in very low densities therefore artificial lighting may attract transient turtles at the individual level.

Birds

The Operational Area overlaps with foraging BIAs for the following birds: the Australian Fairy Tern, Wedge-tailed Shearwater, Caspian Tern and Pacific Gull, and Little Shearwater (Section 4.9). Foraging seabirds can spend extended time at sea and therefore may be susceptible to light attraction. The Operational Area may be occasionally visited by migratory and oceanic birds but does not contain any emergent land that could be used as roosting or nesting habitat and contains no known critical habitats. Migratory shorebirds may be present in or fly through the region between July and December and again between March and April as they complete migrations between Australia and offshore locations (DSEWPaC, 2012b). The risk associated with collision from seabirds attracted to the light is considered to be low, given the short duration of IMR activities and the lack of critical habitat for these species within the Operational Area.

Fish

Lighting from the presence of a vessel may result in the localised aggregation of fish below the vessel. These aggregations of fish are considered localised and temporary and any long term changes to fish species composition or abundance is considered highly unlikely.

Mitigation Measures

Legislation, Codes and Standards

No specific measures identified.

Industry Good Practice

External lighting of vessels operating at night will be minimised to that required for navigation, vessel safety and safety of deck operations, except in the case of an emergency.

Demonstration of ALARP

For operational lighting, the below mitigation / controls were considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
Use of lighting wavelengths that are less intrusive to marine fauna.	Would result in a slight reduction in light emissions. Little benefit given relatively low numbers of sensitive receptors such as marine turtles in Operational Area and surrounding waters.	X	Not practicable given the range of marine fauna that may be present, and the different wavelengths that may affect behaviours of different species. Would result in little benefit given low level of impacts expected.
Additional Measures Considered			
All maintenance activities will be carried out during daylight hours.	Would result in a slight reduction in light emissions. Little benefit given relatively low numbers of sensitive receptors such as marine turtles in Operational Area and surrounding waters.	X	Daylight operations considered to introduce unnecessary cost (i.e. 12 vs 24 hr ops.), 24 hr ops reduces the total timeframe of activities and therefore reduces the potential for displacement or interference with other marine users. Additional costs associated with longer term vessel hire, personnel day rates and equipment.

Routine Light Emissions			
Reduction of vessel lighting below levels required for navigation and vessel safety.	Would result in a slight reduction in light emissions. Little benefit given relatively low numbers of sensitive receptors such as marine turtles in Operational Area and surrounding waters.	X	No additional cost but introduces unacceptable safety risks to personnel and vessels and would not meet legislative requirements.

ALARP Statement

Artificial lighting is required for safe operations of marine vessels and cannot be eliminated. Artificial lighting may be required during vessel mobilisation or demobilisation, or during emergency pipeline repairs. IMR activities are expected to be short in duration.

It is considered that the industry standard controls to reduce routine light emissions that have been proposed reduce the potential impacts to ALARP. Alternative and additional controls were considered but not adopted as detailed.

On the basis of the environmental risk assessment outcomes, TEO considers the adopted controls appropriate to manage the impacts of routine light emissions. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.

Residual Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Residual Risk
External light emissions on board the IMR vessels	Change in fauna behaviour, disorientation of marine fauna	C	1	Low (3)

Measurement of Environmental Performance

Performance Objective	Environmental Performance Standards	Measurement Criteria
Activity lighting managed in accordance with navigational and safety requirements.	The requirement to keep external lighting to the minimum required for occupational and navigational safety is included in environmental induction materials for vessel-based personnel. All IMR vessels to maintain appropriate navigation aids (light shapes etc.) in accordance with Marine Orders 21 (Safety of navigation and emergency procedures) and 30 (Prevention of collisions).	Audit report confirms that environmental induction materials for vessel-based personnel include requirements to keep external lighting to the minimum for occupational and navigational safety. Audit reports confirm all IMR vessels maintain appropriate navigation aids.

Demonstration of Acceptability

Acceptability	Answer
Is the risk of impact ranked low to high?	Yes, residual risk is Low for: • Routine Light Emissions
Is further information required in the consequence assessment?	No – potential impacts and risks are well understood based on the information currently available.

Routine Light Emissions	
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the 'Routine light emissions' activities and their respective assessment and management of risks has addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.
Acceptability Statement	
IMR activities will result in short-term, highly localised impacts to fauna due to routine lighting emissions. The residual risk is Low (3), which is acceptable in accordance with the TEO acceptability criteria. The impacts of lighting emissions on the receiving environment have therefore been determined to be ALARP and acceptable.	

6.4 Physical Presence: Routine Acoustic Emissions

Routine Acoustic Emissions				
Aspects / Events	Generation of noise from IMR vessels, helicopters and machinery/equipment			
Receptors	Marine Fauna			
Inherent Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Generation of noise from IMR vessels, helicopters and machinery/equipment.	Avoidance or behavioural changes in marine fauna.	C	1	Low (3)

Aspect/event Details

During routine IMR activities on the pipelines, noise emissions may be generated by IMR vessels, helicopters and machinery/equipment. These noise emissions may exceed ambient noise levels which range from approximately 90 dB re 1 µPa under very calm, low wind conditions, to 120 dB re 1 µPa under windy conditions (McCauley, 2005).

IMR vessels will be contracted on an as needed basis and will be selected based on the activity that will be undertaken. The number of vessels conducting IMR activities is expected to consist of approximately one to two vessels on site at a given time. A project vessel will conduct an inspection along the pipeline every two years. Aerial surveys have typically been undertaken every three weeks (21 days) via a helicopter to inspect for hydrocarbons leaks on the waters' surface. The base-case is to maintain the current frequency of inspections and maintenance throughout NPP and C&M, however the frequency of activities are likely to be reduced.

IMR activities such as rock dumping or grout bagging, high pressure water jetting, abrasive marine growth removal and pipeline repair may generate underwater noise emissions, however these activities occur less frequently and are expected to be of a lower intensity than vessel related noise.

Vessel noise comprises a combination of continuous noise generated by engine and machinery noise, and modulated, broadband noise produced by propeller rotation and cavitations (Richardson et al., 1995; Jensen et al., 2009; Wales & Heitmeyer 2002; Hildebrand, 2009). Vessel noise emissions varies with the size, speed, and engine type and the Activity being undertaken. Noise levels for a range of vessels have been measured at 164-182 dB re µPa at 1 m (SPL) at dominant frequencies between 50 Hz and 7 kHz (Simmonds et al., 2004). Note that all IMR vessels are required to comply with EPBC Regulation 2000 – Part 8 Interacting with Cetaceans to reduce the likelihood of collisions with cetaceans. Implementing this control may incidentally reduce the noise generated by vessels in proximity to cetaceans as vessels will be travelling slower. Slower vessel speeds may reduce underwater noise from machinery noise (main engines) and propeller cavitation.

The main source of noise from a helicopter is the main rotor. Dominant tones from helicopters are generally below 500 Hz (Richardson et al., 1995). The penetration of noise into the ocean is dependent on the angle of the aircraft and its distance from the sea surface. Typically, noise does not transmit well from air into water due to impedance at the air-water interface. Sound pressure in the water directly below a helicopter is greatest at the surface but diminishes with depth. Noise levels from a Bell 212 helicopter flying at altitudes of 610 to 152 m respectively were measured at 101 – 109 dB re µPa at 3 m (SPL) (Richardson et al., 1995). This provides an indication of the low received level of noise that may be expected from a helicopter.

Impact Assessment

Potential Impacts to Marine Fauna

The marine fauna associated with the Operational Area will be predominately pelagic and demersal species of fish, with species such as cetaceans, pinnipeds, turtles and sharks transiting the area occasionally.

Elevated underwater noise can affect marine fauna, including cetaceans, fish, turtles, shark and rays in three main ways (Richardson et al., 1995; Simmonds et al., 2004):

- By causing direct physical effects on hearing or other organs (injury);
- By masking or interfering with other biologically important sounds (including vocal communication, echolocation, signals and sounds produced by predators or prey); and
- Through disturbance leading to behavioural changes or displacement from important areas.

Routine Acoustic Emissions

The thresholds that could result in behavioural responses for cetaceans is expected to be 120 dB re 1 µPa SPL for continuous noise sources, and 160 dB re 1 µPa SPL for impulsive noise sources. These thresholds are adopted by the National Oceanic and Atmospheric Administration (NOAA) and are consistent with the levels presented by Southall et al., (2007). Potential for injury to hearing would be expected to occur at 230 dB re 1 µPa (pk) (Southall et al., 2007). Typical noise levels generated by IMR vessels (and associated equipment) and helicopters will not exceed that level, so acoustic related injury to protected species is not anticipated.

Protected species that could potentially be impacted by underwater noise resulting in behavioural disturbance within the Operational Area primarily include cetaceans as well as pinnipeds, turtles and sharks. No known key aggregation areas (resting, breeding or feeding) for protected species are located within or immediately adjacent to the Operational Area; however, the following BIAs overlap with the Operational Area:

- Pygmy blue whale migration, distribution and foraging BIA. Seasonally present April to August (north bound migration) and October to December (south bound migration).
- Migration BIA for the southern right whale (late April to November).
- Migration BIA for the humpback whale (June to November).
- Foraging BIA for the Australian sea lion.

It is likely that there may be increased numbers of pygmy blue whales, southern right whales and humpback whales within the Operational Area during migratory periods, whilst Australian sea lions are likely to be present foraging year-round. However, even with the increased likelihood of interaction the potential impacts are not considered to be significant, given the noise levels associated with IMR activities. It is reasonable to expect that marine fauna may demonstrate avoidance or attraction behaviour to the noise generated. For example, when transiting through the area, pygmy blue whales may deviate slightly from their migration route, but will continue on their migration pathway. Potential impacts from predicted noise levels are not considered to be ecologically significant at a population level. Furthermore, vessel-based activities will only occur approximately every two years and will be of short duration (up to 2-3 weeks), therefore limiting the potential for impact.

Therefore, potential impacts from acoustic emissions are likely to be restricted to temporary avoidance behaviour to individuals transiting through the Operational Area and are therefore considered localised with no lasting effect.

Mitigation Measures

Legislation, Codes and Standards

- In accordance with Part 8 of EPBC Regulations (Vessels), all vessels must travel at less than 6 knots within the caution zone of a cetacean (150 m radius for dolphins, 300 m for whales) known to be in the area.
- Helicopters must comply with Part 8 of EPBC Regulations for interacting with cetaceans, unless taking off or landing because they are taking reasonable actions necessary to reduce safety risk to humans.

Industry Good Practice

- Machinery will be maintained in accordance with planned maintenance system.
- CHA Site induction completed by all personnel to ensure understanding of environmental reporting requirements and EPBC regulations.
- Existing pipeline inspection locations will be used for establishing corrosion loss trends, to minimise the requirement to undertake high pressure water jetting.

Demonstration of ALARP

For acoustic emissions, the below mitigation / controls were considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
No high pressure water jetting.	Would result in a slight reduction in acoustic emissions. Little benefit given relatively low numbers of sensitive receptors in Operational	X	Failure to remove marine growth introduces unacceptable risk to the safe operation of the pipeline. Removal of marine growth is considered necessary to reduce the drag the pipeline is subjected to in order to maintain the structural integrity of the

Routine Acoustic Emissions			
	Area and surrounding waters.		pipeline and to allow for routine inspection.
Additional Measures Considered			
Shut down zones for marine fauna.	Would result in a slight reduction in acoustic emissions. Little benefit given relatively low numbers of sensitive receptors in the Operational Area and surrounding waters.	X	It would result in downtime leading to longer activities increasing costs and increasing the presence of additional vessels and activity. Given the low level of noise and minimal impacts to fauna expected, benefits do not outweigh costs.
No vessel / helicopter operations within whale migration period.	Given migration periods occur across 9 months of each year, avoiding these periods for all species would severely limit the possible windows for IMR vessel activities.	X	Negligible benefit in terms of reduced risk to whales, given the low frequency of vessel and helicopter operations and low risk of acoustic emissions due to whale avoidance behaviour. The control would result in extended periods of time where no activities could occur and may lead to delays in work increasing project costs.

ALARP Statement

The potential consequence of routine acoustic emissions on receptors is discussed above. With the control measures in place, including compliance with industry standards and legislation, no significant impacts are expected. As such, noise emitted for the duration of the Activity is not expected to significantly impact on marine fauna within the receiving environment. It is considered that the control measures and industry standards in place reduce the potential impacts of IMR activities resulting in acoustic emissions to ALARP. Additional control measures were considered but not adopted on the basis as not being practicable as described above.

Residual Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Residual Risk
Generation of noise from IMR vessels, helicopters and machinery/equipment.	Avoidance or behavioural changes in marine fauna.	C	1	Low (3)

Measurement of Environmental Performance

Performance Objective	Environmental Performance Standards	Measurement Criteria
Procedures implemented to minimise potential harmful impacts to marine fauna from routine acoustic emissions	Vessels travel at less than 6 knots within the caution zone of a cetacean (150 m radius for dolphins, 300 m for whales) known to be in the area, in accordance with EPBC Regulations (Part 8).	TEO vessel audit or third party inspection document demonstrate that contractor procedures were reviewed to ensure compliance with EPBC regulations prior to mobilisation.
	Helicopters stay at least 1000 m away from a cetacean and do not hover over a cetacean, as per the EPBC Regulations (Part 8), unless taking off or landing.	TEO vessel audit or third party inspection document confirm contractors complied with the requirements of EPBC Regulations (Part 8). All incidences of non-compliance with EPBC Regulations 2000 - Part 8

Routine Acoustic Emissions		
		Division 8.1 (interacting with cetaceans) were recorded. Incident report in MyOSH and written notification as per reporting requirements.
	Vessels, helicopters, IMR equipment (e.g. ROVs) are maintained in accordance with vendor recommendations through auditable planned maintenance systems to ensure no unplanned noise.	Equipment maintenance records demonstrate vessels, helicopters, IMR equipment (e.g. ROVs) were maintained in accordance with vendor recommendations.
	CHA Site Induction (10HSEQGENPC03) carried out for all personnel which includes requirements of EPBC Regulations (Part 8).	Training records show all personnel travelling offshore have received a site Induction including environmental requirements of EPBC Regulations (Part 8).
	Pipeline inspections utilise existing inspection locations when used for establishment of corrosion loss trends (note that the safety and structural integrity of the pipeline is the prime consideration when undertaking inspections and maintenance).	Pipeline inspection documentation verifies the inspection location status (i.e. whether previously cleared of insulation).

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact ranked low to high?	Yes, residual risk is Low for: • Routine Acoustic Emissions.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes.
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy.
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the 'Routine acoustic emissions' activities and their respective assessment and management of risks has addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.

Acceptability Statement
The use of vessels and helicopters is unavoidable to ensure safe and efficient maintenance of the pipeline. Equipment maintenance will keep the vessel and equipment noise levels to within normal operating limits,

Routine Acoustic Emissions
which will also aid in reducing the likelihood of impacts to sensitive receptors. IMR activities are required to maintain the pipeline integrity and some activities will create underwater noise (e.g. water jetting). The residual risk is Low (3), which is acceptable in accordance with the TEO acceptability criteria. Controls and performance standards applied to the impact are standard industry practice and no additional controls were identified that could further reduce the impacts.

6.5 Routine Atmospheric Emissions

Routine Atmospheric Emissions				
Aspects / Events	Atmospheric emissions from the routine operation of internal combustion engines and incinerators on IMR vessels			
Receptors	Air quality			
Inherent Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Atmospheric emissions from the routine operation of internal combustion engines and incinerators on IMR vessels.	Local decline in air quality.	C	1	Low (3)

Aspect/event Details

Atmospheric emissions will be generated by the IMR vessels from internal combustion engines (including all equipment and generators) and incineration activities (including on-board incinerators) during project activities. Emissions will include sulfur dioxide (SO_2), nitrogen oxide (NOx), ozone-depleting substances, carbon dioxide (CO_2), particulates and volatile organic compounds (VOCs). The inspection, maintenance and/or repair activities undertaken from IMR vessels as described in Section 3 occur infrequently (approximately every two years).

Impact Assessment

Potential Impacts to Air Quality

Fuel combustion and incineration has the potential to result in a localised, temporary reduction in air quality. Potential impacts include a localised reduction in air quality, generation of dark smoke and contribution to greenhouse gas emissions. Given the infrequency of and, the short duration of IMR activities, atmospheric emissions are expected to be localised and temporary and would not contribute to global GHG emissions. In addition, the exposed offshore location of the Operational Area will lead to the rapid dispersion of the low volumes of atmospheric emissions. Therefore, potential impacts are expected to be minor, with no cumulative impacts when considered in the context of existing commercial shipping operations in the region.

Mitigation Measures

Legislation, Codes and Standards

Marine Order 97 (marine pollution prevention – air pollution), which details requirements for:

- International Air Pollution Prevention Certificate, required by vessel class
- use of low sulphur fuel when available
- Ship Energy Efficiency Management Plan, where required by vessel class
- Shipboard incinerators (if onboard) will possess an IMO-type approval certificate for each incinerator as per Marine Order 97.

Industry Good Practice

- Vessels, helicopters, IMR equipment (e.g. ROVs) are maintained in accordance with vendor recommendations through auditable planned maintenance systems to ensure efficient engine performance.

Demonstration of ALARP

In addition to the above mitigation measures / controls, the below mitigation / controls were also considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Routine Atmospheric Emissions			
Mitigation	**Benefit**	**Adopt**	**Justification**
Alternatives/Substitutes Considered			
Do not combust fuel.	Minor reduction in atmospheric emissions	X	This is not feasible given there are no vessels that do not use internal combustion engines.
Do not incinerate.	Minor reduction in atmospheric emissions	X	Storage of vessel-based is not feasible.
Additional Measures Considered			
No additional measures identified.			
ALARP Statement			
All vessels use internal combustion engines. IMR activities are expected to be infrequent and of short duration. It is considered that the industry standard controls to reduce atmospheric emissions that have been proposed reduce the potential impacts to ALARP. Alternative and additional controls were considered but not adopted as detailed. The proposed control measures are considered appropriate to manage the risk to ALARP.			

Residual Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Residual Risk**
Atmospheric emissions from the routine operation of internal combustion engines and incinerators on IMR vessels.	Local decline in air quality.	C	1	Low (3)

Measurement of Environmental Performance		
Performance Objective	**Environmental Performance Standards**	**Measurement Criteria**
Atmospheric emissions will be restricted to what is necessary to perform the Activity and meet legislative standards.	IMR vessels compliant with Marine Order 97 (marine pollution prevention – air pollution), specifically: • Current International Air Pollution Prevention Certificate, by vessel class. • Use of low sulphur fuel when available. • Ship Energy Efficiency Management Plan, where required by vessel class. • Shipboard incinerators (if onboard) possess an IMO type approval certificate for each incinerator as per Marine Order 97.	TEO vessel audit or third party inspection document demonstrate: • Current International Air Pollution Prevention Certificate, by vessel class. • Use of low sulphur fuel when available. • Ship Energy Efficiency Management Plan in place, where required by vessel class. • Shipboard incinerators (if onboard) possess an IMO type approval certificate for each incinerator as per Marine Order 97.
	Vessel marine assurance process conducted prior to contracting vessels, to ensure suitability and compliance with vessel combustion certification/ Marine Order requirements.	Evaluation records of marine assurance demonstrate contracted vessels were compliant with vessel combustion certification/ Marine Order requirements.
	Vessels, helicopters, IMR equipment (e.g. ROVs) are maintained in	Equipment maintenance records demonstrate vessels, helicopters,

Routine Atmospheric Emissions		
	accordance with vendor recommendations through auditable planned maintenance systems to ensure efficient engine performance.	IMR equipment (e.g. ROVs) were maintained in accordance with vendor recommendations.

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact ranked low to high?	Yes, residual risk is Low for • Routine atmospheric emissions
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the 'routine atmospheric emissions' activities involving marine vessel and equipment use and the respective assessment and management of risks has addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.

Acceptability Statement
IMR activities will result in short-term, highly localised impacts to air quality due to routine atmospheric emissions. The residual risk is Low (3), which is acceptable in accordance with the TEO acceptability criteria. The impacts of routine atmospheric emissions on the receiving environment have therefore been determined to be ALARP and acceptable.

6.6 Routine Discharges to the Marine Environment from IMR Vessels

Routine Discharges				
Aspects / Events	Routine discharges to the marine environment from IMR vessels			
Receptors	Water quality Marine Fauna			
Inherent Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Routine discharge of sewage, grey water and putrescible wastes to marine environment from IMR vessels	Local decline in water quality. Secondary impacts including: • toxicity to marine fauna • change in fauna behaviour	C	1	Low (3)
Routine discharge of deck and bilge water to marine environment from IMR vessels		C	1	Low (3)
Routine discharge of cooling water or brine to the marine environment from IMR vessels		C	1	Low (3)

Aspect/event Details

IMR vessels generate/discharge the following:

- Small volumes of treated sewage and putrescible wastes to the marine environment – The impact assessment is based on a maximum approximate discharge of 100 L of sewage/greywater, and approximately 1 – 2kg of food waste, per person per day.
- Routine/periodic discharge of relatively small volumes of bilge water – Bilge tanks receive fluids from many parts of a vessel. Bilge water can contain water, oil, detergents, solvents, chemicals, particles and other liquids, solids or chemicals.
- Variable water discharge from vessel decks directly overboard or via deck drainage systems – Water sources could include rainfall events and/or deck activities such as cleaning/wash-down of equipment/decks.
- Cooling water from machinery engines and brine water produced during the desalination process of reverse osmosis to produce potable water on board the IMR vessels.

The inspection, maintenance and/or repair activities undertaken from IMR vessels as described in Section 3 occur infrequently (approximately every two years).

Environmental risk relating to unplanned (accidental) disposal/discharge of waste is addressed in Section 7.3.

Impact Assessment

Potential Impacts to Water Quality and Marine Fauna

Sewage, Grey Water and Putrescible Waste

Sewage, grey water and putrescible waste discharge is routinely carried out as a standard practice during maritime activities and is permitted (and regulated) under the MARPOL Annexes IV (Prevention of pollution – sewage) and V (Prevention of pollution by garbage), as appropriate for vessel class. Under MARPOL Annexes IV, vessels will transit outside the 3 nm boundary (beyond State waters) to discharge.

Such wastes discharged to the marine environment may result in a localised, temporary reduction in water quality, namely increased turbidity and nutrient availability. Increased water column turbidity can temporarily inhibit photosynthesis by plankton and benthic primary producers by decreasing light availability in the surface

Routine Discharges

waters. Sewage and putrescible wastes can result in eutrophication in the surrounding waters resulting in changes to plankton in the immediate area.

Ingestion of sewage discharges by fish, cetaceans, marine turtles or foraging seabirds could result in bioaccumulation of contaminants. In general, dilution after discharge at sea is rapid with results showing 1 in 1000 dilution within 30 minutes (Costello and Read, 1994). Based on this, acute toxicity is unlikely to occur at ecologically significant or detectable levels at discharge sites.

Because of the small volumes generated and the well mixed surface waters in the defined area, no significant impacts from routine discharges of sewage, grey water and putrescible wastes from vessels are expected.

Deck and Bilge Water

The potential sources of oily water from vessels include bilge water and deck wash down water. Once discharged into the marine environment, oily water may result in a localised, temporary decrease in water quality and toxicity to marine organisms in the immediate vicinity of the discharge point. Oily water discharged from vessels will be treated to a concentration of <15 parts per million (ppm) or contained and not discharged to sea, the potential for impact is therefore low and would be further reduced due to the strong tidal movements experienced in the region. Dispersion and biodegradation of potentially contaminated oily water drainage is expected to be rapid and highly localised resulting in no long-term or adverse effects on water quality or marine ecology.

Cooling Water and Brine

Cooling water and brine water produced during the desalination process may alter water quality in the immediate area of discharge, by changing the water temperature and salinity, respectively. Dispersion of cooling water and brine is expected to be rapid and highly localised resulting in no long-term or adverse effects on water quality or marine ecology.

Due to the intermittent nature of these routine discharges, impacts to water quality and marine fauna within the Operational Area are expected to be localised with negligible environmental impacts.

Mitigation Measures

Legislation, Codes and Standards

- Marine Order 95 – marine pollution prevention—garbage (as appropriate to vessel class) which requires:
  - food waste comminuted or ground to particle size <25 mm must be discharged ≥3 nm from the nearest land whilst vessel is en route
  - food waste that is not comminuted or ground must be discharged ≥12 nm from the nearest land whilst vessel is en route
  - operations of the project vessel will be in accordance with Marine Notice 3/2017: Revised Garbage Discharge Regulations for Ship
  - garbage Record Book in place for IMR vessels.
- Marine Order 96 – marine pollution prevention—sewage (as appropriate to vessel class) which includes the following requirements:
  - a valid International Sewage Pollution Prevention Certificate, as required by vessel class
  - a sewage treatment plant approved by AMSA or an issuing body
  - a sewage comminuting and disinfecting system
  - a sewage holding tank sized appropriately to contain all generated waste (black and grey water)
  - discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land
  - discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land
  - discharge of sewage will occur at a moderate rate while support vessel is proceeding (> 4 knots).
- Where there is potential for loss of primary containment of oil and chemicals on the IMR vessels, deck drainage must be collected via a closed drainage system.
- Marine Order 91 – marine pollution prevention—oil (as relevant to vessel class) requirements, which includes mandatory measures for processing oily water prior to discharge:

Routine Discharges

- machinery space bilge/oily water shall have IMO-approved oil filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 ppm prior to discharge
- IMO-approved oil filtering equipment shall also have an alarm and an automatic stopping device or be capable of recirculating if OIW concentration exceeds 15 ppm
- a deck drainage system shall be capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination
- there shall be a waste oil storage tank available, to restrict oil discharges
- if machinery space bilge discharges cannot meet the oil content standard of <15 ppm without dilution or be treated by an IMO-approved oil/water separator, they will be contained on-board and disposed onshore
- valid International Oil Pollution Prevention Certificate.

Industry Good Practice

- Sewage system and oil filtering equipment will be maintained in accordance with planned maintenance system.

Demonstration of ALARP

In addition to the above mitigation measures / controls, the below mitigation / controls were also considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
Storage, transport and treatment/disposal onshore of sewage, greywater, putrescible and bilge wastes.	Limited benefit given current controls and intermittent nature of the Activity	X	Would present additional safety and hygiene hazards resulting from the storage, loading and transport of the waste material.
Additional Measures Considered			
No additional measures identified.			

ALARP Statement

All vessels undertake routine discharges in accordance with legislative requirements under Marine Orders 91, 95 and 96. IMR activities are expected to be infrequent and of short duration.

It is considered that the industry standard controls to reduce routine discharges that have been proposed reduce the potential impacts to ALARP. Alternative and additional controls were considered but not adopted as detailed. The proposed control measures are considered appropriate to manage the risk to ALARP.

Residual Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Residual Risk
Routine discharge of sewage, grey water and putrescible wastes to marine environment from IMR vessels.		C	1	Low (3)
Routine discharge of deck and bilge water to marine environment from IMR vessels.		C	1	Low (3)

Routine Discharges				
Routine discharge of cooling water or brine to the marine environment from IMR vessels.	Local decline in water quality. Secondary impacts including: • toxicity to marine fauna • change in fauna behaviour	C	1	Low (3)

Measurement of Environmental Performance		
Performance Objective	**Environmental Performance Standards**	**Measurement Criteria**
No impact to water quality greater than a consequence level of 1 from discharge of sewage, greywater, putrescible wastes, bilge and deck drainage to the marine environment during the Activity.	Food waste discharges from IMR vessels will comply with the following requirements of MARPOL Annex V and Marine Order 95 (as appropriate to vessel class): • Food waste comminuted or ground to particle size <25 mm must be discharged ≥3 nm from the nearest land whilst vessel is en route. • Food waste that is not comminuted or ground must be discharged ≥12 nm from the nearest land whilst vessel is en route. • Operations of the project vessel will be in accordance with Marine Notice 3/2017: Revised Garbage Discharge Regulations for Ship. • Garbage Record Book in place for IMR vessels.	TEO vessel audit or third party inspection document demonstrate compliant macerator on board all IMR vessels. Completed garbage record book (if applicable) showing dates and location of discharge.
	IMR vessels compliant with Marine Order 96 (as appropriate to vessel class), specifically: • A valid International Sewage Pollution Prevention Certificate, as required by vessel class. • A sewage treatment plant approved by AMSA or an issuing body. • A sewage comminuting and disinfecting system. • A sewage holding tank sized appropriately to contain all generated waste (black and grey water) • Discharge of sewage which is not comminuted or disinfected only occurs at a distance of more than 12 nm from the nearest land • Discharge of sewage which is comminuted or disinfected using	TEO vessel audit or third party inspection document demonstrate all IMR vessels have: • A valid International Sewage Pollution Prevention Certificate, as required by vessel class. • A sewage treatment plant approved by AMSA or an issuing body. • A sewage comminuting and disinfecting system. • A sewage holding tank sized appropriately to contain all generated waste (black and grey water). • Records demonstrating discharge of sewage which is not comminuted or disinfected only occurs at a distance of more than 12 nm from the nearest land.

Routine Discharges		
	a certified approved sewage treatment plant only occurs at a distance of more than 3 nm from the nearest land. • Discharge of sewage occurs at a moderate rate while support vessel is proceeding (> 4 knots).	• Records demonstrating sewage which is comminuted or disinfected using a certified approved sewage treatment plant is only discharged at a distance of more than 3 nm from the nearest land. • Records demonstrating discharge of sewage occurs at a moderate rate while support vessel is proceeding (> 4 knots).
	Any contaminated drainage is contained, treated and/or separated prior to discharge via a closed drainage system.	TEO vessel audit or third party inspection document demonstrate IMR vessels have a functioning deck drainage water management system.
	Discharge of machinery space bilge/oily water meets oil content standard of <15 ppm without dilution.	TEO vessel audit or third party inspection document demonstrate discharge of machinery space bilge/oily water met oil content standard of <15 ppm without dilution.
	Vessels and equipment (including sewage system and oil filtering equipment) are maintained in accordance with vendor recommendations through auditable planned maintenance systems to ensure discharges are able to meet requirements.	Equipment maintenance records demonstrate vessels and equipment (including sewage system and oil filtering equipment) were maintained in accordance with vendor recommendations.

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact ranked low to high?	Yes, residual risk is Low for • Routine discharges
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the ‘routine discharges’ activities involving marine vessel and equipment use and the respective assessment and management of risks has addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.

Routine Discharges
Acceptability Statement
IMR activities will result in short-term, highly localised impacts to water quality due to routine discharges. The impact assessment has determined that, given the adopted controls, routine discharges to the marine environment from IMR vessels are unlikely to result in a potential impact greater than localised impacts not significant to environmental receptors. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet legislative requirements under Marine Orders 91, 95 and 96. The residual risk is Low (3), which is acceptable in accordance with the TEO acceptability criteria. The impacts of routine discharges on the receiving environment have therefore been determined to be ALARP and acceptable.

7 Unplanned Events: Environmental Risk Assessment, Performance Objectives, Standards and Measurement Criteria

This section describes the environmental risks, mitigation measures, performance objectives, performance standards and measurement criteria developed by TEO to address the environmental risks associated with unplanned events, in accordance with Regulation 14(4) of the Petroleum (Submerged Lands) (Environment) Regulations 2012.

The sub- sections below contain the following details:

- The unplanned events identified that may pose a risk of environmental impact.
- Potential nature and scale of environmental risks.
- Risk assessment summary (derived from an Environmental Risk Assessment / Identification workshop held on 12 February 2020).
- Environmental Performance Objectives (EPO), Environmental Performance Standards (EPS) and Measurement Criteria.
- Assessment of ALARP and acceptability to identify if further risk reduction measures are required.

7.1.1 Accidental Hydrocarbon Release: Vessel Collision

Accidental Hydrocarbon Release: Vessel Collision				
Aspects / Events	Loss of hydrocarbons to marine environment due to a vessel collision (e.g. support vessels or other marine users)			
Receptors	Benthic Habitats and Communities Water and Air Quality Marine Fauna Socio-economic			
Inherent Impact and Risk Analysis and Ranking[6]				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Loss of hydrocarbons to marine environment due to a vessel collision (e.g. support vessels or other marine users)	Changes to the quality of: • water • air • benthic habitats. Secondary impacts including: • injury / mortality to fauna • change in fauna behaviour • changes to the functions, interests or activities of other users • change in aesthetic value.	C	4	High (12)
Aspect/event Detail				

Background

The temporary presence of IMR vessels in the Operational Area will result in a navigational hazard for commercial shipping, fishers and recreational boating within the immediate area (as discussed in Section 4.13). This navigational hazard could result in a third party vessel colliding with the IMR vessel which could release hydrocarbons. The potential hazards associated with the release of large volumes of MDO on to the sea surface within the Operational Area are a temporary and localised reduction in water quality and temporary toxicity effects to marine biota.

The worst credible scenario for loss of diesel would be an incident whereby all diesel located in the vessel's tanks was released into the marine environment, it is not expected that any vessel with a fuel capacity greater than 500 m^3 would be used for CHA operations. Vessels used for IMR type activities typically have vessel tank size of approximately <200 m^3. It is possible that a large pipelay or construction vessel, if required, may have a single tank volume of up to 500 m^3. Therefore, this has been assessed as the worst-case potential spill resulting from vessel collision. It is noted that a vessel of this size has only been used once in the history of the field when undertaking HWU workover activities and there are no plans for future use of vessels of this size, therefore assuring conservatism in the spill modelling and spill response assessment.

During the Non Production Phase, IMR activities will be undertaken intermittently (Section 3.7). The number of vessel movements will become less frequent therefore reducing the risk of vessel collision and potential diesel spill in the Operational Area during non-production compared to the Operations Phase.

[6] TEO's Risk Matrix is provided in Appendix A

Accidental Hydrocarbon Release: Vessel Collision

Credible Scenario

For a vessel collision to result in the worst-case scenario of a hydrocarbon spill potentially impacting an environmental receptor, several factors must align as follows:

- The identified causes of vessel interaction must result in a collision.
- The collision must have enough force to penetrate the vessel hull.
- The collision must be in the exact location of a fuel tank.
- The fuel tank must be full or contain fuel up to a level higher than the point of penetration.

The probability of the chain of events described above aligning, to result in a breach of fuel tanks resulting in a spill that could potentially affect the marine environment, is considered remote.

The environmental risk analysis and evaluation identified and assessed a range of potential scenarios that could result in a loss of vessel structural integrity, resulting in damage to fuel storage tank(s) and a loss of marine diesel to the marine environment. The scenarios considered damage to single and multiple fuel storage tanks in a project vessel and support vessel due to dropped objects and various combinations of vessel to vessel collisions.

A collision between the project vessel and a third party vessel was considered credible, although unlikely given the slow speeds of IMR vessels when travelling within the Operational Area. The maximum volume to be assumed in the assessment is therefore 500 m³ of MDO, which corresponds to rupture of the largest single tank inventory of a vessel previously used to support CHA operations.

Quantitative Hydrocarbon Risk Assessment

Modelling of a 500 m^3 surface release of MDO was conducted by RPS APASA in 2017 for the CHA Operations. The release location used for the spill modelling within the Operational Area is located approximately 10 km from the coastline at a depth of 12 m (Table 7-1). A vessel with a tank size of 500 m^3 would be unlikely to be operating in State waters that shallow. Therefore, basing the impact assessment for a vessel collision scenario on this modelling location is considered highly conservative.

The modelling assessed the extent of a MDO spill volume of 500 m³ starting in two seasons, i.e. summer months (October to April) and winter months (May to September) using an historic sample of wind and current data for the region.
A total of 100 replicate simulations were modelled using a three-dimensional hydrocarbon spill trajectory and weathering model (SIMAP) (RPS APASA, 2017).

Table 7-1: Vessel MDO Spill Scenario

Oil Type	Spill Volume (m^3)	Location	Release Depth	Spill Duration	Simulation Duration
Diesel	500	29° 27’ 00.4” S 114° 52’ 12.1” E	Surface	3 hours	13 days

Impact Assessment

Environment that May Be Affected

Surface Hydrocarbons: If this scenario occurred, a surface hydrocarbon slick would initially travel northwest of the release location, with the trajectory dependent on prevailing wind and current conditions at the time. If this spill scenario occurs in summer, the shoreline section around Dongara including the shallow water areas from 0 to 20m is estimated to have up to 90% probability of exposure by floating oil concentrations > 10 g/m^2 (as an aerial average). The minimum time for diesel to make contact with this section at these concentrations is forecasted to be 1 hr. The shoreline section around Leeman is forecasted to have 2% probability of contact at > 10 g/m^2, but after diesel had been on the water for over 17 hours; suggesting the diesel would be weathered by the time of potential shoreline contact.

A wider socio-cultural EMBA for surface hydrocarbons which includes the exposure value for visible surface hydrocarbons of 1 g/m^2 may extend up to approximately 60 km from the release site during cooler winter

Accidental Hydrocarbon Release: Vessel Collision

conditions or when conditions are relatively calm, but will generally not occur more than 20-30 km from the release site under summer conditions or if sea conditions are energetic.

Entrained Hydrocarbons: If this vessel collision scenario occurred, a plume of entrained hydrocarbons would tend northwest of the release location, with the trajectory dependent on prevailing current conditions at the time. The modelling indicated that entrained diesel would be distributed close to the water surface (< 3 m depth) with higher concentrations towards the surface, and subject to re-floating as patches.

The modelling indicates that locations exposed to entrained hydrocarbons at or above the exposure value of 100 ppb would occur within the buffer zone of the shoreline around Dongara, with 68% probability if this spill scenario occurred during summer and 36% probability if it occurred in the winter. There is a seasonal trend indicated in the likely transport of entrained plumes with a trend for transport to the north for a spill occurring in summer and increased likelihood of exposure to the south for a spill occurring in winter.

Dissolved Hydrocarbons: Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb exposure value have a very low probability of reaching the shoreline, with a 6% probability that concentrations > 50 ppb would occur within the buffer zone around Dongara. There is a less than 1% probability that any other coastal receptors would be reached in the event of a spill.

The analysis indicated the potential for integrated exposure to dissolved aromatic hydrocarbons at the most conservative exposure value (> 576 ppb.hr - equivalent to 6 ppb over 96 hrs) in the upper 10 m of the buffer zone around Dongara, but at low probability (2% probability for a spill occurring during either summer or winter). Exceedance events can be attributed to cases where entrained diesel was held up against a section of shoreline for durations of several hours. No exceedance is indicated for the neighbouring zones, indicating that dispersal and variations in the trajectory of any plumes that are generated would prevent integrated exposure exceeding exposure values.

Potential Impacts to Environmental Values

Potential Impacts to Water Quality

An accidental release of MDO has the potential to result in:

- change in water quality.

Water quality would be affected due to hydrocarbon contamination which is described in terms of the biological effect concentrations. It is likely water quality will be reduced within a localised area around the marine diesel spill, with contamination levels above background levels and/or national/international water quality standards. However, such impacts to water quality would be temporary and highly localised in nature due to the relatively small EMBA and the rapid dispersion of marine diesel. The potential impact is therefore considered low.

Potential Impacts to Air Quality

An accidental release of MDO has the potential to result in:

- change in air quality.

A worst-case vessel spill of MDO has the potential to result in a localised, temporary reduction in air quality, primarily associated with methane, volatile organic compound (VOC) vapours released from fresh surface hydrocarbons near the release site. Potential impacts are expected to be slight and temporary localised effect to ecosystems, species and/or habitats in the area.

There is potential for effects to air-breathing marine fauna and avifauna (as assessed above). There is also the potential for human health effects for workers in the immediate vicinity of atmospheric emissions. The ambient concentrations of methane and VOCs released from diffuse sources is difficult to accurately quantify, although their behaviour and fate is predictable in open offshore environments as it is dispersed rapidly by meteorological factors such as wind and temperature. Methane and VOC emissions from a hydrocarbon release in such environments are rapidly degraded in the atmosphere by reaction with photo-chemically-produced hydroxyl radicals.

In the unlikely occurrence of a worst-case vessel spill of MDO, given the temporary nature of any methane or VOC emissions (from either gas surfacing or weathering of liquid hydrocarbons); the predicted behaviour and fate of methane and VOCs in open offshore environments; and the significant distance from the Operational

Accidental Hydrocarbon Release: Vessel Collision

Area to the nearest sensitive air shed (town of Dongara about 16 km north), the potential impacts are expected to be minor and temporary.

Potential Impacts to Protected Areas

An accidental release of MDO has the potential to result in:

- change in water and air quality
- change in habitat
- injury / mortality to fauna
- change in fauna behaviour
- changes to the functions, interests or activities of other users
- change in aesthetic value.

The quantitative spill risk assessment results indicate that two State Marine Parks and Commonwealth Australian Marine Parks (AMPs) are located within the EMBA (Section 4.3.1) and may be affected by the released hydrocarbons in the unlikely event of a worst-case vessel spill of MDO.

There is a low chance surface hydrocarbon will enter the Jurien Bay State Park. Potential sensitivities that may be impacted by surface diesel include seabirds and marine mammals. There is a moderate chance entrained diesel will enter the Jurien AMP with small volumes of accumulated diesel predicted. Potential sensitivities that may be impacted by entrained oil include fish, marine mammals and sensitive habitats (e.g. coral, seagrass). Impacts on these receptors are discussed below.

There is also a low probability of surface, entrained and dissolved hydrocarbons entering the Abrolhos Islands' Fish Habitat Protection Area, with very small volumes expected to make contact. Hydrocarbons are not forecast to make contact with the islands within the Abrolhos AMP.

The fish habitat protection area has been established around the Abrolhos Islands and is located within the northern extend at which entrained and dissolved hydrocarbons may reach. Under the *Fish Resources Management Act 1994*, the definition of "fish" can include a range of organisms such as finfish, crustaceans, molluscs, corals, seagrasses and algae at all stages of their life cycles. Potential impacts to these receptors are discussed below.

Objectives in the management plans for AMPs within the EMBA require consideration of a number of physical, ecological, socio-economic and heritage values identified in these areas. Impact on the values of these State Marine Parks and AMPs are discussed in the relevant sections below for ecological and physical values and below for socio-economic and heritage values.

Additionally, such hydrocarbon contact may alter stakeholder understanding and/or perception of the protected marine environment, given these represent areas largely unaffected by anthropogenic influences and contain biological diverse environments.

Threatened Ecological Communities

An accidental release of MDO has the potential to result in:

- change in water and air quality
- change in habitat
- injury / mortality to fauna
- change in fauna behaviour
- change in aesthetic value.

Saltmarshes

The Subtropical and Temperate Coastal Saltmarsh TEC may be contacted by entrained diesel in the event of a 500 m^3 release of marine diesel. Surface hydrocarbons may coat saltmarsh flora reducing photosynthesis and can lead to toxic effects, both negatively impacting vegetation growth. Entrained hydrocarbons may be absorbed through the roots of saltmarsh flora which may cause defoliation through leaf damage. Impacts to this TEC are unlikely given the volumes potentially encountered and the natural protection offered by the shape of the coastline where this community is found.

Key Ecological Features

An accidental release of MDO has the potential to result in:

Accidental Hydrocarbon Release: Vessel Collision

- change in water and air quality
- change in habitat
- injury / mortality to fauna
- change in fauna behaviour.

KEFs potentially impacted by the hydrocarbon spill from a worst-case vessel spill of MDO are:

- Commonwealth marine environment within and adjacent to the west coast inshore lagoons
- Western Rock Lobster
- Commonwealth marine environment surrounding the Houtman Abrolhos Islands
- Ancient coastline at 90-120m depth.

The consequences of a hydrocarbon spill from a vessel spill are predicted to result in moderate impacts with values of the KEF areas affected. Potential impacts include: the contamination of sediments, impacts to benthic fauna/habitats, associated impacts to demersal fish populations, and reduced biodiversity as described in more detail below under the relevant subsections. Most of the KEFs within the EMBA have relatively broad-scale distributions and are unlikely to be significantly impacted in the event of an unplanned vessel spill.

Potential Impacts to Benthic Habitats and Communities

An accidental release of MDO has the potential to result in:

- change in habitat
- injury / mortality to fauna
- change in aesthetic value.

Seagrass Habitats

Seagrasses occur in varying density throughout the region, with two identifiably distinct habitat types (Section 4.4.1.3). Seagrass habitat is found within the Operational Area, in areas around the Abrolhos Islands and the nearshore areas of the WA coast, within the wider EMBA. A chain of inshore lagoons extends along the Western Australian coast from south of Mandurah to Kalbarri, these fall within the west coast inshore lagoons KEF which is dominated by seagrass and epiphytic algae and provides habitat and food for many marine species (directly and indirectly). The extensive beds of macroalgae (principally Ecklonia spp.) extend to a depth of 30 m.

Seagrass and macroalgal beds may be susceptible to impacts from entrained hydrocarbons. Toxicity effects can also occur due to absorption of soluble fractions of hydrocarbons into tissues (Runcie et al., 2010). The potential for toxicity effects of entrained hydrocarbons may be reduced by weathering processes that should serve to lower the content of soluble aromatic components before contact occurs. Exposure to entrained/dissolved aromatic hydrocarbons may result in mortality, depending on actual entrained aromatic hydrocarbon concentration received and duration of exposure. Physical contact with entrained hydrocarbon droplets could cause sub-lethal stress, causing reduced growth rates and a reduction in tolerance to other stress factors (Zieman et al., 1984). Impacts on seagrass and macroalgal communities are likely to occur in areas where hydrocarbon exposure values are exceeded.

Surface or stranded diesel can have lethal or sub-lethal effects on seagrasses and macroalgae potentially leading to a reduction in productivity, with the shoreline section around Dongara estimated to have up to 90% probability of exposure by surface oil concentrations > 10 g/m^2 (as an aerial average). These impacts, if combined, could result in detrimental effects on the overall ecological community.

Rocky shore, intertidal reefs

There are a number of islands, reefs and shoals distributed broadly throughout the EMBA (Section 4.4.1). Shallow subtidal reefs are also broadly distributed throughout the inner continental shelf waters throughout the region, providing hard substrate for benthic assemblages. The Abrolhos shoals are submerged shoals to the east of the emergent Abrolhos Islands. There is a very low probability (3%) that entrained oil > 100 ppb of will reach the shoals after approximately 99 hours.

Potential biological impacts from entrained hydrocarbons could include sub-lethal stress and in some instances total or partial mortality of sensitive benthic organisms such as corals and the early life stages of resident fish and invertebrate species.

Impacts to plankton communities from exposure to entrained hydrocarbons above exposure values may result in short-term changes in plankton community composition but recovery would occur. Hydrocarbon

Accidental Hydrocarbon Release: Vessel Collision

contact during the spawning seasons for resident shoal community benthos and fish (meroplankton), particularly exposure to in-water toxicity effects to biota, may result in the loss of a discrete cohort population but would not affect the longer term viability of resident populations. Therefore, any impacts to resident shoal community benthos and fish (meroplankton) are likely to be localised at the shoals and temporary.

Exposure to dissolved (aromatic) hydrocarbons (≥50 ppb) are not predicted at the Abrolhos shoals.

Intertidal Habitats and Communities

A number of sandy beaches are found along the WA coast within the EMBA. The coastline between Geraldton and Leeman (within the EMBA) is almost entirely made up of sandy beaches. Sandy beaches provide habitat for a variety of burrowing invertebrates and subsequently provide foraging grounds for shorebirds.

There is the potential for some diesel to be temporarily stranded on the sandy shores and beaches as the tide ebbs, with accumulation of hydrocarbons above the 100 g/m^2 impact exposure value predicted at the shoreline locations of Dongara and Leeman. No surface diesel > 10g/m^2 or shoreline accumulation above the 100 g/m^2 impact exposure value are predicted to reach the beaches of Geraldton. Impacts of stranded diesel include lethal and sub-lethal effects on associated fauna and flora from potential toxic and physical (smothering) effects.

Intertidal habitats are found intermittently along the WA coast and within the EMBA but are well represented in the region. There are small groups of islands that that fall within the EMBA that support intertidal reefs, such as the Beagle, Lipfert and Milligan islands.

Surface diesel may impact on emergent features, impacts can include impaired feeding, fertilisation, larval settlement and metamorphosis, larval and tissue death and decreased growth rates of rocky shore fauna.

Reef communities may be exposed to entrained and dissolved hydrocarbons (at or above 100 ppb and 50 ppb respectively), depending on the trajectory of the spill. Exposure may induce toxicity effects, particularly for reproductive and juvenile stages of invertebrate and fish species. Exposure to entrained and dissolved hydrocarbons above exposure values has the potential to result in lethal or sub lethal toxic effects to corals and other sensitive sessile benthos within the upper water column.

While a hydrocarbon spill has the potential for impacts to coral reefs, with medium to long-term effects possible (recovery >10 years), the extent of impacts will depend on exposure concentration, duration and degree of weathering of hydrocarbons. Furthermore, the spill modelling presented above predicts a low likelihood of contact, particularly with dissolved hydrocarbons.

Planktonic Communities

Planktonic communities within the EMBA and Operational Area will include zooplankton, fish eggs and larvae, and potentially coral spawn and larvae. Spatially, the EMBA has the potential to overlap with spawning aggregations of some fishes. Given the year-round spawning of some species, the Activity has the potential to overlap spawning periods for some fish species.

The lagoons associated with the KEF are important areas for the recruitment of commercially and recreationally important fishery species.

There is potential for localised mortality of plankton due to reduced water quality and toxicity from entrained hydrocarbons. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest.

In the unlikely event of a spill occurring, fish and coral eggs and larvae may be impacted by hydrocarbons entrained in the water column. However, following release, the marine diesel will rapidly evaporate and disperse in the offshore environment, reducing the concentration and toxicity of the spill. Given the quick evaporation and dispersion of marine diesel, impacts to fish eggs and larvae are not expected to be significant.

Any planktonic communities impacted by entrained hydrocarbons are expected to recover quickly (weeks/months) due to fast population turnover (ITOPF, 2011), and high rates of natural mortality. Given the relatively small EMBA and the fast population turnover of open water planktonic populations it is considered that any potential impacts will be low and temporary in nature.

Potential Impacts to Marine Fauna

Accidental Hydrocarbon Release: Vessel Collision

Protected Species

An accidental release of MDO has the potential to result in:

- injury / mortality to fauna
- change in fauna behaviour

Marine mammals

Marine mammals that have direct physical contact with surface slicks and entrained hydrocarbons may suffer surface fouling or ingestion of hydrocarbons and inhalation of toxic vapours. This may result in the irritation of sensitive membranes such as the eyes, mouth, digestive and respiratory tracts and organs, impairment of the immune system or neurological damage (Etkins, 1997). For example, fouling of baleen whales (e.g. humpback whales) may disrupt feeding by decreasing the ability to intake prey. If prey (fish and plankton) is also contaminated, this can result in the absorption of toxic components of the hydrocarbons (polycyclic aromatic hydrocarbons - PAHs). Toothed whales (including dolphins), are 'gulp-feeders' targeting specific prey at depth in the water column away from any potential surface slick and are likely to be less susceptible to the ingestion of hydrocarbons. Furthermore, given cetaceans are smooth skinned and hydrocarbons would not tend to adhere to body surfaces, the likely biological consequences of physical contact with surface hydrocarbons is likely to be in the form of irritation and sub-lethal stress.

Impacts to cetaceans will depend on the exposure pathway; with exposure to entrained oil and surface slicks not expected to result in significant impacts due to the relatively volatile, non-persistent nature of the hydrocarbons. Direct toxic effects from external exposure are not expected to occur, although mucous membranes and eyes may become irritated. Indirect toxic effects, such as hydrocarbon ingestion through accumulation in prey, may occur. Baleen whales feeding within entrained hydrocarbon plumes may ingest hydrocarbons, potentially resulting in toxic effects (particularly fresh hydrocarbons near the release location). This is expected to be limited in migrating baleen whales, such as pygmy blue and humpback whales, which are known to primarily feed in the Southern Ocean (although may opportunistically feed during migrations).

A number of cetaceans were identified as potentially occurring within the Operational Area and the EMBA (Section 4.7). No critical habitats for cetaceans were identified within or adjacent to the Operational Area. In the event of a vessel spill of MDO, surface, entrained and dissolved hydrocarbons exceeding exposure values may drift across habitat for oceanic cetaceans considered to be Matters of National Environmental Significance (MNES), including the humpback whale BIA (northbound and southbound migrations), southern right whale migration BIA, pygmy blue whale migration BIA, and a pygmy blue whale foraging BIA. These BIAs are described in detail below.

The southern extent of the EMBA overlaps with a foraging area for the pygmy blue whale, which extends across the outer continental shelf from Cape Naturaliste to south of Jurien Bay. This BIA is linked to the whale's migration route and is thought to provide foraging opportunities during the migration period, which peaks from March–May (McCauley et al., 2004; Thums et al., 2025). The pygmy blue whale migration BIA extends from Augusta to the Timor Sea and overlaps with the western portion of the EMBA. The timing of the pygmy blue whale migration is well defined, during the northern migration whales enter the Perth Canyon from January to May and pass Exmouth from April to August, before continuing north to Indonesia (McCauley and Jenner, 2010).

During the southern migration, whales follow the WA coastline from October to late December. Pygmy blue whales may be present in the EMBA as transitory individuals or small groups, particularly during their northern and southern migration along the WA coast.

The humpback whale migration BIA overlaps the Operational Area and the wider EMBA. Feeding during migrations for this species is low level and opportunistic, reducing the potential for ingestion of hydrocarbons. Sub-lethal impacts from external exposure are therefore more likely. Migrations of humpback whales are protracted through time and space (i.e. the whole population will not be within the EMBA), and as such, a worst-case vessel spill of MDO is unlikely to affect an entire population.

Cetacean populations that are resident within the potential EMBA may be susceptible to impacts from spilled hydrocarbons if they interact with an area affected by a spill. Impacts from physical contact with hydrocarbons are likely to be in the form of irritation and sub-lethal biological effects (e.g. skin irritation, reproductive failure) and in rare circumstances, death. Surfacing within a hydrocarbon slick may lead to a toxic level of exposure. However, cetaceans have a thickened epidermis that greatly reduces the likelihood of hydrocarbon toxicity from skin contact with oiled waters (Geraci, 1990; O'Shea and Aguilar, 2001). Suitable habitat for oceanic toothed whales (e.g. sperm whales) and dolphins is broadly distributed throughout the region and as such, impacts from the spatial extent of a single spill trajectory (as opposed to the full EMBA) are unlikely to affect an entire

Accidental Hydrocarbon Release: Vessel Collision

population. Other species identified in (Section 4.7 may also have possible transient interactions with the EMBA (refer Section 4.7 for the list of receptor locations important for cetaceans). Physical contact with hydrocarbons to these species may result in biological consequences. However, it is noted that spilled hydrocarbon is expected to weather quickly beyond the release location, thereby reducing the potential for impact with increasing distance.

Cetaceans appear to not exhibit avoidance behaviours. Evidence suggests that many cetacean species are unlikely to detect and avoid spilled oil (Harvey and Dahlheim, 1994; Matkin, et al. 2008). There are numerous examples where cetaceans have appeared to incidentally encounter oil and/or not demonstrated any obvious avoidance behaviour; e.g. following the Exxon oil spill, Matkin et al., (2008) reported killer whales in slicks of oil as early as 24 hours after the spill.

Australian sea lions are regularly observed feeding around the larger reefs in the area, the nearest breeding grounds are on the Beagle Islands, which fall within the EMBA. Sea lion foraging BIA's within the EMBA include the waters surrounding the Abrolhos Islands and along the coastline extending south from Geraldton. Australian sea lions are also known to pup along the WA coastline (Section 4.7). While sea lions breed asynchronously (i.e. with no peak in breeding activity) they are present year round and could be impacted by a spill.

Should pinnipeds come into contact with diesel, the diesel may stick to the fur and be ingested during grooming, incurring the associated toxicological effects. The fur may also become smothered leading to reduced waterproofing and hypothermia. Sea lions come ashore to pup, raise their offspring and rest. The nearest breeding and haul out BIA's within the EMBA are on the Beagle Islands and within the Abrolhos Islands. Sea lions may encounter stranded diesel as they haul out. Pups in particular are quite immobile, being restricted to breeding grounds until weaning and may therefore be more susceptible.

It is acknowledged that the humpback whale and Australian sea lion are culturally significant species to First Nations people as they follow ancient songlines and hold totemic value (Section 4.14).

Based on the assessment above, a worst-case vessel spill of MDO could disrupt a number of pygmy blue whales, humpback whales, southern right whales, Australian sea lions or other marine mammals. Such disruption may include behavioural impacts (e.g. avoidance of impacted areas), sub-lethal biological effects (e.g. skin irritation, irritation from ingestion or inhalation, reproductive failure) and, in rare circumstances, death. Given that impacts are expected to be largely sub-lethal, such disruptions or impacts are not predicted to impact on the overall population viability of marine mammals within offshore waters of the EMBA.

Marine Reptiles

Four species of protected marine turtles were identified as potentially occurring within the Operational Area and wider EMBA. However, no turtle nesting, breeding, or other BIAs are located within the vicinity of the Operational Area or EMBA. Accordingly, although marine turtles may occur it is unlikely that they will be present in significant numbers.

Like cetaceans, adult turtles exhibit no avoidance behaviour when they encounter hydrocarbon slicks (NOAA, 2010).

Contact with surface slicks, or entrained hydrocarbon, can therefore result in hydrocarbon adherence to body surfaces (Gagnon and Rawson, 2010) irritating mucous membranes in the nose, throat and eyes leading to inflammation and infection (NOAA, 2010). Oiling can result in ingestion of hydrocarbons; indicators of polycyclic aromatic hydrocarbons (PAH) were higher in tissues, stomach content, colon content and faeces of visibly oiled turtles compared to non-visibly oiled turtles (Ylitalo et al., 2017). A stress response associated with this exposure pathway includes an increase in the production of white blood cells, and even a short exposure to hydrocarbons may affect the functioning of their salt gland (Lutcavage et al., 1995). Oiling can result in mortality depending on the extent of oiling and the size of the marine turtle (DWH Natural Resource Damage Assessment Trustees, 2016).

Hydrocarbons in surface waters may also impact turtles when they surface to breathe and inhale toxic vapours. Their breathing pattern, involving large 'tidal' volumes and rapid inhalation before diving, results in direct exposure to petroleum vapours which are the most toxic component of the hydrocarbon spill (Milton and Lutz, 2003). This can lead to lung damage and congestion, interstitial emphysema, inhalant pneumonia and neurological impairment (NOAA, 2010). Contact with entrained hydrocarbons can result in hydrocarbon adhering to body surfaces (Gagnon and Rawson, 2010), irritating mucous membranes in the nose, throat and eyes leading to inflammation and infection (Gagnon and Rawson, 2010).

The EMBA does not overlap with any marine turtle BIA. Due to the absence of potential critical habitats or aggregation areas (feeding, breeding, resting), the Operational Area and EMBA are unlikely to represent

Accidental Hydrocarbon Release: Vessel Collision

important habitat for marine turtles. However, very low numbers of transient individuals could be encountered in the wider EMBA on occasion.

In the event of a worst case vessel spill of MDO, there is a potential that surface and entrained hydrocarbons exceeding impact exposure values (10 g/m^2 and 100 ppb respectively) will be present in offshore waters; however it is not expected to form surface slicks in areas where turtles are likely to occur in high densities (e.g. near nesting areas, foraging habitat). Inhalation of harmful concentrations of hydrocarbon vapour by turtles is therefore expected to be limited. Furthermore, toxicity of hydrocarbons will be significantly reduced by weathering over such distances, with the volatile and water soluble (often the most toxic) components expected to have dissipated beyond the vicinity of the spill site. Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb exposure value are also predicted to be limited to the immediate vicinity of the spill site.

A hydrocarbon spill has the potential to result in sub-lethal and lethal impacts to turtles in offshore waters over a wide area in the unlikely event of a worst-case vessel spill of MDO. However, based on the assessment above and given the volatile and non-persistent nature of the hydrocarbons, the extent of impacts is not expected to result in a threat to the overall viability of marine turtle populations in the broader region.

Marine Birds

Offshore waters are potential foraging grounds for seabirds associated with coastal roosting and nesting habitat. The EMBA overlaps with foraging BIAs for the following seabirds and or migratory species:

- Caspian Tern
- Fairy Tern
- Little Shearwater
- Pacific Gull
- Wedge-tailed Shearwater
- Bridled Tern
- Roseate Tern
- Australian Lesser Noddy
- Common Noddy
- Soft-plumaged Petrel
- Sooty Tern
- White-faced Storm-petrel

A number of other bird species are identified as potentially occurring in the EMBA (Section 4.9).

Seabirds generally do not exhibit avoidance behaviour to floating hydrocarbons. Physical contact of seabirds with surface slicks is by several exposure pathways, primarily immersion, ingestion and inhalation. Such contact with hydrocarbons may result in plumage fouling and hypothermia (loss of thermoregulation), decreased buoyancy and potential to drown, inability to fly or feed, anaemia, pneumonia and irritation of eyes, skin, nasal cavities and mouths (AMSA, 2013; International Petroleum Industry Environmental Conservation Association (IPIECA), 2004) and result in mortality due to oiling of feathers or the ingestion of hydrocarbons. Longer-term exposure effects that may potentially impact seabird populations include a loss of reproductive success (loss of breeding adults) and malformation of eggs or chicks (AMSA, 2013).

The extent of the EMBA for surface hydrocarbon concentration of >10 g/m^2, as a result of a worst-case vessel spill of MDO, is simulated by stochastic modelling to extend approximately 100 km from the release location (at 1% probability and above). Therefore, a hydrocarbon spill is unlikely to disrupt a significant portion of the foraging habitat for seabirds.

Sharks, Fishes and Rays

Hydrocarbon contact may affect whale sharks through ingestion (entrained/dissolved hydrocarbons), particularly if feeding. The EMBA does not overlap with the whale shark migration BIA however individuals may transit through on occasion. Individual whale sharks that have direct contact with hydrocarbons within the spill-affected area may therefore be impacted.

Impacts to protected sharks and rays (including giant manta rays) may occur through direct contact with hydrocarbons and contaminate the tissues and internal organs, either through direct contact or via the food chain (consumption of prey). As gill breathing organisms, sharks and rays may be vulnerable to toxic effects of dissolved hydrocarbons (entering the body via the gills) and entrained hydrocarbons (coating of the gills, inhibiting gas exchange). The potential impacts are expected to vary depending on the weathered state of the hydrocarbon. White shark foraging BIAs have been identified in waters adjacent to pinniped colonies

Accidental Hydrocarbon Release: Vessel Collision

throughout the South-west Marine Region. Within the EMBA, this includes foraging BIAs around the Abrolhos Islands, Beagle Island, Fisherman Islands and Buller Island.

In the offshore environment, it is probable that pelagic shark species are able to detect and avoid surface waters underneath hydrocarbon spills by swimming into deeper water or away from the affected areas. Therefore, any impact on sharks and rays is predicted to be minor and localised.

Potential Impacts to Other Species of Marine Fauna

An accidental release of MDO has the potential to result in:

- injury / mortality to fauna
- change in fauna behaviour.

Sharks, Fishes and Rays

Fish mortalities are rarely observed to occur as a result of hydrocarbon spills (ITOPF, 2011). This has generally been attributed to the possibility that pelagic fish are able to detect and avoid surface waters underneath hydrocarbon spills by swimming into deeper water or away from the affected areas. Fish that have been exposed to dissolved aromatic hydrocarbons are capable of eliminating the toxicants once placed in clean water, hence individuals exposed to a spill are likely to recover (King et al., 1996).

Where fish mortalities have been recorded, the spills (resulting from the groundings of the tankers Amoco Cadiz in 1978 and the Florida in 1969) have occurred in sheltered bays.

Laboratory studies have shown that adult fish are able to detect hydrocarbons in water at very low concentrations, and large numbers of dead fish have rarely been reported after oil spills (Hjermann et al., 2007). This suggests that juvenile and adult fish are capable of avoiding water contaminated with high concentrations of hydrocarbons.

However, sub-lethal impacts to adult and juvenile fish may be possible, given long-term exposure (days to weeks) to PAH concentrations (Hjermann et al., 2007). It is noted that modelling of the worst-case vessel spill of MDO indicates the potential EMBA for dissolved hydrocarbons is limited to the immediate vicinity of the spill location.

No time-integrated exposure metrics were modelled, but would show an even smaller area of potential impact. Given the oceanographic environment within the wider EMBA and small EMBA for dissolved hydrocarbons, PAH exposures in the order of weeks for pelagic fish are not considered credible.

The effects of exposure to oil on the metabolism of fish appears to vary according to the organs involved, exposure concentrations and route of exposure (waterborne or food intake). Oil reduces the aerobic capacity of fish exposed to aromatics in the water and to a lesser extent affects fish consuming contaminated food (Cohen et al., 2005). The liver, a major detoxification organ, appears to be the organ where anaerobic activity is most impacted, probably increasing anaerobic activity to facilitate the elimination of ingested oil from the fish (Cohen et al., 2005).

Fish are perhaps most susceptible to the effects of spilled oil in their early life stages, particularly during egg and planktonic larval stages, which can become entrained in spilled oil. Contact with oil droplets can mechanically damage feeding and breathing apparatus of embryos and larvae (Fodrie and Heck, 2011). The toxic hydrocarbons in water can result in genetic damage, physical deformities and altered developmental timing for larvae and eggs exposed to even low concentrations over prolonged timeframes (days to weeks) (Fodrie and Heck, 2011). More subtle, chronic effects on the life history of fish as a result of exposing early life stages to hydrocarbons include disruption to complex behaviour such as predator avoidance, reproductive and social behaviour (Hjermann et al., 2007). Prolonged exposure of eggs and larvae to weathered concentrations of hydrocarbons in water has also been shown to cause immunosuppression and allows expression of viral diseases (Hjermann et al., 2007). PAHs have also been linked to increased mortality and stunted growth rates of early life history (pre-settlement) of reef fishes, as well as behavioural impacts that may increase predation of post-settlement larvae (Johansen et al., 2017). However, the effect of a hydrocarbon spill on a population of fish in an area with fish larvae and/or eggs, and the extent to which any of the adverse impacts may occur, depends greatly on prevailing oceanographic and ecological conditions at the time of the spill and its contact with fish eggs or larvae.

Accidental Hydrocarbon Release: Vessel Collision

Mortality and sub lethal effects may impact pelagic fish in an area close to the spill location within the EMBA for entrained/dissolved aromatic hydrocarbons (100 - 50 ppb respectively).

Fish and shark species are associated with the Commonwealth marine environment within and adjacent to the west coast inshore lagoons KEF, which overlap the Operational Area and EMBA and provide habitat for pelagic fish species. The spill affected area will likely be confined to the upper surface layers (0-10 m). It is therefore unlikely that fish populations would be exposed to hydrocarbon contamination. Fish populations are likely to be distributed over a wide geographical area so impacts on populations or species level are considered to be negligible. Combined with these factors and the rapid dispersion of marine diesel, it is considered that any potential impacts will be negligible.

Commercially Significant Populations

The EMBA overlaps with the Western Rock Lobster KEF, the species being the dominant large benthic invertebrate in the bioregion. It is also an important part of the food web on the inner shelf, particularly as a juvenile, when it is preyed upon by octopus, cuttlefish, baldchin groper, blue groper, dhufish, pink snapper, wirrah cod and breaksea cod. The western rock lobster is also the basis of one of Australia's most valuable commercial fisheries. Acute or chronic exposure, through surface contact, and/or ingestion can result in toxicological risks.

However, the presence of an exoskeleton, for example with rock lobsters will reduce the impact of hydrocarbon absorption through the surface membrane.

Other invertebrates with no exoskeleton and larval forms may be more prone to impacts from pelagic hydrocarbons. However adult marine invertebrates and larvae usually reside within benthic substrates and pelagic waters, rarely reaching the water's surface in their life cycle (to breed, breathe and feed). Therefore, surface hydrocarbons are not considered to pose a high risk to marine invertebrates within the EBMA. Furthermore, the concentration of entrained and dissolved hydrocarbons at or above exposure values of concern will be less in any one location in comparison to surface oil because of the effects of dilution with seawater.

Although entrained and dissolved hydrocarbons can have negative impacts on marine invertebrates and associated larval forms, given the nature of a surface spill of MDO (which would typically entrain in the upper water column), it is considered unlikely that benthic fauna populations would be exposed to hydrocarbon contamination. Any exposure that may occur would likely remain at or below sub-lethal concentrations. Considering the large extent of suitable marine habitat (and potential spawning areas), the impact on marine invertebrates, specifically rock lobsters, the impact is considered minor.

Potential Impacts to Socio-economic Values

Commercial Fisheries

An accidental release of MDO has the potential to result in:

- changes to the functions, interests or activities of other users

The predicted EMBA resulting from a vessel diesel spill may impact the area fished by a number of State and Commonwealth fisheries (refer Section 4.13.1); however the spill scenario modelled is unlikely to cause significant direct impacts on the target species of offshore State and Commonwealth fisheries and within the defined EMBA, except for those occurring in close proximity to the release location. Indirect impacts may occur through the contamination of prey organisms near the release site and the subsequent ingestion of this prey, which could result in long term impacts to fish as a result of bioaccumulation. Further details are provided below.

Fish exposure to hydrocarbon can result in 'tainting' of their tissues. Even very low levels of hydrocarbons can impart a taint or 'off' flavour or smell in seafood. Tainting is reversible through the process of depuration which removes hydrocarbons from tissues by metabolic processes, although it is dependent upon the magnitude of the hydrocarbon contamination. Fish have a high capacity to metabolise these hydrocarbons while crustaceans (such as prawns) have a reduced ability (Yender et al., 2002). Seafood safety is a major concern associated with spill incidents. Therefore, actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (Yender et al., 2002). A major spill may result in the establishment of a fishing exclusion zone around the spill-affected area.

Accidental Hydrocarbon Release: Vessel Collision

There would be a temporary prohibition on fishing activities for a period of time and subsequent potential for economic impacts to affected commercial fishing operators. Additionally, hydrocarbons can foul fishing equipment such as traps and trawl nets, requiring cleaning or replacement.

State-Managed Fisheries

The predicted EMBA resulting from a major spill may impact the area fished by a number of State fisheries (Section 4.13.1). These fisheries generally operate from shallow inshore water to water depths up to 200 m, targeting benthic species such as specimen shells and the west coast rock lobster and pelagic species such as mackerel and sharks. In the unlikely event of a major hydrocarbon spill, there is the potential for the targeted fish species to be exposed to entrained and/or dissolved aromatic hydrocarbons in the water column. Demersal and benthic species (such as finfish and crustaceans) have limited mobility and therefore will not be able to easily move away from a spill. Mortality/sub-lethal effects may impact populations in the immediate vicinity of the spill location. A major loss of hydrocarbons from the Activity may lead to an exclusion of fishing from the spill-affected area for an extended period.

Commonwealth Managed Fisheries

The management boundaries for a number of the Commonwealth-managed fisheries overlap the EMBA. Only the Western Tuna and Billfish Fishery has recorded limited fishing activity in this area in recent years. The Southern Bluefin Tuna Fishery do not fish in these waters, with the closest recorded fishing effort occurring in South Australia, far from the EMBA. The target species does migrate south from the Java Sea along the WA coastline and may pass through the EMBA. The Western Skipjack Fishery has not been active since the 2008/09 fishing season. The Western Deepwater Trawl Fishery has not reported effort within the wider EMBA since the 2021/2022 season. Effort from the Small Pelagic Fishery is concentrated off South Australia, Victoria and NSW with no reported catch in WA.

Adult pelagic fish are highly mobile and able to move away from the spill-affected area or avoid the surface waters; however, hydrocarbon concentrations in the upper water column could lead to potential exposure through direct absorption of hydrocarbons and indirectly by the consumption of contaminated prey. Given these pelagic species are distributed over a wide geographical area, the impacts at the population or species level are considered minor in the unlikely event of a spill. Fishing activity for the southern bluefin tuna, small pelagics, western skipjack tuna and the Western Deepwater trawl Fishery are not expected within the Operational Area or EMBA (Section 4.13.1.2), therefore impacts or tainting to target fish species is not expected. The Western Tuna and Billfish fishery operates in Australia's EEZ and high seas of Indian Ocean. In recent years effort has been concentrated off southwest WA and SA (AFMA, 2018a), with no significant effort in the vicinity of the EMBA documented. Given the distribution of targeted species and the fishery, this fishery is unlikely to be impacted as a result of a diesel spill.

Tourism and recreation

An accidental release of MDO has the potential to result in:

- changes to the functions, interests or activities of other users
- change in aesthetic value.

Key areas in the region for tourism (recreational fishing and diving) include the Jurien AMP, State Jurien Marine Park and the Abrolhos Islands. While there is potential for entrained and dissolved hydrocarbons to enter these locations, surface hydrocarbons and shoreline accumulation are not forecast to occur within the marine parks at concentrations that would be visually noticed by recreational users. If a spill were to occur, there is a possibility that tourists and recreational users may avoid areas due to perceived impacts. Recovery and return of tourism to pre-spill levels will depend on the size of the spill and change in any public perceptions regarding the spill.

Accidental Hydrocarbon Release: Vessel Collision

Ports and Shipping

An accidental release of MDO has the potential to result in:

- changes to the functions, interests or activities of other users.

According to the modelling, the Geraldton coastal receptor is estimated to have 32% probability of entrained oil concentrations > 100 ppb in summer, but this is estimated to reduce to 2% for a spill in winter. No surface diesel is predicted to reach Geraldton. The Geraldton Port has a high amenity value, however the predicted low volumes and concentrations to reach Geraldton are unlikely to be of significance to port and vessel activities.

Petroleum Exploration and Production

An accidental release of MDO has the potential to result in:

- changes to the functions, interests or activities of other users.

In the unlikely event of a major spill, surface hydrocarbons may affect production from existing petroleum facilities (platforms and floating production, storage and offtake vessels).

For example, facility water intakes for cooling and fire hydrants could be shut off which could in turn lead to the temporary cessation of production activities. Spill exclusion zones established to manage the spill could also prohibit support vessel access.

The impact on ongoing operations of regional production facilities would be determined by the nature and scale of the spill and metocean conditions. Furthermore, decisions on the operation of production facilities in the event of a spill would be based primarily on health and safety considerations.

Production License WA-31-L, in which the Cliff Head platform is located, includes two exploration wells and 12 extension/ appraisal and development wells in the Cliff Head oil field. Two exploration wells have been drilled in State waters directly adjacent to the permit area. The Cliff Head platform is in a non-production phase and is therefore unlikely to be affected in the event of a worst-case vessel spill of diesel.

Mitigation Measures

Legislation, Codes and Standards

- IMR vessels to comply with Marine Orders 21 (Safety of navigation and emergency procedures), specifically:
  - adherence to minimum safe manning levels
  - emergency management plan to be on board vessels.
- IMR vessels to comply with Marine Order 27 (Radio equipment), specifically:
  - radio and navigational systems of IMR vessels are in accordance with Regulations 7 to 11, 19 and 20 of Safety of Life at Sea (SOLAS)
  - automatic identification system (AIS) provides other users with information about the vessel's identity, type, position, course, speed, navigational status and other safety-related data
  - maintenance of radio navigation equipment in efficient working order (compass/radar).
- IMR vessels to comply with Marine Order 30 (Prevention of collisions), specifically adherence to the requirements of the International Regulations for Preventing Collisions at Sea 1972 (COLREGS):
  - adherence to steering and sailing rules including maintaining lookouts (e.g. visual, hearing, radar,), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar)
  - adherence to navigation light display requirements, including visibility, light position/shape appropriate to activity
  - adherence to navigation noise signals as required.
- Oil record book or equivalent is maintained to record all oil waste management to ensure compliance with EP.

Accidental Hydrocarbon Release: Vessel Collision

- Marine Order 91 (marine pollution prevention – oil) 2014, requires Ship Oil Pollution Emergency Plan (SOPEP)/ Spill Monitoring Programme Execution Plan (SMPEP) (as appropriate to vessel class).

Industry Good Practice

- Marine operations undertaken as per Cliff Head Marine Operations Procedure (10OPGOPC04).
- Spill response exercises on vessels undertaken as per vessel's safety management system.
- All personnel will receive an environmental induction which includes hydrocarbon management requirements
- All vessels will be provided with a copy of the Cliff Head Management Plan and OSCP. These outline the requirement for vessels to notify TEO of any pollution incidents. Instruction will be provided to vessel on source control and incident response by TEO and the Control Agency.
- No HFO or IFO used during activity to minimise potential impacts to sea.
- Any vessels selected will have individual fuel tank capacities less than 500 m^3.
- DoT/ DEMIRS accepted OSCP provides response options for an unplanned hydrocarbon/chemical spill. In all cases, the NEBA of the spill response is considered by the Control Agency when implementing the OSCP.
- Notifications to AMSA JRCC for AUSCOAST warnings issued prior to any IMR activity to ensure other sea users aware of activity and reduce potential for 3rd party collision.
- Notifications to AHS issued for Notice to Mariners prior to any prior to any IMR activity to ensure other sea users aware of activity and reduce potential for 3rd party vessel interference.
- Notification to be made to key stakeholders prior to commencing vessel-based IMR activities.

Demonstration of ALARP

In addition to the above mitigation measures / controls, the below mitigation / controls were also considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation (Control)	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
Use vessels with smaller tank sizes.	Reduces the potential volume of the spill in the event of a vessel collision	X	More refuelling would be needed, introducing additional risk. Delays to activities caused by delays to contracting vessel.
Additional Measures Considered			
Rock lobster fishers consulted to ensure they are aware of upcoming activities in the scope of the EP and MOU remains valid; limit IMR activities to avoid peak rock lobster fishing activities.	Consultation and limiting IMR activities to avoid peak rock lobster fishing activities will ensure rock lobster fishers are aware of activities and reduces the potential for interaction.	✓	Consultation will ensure the requirements within the MOU with rock lobster fishers are met.
Use of vessels to manage interactions.	Reduces the potential for vessel collision with a 3rd party vessel	X	Additional operational cost and HSE risks for an additional vessel. Minimal benefits given that the CHA and use of vessels have been communicated to fishers and other sea users.

ALARP Statement

Accidental Hydrocarbon Release: Vessel Collision				
The spill volume of 500 m^3 of marine diesel from a vessel is highly conservative, representing the potential fuel volume on board a project vessel while the fuel volume on the typical inspection vessel would be significantly less (approximately 20 to 200 m^3). Vessels are required to undertake the Activity. There are no suitable alternatives to the use and number of vessels to complete the Activity. It is considered that the industry standard and activity-specific controls to reduce collision risks that have been proposed and the contingencies in place in the event of the hazard occurring reduce the likelihood and potential impacts from a loss of fuel as a result of a vessel collision to ALARP. Alternative and additional controls were considered but not adopted as detailed. The proposed control measures are considered appropriate to manage the risk to ALARP. On the basis of the environmental risk assessment outcomes, TEO considers the adopted controls appropriate to manage the impacts and risks of an unplanned loss of hydrocarbon as a result of vessel collision. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				
Residual Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Residual Risk**
Loss of hydrocarbons to marine environment due to a vessel collision (e.g. support vessels or other marine users).	Reduction in water quality and toxicity effects to marine biota.	B	4	Medium (8)
Measurement of Environmental Performance				
Performance Objective	**Environmental Performance Standards**		**Measurement Criteria**	
No release of hydrocarbons to the marine environment due to a vessel collision during the Activity.	IMR vessels maintain compliance with Marine Order 21 for the duration of the EP, specifically: • Vessels adhere to minimum safe manning levels. • emergency management plan is on board vessels.		TEO vessel audit or third party inspection document demonstrate that: • All IMR vessels have adhered to minimum safe manning levels. • The emergency management plan was on board all IMR vessels.	
	IMR vessels maintain compliance with Marine Order 27 for the duration of the EP, specifically: • Radio and navigational systems of IMR vessels are in accordance with Regulations 7 to 11, 19 and 20 of SOLAS. • AIS is in place and functioning. • Radio navigation equipment is maintained in efficient working order (compass/radar).		TEO vessel audit or third party inspection document demonstrate that: • Radio and navigational systems of IMR vessels were in accordance with Regulations 7 to 11, 19 and 20 of SOLAS. • AIS was in place and functioning on all relevant IMR vessels. • Maintenance of radio navigation equipment completed.	
	IMR vessels maintain compliance with Marine Order 30 for the duration of the EP, specifically: • Adherence to steering and sailing rules including maintaining lookouts (e.g. visual, hearing, radar), proceeding at safe speeds, assessing risk of collision and		TEO vessel audit or third party inspection document demonstrate that: • All IMR vessels have adhered to steering and sailing rules including maintaining lookouts (e.g. visual, hearing, radar), proceeding at safe speeds, assessing risk of collision and	

Accidental Hydrocarbon Release: Vessel Collision		
	taking action to avoid collision (monitoring radar). • Adherence to navigation light display requirements, including visibility, light position/shape appropriate to activity • Adherence to navigation noise signals as required.	taking action to avoid collision (monitoring radar). • All IMR vessels have adhered to navigation light display requirements, including visibility, light position/shape appropriate to activity • All IMR vessels have adhered to navigation noise signals as required.
	Vessels maintain an Oil Record Book, as appropriate for vessel class.	Completed oil record book showing dates, volume and fate of oil waste.
	All IMR vessels maintain SOPEP/ SMPEP (as appropriate to vessel class), as per Marine Order 91 for the duration of the EP. Appropriate initial responses prearranged and drilled in case of a hydrocarbon spill, as appropriate to vessel class.	TEO vessel audit or third party inspection document demonstrate current SOPEP/ SMPEP in place and available. Initial response drill records verify timing and completion of hydrocarbon spill exercises.
	Vessel Master to monitor meteorological forecasts at least once daily as per Operating conditions in Cliff Head Marine Operations Procedure (10OPGOPC04).	Vessel logs record timing and conditions for operations on a daily basis.
	Spill response exercises conducted at least every three months to ensure personnel are prepared.	Spill response exercise records documenting timing and completion of exercises.
	An OSCP exercise is conducted within two weeks of the EP/OSCP acceptance or any significant amendment to the OSCP. The scope of the exercise tests the capability of the organisation to implement the significant changes to the OSCP.	Post-exercise review meeting records demonstrate the OSCP was appropriately tested and effectiveness verified by the HSE Advisor (or delegate) and that appropriate corrective actions have been developed and closed out.
	The HSE Advisor (or delegate) verifies the exercise has been undertaken in accordance with the OSCP and the Emergency Management Plan requirements by: • Reviewing and signing off on the scenario and objectives prior to the exercise. • Observing and evaluating the exercise and the performance of the Integrated Managed Team (IMT). • Participating in the post-exercise review meeting and agreeing lessons learned and/or corrective actions required and appropriate timelines for close out of identified actions.	Completed Exercise Log and Post-Exercise review meeting records demonstrating that a Level 3 oil spill exercise was carried out and effectiveness verified by the HSE Advisor (or delegate) and that appropriate corrective actions have been developed and closed out.

Accidental Hydrocarbon Release: Vessel Collision		
	• Verifying and signing off on the Post-exercise Meeting Minutes. • Verifying and signing off on the closeout documentation for corrective/improvement actions.	
	All crew are to have completed an environmental induction containing basic information on chemical and hydrocarbon management (good housekeeping), as well as spill prevention and response measures.	Training records show all vessel-based personnel travelling offshore have received an environmental induction.
	All vessels retain the Cliff Head Emergency Response Plan and OSCP on board.	TEO vessel audit or third party inspection document demonstrate IMR vessels retain the Cliff Head Emergency Response Plan and OSCP on board.
	No HFO/IFO is used on vessels.	Fuel records demonstrate no HFO/IFO was used on vessels.
	No vessels fuel tank capacities exceed 500 m^3.	Vessel logs demonstrate that no IMR vessels used have a fuel tank capacity that exceeds 500 m^3.
	OSCP implemented (as required), with the following potentially applicable strategies: • Monitor and evaluate; • Offshore containment and recovery; • Shoreline protection and deflection; • Shoreline clean-up; and • Oiled wildlife response.	Incident reports confirm OSCP and NEBA was implemented. Incident report includes volume of hydrocarbon release to sea due to vessel collision. Record of accepted OSCP maintained. Record of oil spill response equipment list maintained.
	Notifications to AUSCOAST, via AMSA JRCC, to ensure radio navigation warnings for inspection, maintenance and repair activities conducted on pipelines. Information provided should include: • vessel details • satellite communication details • area of operation • start and end dates.	Notification records to AMSA JRCC demonstrate radio navigation warnings for inspection, maintenance and repair activities conducted on pipelines.
	Notice to Mariners, via notification of AHS no less than 4 weeks prior to activity commencing, to be issued for inspection, maintenance and repair activities conducted on pipeline or other offshore infrastructure that fall outside the NOPSEMA gazetted PSZ.	Notification records to AHS demonstrate Notice to Mariners issued for inspection, maintenance and repair activities conducted on pipeline or other offshore infrastructure that fall outside the NOPSEMA gazetted PSZ via notification of AHS was conducted no less than 4 weeks prior to activity commencing.

Accidental Hydrocarbon Release: Vessel Collision		
	Key stakeholders notified prior to commencing vessel-based IMR activities.	Stakeholder notification records demonstrate key stakeholders identified prior to commencing vessel-based IMR activities.
	In accordance with the rock lobster MOU, prior to any maintenance activities, TEO will: • Advise the President of the Dongara Professional Fishing Association (DPFA) in sufficient time. • Mark the area of use with temporary marine buoys. • Avoid the "whites" season (mid-November to end December) unless otherwise agreed with DPFA and rock lobster fishery through consultation prior to activity commencement. • Consider any additional requests that arise through ongoing consultation, and update MOU accordingly.	Consultation records with DPFA and rock lobster fishery maintained. Signed and valid MOU with DPFA in place.

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact from an unplanned event ranked low to high?	Yes, residual risk is Medium for: • Loss of hydrocarbons / water to the marine environment from a vessel collision
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the assessment and management of risks of 'loss of containment of hydrocarbons' to the marine environment due to a vessel collision (e.g. support vessels or other marine users) have addressed the principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.

Accidental Hydrocarbon Release: Vessel Collision	

Acceptability Statement

There is a low likelihood of vessel collision resulting in a hydrocarbon spill to the marine environment. Eliminating the (Medium) risk associated would require ceasing critical inspection and maintenance activities on the pipelines.

Controls and performance standards applied to the risk are standard industry practice and have been determined to be ALARP.

The residual risk is considered Medium, which has been determined as acceptable, in accordance with the TEO acceptability criteria. The loss of containment from a vessel collision which could lead to impact to the environment is therefore ALARP and considered environmentally acceptable.

7.1.2 Accidental Hydrocarbon Release: Pipeline Leak

<table>
<tr><th colspan="5">Accidental Hydrocarbon Release: Loss of Containment Along the Pipeline</th></tr>
<tr><td>Aspects / Events</td><td colspan="4">Loss of pipeline fluids from the pipeline through corrosion or external impact</td></tr>
<tr><td>Receptors</td><td colspan="4">Water Quality
Benthic Habitats and Communities
Marine Fauna
Socio-economic</td></tr>
<tr><th colspan="5">Inherent Impact and Risk Analysis and Ranking</th></tr>
<tr><th>Aspect / Event</th><th>Environmental Impact</th><th>Likelihood</th><th>Consequence</th><th>Inherent Risk</th></tr>
<tr><td>Loss of pipeline fluids (including residual hydrocarbons and inhibited produced formation water) to the marine environment due to corrosion, materials fatigue or physical damage (e.g. during IMR activities).</td><td rowspan="2">Changes to the quality of:
water
sediment
benthic habitats.
Secondary impacts including:
injury / mortality to fauna
change in fauna behaviour
changes to the functions, interests or activities of other users
change in aesthetic value</td><td>C</td><td>1</td><td>Low (3)</td></tr>
<tr><td>Loss of pipeline fluids to the marine environment from due to physical damage arising from objects being dropped on the pipeline, vessel interaction (e.g. anchor drag) or equipment (e.g. fishing) being dragged across the pipeline.</td><td>C</td><td>1</td><td>Low (3)</td></tr>
<tr><th colspan="5">Aspect/event Details</th></tr>
<tr><td colspan="5">Background
Pipeline fluids are inhibited Produced Formation Water (PFW) and some residual oil of up to 50ppm, but typically 10-30 ppm.
The Cliff Head development includes two pipelines, connected via a pigging loop at CHA to form a single system for pigging operations:
The insulated subsea production pipeline which carried the well stream fluids from the wellhead platform (CHA) to the onshore plant (ASP). This pipeline has been flushed for the NPP and pipeline fluids.
The insulated subsea water injection pipeline, which transported PFW and additional make-up injection water from the ASP to CHA. This pipeline has been flushed for the NPP and now contains pipeline fluids.
Pipelines were widely used for transporting hydrocarbons and are designed to withstand environmental loading conditions to ensure safe distibution from the point of production to the shore (Adegboye, 2019). Throughout the NPP and Care and Maintenance phases, the CHA pipelines will be preserved using treated produced water to prevent microbially induced corrosion. A corrosion inhibitor (for example CORR31331A is periodically injected to the pipelines and maintained at a target 1000 ppm (Section 8.7). However, without adequate controls, corrosion of the pipeline and pipeline fittings over extended timeframes can lead to loss of pipeline fluids into the marine environment. Loss of pipeline fluids may also occur if an external impact is applied to the pipeline with sufficient force to fracture the pipeline (e.g. machinery impact duing routine inspection, maintenance and repair activities).</td></tr>
</table>

The potential hazards associated with the release of pipeline fluids at the seabed along the pipeline route include a temporary and localised reduction in water quality and temporary toxicity effects to marine biota.

Credible Scenario

For corrosion to result in the worst-case scenario of a pipeline fluids release potentially impacting an environmental receptor, the following factors must align:

- The pipeline must be exposed to chronic environmental conditions that result in exceedance of its loading condition specifications.
- The corrosion must go undetected by regular maintanence and inspection activities.

For an external impact to result in the worst-case scenario of a pipeline fluids release potentially impacting an environmental receptor, the following factors must align as follows:

- The controls in place for preventing an impact (e.g. marking on navigation charts, handling procedures when performing maintanence activities) must fail.
- The collision must have enough force to penetrate the pipeline.

The probability of the events described above aligning to result in a breach of the pipeline, in turn resulting in a leak that could potentially affect the marine environment, is considered highly unlikely. Several engineering, administration and mitigative strategies are in place to prevent and detect pipeline corrosion. The pipeline is also designed to withstand fishing vessel collisions and accommodate rock lobster fishing activity. However, both scenarios are considered credible and warrant a risk assessment.

Several pipeline release scenarios have been identified in Table 7-2.

Table 7-2: Cliff Head pipeline fluids release credible scenarios

Scenario	Estimated Volume	Oil Type	Release Location
A. Pipeline rupture during routine NPP steady state or C&M Phase	35.5 L oil / 710 m^3 treated PFW	Residual Cliff Head crude	Seabed
B. Pipeline rupture during non-routine well control or well flushing operations. If activity is required during the NPP, injection water will be pumped from the ASP to CHA via the Injection Water Pipeline, down the well bore and into the reservoir. Fluids may also be circulated back to the ASP, with an estimated 8 m^3 of hydrocarbons to be removed from the wellbore tubing.	19.2 m^3 with an approximate 200 L oil component (based on 2% of maximum flow over an 8 hour period.)	Cliff Head crude (from wellbore)	Seabed
C. Pipeline rupture during non-routine remnant oil reinjection. Remnant oil at ASP (estimated 320 m^3) may be re-injected back into the offshore reservoir via the IW pipeline. The transfer operation would involve comingling the oil into the injection water at ASP at a ratio of up to 15% OIW. The entire batch disposal operation would likely be executed over a 96 hour period.	230 m^3 with an approximate 6,600 L oil component within co-mingled fluid batches (2% of maximum flow over a 96 hour period)	Cliff Head crude (from ASP)	Seabed

Impact Assessment
Potential Impacts to Water Quality, Marine Fauna and Socio-economic Receptors
A pipeline fluid release from a pipeline leak related to a corrosion, materials fatigue or physical damage has the potential to cause impacts to the marine environment through a temporary reduction in water quality and marine fauna exposure. The release depth for the pipeline leak is specified as between 0 and 15 m. Residual Cliff Head hydrocarbons are forecasted to float to the surface rapidly from a leak at the seabed, and to then resist entrainment once it cools and solidifies. Pipeline fluids are expected to be rapidly diluted in the highly dynamic nearshore environment. Given the small volumes potentially released, impacts to marine habitats are not expected. Approximately 21% of the oil volume would evaporate over the first day. The rate of evaporation of Cliff Head crude oil on the water surface under variable winds reaching speeds that would generate breaking surface waves (> 12 knots) would increase marginally with the effect that the proportion remaining on the surface should decrease. Crude has the capacity to entrain into the water column during the presence of moderate winds (>10 knots) and can potentially remain entrained for as long as the winds persist. Hence, the portion of entrained hydrocarbons and in turn evaporative loss varies under moderate and calm wind conditions. A decrease in water quality in the immediate area of the spill may occur, however given the small volumes related to a seabed release of residual Cliff Head hydrocarbons and associated PFW and corrosion inhibitor from a pipeline leak, receptors such as marine fauna may only be affected if they come in direct contact with a release by traversing the immediate spill area at the time of the spill. If marine fauna come into contact with a release they could suffer fouling, ingestion, inhalation of toxic vapours, irritation of sensitive membranes in the eyes, mouth, digestive and respiratory tracts and organ or neurological damage. However, given the low concentrations of hydrocarbons within the pipeline fluids, small volume of the potential spill and the dilution and weathering of any spill, ecological impacts to marine fauna (protected species) are expected to be temporary and negligible with any effects contained locally (i.e. consequence level 1).

Mitigation Measures

Legislation, Codes and Standards

No specific measures identified.

Industry Good Practice

- To ensure safety and environmental management all IMR activities will be performed in accordance with the Cliff Head Pipeline and Umbilical Integrity Management Plan.
- Pipeline repairs and replacement undertaken in accordance with Cliff Head Offshore Pipeline Repair Plan.
- Design and installation of pipeline were in accordance with industry standards to ensure integrity is appropriate.
- Automatic shutdown if low pressure detected.
- Pipeline route is present on marine charts to reduce potential for third party interference.
- Lifting activities will be undertaken in accordance with Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24), which requires:
  - the security of loads to be checked prior to commencing lifts
  - loads to be covered if there is a risk of losing loose materials
  - all lifting equipment is rated for intended activities and maintained.
- Personnel involved in lifting operations are competent as per requirements within the Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24).
- CHA crane, rigging and lifting connections (designed, constructed and installed to appropriate standards and codes) are inspected and maintained fit-for-purpose.
- Cliff Head Lift Plan (10HSEQGENPC24FM01) is implemented for all lifting operations detailing load ratings of lifting equipment, intended loads, operational limits (e.g. weather) and procedures.
- Pipeline wall integrity assessments completed to ensure adequate load strength and reduce potential for pipeline rupture.
- Pipelines flushed to ensure they are hydrocarbon free prior to undertaking pipeline repair to reduce potential hydrocarbon releases to sea.
- Appropriate stabilisation materials selected to ensure no damage to pipeline during IMR activities.
- Temporary mooring locations to be installed in accordance with activity-specific Mooring Plan.
- Marine operations undertaken as per Cliff Head Marine Operations Procedure (10OPGOPC04).
- Aerial surveys undertaken periodically to observe for sheen in vicinity of the Operational Area.
- DoT/ DEMIRS accepted OSCP provides response options for an unplanned hydrocarbon/chemical spill. In all cases, the NEBA of the spill response is considered by the Control Agency when implementing the OSCP.
- Periodic Smartball inspection (leak detection tool).

Demonstration of ALARP

In addition to the above mitigation measures / controls and EPS, the below mitigation / controls were also considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
No alternatives/substitutes identified.			
Additional Measures Considered			

Increase aerial survey frequency.	Minimal benefits given aerial survey frequency is based on the minimum time requirements to detect a spill.	X	Further aerial inspections present a disproportionate cost (including the indirect cost in time and resources) compared to the environmental benefits. Given the other controls in place, it is determined that increasing frequency would not present significant environmental benefit when compared to the cost.
Put up additional barriers along the length of pipeline to mitigate against external impact.	Would reduce the likelihood of an impact to the pipeline which causes a rupture.	X	Placement of additional barriers to protect against an external impact event is high cost, which is disproportionate to the risk. To date there have been no external impacts causing a rupture event and should this happen TEO have a pipeline shut-in process to mitigate additional hydrocarbon loss from the pipeline. In addition, a spill of this type would result in only highly localised impacts to the immediate marine environment.
Additional vessel permanently required on site to minimise collision of fishing vessel with pipelines	Minimal benefits given that the pipelines are marked on marine charts and communicated to fishers.	X	Additional vessels present a disproportionate cost (including the indirect cost in time and resources) compared to the environmental benefits
Conduct pipeline maintenance at a more frequent interval than the current plan to identify potential damage to pipeline.	Minimal benefits given maintenance intervals of every 2 years will not decrease the time it takes for a leak to be detected.	X	More frequent maintenance intervals present a disproportionate cost (including the indirect cost in time and resources) compared to the environmental benefits. Given the other controls in place, it is determined that increasing frequency would not present significant environmental benefit when compared to the cost.

ALARP Statement

It is considered that the control measures and industry standards in place reduce the likelihood and potential impacts of a pipeline leak to ALARP. Additional control measures were considered but not adopted on the basis as not being practicable as described above.

Residual Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Residual Risk
Loss of pipeline fluids to the marine environment from the pipeline due to corrosion leak.	Temporary and localised reduction in water quality and temporary toxicity effects to marine biota.	B	2	Low (4)
Pipeline fluids to the marine environment due to external impact (e.g. machinery impact) leading to pipeline rupture.	Temporary and localised reduction in water quality and temporary toxicity effects to marine biota.	B	2	Low (4)

Measurement of Environmental Performance

Performance Objective	Environmental Performance Standards	Measurement Criteria
No loss of containment along the pipeline	All IMR activities are performed to ensure adequate safety and environmental management in accordance with the Cliff Head Pipeline and Umbilical Integrity Management Plan, specifically: • The recommended inspection, maintenance and monitoring activities are identified and applied to ensure the integrity risk of the system is as ALARP. • Maximum inspection intervals are met based on the risk levels identified. • Acceptance criteria when evaluating the results of the IMR activities are met.	Maintenance/inspection records demonstrate that: • The recommended inspection, maintenance and monitoring activities have been identified and applied to ensure the integrity risk of the system is as ALARP. • Maximum inspection intervals have been met based on the risk levels identified. • Acceptance criteria when evaluating the results of the IMR activities have been met.
	Recommended procedures for the repair of the pipeline are performed to ensure safety and environmental management, in accordance with the Cliff Head Offshore Pipeline Repair Plan. As per the Plan, the following methodology will be applied depending on the scenario: • Subsea Clamp Strategy, or • Offshore Welding Strategy.	Records demonstrate that the Cliff Head Offshore Pipeline Repair Plan was followed in the event of a defect or potential pinhole leak.
	A heavy walled pipe (rated to the full well pressure possible for any production wells) carries the pipeline fluids. The pipelines are designed and tested in accordance with the relevant codes and standards for pipelines (i.e. AS 2885 and DNV-OS-F101). Pipeline designed to withstand fishing vessel collisions and accommodate rock lobster fishers.	As-built piping and instrumentation diagrams (P&IDs) verify pipeline design. Pipeline testing records verify pipelines were tested in accordance with the relevant codes and standards for pipelines (AS 2885 and DNV-OS-F101).
	Automatic low-pressure shutdown capability is confirmed on CHA	Audit report confirms automatic low-pressure shutdown capability was in place and effective. Annual environmental performance reports indicate no unplanned discharge of hydrocarbons to sea during routine operation. Incident report includes volume of hydrocarbons accidentally released to sea during routine operation.
	The pipeline route is provided on marine charts.	Marine charts verify pipeline route.

	Lifting activities are undertaken in accordance with Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24), which requires: • The security of loads to be checked prior to commencing lifts. • Loads to be covered if there is a risk of losing loose materials. • All lifting equipment is rated for intended activities and maintained.	PTW and JSA records demonstrate that the following requirements were followed: • The security of loads were checked prior to commencing lifts. • Loads were covered if there is a risk of losing loose materials. • All lifting equipment was rated for intended activities and maintained.
	Personnel involved in lifting operations are competent as per requirements within the Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24): • Competency of equipment operators meets Australian legislative standards, and all equipment operators hold a Certificate of Competency issued by a recognised State Authority or a National License issued in accordance with the National Standard NOHSC-1006-2001 - Lifting Competency Requirements. • Lifting Equipment Maintenance Personnel hold current Certificates of Competency and Licenses.	Training/certification records demonstrate all personnel involved in lifting operations have the appropriate training/certifications.
	CHA crane, rigging and lifting connections (designed, constructed and installed to appropriate standards and codes) are inspected and maintained fit-for-purpose.	Maintenance records verify CHA crane, rigging and lifting connections were inspected and are fit-for-purpose. Certification records have been maintained for lifting equipment.
	Cliff Head Lift Plan (10HSEQGENPC24FM01) is implemented for all lifting operations detailing load ratings of lifting equipment, intended loads, operational limits (e.g. weather) and procedures.	Documented lifting plan verifies all lifting operations considered load ratings of lifting equipment, intended loads and operational limits (e.g. weather).
	Assessment of pipeline wall integrity to be carried out prior to maintenance activities to confirm intended loads do not exceed pipeline strength.	Inspection records demonstrate pipeline wall integrity assessment has been undertaken prior to commencing maintenance.
	Pipelines flushed prior to commencing pipeline replacement activities.	Daily report confirms that pipeline flushed prior to pipeline section replacement as recorded on daily reports.

	All stabilisation materials used to be consistent with parameters identified in pipeline rupture assessment. Installation of stabilisation material to be lowered to seabed slowly in accordance with freespan rectification procedure.	Inspection of span rectification documentation confirms stabilisation material was consistent with pipeline rupture assessment and installation was in accordance with freespan rectification.
	All temporary moorings are installed within the Operational Area in accordance with the activity-specific Mooring Plan which specifies the coordinates, vessel bearing and angle for the mooring location.	Documented inspection records during activity confirm that temporary moorings were installed in accordance with the activity-specific Mooring Plan.
	Vessel Master to monitor meteorological forecasts at least once daily as per Operating conditions in Cliff Head Marine Operations Procedure (10OPGOPC04).	Vessel logs record timing and conditions for operations on a daily basis.
	Helicopters undertake periodic flyover to conduct an aerial survey of the pipeline to observe for sheen in vicinity of the Operational Area.	Aerial survey reports document periodic surveys undertaken. Incident report includes observations of any sheens recorded.
	OSCP implemented (as required), with the following potentially applicable strategies: • Monitor and evaluate; • Offshore containment and recovery; • Shoreline protection and deflection; • Shoreline clean-up; and • Oiled wildlife response.	Incident reports confirm OSCP and NEBA was implemented. Incident report includes volume of hydrocarbon release to sea due to vessel collision. Record of accepted OSCP maintained. Record of oil spill response equipment list maintained.
	Leak detection Smartball inspection is performed periodically to ensure the integrity risk of the system is ALARP.	Maintenance/inspection records demonstrate that periodic leak detection inspections have been carried out in accordance with Smartball inspection procedure.

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact from an unplanned event ranked low to high?	Yes, residual risk is Low for: • Loss of containment of pipeline fluids along the pipeline
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.

Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the assessment and management of risks of 'loss of containment along pipelines' from corrosion or external impacts have addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.
Acceptability Statement	
A release of pipeline fluids (containing residual hydrocarbons and inhibited produced formation water) to the marine environment could result in minor impacts to water and seabed sediment quality in the immediate area surrounding the release location. Controls and performance standards applied to the risk are standard industry practice and have been determined to be ALARP. The residual risk is considered Low, which has been determined as acceptable, in accordance with the TEO acceptability criteria. The risk of a loss of containment along the pipelines which could lead to impact to the environment is therefore ALARP and considered environmentally acceptable.	

7.1.3 Accidental Hydrocarbon Release: Refuelling Spill

Accidental Hydrocarbon Release: Refuelling Spill	
Aspects / Events	Accidental discharge of marine diesel into the marine environment during refuelling
Receptors	Water quality Marine fauna Socio-economic

Inherent Impact and Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Inherent Risk
Accidental discharge of marine diesel into the marine environment during refuelling	Changes to the quality of: • water Secondary impacts including: • injury / mortality to fauna • changes to the functions, interests or activities of other users	C	1	Low (3)

Aspect/event Details

Vessels are used to support IMR activities as described in Section 3.8. Refuelling of vessels at sea is considered an unlikely occurrence given the distance to the nearest port for refuelling, however it is retained as a contingency option. A minor spill (~37.5 m^3) of marine diesel could occur during refuelling resulting in a loss of hydrocarbons to the marine environment at sea surface. Spills during refuelling can occur through several pathways, including fuel hose breaks, coupling failure or tank overfilling.

Spills resulting from overfilling will be contained within the vessel drains and slops tank system. In the event that the refuelling hose is ruptured, the fuel bunkering activity will cease by turning off the pump; the fuel remaining in the transfer line will escape to the environment as well as fuel released prior to the transfer operation being stopped. The guidance provided by AMSA (2015) for a refuelling spill under continuous supervision is considered appropriate given refuelling would be constantly supervised. The maximum credible spill volume during refuelling is calculated as: transfer rate x 15 minutes of flow. The detection time of 15 minutes is seen as conservative but applicable following failure of multiple barriers followed by manual detection and isolation of the fuel supply. Based on a worst-case transfer rate of 150 m^3/ hr, a marine diesel spill of 37.5 m^3 was calculated as the maximum credible volume of marine diesel that could be released into the marine environment during refuelling.

Impact Assessment

Potential Impacts to Water Quality, Marine Fauna and Socio-economic Receptors

Spills of marine diesel during refuelling events have the potential to cause impacts to the marine environment through a reduction in water quality and marine fauna exposure. Marine diesel at the sea surface will spread rapidly in the direction of the prevailing wind and surface currents. Diesel spills can cause chemical (e.g. toxic) and physical (e.g. oiling of wildlife at sea surface) impacts to marine species, a decline in water quality and secondary impacts to socio-economic receptors (e.g. commercial fisheries). Potential impacts of marine diesel have already been described for a much larger spill of 500m^3 due to a vessel collision, therefore impacts from a refuelling spill would be much less.

Given the small volumes potentially released (~37.5 m^3) impacts to marine habitats are not expected. Marine diesel is expected to evaporate quickly given the volatility of it with >50% evaporating within several hours. Entrainment of the hydrocarbon is likely, resulting in temporary decline in water quality. Given the nature and scale of the spill, a significant decline in water quality as a result of a diesel spill during refuelling is not expected and therefore impacts to marine fauna in the vicinity are expected to be temporary.

Accidental Hydrocarbon Release: Refuelling Spill

Impacts to marine fauna would only occur if an individual was immediately adjacent to the spill source, which is unlikely due to the low frequency of vessel activity and the unlikely requirement of refuelling within the Operational area (given the close proximity to port). The spill would rapidly disperse throughout the water column diluting the spill and reducing its toxicity and potential impacts to receptors.

Given the small area of the potential spill and the dilution and weathering of any spill, ecological impacts to marine fauna (protected species) are expected to be negligible with any effects contained locally (i.e. consequence level 1).

Mitigation Measures

Legislation, Codes and Standards

- Marine Order 91 (marine pollution prevention – oil) 2014, requires Ship Oil Pollution Emergency Plan (SOPEP)/ Spill Monitoring Programme Execution Plan (SMPEP) (as appropriate to vessel class).

Industry Good Practice

- Marine operations undertaken as per Cliff Head Marine Operations Procedure (10OPGOPC04).
- Fuel storage areas are bunded or secondarily contained when they are not being handled/moved temporarily.
- All chemicals stored in accordance with the product SDS.
- Spill kits positioned in high risk locations around the vessel (near potential spill points such as transfer stations).
- Bulk liquid transfer procedures reduce potential for accidental overboard release.
- All vessels will be provided with a copy of the Cliff Head Management Plan and OSCP. These outline the requirement for vessels to notify TEO of any pollution incidents. Instruction will be provided to vessel on source control and incident response by TEO and the Control Agency.
- Spill response exercises on vessels undertaken as per vessel's safety management system.
- All personnel will receive environmental induction which includes hydrocarbon management requirements.
- No HFO or IFO used during activity to minimise potential impacts to sea.
- DoT/ DEMIRS accepted OSCP provides response options for an unplanned hydrocarbon/chemical spill. In all cases, the NEBA of the spill response is considered by the Control Agency when implementing the OSCP.

Demonstration of ALARP

In addition to the above mitigation measures / controls and EPS, the below mitigation / controls were also considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
No at sea refuelling	Reduce the likelihood of an impact from a spill due to at sea refuelling.	X	Although refuelling at sea is not planned due to the close proximity to port, it remains an option and therefore is included. Additional operational cost and HSE risks for an additional refuelling vessel. Also, additional HSE risk associated with refuelling at sea. Minimal benefit given the close proximity of port for refuelling.

Accidental Hydrocarbon Release: Refuelling Spill			
Use of vessels with larger tank sizes to reduce possibility of refuelling	Less refuelling would be required.	X	Additional risks associated with a larger vessel includes larger tank sizes therefore the potential for impact in the event of a vessel collision would be greater. Typically, small support vessels are used for these activities and given the distance to shore, are more cost effective than larger vessels.
No marine diesel will be used	Reduce impacts from marine diesel	X	Marine diesel is required to operate the vessel.

Additional Measures Considered

No additional measures identified.

ALARP Statement

There are no possible alternative options to the use of vessels during the activity and therefore at sea refuelling remains a possibility. It is considered that the control measures and industry standards in place reduce the likelihood and potential impacts of a refuelling spill to ALARP.

Additional control measures were considered but not adopted on the basis as not being practicable as described above.

Residual Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Residual Risk
Accidental discharge of marine diesel into the marine environment during refuelling	Changes to the quality of: • water Secondary impacts including: • injury / mortality to fauna. • changes to the functions, interests or activities of other users	B	1	Low (2)

Measurement of Environmental Performance

Performance Objective	Environmental Performance Standards	Measurement Criteria
No accidental loss of hydrocarbons to the marine environment during vessel refuelling	All IMR vessels maintain SOPEP/ SMPEP (as appropriate to vessel class), as per Marine Order 91 for the duration of the EP. Appropriate initial responses prearranged and drilled in case of a hydrocarbon spill, as appropriate to vessel class.	TEO vessel audit or third party inspection document demonstrate current SOPEP/ SMPEP was in place and available. Initial response drill records verify timing and completion of hydrocarbon spill exercises.
	Vessel Master to monitor meteorological forecasts at least once daily as per Operating conditions in Cliff Head Marine Operations Procedure (10OPGOPC04).	Vessel logs record timing and conditions for operations on a daily basis.

Accidental Hydrocarbon Release: Refuelling Spill		
	Fuel storage areas are bunded or secondarily contained, such that failure of primary containment in storage areas does not result in loss to the marine environment.	Workplace Inspection records and audit report confirms all fuels were stored in bunded/ secondarily contained areas when not being handled/moved temporarily.
	Product SDS to be available on project vessel where relevant and all chemicals stored in accordance with the product SDS.	Inspection records demonstrate SDS were available on project vessel and chemicals stored in accordance with SDS.
	Spill kits are available for use to clean up deck spills and are positioned in high risk locations around the vessel (near potential spill points such as transfer stations).	Workplace Inspection records and audit report confirms spill kits were present in high risk locations around the vessel, maintained and suitably stocked.
	Bulk liquid transfer procedures implemented to ensure: • Hose integrity checked prior to use • Certified hoses used for refuelling • Dedicated personnel on hose watch during refuelling (i.e. operation is supervised) • Emergency shutdown in event of hose integrity failure • Constant communication between refuelling vessels • Emergency shutdown: vessel emergency pumping stop tested before each transfer operation.	TEO vessel audit or third party inspection document confirm that refuelling procedures were in place. Annual environmental performance reports indicate no hydrocarbon release during refuelling.
	All vessels retain the Cliff Head Emergency Response Plan and OSCP on board.	TEO vessel audit or third party inspection document demonstrate IMR vessels retain the Cliff Head Emergency Response Plan and OSCP on board.
	Spill response exercises conducted at least every three months to ensure personnel are prepared.	Spill response exercise records documenting timing and completion of exercises.
	An OSCP exercise is conducted within two weeks of the EP/OSCP acceptance or any significant amendment to the OSCP. The scope of the exercise tests the capability of the organisation to implement the significant changes to the OSCP.	Post-exercise review meeting records demonstrate the OSCP was appropriately tested and effectiveness verified by the HSE Advisor (or delegate) and that appropriate corrective actions have been developed and closed out.
	The HSE Advisor (or delegate) verifies the exercise has been undertaken in accordance with the OSCP and the Emergency Management Plan requirements by: • Reviewing and signing off on the scenario and objectives prior to	Completed Exercise Log and Post-Exercise review meeting records demonstrating that a Level 3 oil spill exercise was carried out and effectiveness verified by the HSE Advisor (or delegate) and that appropriate corrective actions have been developed and closed out.

Accidental Hydrocarbon Release: Refuelling Spill		
	the exercise. • Observing and evaluating the exercise and the performance of the Integrated Managed Team (IMT). • Participating in the post-exercise review meeting and agreeing lessons learned and/or corrective actions required and appropriate timelines for close out of identified actions. • Verifying and signing off on the Post-exercise Meeting Minutes. • Verifying and signing off on the closeout documentation for corrective/improvement actions.	
	All crew are to have completed an environmental induction containing basic information on chemical and hydrocarbon management (good housekeeping), as well as spill prevention and response measures.	Training records show all vessel-based personnel travelling offshore have received an environmental induction.
	No HFO/IFO is used on vessels.	Fuel records demonstrate no HFO/IFO was used on vessels.
	OSCP implemented (as required), with the following potentially applicable strategies: • Monitor and evaluate; • Offshore containment and recovery; • Shoreline protection and deflection; • Shoreline clean-up; and • Oiled wildlife response.	Incident reports confirm OSCP and NEBA was implemented. Incident report includes volume of hydrocarbon release to sea due to vessel collision. Record of accepted OSCP maintained. Record of oil spill response equipment list maintained.

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact from an unplanned event ranked low to high?	Yes, residual risk is Low for: • Refuelling spill
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes

Accidental Hydrocarbon Release: Refuelling Spill	
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the assessment and management of risks of 'deck and subsea spills' have addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.
Acceptability Statement	
The risk assessment has determined that, given the adopted controls, refuelling spills represent a low current risk rating that is unlikely to result in a potential impact above minor and no lasting impacts on species or socio-economic receptors. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet legislative requirements (Marine Order 91). The risk and potential impacts from a refuelling spill is considered broadly acceptable if the adopted controls are implemented. The residual risk is considered Low, which has been determined as ALARP and acceptable, in accordance with the TEO acceptability criteria.	

7.2 Unplanned Discharges: Deck and Subsea Spills

Unplanned Discharges: Deck and Subsea Spills	
Aspects / Events	Accidental discharge to the ocean of other hydrocarbons/ chemicals from project vessel deck activities and equipment (e.g. cranes), including subsea spills from subsea equipment including the ROV
Receptors	Water quality Marine fauna Socio-economic

Inherent Impact and Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Inherent Risk
Accidental discharge to the ocean of other hydrocarbons/ chemicals from project vessel deck activities and equipment (e.g. cranes), including subsea spills from subsea equipment including the ROV.	Changes to the quality of: • water Secondary impacts including: • injury / mortality to fauna.	C	1	Low (3)

Aspect/event Details

Deck spills can result from spills from stored hydrocarbons/chemicals or equipment. IMR vessels will typically store hydrocarbon/chemicals in various volumes (20 L, 205 L; up to about 4000–6000 L). Storage areas are typically set up with effective primary and secondary bunding to contain any deck spills. Releases from equipment are predominantly from the failure of hydraulic hoses, which can either be located within bunded areas or outside of bunded or deck areas (e.g. over water on cranes).

Subsea spills can result from a loss of containment of fluids from subsea equipment including the ROV. The ROV hydraulic fluid is supplied through hoses containing about 20 L of fluid. Hydraulic lines to the ROV arms and other tooling may become caught, resulting in minor leaks to the marine environment. Small volume hydraulic leaks may occur from equipment operating via hydraulic controls subsea (subsea control fluid). These include the diamond wire cutter, bolt tensioning equipment, ROV tooling, etc.

Spills are most likely to originate from hydraulic hoses, with a release of less than 100 L, with an average volume <10 L.

Impact Assessment

Potential Impacts to Water Quality, Marine Fauna and Socio-economic Receptors

Given the frequency of vessel-based activities (every 2 years) and activity duration (typically up to 2-3 weeks) an accidental deck spill of hydrocarbons or chemicals from IMR vessels is highly unlikely to occur. In the event it did occur, a decrease in water quality in the immediate area of the spill may occur; however, the impacts would be expected to be temporary and localised.

Given the small volumes related to a deck or subsea spill, receptors such as marine fauna may only be affected if they come in direct contact with a release that is by traversing the immediate spill area at the time of the spill. If marine fauna come into contact with a release they could suffer fouling, ingestion, inhalation of toxic vapours, irritation of sensitive membranes in the eyes, mouth, digestive and respiratory tracts and organ or neurological damage. Cetaceans may exhibit avoidance behaviour patterns and given they are smooth skinned, hydrocarbons and other chemicals are not expected to adhere.

Given the small area of the potential spill and the dilution and weathering of any spill, ecological impacts to marine fauna (protected species) are expected to be negligible with any effects contained locally (i.e. consequence level 1).

Unplanned Discharges: Deck and Subsea Spills

Mitigation Measures

Legislation, Codes and Standards

- Marine Order 91 (marine pollution prevention – oil) 2014, requires Ship Oil Pollution Emergency Plan (SOPEP)/ Spill Monitoring Programme Execution Plan (SMPEP) (as appropriate to vessel class).

Industry Good Practice

- Liquid chemical and fuel storage areas are bunded or secondarily contained when they are not being handled/moved temporarily.
- All chemicals stored in accordance with the product SDS.
- Spill kits positioned in high risk locations around the vessel (near potential spill points such as transfer stations).
- IMR vessels have self-containing hydraulic oil drip tray management system.

Demonstration of ALARP

In addition to the above mitigation measures / controls, the below mitigation / controls were also considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
No alternatives/substitutes identified.			
Additional Measures Considered			
Below-deck storage of all hydrocarbons and chemicals.	Minimal reduction in the likelihood of an impact from a deck spill.	X	During operations there is a need to keep small volumes of hydrocarbons and chemicals near activities and within equipment.

ALARP Statement

The use of hydrocarbons and chemicals on deck is necessary for project activities to occur, there are no suitable alternatives. It is considered that the control measures and industry standards in place reduce the likelihood and potential impacts of a deck or subsea spill to ALARP.

Additional control measures were considered but not adopted on the basis as not being practicable as described above.

Residual Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Residual Risk
Accidental discharge to the ocean of other hydrocarbons/ chemicals from project vessel deck activities and equipment (e.g. cranes), including subsea spills from subsea equipment including the ROV.	Changes to the quality of: • water Secondary impacts including: • injury / mortality to fauna.	B	1	Low (2)

Measurement of Environmental Performance

Unplanned Discharges: Deck and Subsea Spills		
Performance Objective	**Environmental Performance Standards**	**Measurement Criteria**
No accidental loss of hydrocarbons to the marine environment	All IMR vessels maintain SOPEP/ SMPEP (as appropriate to vessel class), as per Marine Order 91 for the duration of the EP. Appropriate initial responses prearranged and drilled in case of a hydrocarbon spill, as appropriate to vessel class.	TEO vessel audit or third party inspection document demonstrate current SOPEP/ SMPEP was place and available. Initial response drill records verify timing and completion of hydrocarbon spill exercises.
	Liquid chemical and fuel storage areas are bunded or secondarily contained, such that failure of primary containment in storage areas does not result in loss to the marine environment.	Workplace Inspection records and audit report confirms all liquid chemicals and fuel were stored in bunded/ secondarily contained areas when not being handled/moved temporarily.
	Product SDS to be available on project vessel where relevant and all chemicals stored in accordance with the product SDS.	Inspection records demonstrate SDS were available on project vessel and chemicals stored in accordance with SDS.
	Spill kits are available for use to clean up deck spills and are positioned in high risk locations around the vessel (near potential spill points such as transfer stations).	Workplace Inspection records and audit report confirms spill kits were present in high risk locations around the vessel, maintained and suitably stocked.
	IMR vessels have self-containing hydraulic oil drip tray management system to contain any on-deck spills of hydraulic oil.	TEO vessel audit or third party inspection document demonstrate IMR vessels were equipped with self-containing hydraulic oil drip tray management system.

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact from an unplanned event ranked low to high?	Yes, residual risk is Low for: • Deck and subsea spills
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy

Unplanned Discharges: Deck and Subsea Spills	
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the assessment and management of risks of 'deck and subsea spills' have addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.
Acceptability Statement	
The risk assessment has determined that, given the adopted controls, deck and subsea spills represent a low current risk rating that is unlikely to result in a potential impact above minor and no lasting impacts on species or socio economic receptors. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet legislative requirements (Marine Order 91). The risk and potential impacts from a deck or subsea spill is considered broadly acceptable if the adopted controls are implemented. The residual risk is considered Low, which has been determined as ALARP and acceptable, in accordance with the TEO acceptability criteria.	

7.3 Unplanned Discharges: Loss of Solid Hazardous and Non-hazardous Wastes

Unplanned Discharges: Loss of Solid Hazardous and Non-hazardous Wastes				
Aspects / Events	Accidental loss of hazardous or non-hazardous wastes/ equipment to the marine environment			
Receptors	Water Quality Marine Fauna			
Inherent Impact and Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Accidental loss of hazardous or non-hazardous wastes/ equipment to the marine environment.	Changes to the quality of: • water Secondary impacts including: • injury / mortality to fauna	C	1	Low (3)
Aspect/event Details				
The IMR vessels will generate a variety of solid wastes including packaging and domestic wastes such as aluminium cans, bottles, paper and cardboard and hazardous wastes such aerosols, batteries and paints and solvents. Hence, there is the potential for solid wastes to be lost overboard to the marine environment. Loss of solid wastes has potential to occur during periods of adverse weather and incorrect waste storage.				
Impact Assessment				
Potential Impacts to Water Quality and Marine Fauna				
The potential impacts of solid wastes accidentally discharged to the marine environment include impacts to water quality and direct pollution and contamination of the environment and secondary impacts relating to potential contact of marine fauna with wastes, resulting in entanglement or ingestion and leading to injury and death of individual animals. Impacts to water quality and protected species in the event of accidental solid waste loss is very unlikely, given the frequency (every two years) and duration (up to 2-3 weeks) of vessel-based activities. The temporary or permanent loss of waste materials into the marine environment environmental impact is expected to have a negligible environmental impact, based on the types, size and frequency of wastes that could occur and species present.				
Mitigation Measures				
Legislation, Codes and Standards				
• Marine Order 95 – pollution prevention – garbage (as appropriate to vessel class), prescribes matters necessary to give effect to Annex V of MARPOL, which prohibits the discharge of all garbage into the sea, except as provided otherwise.				
Industry Good Practice				
• Project vessel waste arrangements, which require: - dedicated waste segregation bins - records of all waste to be disposed, treated or recycled - waste streams to be handled and managed according to their hazard and recyclability class.				
Demonstration of ALARP				
No further additional mitigation measures / controls to those above were identified.				

Unplanned Discharges: Loss of Solid Hazardous and Non-hazardous Wastes			
Mitigation	**Benefit**	**Adopt**	**Justification**
Alternatives/Substitutes Considered			
No alternatives/substitutes identified.			
Additional Measures Considered			
No additional measures identified.			
ALARP Statement			
The storage of solid hazardous and non-hazardous wastes on IMR vessels is necessary for project activities to occur, there are no suitable alternatives. It is considered that the control measures and industry standards in place reduce the likelihood and potential impacts of a pipeline leak to ALARP. No additional control measures were identified.			

Residual Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Residual Risk**
Accidental discharge to the ocean of other hydrocarbons/ chemicals from project vessel deck activities and equipment (e.g. cranes), including subsea spills	Changes to water quality. Secondary impacts including injury / mortality to fauna.	B	1	Low (3)

Measurement of Environmental Performance		
Performance Objective	**Environmental Performance Standards**	**Measurement Criteria**
No accidental loss of solid hazardous or non-hazardous waste to the marine environment	IMR vessels do not discharge garbage to the sea as per Marine Order 95 – pollution prevention – garbage (as appropriate to vessel class).	TEO vessel audit or third party inspection document demonstrate no garbage discharged from IMR vessels.
	Hazardous and non-hazardous waste are managed in accordance with TEO's Prescribed Waste Management, specifically: • Containers used to transport the waste are fit for the transport of that particular prescribed waste • Spills are contained with the use of an absorbent material and contaminated materials are stored appropriately. • All liquid waste oils and glycols that are able to be contained and stored in its liquid state are stored in a 205 L drum. • Transport Waste Certificates are in place for each consignment of waste transported.	TEO vessel audit or third party inspection document demonstrate compliance TEO's Prescribed Waste Management, specifically: • Containers used to transport the waste were fit for the transport of that particular prescribed waste • Spills were contained with the use of an absorbent material and contaminated materials are stored appropriately. • All liquid waste oils and glycols that were able to be contained and stored in its liquid state were stored in a 205 L drum. • Transport Waste Certificates were in place for each consignment of waste transported.

Unplanned Discharges: Loss of Solid Hazardous and Non-hazardous Wastes	
Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact from an unplanned event ranked low to high?	Yes, residual risk is Low for: • Loss of Solid Hazardous and Non-hazardous Wastes
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the assessment and management of risks of 'accidental loss of hazardous or non-hazardous wastes/ equipment to the marine environment' have addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP demonstration above.
Acceptability Statement	
The risk assessment has determined that, given the adopted controls, accidental discharge of solid waste represents a low current risk rating that is unlikely to result in a potential impact above minor and no lasting impacts on species or habitat. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet legislative requirements (Marine Order 95). The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. The residual risk is considered Low, which has been determined as ALARP and acceptable, in accordance with the TEO acceptability criteria.	

7.4 Physical Presence: Vessel Collision with Marine Fauna

Vessel Collision with Marine Fauna				
Aspects / Events	Accidental collision between IMR vessels and protected marine fauna			
Receptors	Marine Fauna			
Inherent Impact and Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Accidental collision between IMR vessels and protected marine fauna	Injury / mortality to fauna	B	2	Low (4)
Aspect/event Details				
IMR vessels operating in the vicinity of the pipelines may present a potential hazard to protected marine fauna, including cetaceans and sea lions. Vessel movements can result in collisions between the vessel (hull and propellers) and marine fauna, potentially resulting in superficial injury, serious injury that may affect life functions (e.g. movement and reproduction) and mortality. Factors that contribute to the frequency and severity of impacts due to collision vary greatly due to vessel type, vessel operation (specific activity, speed), physical environment (e.g. water depth), the type of animal potentially present and their behaviours. IMR vessels will typically be stationary or moving at low speeds when performing IMR activities. The number of vessels conducting IMR activities is expected to consist of approximately one to two vessels within the Operational Area at a given time. During the Non Production Phase and C&M Phase, IMR activities will be undertaken intermittently (Section 3.7). The number of vessels will become less frequent therefore reducing the risk of vessel collision in the Operational Area during non-production compared to the Operations Phase.				
Impact Assessment				
Potential Impacts to Protected Species				
The likelihood of vessel/whale collision being lethal is influenced by vessel speed; the greater the speed at impact, the greater the risk of mortality (Jensen and Silber, 2004; Laist et al., 2001). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike increases from about 20% at 8.6 knots to 80% at 15 knots. At a speed of four knots, the risk was estimated to be less than 10%. Vessel–whale collisions at this speed are uncommon and, based on reported data contained in the NOAA database (Jensen and Silber, 2004), there are only two known instances of collisions when the vessel was travelling at less than six knots. Both of these were from whale watching vessels that were deliberately placed among whales. Once within the Operational Area, IMR vessels are likely to be travelling less than eight knots; therefore, the chance of a vessel collision with protected species resulting in a lethal outcome is significantly reduced versus faster moving vessels. No known key aggregation areas (resting, breeding or feeding) for protected species are located within or immediately adjacent to the Operational Area; however, the following BIAs overlap with the Operational Area:				

Vessel Collision with Marine Fauna

- Migration and foraging BIA for the Pygmy blue whale, seasonally present April to August (north bound migration) and October to December (south bound migration). Given the species distribution, migratory patterns and species BIAs, the species is likely to traverse the Operational Area.
- Migration BIA for the humpback whale. Given the species distribution, migratory patterns and species BIAs, the species is likely to traverse the Operational Area.
- Migration BIA for the southern right whale, seasonally present April through November. Given the species distribution, migratory patterns and species BIAs, the species is likely to traverse the Operational Area.
- Foraging BIA for the Australian sea lion, given the species movement range and distance between the Operational Area and the Abrolhos Islands, male seas lions may traverse the Operational Area while it is highly unlikely that female sea lions will be present.

Whale sharks and marine turtles are also susceptible to vessel strike however the Operational Area does not overlap with BIAs for these protected species. Therefore, any occurrence in the Operational Area would be transitory and of short duration.

The activity could occur at any time throughout the year (all seasons); therefore, it is possible that the Activity will overlap with the seasonal presence of the species discussed above and there may be increased numbers of individuals of these species within the Operational Area during the seasonal periods described above.

It is unlikely that vessel movement associated with project activities will have a significant impact on marine fauna populations, given: (1) the low presence of transiting individuals; (2) avoidance behaviour commonly displayed by whales; and (3) low operating speed of the IMR vessels (generally less than eight knots or stationary in the Operational Area.

Mitigation Measures

Legislation, Codes and Standards

- Project and support vessels will adhere to the requirements of EPBC Regulations 2000 Part 8, Division 8.1 Interacting with cetaceans, including the following measures:
  - IMR vessels will not travel faster than six knots within 300 m of a cetacean or turtle (caution zone) and not approach closer than 100 m from a whale
  - IMR vessels will not approach closer than 50 m for a dolphin or turtle and/or 100 m for a whale (with the exception of animals bow-riding)
  - if the cetacean or turtle shows signs of being disturbed, IMR vessels will immediately withdraw from the caution zone at a constant speed of less than six knots.
- Vessels to maintain bridge watch (consistent with Marine Order 30 - Safety and emergency arrangements) to ensure risk of marine fauna collision is minimised.
- Operation of vessels will be in accordance with Marine Notice 15/2016: Minimising the risk of ships colliding with cetaceans.

Industry Good Practice

- CHA Site induction completed by all personnel to ensure understanding of environmental reporting requirements and EPBC regulations.
- Marine fauna sightings reported to DCCEEW and any vessel/helicopter strikes reported.

Demonstration of ALARP

In addition to the above mitigation measures / controls, the below mitigation / controls were also identified, but not adopted based on the cost or effort being disproportional to the environmental benefit.

Mitigation (Control)	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
No alternative/substitute controls identified.			

Vessel Collision with Marine Fauna			
Additional Measures Considered			
The use of dedicated MFOs on the IMR vessels for the duration of each activity to watch for whales and provide direction on and monitor compliance with Part 8 of the EPBC Regulations.	Given support vessel bridge crews already maintain a constant watch during operations, additional MFOs would not significantly further reduce the risk.	X	Additional operation costs. The cost/sacrifice outweighs the benefit gained.
Varying the timing of the project activities to avoid migration periods.	Minor benefit in terms of reduced risk to whales, given low frequency of vessel's operations and also the low numbers of whale individuals expected to be encountered within the operational area. Would result in 4-5 months where no activities or could occur leading to financial losses.	X	Not adopted – control not feasible.

ALARP Statement

Vessels are required to undertake the Activity. There are no suitable alternatives to the use and number of vessels to complete the Activity. It is considered that the industry standard and activity-specific controls to reduce marine fauna collision risks that have been proposed and the contingencies in place in the event of the hazard occurring reduce the likelihood of marine fauna collision to ALARP.

Alternative and additional controls were considered but not adopted as detailed. The proposed control measures are considered appropriate to manage the risk to ALARP.

On the basis of the environmental risk assessment outcomes, TEO considers the adopted controls appropriate to manage the impacts and risks of an unplanned collision with marine fauna. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.

Residual Risk Analysis and Ranking

Aspect / Event	Environmental Impact	Likelihood	Consequence	Residual Risk
Accidental collision between IMR vessels and protected marine fauna	Injury or mortality to marine fauna	A	2	Low (2)

Measurement of Environmental Performance

Performance Objective	Environmental Performance Standards	Measurement Criteria
No vessel collision with marine fauna as a result of vessel movements.	All vessels comply with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05 and 8.06) Interacting with cetaceans, specifically: • IMR vessels will not travel faster than six knots within 300 m of a cetacean or turtle (caution zone) and not	All incidences of non-compliance with EPBC Regulations 2000 - Part 8 Division 8.1 (interacting with cetaceans) have been recorded. Incident report in MyOSH and written notification as per reporting requirements.

Vessel Collision with Marine Fauna		
	approach closer than 100 m from a whale • IMR vessels will not approach closer than 50 m for a dolphin or turtle and/or 100 m for a whale (with the exception of animals bow riding) • If the cetacean or turtle shows signs of being disturbed, IMR vessels will immediately withdraw from the caution zone at a constant speed of less than six knots.	
	All vessel strike incidents with cetaceans will be reported in the National Ship Strike Database (as outlined in the Conservation Management Plan for the Blue Whale—A Recovery Plan under the EPBC Act 1999, Commonwealth of Australia, 2015).	Incident reports demonstrate reporting cetacean ship strike incidents to the National Ship Strike Database.
	Contractor procedures reviewed to ensure vessels adhere to EPBC Regulations (Part 8) during activity to reduce potential for impact to cetaceans prior to mobilisation.	Records demonstrate that contractor procedures are reviewed to ensure compliance with EPBC regulations prior to mobilisation TEO vessel audit or third party inspection document confirm contractors comply with Cliff Head Marine Operations Procedure (10OPGOPC04) which includes EPBC regulations requirement All incidences of non-compliance with EPBC Regulations 2000 – Part 8 Division 8.1 (interacting with cetaceans) to be recorded Incident report in MyOSH and written notification as per reporting requirements.
	Maintain constant bridge watch for marine fauna during vessel movements by vessel crew.	Vessel log demonstrates bridge watch was constantly maintained during activities.
	Vessels are required to: • Maintain a look out for cetaceans, especially during the times and locations mentioned overleaf. • Warn other vessels in the vicinity using all appropriate means of communication, if cetaceans have been sighted; • Consider reducing vessel speed in areas where cetaceans have been sighted.	Conformance checked via vessel logs and completed marine fauna data sheet. Annual environmental performance reports indicate no vessel collision with marine fauna as a result of vessel movement.

Vessel Collision with Marine Fauna		
	• Consider modest course alterations away from sightings.	
	CHA Site Induction (10HSEQGENPC03) carried out for all personnel which includes requirements of EPBC Regulations (Part 8).	Training records show all personnel travelling offshore have received a site Induction including environmental requirements of EPBC Regulations (Part 8).
	Marine Fauna Sighting Datasheets submitted to DCCEEW. Vessel strikes reported to NMMC Death or injury to EPBC Act listed marine fauna (including cetaceans or whale sharks) from vessel/helicopters collision are recorded/reported to DEMIRS and DCCEEW in line with regulations	Cetacean Sighting Records maintained; records of transmittal to DCCEEW

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact from an unplanned event ranked low to high?	Yes, residual risk is Low for: • Vessel collision with marine fauna
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the assessment and management of risks of 'accidental collision with marina fauna' have addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP above.

Acceptability Statement
There is a low likelihood of vessel collision with marine fauna. Eliminating the (low) risk associated would require ceasing critical inspection and maintenance activities on the pipelines. Controls and performance standards applied to the risk are standard industry practice and have been determined to be ALARP. The residual risk is considered Low, which has been determined as acceptable, in accordance with the TEO acceptability criteria. The loss of containment from a vessel collision which could lead to impact to the environment is therefore ALARP and considered environmentally acceptable.

7.4.1 Physical Presence: Dropped Object

Physical Presence: Dropped Object				
Aspects / Events	Dropped objects resulting in seabed disturbance			
Receptors	Marine Sediment Benthic habitat and communities			
Inherent Impact and Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Dropped objects resulting in seabed disturbance	Changes to the quality of: • sediment • benthic habitats and communities.	C	1	Low (3)
Aspect/event Details				
There is the potential for objects to be dropped overboard from the IMR vessels to the marine environment. Objects that have been dropped during previous offshore projects include small numbers of personnel protective gear (e.g. glasses, gloves, hard hats), small tools (e.g. spanners) and hardware fixtures.				
Impact Assessment				
In the unlikely event of loss of equipment or materials to the marine environment, potential environmental effects would be limited to localised physical impacts on benthic habitats and communities. As a result of recovery of any dropped objects, this impact will be temporary in nature. However, if the object cannot be recovered due to health and safety, operational constraints and other factors (locating dropped objects at depth) then the minor impact will be long-term. The temporary or permanent loss of dropped objects into the marine environment is unlikely to have a significant environmental impact on the benthic communities, given the frequency (every two years) and duration (up to 2-3 weeks) of vessel-based activities. The Operational Area overlaps two KEFs, the Commonwealth marine environment within and adjacent to the west coast inshore lagoons and the Western Rock Lobster. Given only a very small proportion of the KEFs overlap the Operational Area, and the nature and scale of impacts and risks from dropped objects, seabed sensitivities associated with this KEFs will not be significantly impacted. Further, considering the types, size and frequency of dropped objects that could occur, it is unlikely that a dropped object would have a significant impact on any benthic community.				
Mitigation Measures				
Legislation, Codes and Standards				
No specific measures identified.				
Industry Good Practice				
• Lifting activities will be undertaken in accordance with Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24), which requires: - the security of loads to be checked prior to commencing lifts - loads to be covered if there is a risk of losing loose materials - all lifting equipment is rated for intended activities and maintained. • CHA crane, rigging and lifting connections (designed, constructed and installed to appropriate standards and codes) are inspected and maintained fit-for-purpose. • Cliff Head Lift Plan (10HSEQGENPC24FM01) is implemented for all lifting operations detailing load ratings of lifting equipment, intended loads, operational limits (e.g. weather).				
Demonstration of ALARP				

Physical Presence: Dropped Object			
No further additional mitigation measures / controls to those above were identified.			
Mitigation (Control)	**Benefit**	**Adopt**	**Justification**
Alternatives/Substitutes Considered			
No alternatives/substitutes identified.			
Additional Measures Considered			
No additional measures identified.			
ALARP Statement			
The use of topside equipment is necessary to undertake IMR activities in a safe manner. It is considered that the control measures and industry standards in place reduce the likelihood and potential impacts of a dropped object to ALARP. Additional control measures were considered but not adopted on the basis as not being practicable as described above.			

Residual Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Residual Risk**
Dropped objects resulting in seabed disturbance	Changes to the quality of: • sediment • habitats.	B	1	Low (2)

Measurement of Environmental Performance		
Performance Objective	**Environmental Performance Standards**	**Measurement Criteria**
No incidents of dropped objects to the marine environment greater than a consequence level of Minor.	Lifting activities are performed in accordance with the following standards as specified in the Cliff Head Lifting Operations and Lifting Equipment Procedure (10HSEQGENPC24): • The security of loads to be checked prior to commencing lifts. • Loads to be covered if there is a risk of losing loose materials. • All lifting equipment is rated for intended activities and maintained.	PTW and JSA records demonstrate that the following requirements were followed: • The security of loads were checked prior to commencing lifts • Loads were covered if there is a risk of losing loose materials. • All lifting equipment was rated for intended activities and maintained.
	CHA crane, rigging and lifting connections (designed, constructed and installed to appropriate standards and codes) are inspected and maintained fit-for-purpose.	Maintenance records verify CHA crane, rigging and lifting connections were inspected and are fit-for-purpose. Certification records have been maintained for lifting equipment.
	Cliff Head Lift Plan (10HSEQGENPC24FM01) is implemented for all lifting operations detailing load ratings of	Documented lifting plan verifies all lifting operations considered load ratings of lifting equipment, intended loads and operational limits (e.g. weather).

Physical Presence: Dropped Object		
	lifting equipment, intended loads, operational limits (e.g. weather).	

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact from an unplanned event ranked low to high?	Yes, residual risk is Low for: • Dropped Objects
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the assessment and management of risks of 'dropped objects' resulting in seabed disturbance have addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP above.

Acceptability Statement
The impact assessment has determined that, given the adopted controls, dropped objects will not result in a potential impact greater than a localised disruption to a small area of the seabed, a small proportion of the benthic population and no impact on critical habitat or activity. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice. The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. The residual risk is considered Low, which has been determined as acceptable, in accordance with the TEO acceptability criteria. Dropped objects along the pipelines which could lead to impact to the environment is therefore ALARP and considered environmentally acceptable.

7.5 Physical Presence: Accidental Introduction and Establishment of IMS

Physical Presence: Accidental Introduction and Establishment of IMS				
Aspects / Events	Accidental introduction and establishment of invasive marine species (IMS)			
Receptors	Ecosystems and Habitats Marine Fauna Socio-economic			
Inherent Impact and Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Inherent Risk**
Accidental introduction of IMS	Changes to the quality of: • Benthic habitats and communities. Impacts including: • injury / mortality to fauna • out-competing of native flora and fauna • changes to the functions, interests or activities of other users	C	3	Medium (9)

Source of Risk

IMS are a subset of Non-indigenous Marine Species (NIMS) that have been introduced into a region beyond their natural biogeographic range, resulting in impacts to social/cultural, human health, economic and/or environmental values. NIMS are species that have the ability to survive, reproduce and establish founder populations. However, not all NIMS introduced into an area will thrive or cause demonstrable impacts. The majority of NIMS around the world are relatively benign and few have spread widely beyond sheltered ports and harbours.

During project activities, vessels will be transiting to and from the Operational Area, potentially including traffic mobilising from beyond Australian waters. TEO usually contracts vessels that are located in Australian waters and would not usually mobilise a vessel from international waters. However, in the event that this occurs, there is a higher risk of IMS introduction.

During project activities, IMR vessels have the potential to introduce IMS to the Operational Area through biofouling (containing IMS) on vessels, as well as ballast water exchange. Cross contamination between vessels can also occur (e.g. IMS translocated between IMR vessels).

All vessels are subject to some level of marine fouling. The use (intake/ storage/ discharge) of seawater ballast is a standard operation in the management of vessel stability during operations. Organisms can also be drawn into ballast tanks during onboarding of ballast water. The organisms may survive within ballast tanks and can be relocated and then discharged with the ballast water into the Operational Area.

Organisms attach to the vessel hull, particularly in areas where organisms can find a good attachment surface (e.g. seams, strainers and unpainted surfaces) or where turbulence is lowest (e.g. niches, sea chests). Biofouling on vessels hulls, on other external/internal niche areas, and on equipment routinely immersed in water all pose a potential risk of translocating marine species. This can lead to the introduction of IMS, if the environmental conditions are suitable. Commercial vessels typically maintain anti-fouling coatings to reduce the build-up of fouling organisms as per AMSA Marine Order 98—Marine pollution—anti-fouling systems. During the Non Production Phase and C&M Phase, IMR activities will be undertaken intermittently (Section 3.7).

The number of vessels will become less frequent therefore reducing the risk of IMS introduction in the Operational Area during non-production compared to the Operations Phase.

Physical Presence: Accidental Introduction and Establishment of IMS

Impact Assessment

Potential Impacts to Ecosystems/Habitats, Marine Fauna and Socio-economic Values

Potential IMS have historically been introduced and translocated around Australia by a variety of natural and human means including biofouling and ballast water. Potential IMS vary from one region to another depending on various environmental factors such as water temperature, salinity, nutrient levels and habitat type, which dictate their survival and invasive capabilities. IMS typically require hard substrate in the photic zone, therefore requiring shallow waters to become established. Highly-disturbed, shallow-water environments such as shallow coastal waters, ports and marinas are more susceptible to IMS colonisation, whereas IMS are generally unable to successfully establish in deep water ecosystems and open-water environments where the rate of dilution and the degree of dispersal are high (Williamson and Fitter, 1996; Paulay et al., 2002; Geiling, 2014). Therefore, the shallow water location of part of the Operational Area, may represent suitable habitat for the establishment of IMS. However, given the frequency of vessel-based activities (every two years) and the short duration of the proposed activities (typically 2-3 weeks), the likelihood of IMS introduction and establishment is very unlikely.

Once introduced, IMS may pose a considerable threat to the Australian marine environment, including commercial fisheries. IMS may prey on local species (which had previously not been subject to this kind of predation and therefore have not evolved protective measures), they may outcompete indigenous species for food, space or light, and can also interbreed with local species, creating hybrids such that the endemic species is lost. These changes to the local marine environment result in changes to the natural ecosystem.

IMS have also proven economically damaging to areas where they have been introduced and established. Such impacts include direct damage to assets (fouling of vessel hulls and infrastructure) and depletion of commercially harvested marine life (e.g. shellfish stocks). IMS have proven particularly difficult to eradicate from areas once established. If the introduction is detected early, eradication may be effective but is likely to be expensive, disruptive and, depending on the method of eradication, harmful to other local marine life.

Under the arrangements of the Australian Ballast Water Management Requirements (CoA, 2020) that are enforced under the Biosecurity Act 2015, all vessels that have travelled from international waters are obligated to assess and manage their ballast water in accordance with the Australian Ballast Water Management Requirements. These arrangements prohibit the discharge of high-risk ballast water within Australian territorial seas (within 12 nautical miles of Australian territories) including Australian ports. It is also recommended under the Australian Ballast Water Management Requirements that ballast exchanges be conducted as far as possible away from shore and in water at least 200 m deep.

Ballast water is responsible for 20–30% of all marine pest incursions into Australian waters, however, research indicates that biofouling (the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces) has been responsible for more foreign marine introductions than ballast water (DAFF, 2011).

Biofouling on vessel hulls and other external niche areas, biofouling on internal niches and biofouling on equipment routinely immersed in water all pose a potential risk of introducing IMS into Australia. The potential biofouling risk presented by the project/ support vessels will relate to the length of time that these vessels have already been operating in Australian waters or, if they have been operating outside Australian waters, the location/s of the surveys they have been undertaking, the length of time spent at these location/s, and whether the vessels have undergone hull inspections, cleaning and application of new anti-foulant coating prior to returning to operate in Australia.

The Cliff Head IMS Risk Assessment Procedure must be conducted for all vessels associated with a project prior to the vessel first mobilising to the project and within the Operational Area includes the following:

- Provide the IMS vessel questionnaire (10HSEQENVPC06FM02) to the vessel provider / contractor prior to undertaking the assessment. Where a question is not relevant, indicate that this is the case. Where information is not available or unknown, this should be documented in the questionnaire
- Following receipt of the completed questionnaire, the information should then be entered into the VRASS, either in electronic or hard copy format.
- Once the VRASS is completed, the risk assessment ranking should be assessed and, if required additional biofouling management measures considered.

Physical Presence: Accidental Introduction and Establishment of IMS

- Complete a Submersible Equipment Risk Assessment Score Sheet (ERASS)(10HSEQENVPC06FM03) on all equipment that may be submerged whilst undertaking work in relation to the project e.g. anchors, moorings, ROVs.

The risk assessment calculation relies on a number of overall assumptions which provide a simplified version of the real world. These assumptions underpin the selection of questions in the assessments.

The purpose of the assumptions is to take a pragmatic approach which balances level of detail with practicality, and enables a versatile, high-level risk assessment for the application and purposes as outlined above

The VRASS tool uses a high-level, semi-quantitative approach based on a number of assumptions detailed in the IMS Risk Assessment Procedure (10HSEQENVPC06), to assign a vessel to one of three overall theoretical risk categories: Low / Acceptable, Uncertain and High.

It does not attempt to pinpoint whether or not a vessel is actually carrying an Invasive Marine Species but ranks vessels on a relative scale of 'more' or 'less' risk, in order to isolate which vessels may require further detailed investigation and/or management actions to reduce potential risk.

To this end, only the broad categories of the calculated risk are in the tool results. This is because to include an exact score may imply greater precision than is valid, which could distract from the overall result.

Vessels that remain in the region and do not enter ports that are known to host IMS do not require re-assessment between operations. Short duration trips from the project site, such as returning personnel to shore, refuelling or short duration berthing (days) in local harbours that do not have documented pest incursions will not require a vessel to be re-assessed. However, a risk assessment will be conducted annually on vessels providing ongoing support to CHA Operations.

It is then up to TEO in consultation with the Vessel Owner/Operator to consider the actions suggested and decide which actions are most appropriate for the vessel to ensure potential biofouling risks are mitigated to ALARP. The Department will actively provide advice to vessels should they require more detailed information to manage potential biofouling risks prior to their arrival into WA state waters.

International vessels will carry a current Statement of Compliance for International Anti-fouling Inspection Systems and will be assessed for bio-fouling risk prior to entry into Australian waters in accordance with the National Biofouling Management Guidance to the Petroleum Production and Exploration Industry with any required corrective actions such as inspection, cleaning and coating reapplication undertaken as appropriate.

Industry standards already in place ensure risks are reduced, these include recently introduced mandatory requirements of the Department of Agriculture, Fisheries and Forestry (DAFF) Australian Ballast Water Management:

- Operators of all vessels subject to biosecurity control will be required to provide information on how biofouling has been managed prior to arriving in Australian territorial seas. This information will need to be reported through the department's Maritime Arrivals Reporting System (MARS)
- Vessel operators will receive less intervention for biofouling if they comply with one of the following three accepted biofouling management practices:

  Implementation of an effective biofouling management plan; or
  Cleaned all biofouling within 30 days prior to arriving in Australian territory; or
  Implementation of an alternative biofouling management method pre-approved by the department.
- A vessel operator that has not applied one of the three accepted biofouling management practices will be subject to further questions and assessment of the biosecurity risk associated with biofouling on the vessel. Given the shallow water depths of the Operational Area (0 to 9 m) and the distance to landfall, there is the potential for IMS to successfully translocate from the Operational Area to surrounding shallower habitats. However, the Operational Area is not considered to be similar to that of ports given the low vessel traffic, flushing due to the currents which likely results in low marine pollution levels. The western portion of the Operational Area overlaps with the Commonwealth marine environment within and adjacent to the west coast inshore lagoons and Western Rock Lobster KEFs, both of which support benthic habitats.

With controls in place to reduce the risk of introduction of IMS the likelihood of introducing IMS is considered unlikely. In addition, TEO have never had any incident in relation to introduction of IMS.

Mitigation Measures

Physical Presence: Accidental Introduction and Establishment of IMS

Legislation, Codes and Standards

- AMSA Marine Order 98 (Marine pollution—anti-fouling systems) - All IMR vessels will have a valid antifouling certificate.
- IMR vessels will have a Ballast Water Management Plan in accordance with relevant IMO and International Convention for the Control and Management of Ship's Ballast Water and Sediments requirements.
- Ballast water records system maintained which verifies no high risk ballast water on board vessel sin the Operational Area.

Industry Good Practice

- All vessels and submersible equipment to be subject to IMS risk assessment prior to contracting and entering the Operational Area.
- Implementation of additional management options based on IMS risk assessment outcomes.
- Annual IMS risk assessment on vessels providing ongoing support to CHA operations.

Demonstration of ALARP

In addition to the above mitigation measures / controls, the below mitigation / controls were also considered, however are not adopted at present based on the cost or effort being disproportional to the environmental benefit.

Mitigation	Benefit	Adopt	Justification
Alternatives/Substitutes Considered			
Source IMR vessels based in Australia only.	Sourcing vessels from within Australia will reduce the likelihood of IMS from outside Australian waters; however, it does not reduce the likelihood of translocation of species native to Australia but alien to the Operational Area, or of IMS that have established elsewhere in Australia. The consequence is unchanged.	X	Sourcing vessels from Australian waters may result in a reduction in the likelihood of IMS introduction to the Operational Area; however, the potential cost of implementing this control is grossly disproportionate to the minor environmental gain (or reducing an already remote likelihood of IMS introduction) potentially achieved by using only Australian based vessels. Consequently, this risk is considered not reasonably practicable.
Additional Measures Considered			
No routine discharge of ballast water from vessels.	No routine discharge of ballast IMS would reduce the likelihood of IMS being introduced to the Operational Area. However, this reduction is unlikely to be significant given the other control measures implemented. No change in consequence would occur.	X	Ballast water discharges are critical for maintaining vessel stability. Given the nature of project activities, the use of ballast (including the potential discharge of ballast water) is considered to be a safety critical requirement.
IMS Inspection of all vessels.	Inspection of all vessels for IMS would reduce the likelihood of IMS being	X	The IMS inspection of all vessels would result in significant cost and schedule impacts. In addition, TEO's

Physical Presence: Accidental Introduction and Establishment of IMS			
	introduced to the Operational Area. However, this reduction is unlikely to be significant given the other control measures implemented. No change in consequence would occur.		the Cliff Head Invasive Marine Species Risk Assessment Procedure is seen to be more cost effective as this control allows TEO to manage the introduction of marine pests through biofouling, while targeting its efforts to and resources to areas of greatest concern. Inspection of all vessels for IMS would reduce the likelihood of IMS being introduced to the Operational Area. However, this reduction is unlikely to be significant given the other control measures implemented. No change in consequence would occur.
Application of new anti-foulant coating to vessels prior to contract commencement.	Little benefit given recent anti-fouling treatment history for vessels.	X	Substantial additional cost, potential delay to production operation. Little benefit given recent anti-fouling treatment history for vessels.
Hull cleaning on every occasion.	Little benefit since hulls will be inspected and cleaned if required.	X	Additional cost and potential delay to production operation, little benefit since hulls will be inspected and cleaned if required.
Ballast water treatment (e.g. biocide).	Biocide in ballast water may lead to additional environmental impacts (i.e. discharge of toxic ballast), net environmental benefit is considered to be lower. Non-toxic treatment (e.g. UV) constrains vessel selection - see fresh water ballast justification.	X	Biocide in ballast water may lead to additional environmental impacts (i.e. discharge of toxic ballast), net environmental benefit is considered to be lower. Non-toxic treatment (e.g. UV) constrains vessel selection – see fresh water ballast justification
Fresh water ballast.	Requires fresh water on vessels (e.g. tanks, RO plant), which may significantly constrain vessel selection. Given nature and scale of activity, cost is grossly disproportional to environmental benefit	X	Requires fresh water on vessels (e.g. tanks, RO plant), which may significantly constrain vessel selection. Given nature and scale of activity, cost is grossly disproportional to environmental benefit.

Physical Presence: Accidental Introduction and Establishment of IMS
ALARP Statement
Vessels are required to undertake the Activity. There are no suitable alternatives to the use and number of vessels to complete the Activity. It is considered that the industry standard and activity-specific controls to reduce the accidental introduction of IMS that have been proposed and the contingencies in place in the event of the hazard occurring reduce the accidental introduction of IMS to ALARP. Alternative and additional controls were considered but not adopted as detailed. The proposed control measures are considered appropriate to manage the risk to ALARP. On the basis of the environmental risk assessment outcomes, TEO considers the adopted controls appropriate to manage the risks of IMS. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.

Residual Risk Analysis and Ranking				
Aspect / Event	**Environmental Impact**	**Likelihood**	**Consequence**	**Residual Risk**
Accidental introduction of IMS	Changes to the quality of: • Benthic habitats and communities. Impacts including: • injury / mortality to fauna • out-competing of native flora and fauna • changes to the functions, interests or activities of other users	B	3	Medium (6)

Measurement of Environmental Performance		
Performance Objective	**Environmental Performance Standards**	**Measurement Criteria**
No introduction and establishment of invasive marine species into the Operational Area as a result of project activities.	All project/ support vessels have a valid antifouling certificate from the International Association of Classification Societies in accordance with AMSA Marine Order 98 (Marine pollution—anti-fouling systems).	Valid antifouling certificate from the International Association of Classification Societies in accordance with AMSA Marine Order 98 (Marine pollution—anti-fouling systems) was in place and accessible for all IMR vessels.
	IMS risk assessment (10HSEQENVPC06) (operational history, ballast water assessment, anti-fouling coating) to be carried out annually on vessels providing ongoing support to CHA Operations	TEO vessel audit or third party inspection document demonstrate IMS Questionnaire has been undertaken all vessels and annual checks of VRASS forms were completed.
	IMS risk assessment (10HSEQENVPC06) (operational history, ballast water assessment, anti-fouling coating) to be carried out as part of vessel contracting process demonstrating IMS risk is acceptable or low	TEO vessel audit or third party inspection document demonstrate IMS risk assessment has been undertaken to show vessel/ submersible equipment IMS risk is acceptable or low

Physical Presence: Accidental Introduction and Establishment of IMS		
	Management measures are implemented that are commensurate with the risk (such as the treatment of internal systems, IMS inspections or cleaning), to minimise the likelihood of translocating IMS within a vessel's biofouling to the Operational Area.	Records of IMS risk assessments maintained for all IMR vessels to verify IMS risk assessments have been completed prior to mobilisation.
		Records of management measures which have been implemented where identified through the IMS vessel risk assessment process were maintained.
	Ballast water on IMR vessels to be managed in accordance with the Australian Ballast Water Management Requirements.	Ballast Water Records System maintained by vessels which verifies compliance against Australian Ballast Water Management Requirements.
	All ballast water onboard vessels to be low risk (i.e. sourced from Australian waters – 200 NM EEZ)	
	Ballast Water Management Plan for project/ support vessels must comply with: • Regulation B-1 of the International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004; and should have been prepared in accordance with: • IMO Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (IMO Resolution MEPC.127(53)	TEO vessel audit or third party inspection document demonstrate Vessel Ballast Management Plan in place

Demonstration of Acceptability	
Acceptability	**Answer**
Is the risk of impact from an unplanned event ranked low to high?	Yes, residual risk is Medium for: • Accidental introduction and establishment of IMS
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood based on the information currently available.
Are performance standards consistent with industry standards, legal and regulatory requirements?	Yes, performance standards are consistent with industry practice and legal and regulatory requirements.
Are performance standards consistent with stakeholder expectations?	Yes, no concerns raised by stakeholders.
Does the activity comply with Legal Requirements/Laws/Standards?	Yes
Is the activity in accordance with the TEO HSE Policy?	Yes, the activities align with the TEO HSE Policy

Physical Presence: Accidental Introduction and Establishment of IMS	
Is the activity conducted, including assessment of risk, consistent with the principles of ESD?	Yes, the assessment and management of risks of 'accidental introduction and establishment of IMS' have addressed the Principles of ESD.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes, see ALARP above.

Acceptability Statement

The pathways for IMS introduction are well known, and subsequently standard preventative measures are proposed. The ability for IMS to colonise a habitat is dependent on a number of environmental conditions. It has been found that highly disturbed environments (such as marinas) are more susceptible to colonisation than open water environments where the number of dilutions and the degree of dispersal are high. Given the shallow water depths within the Operational Area, the conditions could be considered more favourable (depending on the IMS introduced). However, the Operational Area is not considered to be similar to that of ports given the low vessel traffic, flushing due to the currents which likely results in low marine pollution levels. With controls in place to reduce the risk of introduction of IMS the likelihood of introducing an IMS is considered very unlikely.

In line with industry standards and legislation, vessels and in-sea equipment that are internationally mobilised will meet requirements applied by DPIRB. All vessel sourced will have low IMS risk. Application of the proposed management and adherence to regulations reduces the likelihood of introducing IMS into the operational area.

It is thought that owing to the unlikeliness of IMS entering the operational area, the risk is deemed acceptable, in accordance with the TEO acceptability criteria. The accidental introduction of IMS could lead to impact to the environment is therefore ALARP and considered environmentally acceptable.

8 Implementation Strategy

8.1 Environmental Management Framework

TEO has an established Health, Safety & Environment Policy Statement for all its operations. TEO realises this policy by implementing a tiered management system which includes:

- Manuals.
- Standards.
- Plans.
- Procedures.

8.2 Systems, Practices and Procedures

All operational activities are planned and performed in accordance with relevant legislation, standards and management measures identified in the EP, and internal environment standards and procedures.

Table 8-1 details other relevant HSE procedures applicable to CH operations.

Table 8-1: Relevant HSE Procedures

Procedure	Objective of Procedure
HSE Policies Location: TEO HSE Policy (Section 8)	To outline the main safety criteria to be observed by TEO personnel when conducting activities relating to our Cliff Head Operations.
Cliff Head Emergency Management Plan 10HSEQGENPL01	To ensure that TEO has an effective emergency response management and recovery system.
Cliff Head Offshore Operations Oil Spill Contingency Plan 10HSEQENVPL02	To provide guidance on the management and clean-up of oil spills.
Permit to Work System 10HSEQGENPC17	Work on operating workplaces, including work covered by a work order is covered by a comprehensive PTW procedure. Adherence to these procedures ensures the facility is put in a safe condition before work starts and is kept in this condition until all Personnel involved in the work have signed off completion.
Cliff Head Contractor/Third Party HSEQ Evaluation 10HSEQGENPC15	The contracting of services, the purchase, hire or lease of equipment and materials, and activities with partners, is carried out to minimise any adverse HSE consequences and, where possible, to enhance community development opportunities.
Incident Investigation and Management 10HSEQGENPC23	To ensure that a system exists for all Employees to report all health, safety and environmental incidents; and to ensure that all incidents are investigated to an appropriate level.

8.3 Roles and Responsibilities

The organisation structure during general operations of the Cliff Head Oil Field Development is provided in Figure 8-1.

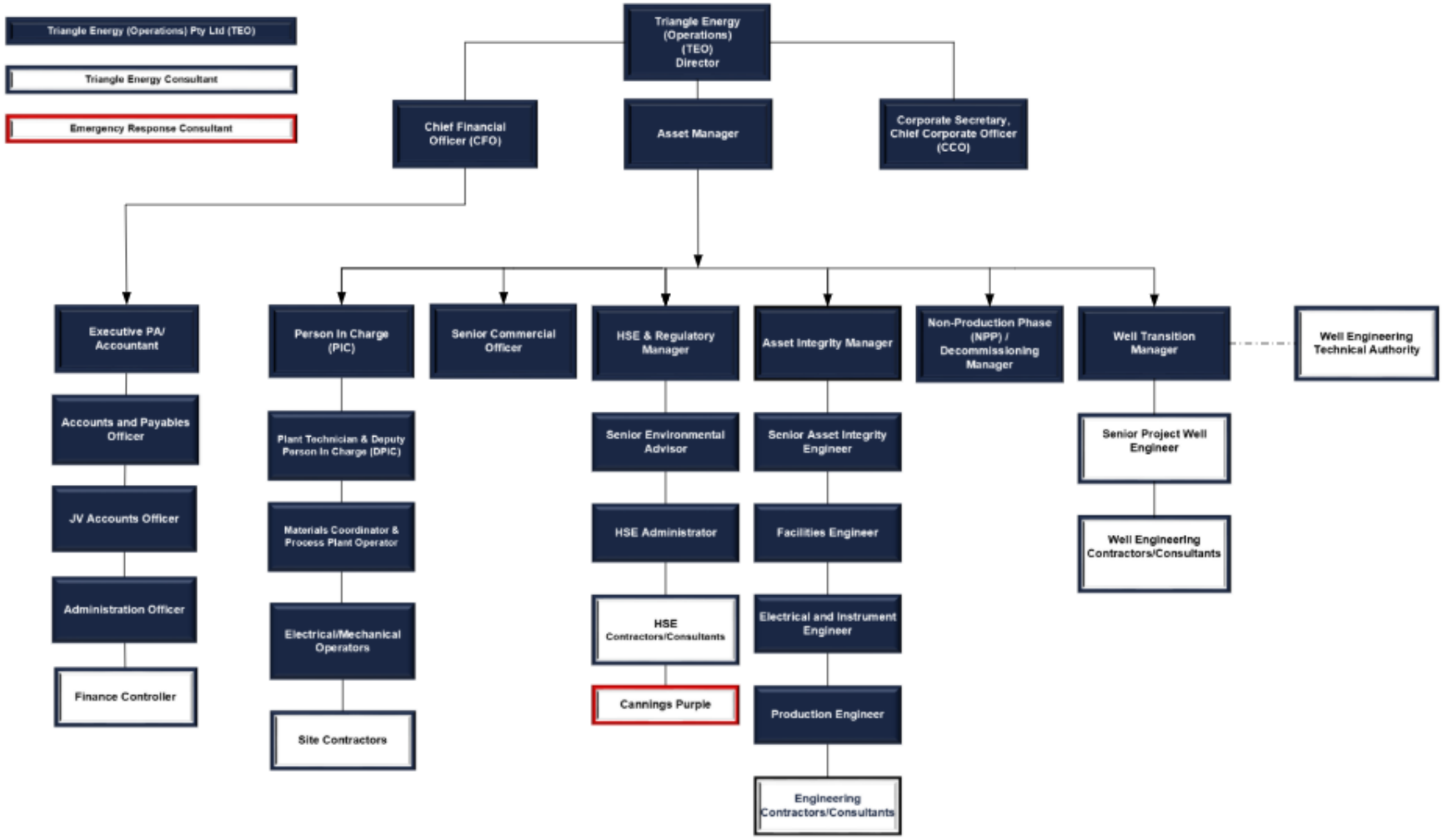


Figure 8-1: Organisational Chart

8.4 Training and Competencies

All staff engaged to work on the Cliff Head Facilities are inducted into the TEO HSEMS on employment. This process includes specific instruction on the TEO HSE Policy and the responsibilities of staff under the HSE Policy. An induction program has been established to provide an overview of the HSEMS objectives. All personnel working on pipeline activities will receive an induction, including environmental management, prior to commencement of their duties on site to ensure understanding of their responsibilities in conforming to performance standards set out in the Environment Plan.

Copies of the Health Safety & Environment Policy Statement are displayed at prominent locations at the work sites (e.g. notice boards, meeting rooms, offices).

8.4.1 Contractors

Contractors, subcontractors and third parties working within the Operational Area must meet and follow the requirements set out in Contractor and Third Party Management Plan (10HSEQGENPL17) when engaged by TEO for any contracted works on the Cliff Head operation.

8.5 Monitoring, Auditing, Management of Non Conformance, and Review

A system is in place to assess operating performance to ensure that the processes and systems adopted are effective in meeting TEO policies and objectives, and legislative requirements.

The Cliff Head Audit Schedule (10HSEQGENPL15) is the key mechanism by which the IMS is audited for compliance. TEO will conduct regular inspections and audits during the operations phase on an annual basis to verify that the EPO and standards outlined in the EP have been met. The audit schedule also includes annual inspections and audits that are conducted on 3rd party contractors (e.g. Vessel contractor and Helicopter contractor) to ensure compliance with the EP.

The TEO Environmental commitments register is a compliance tool which consolidates all environmental commitments and defines key EPOs, EPS, mitigation measures and measurement criteria. Compliance assessment with the register is conducted during the annual internal environmental audit.

In the event that these external changes are required to be reflected in the EP, changes to the EP and OSCP will be made in accordance with the Management of Change (MOC) Procedure (Section 8.5.1).

8.5.1 Management of Change

Changes to the EP and OSCP will be made in accordance with the Cliff Head MOC Procedure (10HSEQGENPC18). The Cliff Head Environmental Change Form (10HSEQENVPC07FM01) is used to assess the environmental impacts of the proposed change and inform the MOC process. The MOC procedure will determine whether a revision of the environment plan is required and whether that revision is to be submitted to DEMIRS pursuant to Regulation 18 of the OPGGS(E) Regulations.

8.5.2 Review of EP

TEO will review the EP within each calendar year following acceptance of the EP as long as the EP remains valid (5 years). This review will be completed through the measurement of environmental performance, ongoing audits, inspections and checks. The results of the review will be detailed in the annual performance report.

8.6 Record Keeping

TEO's records management systems also incorporate HSE regulatory compliance databases, documenting required actions as specified in project commitments and conditions of approval.

As a minimum, TEO will store and maintain the following records for a period of five (5) years. These records will be available to the regulator upon request.

8.7 Details of Chemicals

A list of indicative added chemicals are provided in Figure 8-2.

Figure 8-2 Chemicals and Other Substances

Chemical Application	Proposed Chemical Product	Use Pathway	Proposed Chemical Usage	Potential Environmental Risk[7]
Corrosion inhibitor	HSUR43670A	ASP WI System	Periodic	LOW
Corrosion inhibitor	CORR31331A	ASP WI System	Periodic	LOW
Corrosion inhibitor	CORR22363A	ASP WI System	Periodic	LOW

8.8 Decommissioning

As the Cliff Head facilities have reached CoP, TEO is maturing plans for decommissioning of the pipelines in State Waters in accordance with the PSLA, DEMIRS' policy and guidance, AA3T, EPBC Act Approval Conditions (EPBC 2003/1300) and Ministerial Statement 670.

Petroleum pipelines located in State waters are regulated under the PSLA, and associated regulations. The PSLA Act requires titleholders:

- Maintain structures, equipment and property in the title area in good condition and repair.
- Remove all structures, equipment and property when it is neither used nor to be used in connection with authorised operations.

TEO does not currently have plans to decommission the pipelines within the scope of the EP. Subsequent environmental approvals to undertake decommissioning will be sought under the relevant legislation closer to the time of the activity. TEO's planning basis for decommissioning is therefore complete removal of property, while alternative options may also be investigated and evaluated.

A provisional overview of the decommissioning timeline is as follows:

- Stage 1 (2024) Cessation of Production.
- Stage 2 (2024-26) Decommissioning planning: Well P&A Planning including; Conceptual studies and engineering design, Contracting, Safety Case and WOMP development and acceptance.
- Stage 3 (2024-27) Decommissioning Planning: Cliff Head Infrastructure Conceptual and trade-off studies, engineering design, Contracting and Decommissioning Plan development and acceptance.
- Stage 4 (2024-28) Decommissioning Planning: Pipeline Removal planning including; conceptual and trade-off studies, engineering design, Contracting, Decommissioning Plan development and acceptance.
- Stage 5 (2026-27) Execution: Well P&A Execution.
- Stage 6 (2026-29) Execution: Cliff Head A Removal.
- Stage 7 (2028-29) Execution: Offshore Pipeline Removal.
- Stage 8 (2029-31) Execution: Onshore Infrastructure.
- Stage 9 (2030-2035) Post-decommissioning monitoring (as required) and criteria close-out.
- Stage 10 (2035) Submission of close out decommissioning report to relinquish title.

[7] Potential environmental risk was assessed using "Environmental Risk Assessment of Chemicals" used in WA Petroleum Activities Guideline (DMP, 2013).

9 Stakeholder Engagement

Table 9-1 provides a list of the stakeholders consulted for the EP revision. All stakeholders were provided a copy of the factsheet in Appendix B.

Table 9-1: List of Stakeholders Consulted

WA State Departments	
Department of Mines, Industry Regulation and Safety (DEMIRS)	Department of Fire and Emergency Services (DFES)
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	Public Transport Authority
Department of Biodiversity, Conservation and Attractions (DBCA)	Department of Transport - Marine (DoT)
DWER (Department of Water Environment Regulation)	Environmental Protection Authority (EPA)
Commonwealth Departments	
Australian Fisheries Management Authority (AFMA)	Department of Industry, Innovation and Science (DIIS)
Australian Hydrographic Service (AHS)	Department of Defence
Australian Maritime Safety Authority (AMSA)	Director of National Parks (DNP)
Department of Agriculture – Biosecurity (Marine Pests)	National Native Title Tribunal (NNTT)
Department of Agriculture - Fisheries	National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)
Commercial Fisheries, Tourism, and Recreational Fishing	
Western Australian Fishing Industry Council (WAFIC)	Patience Bulk Haulage (West Coast Rock Lobster Managed Fishery License Holder)
Pearl Producers Association of WA (PPA)	Southern Bluefin Tuna Fishery
Commonwealth Fisheries Association (CFA)	South West Trawl Managed Fishery
Western Rock Lobster Council	Specimen Shell Managed Fishery
Dongara Professional Fisherman's Association	Octopus Interim Managed Fishery
Geraldton Professional Fishermen's Association (GPTA)	Open Access Fishery in the North Coast, Gascoyne Coast and West Coast Bioregions
Recfishwest	West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery
Australian Fisheries Management Authority (AFMA)	West Coast Demersal Scalefish (Interim) Managed Fishery
Abalone Managed Fishery	West Coast Rock Lobster Managed Fishery
Abrolhos Islands and Mid West Trawl Managed Fishery	West Coast Deep Sea Crustacean Management Fishery
Mackerel Managed Fishery	Western Tuna and Billfish Fishery
Marine Aquarium Fish Managed Fishery	West Coast Purse Seine Managed Fishery
Oil & Gas Industry / Other Industry	
Australian Marine Oil Spill Centre (AMOSC)	Mid West Ports
First Nation	

Yamatji Southern Regional Corporation (YSRC)	
Other Relevant Stakeholders	
City of Geraldton	World Wildlife Fund for Nature (WWF)
Shire of Irwin	The Wilderness Society
WA Conservation Council	Clean Energy Regulator (CER)

9.1 Consultation Results

Up to the date of submission of the EP, feedback was provided by eight stakeholders.

Key feedback is summarised in the sections below.

9.1.1 Commercial and Recreational Fisheries

WAFIC is the peak industry body representing commercial fishers in WA, including all WA managed fisheries, as well as WA-based licence holders in the Commonwealth managed WTBF. On behalf of TEO, on the 6 May 2025 WAFIC contacted all licence holders in the below fishers:

- Marine Aquarium Fish Managed Fishery
- Specimen Shell Managed Fishery
- Octopus Interim Managed Fishery Zone 1
- West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery
- West Coast Demersal Scalefish (Interim) Managed Fishery – Mid west zone
- West Coast Deep Sea Crustaceans
- Mackerel Managed Fishery (Area 3).

WAFIC distributed the consultation email and factsheet. On the 3 June 2025, WAFIC confirmed that they did not receive any feedback from the industry regarding the proposed Cliff Head Project - State Pipeline EP 5-year revision.

RecfishWest expressed interest in Triangle's plans for decommissioning and are interested in meeting with Triangle to discuss exploring artificial reefs as an alternative decommissioning option as part of future comparative assessments.

9.1.2 Commonwealth Departments

In response to TEO, AMSA provided a chart of the area of interest for TEO to note that some local vessels, (such as port tender, pleasure craft, fishing) will be encountered in the area during activities. AMSA requests the following:

- the associated vessel/s notify AMSA's Joint Rescue Coordination Centre (JRRC) through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. AMSA's RC will require the vessel details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end.
- AHO must be contacted through datacentre@hydro.gov.au no less than four working weeks before operations commence for the promulgation of related notices to mariners.
- Vessels should exhibit appropriate lights and shapes to reflect the nature of operations – AMSA remind vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs), in particular, the use of appropriate lights and shapes to reflect the nature of operations (e.g restricted in the ability to manoeuvre). Vessels should also ensure their navigation status is set correctly in the ship's Automatic Identification System (AIS) unit.
- Triangle Energy should evaluate and implement adequate anti-collision measures.

9.1.3 State Departments

DPIRD provided a detailed response, providing information regarding the following:

- Commercial and aquaculture fishing interests in the area
- Key fish species to consider and relevant spawning, aggregating and pupping times
- Targeted recreational fishing in the area
- Customary and charter fishing
- Important habitats to consider
- Biosecurity requirements
- Spill Contingency planning

DPIRD also suggested two stakeholders not previously identified by TEO for consultation:

- Aquaculture Council of Western Australia (Aquaculture peak sector body)
- Marine Tourism WA (Charter).

These stakeholders were consulted (via email with the factsheet) on 3 June 2025.

9.1.4 Non-governmental organisations

The Wilderness Society provided TEO with a letter objecting to the current proposal, which they consider presents an unacceptable five year delay to the decommissioning of the cliff head pipeline. The relevant person considers Triangle should have already planned and provisioned for full decommissioning of the Cliff Head operations and are concerned that, if the EP is approved, exacerbates the risk that decommissioning will not be delivered, leaving potential harmful materials in the marine environment and will have financial implications.

The relevant person requested a comprehensive report with a robust and independently verified cost estimate for these works and evidence that the company holds sufficient provisions to complete the work.

Triangle reiterated the pipelines are currently transitioning to a NPP with further activities underway prior to entering the C&M Phase. Triangle will continue to perform IMR on the Cliff Head pipelines throughout all remaining activity phases in such a way that allows for full removal and future use options. The pipelines will be flushed and chemically preserved and IMR activities will reduce the risk of significant maintenance and repairs being required prior to decommissioning.

Triangle remains committed to the full removal of all property, equipment and infrastructure as the base case for decommissioning. In addition to the PSLA, Cliff Head pipelines are subject to the approval of future decommissioning plans under multiple legal instruments including the pipeline AA3T, EPBC conditions (EPBC 2003/1300) and Ministerial Statement 670. TEO and the Cliff Head Development Joint Venture therefore consider the duty to decommission infrastructure to be well transposed into legislation, whilst financial assurance of the JV will continue to be updated as cost estimates are refined at key phases of decommissioning planning.

Planning is already well underway for P&A of the Cliff Head wells, currently expected in 2026.

This consultation was considered an objection or concern. Based on the information provided above, the objection or claim raised is not considered to have merit and an explanation has been provided to the stakeholder.

No other responses to this consultation have been received, and no other issues or concerns regarding the proposed activities have been raised by any other stakeholders contacted during this preparatory consultation.

Appendices

Appendix A TEO Risk Matrix

TEO Risk Matrix

Consequence

The consequence terms to be used to describe worst case credible scenario for the risk, assuming the risk event occurs, and mitigating controls fail.

Table 1 - Consequence categories

		Injury / Health Effect	Regulatory	Environment	Asset / Production Loss	Business Reputation
6	**Catastrophic**	Multiple fatalities or severe and irreversible illness / disability (>30%) to multiple personnel.	Potential jail terms for executives and/or catastrophic fines for company. Or Prolonged litigation. Loss of operating licences.	Extremely severe environmental impact with significant recovery work over a few years.	Catastrophic >$5M	Catastrophic adverse public, political or media outcry, resulting in international coverage. Critical impact on business reputation & future.
5	**Severe**	Single fatality or severe irreversible illness / disability (>30%) to 1 person.	Severe fines or prosecutions. Or Issue of show cause notice.	Severe environmental impact with significant site impact and recovery work over a few months.	Severe $ 2.5M to <$5M	Severe adverse national media /public / political attention.
4	**Major**	Permanent disability / illness (<30%) to 1 person.	Major prosecution and fines. Or Major litigation, including class actions.	Major environmental impact with off-site impact and recovery work over a few weeks.	Major $1M to < $2.5M	Major impact on business reputation and/or national media exposure.
3	**Serious**	Serious injury or serious health effects resulting in more than 5 days lost time or more than 1-month alternate / restricted duties.	Serious breach of legislation. Or Prohibition Notice and/or fines issued by Regulator.	Serious environmental impact with some on-site impact and recovery work over a few days.	Serious $300k to < $1M	Serious, adverse local public or media attention or complaints.
2	**Moderate**	Injury / health effect to individual requiring medical treatment by a medically qualified person with less than 5 days lost time or less than 1 month alternate / restricted duties.	Breach of legislation with investigation required by Regulator. Or Direction / Improvement Notice issued by Regulator.	Moderate or slight environmental impact, negligible remedial / recovery work.	Moderate $30k to < $300k	Moderate or slight impact. Public awareness, but no public concern.
1	**Minor**	Injury or illness requiring first aid (no lost time or alternate / restricted duties).	Minor regulatory breach. Or Compulsory reporting of incident.	Negligible environmental impact, effect contained locally.	$0k to < $30k	Negligible impact on reputation.

Likelihood

The likelihood terms to be used to describe the likelihood from the description that best fits the probability or chance of the selected consequence occurring, based on controls currently in place. For exposure to risk in the future, select the likelihood based on controls which will be in place at the time of exposure to the risk.

Table 2 - Likelihood categories

A **Extremely unlikely**	B **Very unlikely**	C **Unlikely**	D **Likely**	E **Very likely**	F **Almost certain**
Less than once per 100 years Not known to occur in a comparable activity internationally but plausible	Between once per 100 years and once per 10 years Known to occur in a comparable activity internationally but unlikely	Between once per 10 years and once per year Has occurred or could occur in a comparable activity in Australia	Between once every year and 4 times a year Has occurred once or twice in the company	At least once per month Has occurred frequently in the company	At least once per week Has occurred frequently at the facility

Risk ranking

The residual risk rating is determined by considering the potential consequences (Table 1) and the likelihood of occurrence or potential occurrence (Table 2).

Table 3 - Risk ranking

Consequence ↓	Injury / Health Effect	Regulatory	Environment	Asset / Production Loss	Business Reputation	Level	A	B	C	D	E	F
Catastrophic	Multiple fatalities or severe and irreversible illness / disability (>30%) to multiple personnel.	Potential jail terms for executives and/or catastrophic fines for company. Or Prolonged litigation. Loss of operating licences.	Extremely severe environmental impact with significant recovery work over a few years.	Catastrophic >$5M	Catastrophic adverse public, political or media outcry, resulting in international coverage. Critical impact on business reputation & future.	**6**	**High (6)**	**High (12)**	**Very High (18)**	**Very High (24)**	**Extreme (30)**	**Extreme (36)**
Severe	Single fatality or severe irreversible illness / disability (>30%) to 1 person.	Severe fines or prosecutions. Or Issue of show cause notice	Severe environmental impact with significant site impact and recovery work over a few months.	Severe $ 2.5M to <$5M	Severe adverse national media /public / political attention.	**5**	**Medium (5)**	**High (10)**	**High (15)**	**Very High (20)**	**Very High (25)**	**Extreme (30)**
Major	Permanent disability / illness (<30%) to 1 person.	Major prosecution and fines. Or Major litigation, including class actions.	Major environmental impact with off-site impact and recovery work over a few weeks.	Major $1M to < $2.5M	Major impact on business reputation and/or national media exposure.	**4**	**Medium (4)**	**Medium (8)**	**High (12)**	**High (16)**	**Very High (20)**	**Very High (24)**
Serious	Serious injury or serious health effects resulting in more than 5 days lost time or more than 1-month alternate / restricted duties.	Serious breach of legislation. Or Prohibition Notice and/or fines issued by Regulator.	Serious environmental impact with some on-site impact and recovery work over a few days.	Serious $300k to < $1M	Serious, adverse local public or media attention or complaints.	**3**	**Low (3)**	**Medium (6)**	**Medium (9)**	**High (12)**	**High (15)**	**Very High (18)**
Moderate	Injury / health effect to individual requiring medical treatment by a medically qualified person with less than 5 days lost time or less than 1 month alternate / restricted duties.	Breach of legislation with investigation required by Regulator. Or Direction / Improvement Notice issued by Regulator	Moderate or slight environmental impact, negligible remedial / recovery work.	Moderate $30k to < $300k	Moderate or slight impact. Public awareness, but no public concern.	**2**	**Low (2)**	**Low (4)**	**Medium (6)**	**Medium (8)**	**High (10)**	**High (12)**
Minor	Injury or illness requiring first aid (no lost time or alternate / restricted duties).	Minor regulatory breach Or Compulsory reporting of incident.	Negligible environmental impact, effect contained locally.	$0k to < $30k	Negligible impact on reputation.	**1**	**Low (1)**	**Low (2)**	**Low (3)**	**Medium (4)**	**Medium (5)**	**High (6)**

Appendix B Stakeholder Consultation Materials

STAKEHOLDER CONSULTATION INFORMATION SHEET

Cliff Head Field State Waters Environment Plan Revision

May 2025

In accordance with the Petroleum (Submerged Lands)(Environment) Regulations 2012, Triangle Energy (Operations) Pty Ltd (TEO) is required to develop and implement a 5-year revision of it's current Environment Plan (EP) for ongoing care and maintenance of the Cliff Head pipelines in State Waters.

The EP will cover the transition from a current non-production phase (NPP) to a care and maintenance phase of the pipelines located in State Waters for the full 5-year life of the EP. Normal phase activities do not involve vessels or any on-the-water activities. However, vessels may be required to traverse the pipeline route infrequently (approximately every 2 years) for the purpose of inspections, maintenance and/or repair.

WHO IS TRIANGLE ENERGY?

TEO is an oil exploration and production company based in Perth, Western Australia. The company is the majority owner (78.75%) and registered operator of the Cliff Head Oil Field and ASP (**Figure 1**).

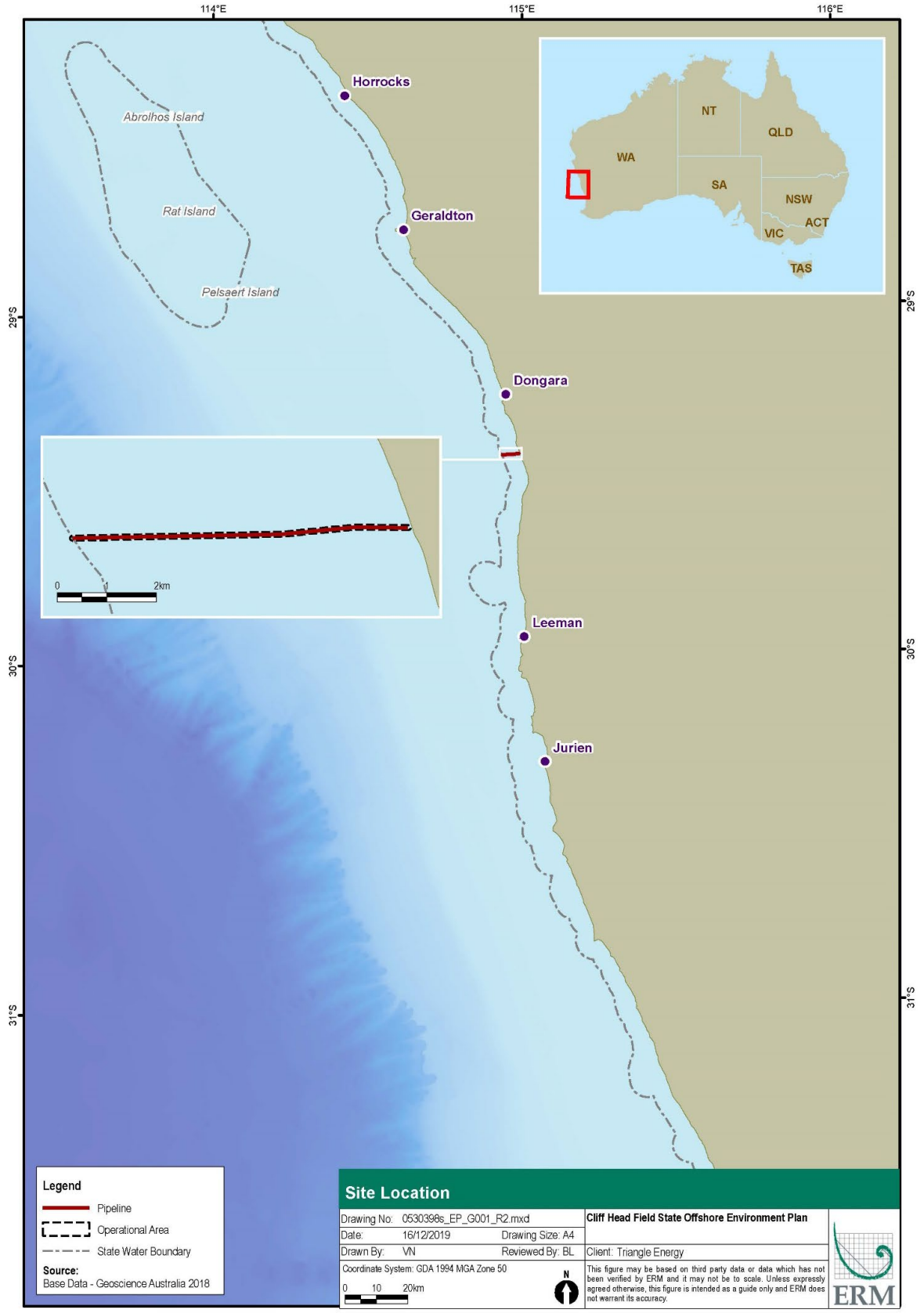
WHERE IS THE PROJECT LOCATED?

The Cliff Head Oil Field is located in the Perth Basin about 270 kilometres (km) north of Perth and 12 km off the coast of Dongara, Western Australia (WA) (**Figure 2**). The CHA offshore platform is connected to the onshore ASP via twin 14 km production and injection pipelines, a subsea power and control cable and a chemical supply umbilical strapped to the production pipeline. The pipelines extend from the platform located in Commonwealth waters into State waters; crossing beneath the shoreline via a horizontal directionally drilled hole located about 500 m offshore. The Cliff Head pipelines traverse 6.9 km across State waters. The pipelines are operated under Access Authority AA3T, which is administered by the Western Australian Department of Energy, Mines, Industry Regulation and Safety (DEMIRS). The scope of this EP includes the presence of the pipelines, cable and umbilical (the pipelines) within State waters, including the associated inspection, maintenance and repair (IMR) activities within a 100 m wide pipeline corridor.

TEO acknowledges the traditional custodians, the Yamatji people, of the land and seas on which the Cliff Head operations are located.

FIGURE 1. Cliff Head Offshore Platform

FIGURE 2. Location of Cliff Head Pipeline



PROJECT STATUS

The Cliff Head development ceased production in August 2024 and subsequently entered a transition to a Non-Production Phase (NPP). The NPP phase involves a substantial reduction in overall activity and will mostly consist of maintenance activities to ensure all infrastructure and equipment remain in a suitable condition for safe decommissioning and removal. Decommissioning is not currently planned during the next 5 years.

WHAT OPERATIONAL ACTIVITIES ARE COVERED BY THE EP?

Non-production Phase: NPP activities will be focused on maintaining the State Waters pipelines in a suitable condition for decommissioning, whilst managing the remaining safety and environmental risks. The key capabilities and operations essential and necessary during NPP includes the ability to execute well integrity and control activities using injection water (IW) stored in the IW tank at the onshore Arrowsmith Stabilisation Plant, piped to the Cliff Head Offshore facility via the State Waters pipeline. This phase includes flushing of pipelines to prepare for decommissioning.

Care & Maintenance: The integrity of the State Waters pipelines will be maintained to enable future removal. Monitoring and inspection of pipelines will be continued.

Decommissioning and Closure Planning: A description of decommissioning and closure planning will be provided in the State Waters Pipelines EP revision in line with TEO's obligations under Section 104(2)(c) of the *Petroleum (Submerged Lands) Act (1982)* to remove all property authorised under Access Authority AA3T.

TEO notes that alternative options to complete removal may be considered by the Minister on a case-by-case basis where all feasible decommissioning and removal options have been considered and a comparative assessment has been made taking into consideration risks and factors associated with the environment, safety, risks to future users of the area and future ownership and liability for the abandoned pipelines.

Decommissioning activities, including alternative options, will be the subject of a separate EP and stakeholder feedback will be sought by TEO during the decommissioning planning process.

If you would like to provide comment or seek further information on the Cliff Head Pipeline, please contact:

Email: SC@triangleenergy.com.au
Phone: +61 8 9219 7111
Post: Suite 2, Ground Floor
100 Havelock Street
Perth, WA 6000

TriangleEnergy

ENVIRONMENT AND SOCIAL IMPACTS AND RISKS

A number of studies have been undertaken to inform the environmental impact and risk assessment for planned and unplanned activities. Activities considered under this EP with controls in place to minimise impacts, are considered low risk. TEO have detailed emergency planning in place to both prevent and respond to unplanned events such as loss of containment, in order to minimise environmental impacts and disruption to other users of the offshore environment.

There are no registered Aboriginal sites protected under the *Aboriginal Heritage Act 1972* located within the area of the pipelines, but TEO understands that the Indigenous concepts of heritage involve both tangible and intangible heritage features. Such features will be considered in the Cliff Head Field State Offshore Pipeline EP.

HOW ARE POTENTIAL ENVIRONMENTAL IMPACTS BEING MANAGED?

The environmental risks and impacts from pipeline activities in State waters are managed in accordance with the Cliff Head Field State Offshore Pipeline EP. Key control measures include:

- Pipeline designed and installed in accordance with industry standards to ensure integrity is appropriate.
- Implementation of the Cliff Head Pipeline and Umbilical Integrity Management Plan, to ensure the integrity of the Cliff Head pipelines and umbilical are maintained.
- Corrosion control system in place to prevent corrosion of pipeline and subsequent leaks.
- Aerial surveys undertaken of the Pipeline Operational Area.
- All project vessels managed in compliance with Navigation Act 2012 and associated Marine Orders.

INVITATION FOR FEEDBACK

In accordance with regulatory requirements, the EP or EP summary will be publicly disclosed upon submission to DEMIRS. This process does not remove the need for TEO to consult with relevant persons during preparation of the EP. As such, TEO encourages your feedback and input. All communications will be logged, assessed and acknowledged with a response, and incorporated into the EP. Information determined to be sensitive will not be made public. Stakeholders are advised to inform TEO if any information provided is confidential and not to be published.

If you would like to provide comment or seek further information on the Cliff Head Pipeline, please contact:

Email: SC@triangleenergy.com.au
Phone: +61 8 9219 7111
Post: Suite 2, Ground Floor
100 Havelock Street
Perth, WA 6000

TriangleEnergy

SUMMARY OF KEY IMPACTS/RISKS AND MANAGEMENT MEASURES

Description of Potential Impact/Risk	Proposed Mitigation and/or Management Measure
All Operational Activities	
Potential Impact/Risk - Seabed Disturbance	

• Seabed disturbance may result from the following activities:
  • Dropped objects
  • Inspection, Maintenance & Repair (IMR) activities
  • High pressure water jetting
  • Non-routine installation of stabilisation materials
  • Emergency vessel anchoring
• Modification to the seabed is expected to be highly localised, short term and limited to the footprints associated with moorings and pipelines.
• Marine epifauna growth may occur on pipelines resulting in artificial habitat in an otherwise relatively barren environment.
• Physical presence of IMR vessels and activities may have potential to impact cultural values and heritage.
	• Vessels are not planned to anchor/moor during routine operations.
	• Monitoring and maintenance of infrastructure is undertaken in accordance with the IMR process.
	• Moorings to be installed and recovered in accordance with mooring plan.
	• Dropped object prevention processes with recovery undertaken where possible.
	• TEO will actively support the capacity of Traditional Custodians for ongoing engagement and consultation, for the purpose of avoiding impacts to cultural heritage values.

Potential Impact/Risk - Interaction with Other Sea Users	
• The presence of the pipelines, vessels and temporary moorings may cause interaction with activities of other marine users within the 100m pipeline corridor where activities may be undertaken including potentially presenting a snagging hazard to commercial fisheries. • Several State managed fisheries have the potential for interaction within the Operational Area.	• Pipeline is present on marine charts to reduce potential for third party interference. • Navigational equipment and lighting maintained, and temporary moorings clearly marked. • Notify relevant government departments, fishing industry representative bodies and licence holders of activities prior to commencement and upon completion of activities. • Consult with stakeholders so that they are informed of the proposed activities. • TEO has a memorandum of understanding (MOU) in place with the Dongara Professional Fisherman's Association that agrees that pots can be placed along the Operational Area for rock lobster fishing and to limit IMR activities within peak rock lobster fishing activities.

SUMMARY OF KEY IMPACTS/RISKS AND MANAGEMENT MEASURES

TABLE 1. Summary of key potential impacts and/or risks and preliminary management measures for planned activities

Description of Potential Impact/Risk	Proposed Mitigation and/or Management Measure
Vessel/Helicopter Activities	
Potential Impact/Risk – Acoustic emissions	
• During infrequent visits to the pipelines, IMR vessels and helicopters will create noise underwater and in the air as a result of machinery, propeller and rotor movement, etc. • Increases in underwater noise can result in behavioural impacts to cetaceans (e.g. whales, dolphins and mammals), sharks and marine reptiles (turtles). Airborne noise can result in behavioural changes to seabirds. • Given the potential noise levels during infrequent vessel and helicopter activities, acoustic emissions are considered low risk.	• Comply with regulatory requirements for interactions with marine megafauna to prevent adverse interactions.
Potential Impact/Risk – Artificial Light	
• Artificial lighting will be used for navigation and routine safe operations on IMR vessels. • Light emissions have the potential to affect animals such as fish, marine reptiles and seabirds by influencing changes in behaviour or orientation in close proximity to vessels.	• Routine vessel and helicopter transfers completed during daylight hours to reduce lighting requirements. • Lighting limited to the minimum required for navigational and safety requirements, except for emergency events.
Potential Impact/Risk - Atmospheric and GHG Emissions	
• Atmospheric emissions generated during routine operation of IMR vessels and helicopters may result in temporary, localised reductions in air quality in the immediate vicinity.	• Vessels compliant with Marine Order 97 to prevent air pollution. • Vessels operate in accordance with MARPOL.
Potential Impact/Risk - Planned Discharges	
• During IMR activities, vessels are expected to discharge deck and bilge water, equipment/machine space drainage, sewage, greywater, putrescible waste and cooling water or brine. • Discharges may result in a temporary, localised decrease in water and sediment quality and toxicity to marine organisms in the vicinity of the discharge.	• Marine discharges managed according to regulatory requirements. • Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.

SUMMARY OF KEY IMPACTS/RISKS AND MANAGEMENT MEASURES

TABLE 2. Summary of key potential impacts and/or risks and preliminary management measures for Unplanned activities

Description of Potential Impact/Risk	Proposed Mitigation and/or Management Measure
Unplanned Activities	
Potential Impact/Risk - Introduction of Invasive Marine Species	
• Introduction and establishment of invasive marine species (IMS) within the Operational Area may occur as a result of biofouling or ballast water exchange. • IMS have the potential to cause ecological effects including over-predation and out-competing of native species, depletion of viable fish stocks and changes in habitat quality.	• Ballast water and biofouling will be managed according to regulatory requirements, including the Australian Ballast Water Management Requirements, and the Australian Biofouling Management Requirements, as applicable. • IMS risk assessment process will be applied for support vessels and ongoing operations.
Potential Impact/Risk - Collision with Marine Fauna	
• Vessel movements have the potential to result in collisions between the vessel (hull and propellers) and marine fauna.	• Comply with regulatory requirements for interactions (e.g. EPBC Regulations 2000 – Part 8) with marine fauna to reduce the likelihood of a collision occurring.
Potential Impact/Risk – Hydrocarbon Spill from a Vessel	
• In the highly unlikely event of a vessel collision, a release of marine diesel oil (MDO) may occur to the marine environment due to tank rupture in the worst-case scenario. • Potential impacts across the EMBA will be assessed including receptors such as plankton, seabirds, coral, tourism, recreation and heritage (for example). • A minor spill of MDO could occur during refuelling or a minor leak, however vessel refuelling at sea is unlikely. • There may be accidental discharge of potentially hazardous materials and liquid chemicals which are stored and utilised on vessel decks, however would be dispersed rapidly and diluted by the open ocean water conditions.	• Comply with regulatory requirements for the prevention of vessel collisions and safety and emergency arrangements. • Notify relevant government departments, fishing industry representative bodies and licence holders of activities prior to commencement and on completion of activities. • Establish exclusion zones around vessels which are communicated to marine users to reduce the likelihood of collision. • Oil Spill Contingency Plan (OSCP) provides options for controlling the source of any unplanned hydrocarbon/chemical spills.
Potential Impact/Risk – Loss of Containment along the Pipelines	
• Potential scenarios resulting in unplanned loss of containment of inhibited seawater along the pipeline include (1) Loss of Pipeline Containment during NPP – Pipeline leak due to corrosion leak or external impact (710 m^3 of seawater with a 40 L hydrocarbon component) or (2) Loss of Pipeline Containment during NPP - Offshore operations concurrent with undetected corrosion leak during NPP (20 m^3 of seawater with a 200 L hydrocarbon component). • Loss of containment could result in minor impacts to marine water quality, sediments and benthic habitats, with potential secondary impacts to marine fauna.	• Pipeline is managed in accordance with the Pipeline and Umbilical Integrity Management Plan (10OPINTPL02) which includes monitoring, inspection and maintenance requirements • Pipeline repairs and replacement undertaken in accordance with Cliff Head Offshore Pipeline Repair Plan. • Remote shutdown capability in place to limit risk and volume of potential spills. • Pipeline route is present on marine charts to reduce potential for third party interference. • Lifting activities will be undertaken in accordance with Cliff Head Lifting Operations and Lifting Equipment • Procedure (10HSEQGENPC24).