Gorgon Gas Development and Jansz Feed Gas Pipeline

Offshore Feed Gas Pipeline Installation Management Plan – Addendum

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Contents

Tables

Figures

1 Introduction

Chevron Australia Pty Ltd (CAPL) is the proponent and the person taking the action for the Gorgon Gas Development and Jansz Feed Gas Pipeline on behalf of the following companies (collectively known as the Gorgon Joint Venturers):

- Chevron Australia Pty Ltd
- Shell Development (Australia) Pty Ltd
- Mobil Australia Resources Company Pty Limited
- Osaka Gas Gorgon Pty Ltd
- Tokyo Gas Gorgon Pty Ltd
- JERA Gorgon Pty Ltd.

1.1 Project

CAPL is developing the gas reserves of the Greater Gorgon Area via the Gorgon Gas Development and Jansz Feed Gas Pipeline, as described in Section 1.2 of the Offshore Feed Gas Pipeline Installation Management Plan (OFGPIMP; Ref. 1). The development includes Feed Gas Pipeline Systems (FGPS) that extend below ground across Barrow Island from a Gas Treatment Plant (GTP) on the east coast, through a shore crossing at North Whites Beach on the west coast, and then continue subsea out to the offshore gas fields. The FGPS comprise feed gas trunklines, MEG and utility pipelines as well as electro-hydraulic umbilicals that contain electrical cables and control lines that provide for remote operation of the offshore infrastructure from the onshore Central Control Room.

To maintain the operating efficiency of offshore gas gathering systems, CAPL is installing two additional umbilicals that will connect the offshore fields and the GTP. In State waters, the additional control (fibre-optic) and electrical (up to ~132 kV AC) umbilicals will be installed parallel to (south of) the existing FGPS that extends north west from the horizontal directionally drilled (HDD) shore crossing exit point, ~400-550m offshore of North Whites Beach, to the State waters' boundary. Installation of the additional umbilicals will use the same technique used for installation of the FGPS in State waters, comprising direct lay to seabed and secondary stabilisation by rock placement.

1.2 Environmental Approvals

Table 1-1 describes State (WA) and Commonwealth (Cth) approvals for the components of the Gorgon Gas Development.

These approvals, and projects approved under these approvals, have been and may continue to be amended (or replaced) from time to time.

Table 1-1: State and Commonwealth Approvals

Project Approval Stage	State	Commonwealth
Jansz Feed Gas Pipeline	Ministerial Statement (MS) 769 (Ref. 2) 28 May 2008	EPBC Reference: 2005/2184 (Ref. 3). 22 March 2006

Project Approval Stage	State	Commonwealth
Initial Gorgon Gas Development (2 LNG trains)	Initial Gorgon Gas Development comprising two LNG trains – MS 748 (Ref. 4). This was superseded by MS 800. 6 September 2007	Initial Gorgon Gas Development comprising two LNG trains – EPBC Reference: 2003/1294 (Ref. 5). 3 October 2007
Revised and Expanded Gorgon Gas Development (3 LNG trains)	MS 800 (Ref. 6) provides approval for both the initial Gorgon Gas Development and the Revised and Expanded Gorgon Gas Development (compromising three LNG trains). This statement supersedes MS 748. 10 August 2009	The Revised and Expanded Gorgon Gas Development (EPBC Reference: 2008/4178 [Ref. 7]) was approved, and the conditions for the initial Gorgon Gas Development (EPBC Reference: 2003/1294 [Ref. 5]) were varied. 26 August 2009
Dredging Amendment	MS 865 (Ref. 8) provides approval to establish a restart mechanism in the event of a Project-attributable coral health management trigger. This statement is an amendment to Conditions 18, 20, and 21 of MS 800. 8 June 2011	Not applicable (N/A)
Additional Support Area	MS 965 (Ref. 9) applies the conditions of MS 800 to an Additional Support Area. 2 April 2014	The conditions for the initial Gorgon Gas Development (EPBC Reference: 2003/1294 [Ref. 5]).and for the Revised and Expanded Gorgon Gas Development (EPBC Reference: 2008/4178 [Ref. 7]) were varied. 15 April 2014
Gorgon Gas Development Fourth Train Expansion	MS 1002 (Ref. 10) applies the conditions of MS 800 to the Fourth Train Expansion, and has additional conditions. 30 April 2015	EPBC Reference: 2011/5942 (Ref. 11). 12 May 2016

1.3 Scope and Purpose of this Addendum

This Addendum has been prepared to update the approved OFGPIMP (Ref. 1) so it adequately covers installation of the additional umbilicals, consistent with the requirements for review/update of the OFGPIMP detailed in Section 7.12 of that document. The Addendum describes how the offshore installation of the additional umbilicals will be managed in a manner that protects environmental values and reduces impacts to the environment as far as practicable.

The scope of this Addendum covers the marine (State waters) installation activities for the umbilicals, which will include secondary stabilisation by rock placement, from the offshore HDD exit point (~400–550 m from shore) to the State waters' boundary. Management of HDD activities associated with the shore crossing and terrestrial activities associated with the installation of the onshore umbilical are addressed separately.

The activities covered by this Addendum comprise:

- subsea umbilical lay
- post-lay stabilisation of the umbilical
- seabed survey

- vessel operations associated with the above activities, including on-board accommodation of personnel.

Following approval, this Addendum will be considered to be approved as part of the OFGPIMP (Ref. 1), but will be maintained as a stand-alone document. Where relevant, amendments made to the OFGPIMP will also be considered to be amendments to this Addendum. Any matters or requirements in the Addendum that are taken from the OFGPIMP (rather than MS 800, MS 769 or EPBC Reference: 2003/1294 and 2008/4178) may be amended from time to time in accordance with amendments to the OFGPIMP. Note that if there is any difference or inconsistency between the OFGPIMP and this Addendum in relation to Condition 23.4 or 23.5 of MS 800, Condition 14.4 of MS 769 or Condition 16.4 or 16.5 of EPBC Reference: 2003/1294 and 2008/4178 with respect to the activities covered by this Addendum, then this Addendum is to be preferred.

1.3.1 Objectives of this Addendum

The objectives of this Addendum, as stated in Condition 23.3 of MS 800, Condition 14.3 of MS 769, Condition 16.3 of EPBC Reference: 2008/4178 and 2003/1294 are to manage the installation of the additional umbilicals to:

- *Reduce the impacts of pipeline installation activities on the Terrestrial and Marine Disturbance Footprints as far as practicable; and*
- *Ensure that pipeline installation activities do not cause Material or Serious Environmental Harm outside the Terrestrial and Marine Disturbance Footprints*

1.3.2 Key Legislative Requirements

This Addendum to revise the approved OFGPIMP satisfies the requirements of Condition 36.2(ii) of MS 800, Condition 21(2) of MS 769 and Condition 25 of EPBC Reference: 2003/1294 and 2008/4178 as applicable to the OFGPIMP (Ref. 1).

Sections 1.6 and 2.0 of the OFGPIMP provide a description of other legal requirements relevant to Gorgon Gas Development and Jansz Feed Gas Pipeline offshore FGPS installation activities. The following changes to legislation relevant to this Addendum are noted:

- The *Quarantine Act 1908* (Cth) has been superseded by the *Biosecurity Act 2015*
- The *Historic Shipwrecks Act 1976* (Cth) has been superseded by the *Underwater Cultural Heritage Act 2018*
- The *Biodiversity Conservation Act 2016* (WA) has been enacted.

1.3.3 Content of this Addendum

Table 1-2 identifies where content in this Addendum addresses relevant specific requirements of MS 800, MS 769, and EPBC Reference: 2003/1294 and 2008/4178.

Table 1-2: Condition Requirements Addressed in this Addendum

Ministerial Document	Condition No.	Requirement	Section in this Addendum
EPBC Reference: 2003/1294 and 2008/4178	3.2.1	A description of the EPBC listed species and their habitat likely to be impacted by the components of the action which are the subject of that plan.	Section 3.3, Section 5
	3.2.2	An assessment of the risk to these species from the components of the action the subject of that plan, relevant to that plan.	Section 5
	3.2.3	Details of the management measures proposed in relation to these species if it is a requirement of the condition requiring that plan.	Section 5
	3.2.4	Details of monitoring proposed for that species if it is a requirement of the condition requiring that plan.	Section 6.4
	3.2.5	Performance standards in relation to that species if it is a requirement of the condition requiring that plan.	Section 5, 7
	3.2.7	Protocols for reporting impacts on the species to the Department.	Section 6.6
	16.4 (I)	Management measures to reduce the impacts from pipeline installation activities in State waters, as far as practicable	Section 5
	16.4 (II)	Management measures to ensure that pipeline activities in State waters do not cause Material or Serious Harm outside the Terrestrial and Marine Disturbance Footprints associated with those facilities listed in Condition 16.1	Section 5
	16.4 (III)	Performance standards against which achievement of the objectives of this condition can be determined.	Section 5, 7
	16.5 (I)	Management measures to address the generation and dispersion of turbidity associated with pipeline installation activities	Section 5.2
	16.5 (II)	Management measures to address direct disturbance of habitat	Section 5.2
	16.5 (III)	Management measures to address preventing harm to, or fatalities of turtles and other EPBC Act listed marine fauna	Section 5.3, 5.4, 5.5, 5.6.1, 5.7
	16.5 (IV)	Program for pre and post pipeline installation seafloor survey of the Marine Disturbance Footprint and the areas at risk of Material or Serious Environmental Harm due to the construction of the pipeline in State waters	Section 2.5
	16.5 (V)	Details of mooring pattern design, including range and bearing from fairleads of individual anchor drops to show how the mooring pattern has been designed to limit impacts in coral habitat in State waters	Section 2.6
	16.5 (VI)	Details of a typical mooring pattern design for areas other than coral habitat in State waters	Section 2.6
	16.5 (VII)	Procedures to reduce as far as practicable, the impacts resulting from anchoring, wire and chain sweep, and wash from thrusters and propellers, on benthic communities in State waters	Section 5.2
	16.5 (VIII)	Details of proposed hydrotest water discharge and how this will be managed to avoid Material or Serious Harm to the marine environment; and	Section 2.1
	16.5 (IX)	A marine monitoring program to detect changes to ecological elements outside the Marine Disturbance Footprint for the Offshore Gas Pipelines in State waters	Section 6.4
	16.6	The person taking the action must implement the Plan.	Section 6.2, 6.3, 6.5

Ministerial Document	Condition No.	Requirement	Section in this Addendum
Condition 23 of MS 800 and Condition 14 of MS 769	23 (4) (i) 14 (4) (i)	Management measures to reduce the impact from pipeline installation activities as far as practicable.	Section 5
	23 (4) (ii) 14 (4) (ii)	Management measures to ensure that pipeline installation activities do not cause Material or Serious Environmental Harm outside the Terrestrial and Marine Disturbance Footprints.	Section 5
	23 (4) (iii)	Performance Standards against which achievement of the objectives of this condition can be determined.	Section 5, 7
	23 (5) (i) 14 (4) (iii)	Management measures to address the generation and dispersion of turbidity associated with pipeline installation activities.	Section 5.2
	23 (5) (ii) 14 (4) (iv)	Management measures to address direct disturbance of habitat.	Section 5.2
	23 (5) (iii) 14 (4) (v)	Management measures to prevent harm to, or fatalities of turtles.	Section 5.3, 5.4, 5.5, 5.6.1, 5.7
	23 (5) (iv) 14 (4) (vi)	Program for pre and post pipeline installation seafloor survey of the Marine Disturbance Footprint and the areas at risk of Material or Serious Environmental Harm due to the construction of the pipeline in State waters.	Section 2.5
	23 (5) (v) 14 (4) (vii)	Details of mooring pattern design, including range and bearing from fairleads of individual anchor drops to show how the mooring pattern has been designed to limit impacts in coral habitat areas within State waters.	Section 2.6
	23 (5) (vi) 14 (4) (viii)	Details of typical mooring pattern design for other than coral habitat areas within State waters.	Section 2.6
	23 (5) (vii) 14 (4) (ix)	Procedures to minimise as far as practicable the impacts resulting from anchoring, wire and chain sweep, and wash from thrusters and propellers, on benthic communities.	Section 5.2
	23.5 (viii) 14.4 (x)	Details of proposed hydrotest water discharge and how this will be managed to avoid Material or Serious Harm to the marine environment.	Section 2.1
	23.5 (ix) 14.4 (xi)	A marine monitoring program to detect changes to ecological elements outside the Marine Disturbance Footprint for the Offshore Gas Pipeline identified in Condition 14.3iv and 14.3v (of Statement No. 800) and Condition 12 (of Statement No. 769).	Section 5
	23 (6) 14 (5)	The Proponent shall implement the Plan.	Sections 6.2, 6.3, 6.5

2 Activity Description

2.1 Overview

Installation of the additional offshore (subsea) umbilicals involves the same methodology that was applied for installation of the existing FGPS in State waters.

Each subsea umbilical will comprise a single sheathed bundle of up to ~250 mm in diameter containing electrical (up to ~132 kV) and fibre-optic cables. For cables carrying high voltage (>35kV) power, the electrical cores are in a trefoil arrangement. The entire length of each umbilical in State waters is expected to be supplied as one continuous line on a single carousel and laid directly to the seafloor from an installation vessel. Stabilisation will be provided primarily through subsequent placement of rock cover along the umbilical with grout/bulk bags or similar used if required near the HDD exit point. In the event of a lag between installation and rock covering, temporary stabilisation may also be provided.

The umbilicals do not contain any fluids and will not be subject to hydrotesting.

2.2 Location

The umbilicals route extends north-westerly from the shore crossing site at North Whites Beach on the north-west of Barrow Island to the State waters' boundary (Figure 2-1). To the extent practicable, the additional umbilicals will be laid roughly parallel to (south of) the existing FGPS route, at a nominal offset distance of ~30 m from the nearest operating asset (i.e. the existing umbilicals).

The offshore alignment extends across a relatively flat seabed, in water depths gradually increasing from ~12.5 -13 m at the HDD exit region to ~25 m at the State waters' boundary. The total infrastructure footprint in State Waters, including two umbilicals and associated rock berms, involves an area of ~8.96 ha (~0.09 km^2). Installation activities will occur within a corridor (also referred to as the 'Operational Area') centred on the umbilical and extending ~ 100 m either side of the umbilical. This area falls within the Marine Disturbance Footprint (MDF), as described in the Coastal and Marine Baseline State and Environmental Impact Report: Offshore Feed Gas Pipeline System and Marine Component of the Shore Crossing (CMBSEIR) (Ref. 15), which includes the area of the seabed associated with the infrastructure footprint and the extent of the surrounding seabed in which the planned installation activities could be expected to disturb the seabed.

The MDF includes the indicative location of anchoring areas around the HDD exit alignment (hatched areas in Figure 3-1).

Figure 2-1: Location of Subsea Umbilicals (State Waters)

2.3 Umbilical Lay

Consistent with the installation method employed for the existing FGPS umbilicals, the additional subsea umbilicals will be direct laid to the seabed by vessel between the HDD exit point and the State waters' boundary. Lay of each umbilical in State waters is expected to take approximately 3 days, with the vessel operating 24 hours/day.

Installation activities will commence with recovery of the messenger wire together with the temporary HDD casing seal plug from the HDD exit point. At the HDD exit, an umbilical installation vessel, potentially supported by a number of smaller support vessels, will be used to disconnect the temporary seal plug (including displacement of marine growth and/or sediment build-up if necessary) and recover the messenger wire. The umbilical installation support vessel will be dynamically positioned ~500–800 m offshore from Barrow Island. Any treated (biocide +/- corrosion inhibitors) water left in the shore crossing casing during HDD, to protect against corrosion and/or fouling between casing installation and umbilical installation, will be released when the temporary seal plug is recovered.

In recovering the messenger wire, the pull-in wire (connected to the messenger wire) will be pulled from the shore-based pull-in winch and secured to the shore crossing umbilical, which will then be winched onshore by the pull-in winch spread set up on the HDD site as part of the shore crossing activities (see Horizontal Directional Drilling Management and Monitoring Plan [Ref. 12]).

Once this operation has been completed, the umbilical installation vessel will move offshore along the predefined umbilical route, laying the subsea umbilical directly to the seabed from its onboard carousel (or equivalent). Alternatively, umbilical-lay may commence offshore and approach North White's Beach, with shore crossing via the HDD borehole as the last stage. This alternative method may involve the use of the smaller support vessels to pull the final section (up to ~1.5km) of umbilical (with attached temporary buoyancy) from the installation vessel to the HDD exit point. The buoyancy bags will then be removed/ recovered prior to the umbilical being winched into the HDD casing. The umbilical will be laid roughly parallel to (south of) the existing FGPS route, at an offset distance of ~30 m from the nearest operating asset (i.e. existing umbilicals).

2.4 Stabilisation

As per the existing FGPS, long-term stability of the additional umbilicals may require the installation of a rock berm between the HDD exit point (~12.5-13 m LAT water depth) and the State waters boundary (3 nm offshore). The rock berm is expected to have a height above the seabed of ~1 m and width of ~8 m. Permanent grout and/or bulk bags may be installed at the HDD exit point to support the umbilical free span and temporary stabilisation, such as via grout, bulk or rock bags and/or concrete mattresses or equivalent, may also be locally applied, particularly if there is expected to be an extended period between umbilical installation and rock placement.

Dedicated DP vessel(s) (fall-pipe or side-cast) will be used for rock installation. Depending on the size and type of vessel, rock placement is expected to take between 3 and 7 days for each umbilical.

The rocks to be used will be transported to site by the rock installation vessel(s). To reduce the risk of introducing any non-indigenous species, any rock placed close to Barrow Island (within 500 m) will be subject to the requirements of the approved QMS (Ref. 35).

2.4.1 Fall-pipe rock placement

On fall-pipe vessels, the rocks are loaded into a pipe running through the water column ('fall-pipe') to contain the rock and to control the rock placement footprint. The quantity of rocks placed is controlled by varying the speed of the conveyor belt used to transport the rocks from the vessel into the fall-pipe and the tracking speed of the vessel distributing the rocks over the umbilical. The rock installation vessel(s) may make several passes over an umbilical to achieve the desired berm profile.

2.4.2 Side-cast rock placement

Where water depths are too shallow or rocks are too large for the use of a fall-pipe, one or more side-cast vessels may be used for rock placement. This method has similar levels of accuracy as rocks placed through a fall-pipe in water depth up to 30 m.

On the side-cast vessel, the rocks are loaded onto the deck holds. Each vessel has a mechanical system that releases the rocks over the side of the vessel, above the waterline. On site, the vessel will be positioned with the side of the vessel parallel to the umbilical to be covered. The rocks will be released from a single point over the side of the vessel and will freefall to the seabed. The quantity of rocks placed is controlled by the amount pushed over the side at any one time. In between drops, the vessel will be repositioned at the next section of umbilical to be covered.

2.5 Seabed Survey

Seabed surveys are to be undertaken before, during, and after installation of the offshore umbilicals, including:

- Pre-lay Survey – carried out to assist installation activity planning to ensure there are no seabed features or obstructions that will create a hazard for the installation, and to confirm seabed data.
- As-laid Surveys – carried out during the installation to monitor progress and to record the location of the umbilical on the seabed.
- As-built Surveys – undertaken once the installation is completed to verify that the works have been completed according to specification.

Multibeam bathymetry and side-scan sonar techniques as well as ROV-mounted video and obstacle avoidance sonar may be used at areas of particular interest.

The surveys are expected to involve ~1-3 days vessel activity in the Operational Area in total.

2.6 Vessels

Installation is expected to involve one to three primary vessels operating 24 hours/day and powered by diesel (i.e. Marine Gas Oil or Marine Diesel Oil [MDO]). Smaller vessels may undertake crew changes or seabed surveys, or may be launched (runabouts) from the primary vessel(s) to assist with specific, short-term activities, such as shore crossing pre-winching preparations.

Post-lay stabilisation will be undertaken by a specialist rock dumping vessel(s).

Vessel crew and offshore construction workers are accommodated onboard the vessels. Emissions, wastes, and discharges are produced from the accommodation of these personnel (e.g. sewage and greywater, putrescibles,

domestic wastes) as well as from the daily operation of the vessels (e.g. power generation, cooling water).

The main installation activities will be undertaken by DP vessel(s). Anchoring (if required) is expected to be limited to the umbilical installation support vessel(s) used for disconnecting the temporary seal plugs, recovering the messenger wire and assisting winching of the umbilical through its casing (see Section 2.3). Anchoring will be restricted to within the previously approved anchoring area established for installation of the existing FGPS (Figure 3-1), with a typical anchor spread smaller than the pattern shown in Figure 3-5 of the OFGPIMP (Ref. 1). There will be no anchoring in areas of coral habitat.

Vessels operating in proximity (within 2.5 km of the coastline) to Barrow Island will be subject to the requirements of the approved QMS (Ref. 35)

2.7 Activity Timeframe

The offshore umbilical installation activities in State waters are expected to take up to ~10 days per umbilical, with vessels operating 24 hours a day. The subsea umbilical installation will occur after the HDD shore crossing has been constructed and will be integrated with installation of offshore facilities, including umbilicals, in Commonwealth waters. There may be a lag between umbilical installation and rock placement. Consequently, activities may occur at any time of the year, including during the summer cyclone (and turtle nesting) season.

3 Existing Environment

3.1 Overview

The route for the additional umbilicals is located immediately south of the existing FGPS (Figure 2-1). Section 4 of the OFGPIMP (Ref. 1) provides a comprehensive description of the physical, biological and socioeconomic characteristics of the marine environment at this location, as well as within the broader environment that may be affected (EMBA) in the event of a large hydrocarbon release. Details of the key environmental values specifically relevant to the planned installation activities for the additional umbilicals are provided in the following sections.

3.2 Physical Marine Environment

3.2.1 Oceanography

State Waters surrounding Barrow Island are characterised by large, semi-diurnal tides and a combination of local wind sea waves and long-range swell waves. Typically, wave heights at Barrow Island are within the range 0.2 m to 0.5 m, with peak periods of two to four seconds (Ref. 16). Currents on the west coast of Barrow Island are complex, driven by a combination of tide, wind, waves and large-scale open-ocean circulations (Ref. 15).

3.2.2 Bathymetry and Seabed Sediments

The seabed on the west coast of Barrow Island is characterised by shallow (generally <5 m deep) limestone pavement reef, which extends into the intertidal zone. Water depths at the HDD shore crossing are approximately 12.5-13 m and approximately 25 m at the limit of State Waters. A patchy and thin (<1 m) veneer of sand and fine gravel overlies rock in deeper waters, but becomes increasingly patchy in high-energy nearshore waters (Ref. 15).

3.2.3 Water Quality

The waters of the region are generally high in quality, with very low background concentrations of metals and organic chemicals. Water column profiles consistently demonstrate that the water column on the west coast of Barrow Island is well mixed with little evidence of stratification, which is indicative of an offshore environment with limited influence from surface water run-off and groundwater inflow, combined with good flushing and mixing by tidal and atmospheric forcing (Ref. 15). Turbidity and concentrations of suspended sediments are generally low (<5 mg/L) and indicative of clear water environments, with wave activity important in contributing to local resuspension of sediments, resulting in elevated turbidity and suspended sediment concentrations. Short periods of elevated suspended sediment concentrations, reduced light levels, and elevated light attenuation as a consequence of increased turbidity in the water column generally coincide with the passage of tropical cyclones. Seabed light levels are primarily influenced by depth and there are seasonal patterns in the daily average light levels (Ref. 15).

3.3 Subtidal Habitats

3.3.1 Marine Disturbance Footprint Concept

As outlined in Section 3.3.1 of the OFGPIMP (Ref. 1), the CMBSEIR (Ref. 15) details the rationale and definition of the MDF. The MDF encompasses the direct

footprint of the umbilicals and associated rock stabilisation, and the adjacent area of seabed potentially disturbed by construction or operations activities.

Figure 3-1 shows the MDF associated with the FGPS, inclusive of the additional umbilicals, and the dominant benthic habitats mapped within the MDF.

3.3.2 Marine Benthic Habitats

The benthic habitats in the vicinity of the Offshore FGPS in State waters are characterised by limestone platform covered with a veneer of unvegetated sand of varying thickness. Macroalgae are the dominant ecological element, but average cover of macroalgae is very low (Ref. 15). Seaward of the HDD exit point the benthic habitats in the vicinity of the Offshore FGPS are predominantly bare sand (see Figure 3-1).

No significant areas of coral habitat or coral assemblages occur (Ref. 15). Corals occur in low abundances and only sparsely scattered colonies of species such as the hard coral *Turbinaria* spp. have been recorded. *Turbinaria* is a widespread and common genus, which is well represented in Barrow Island waters where it is found outside coral habitats in benthic macroinvertebrate-dominated assemblages.

Macroalgal assemblages are the most common primary producer in the areas potentially affected by umbilical installation works. Macroalgal taxa recorded during surveys in the vicinity of the MDF in State waters included *Caulerpa* sp., *Dictyopteris* sp., *Galaxaura* sp., *Halimeda* sp., *Halimeda cuneata, Sargassum* sp., and unidentified *Phaeophyceae*. However, macroalgae coverage is sparse, ranging from a maximum of ~37% near the HDD exit point to an average of <1% further offshore (Ref. 15). The communities involved have widespread local and regional distributions.

Small sparse patches of seagrass occur on sand veneers at a few locations in shallow waters on the west coast of Barrow Island and at low levels of percentage cover, growing in mixed assemblages with macroalgae and occasionally benthic macroinvertebrates. The seagrass species that have been recorded at sites in the MDF and in areas at risk of Material or Serious Environmental Harm are well represented elsewhere in Barrow Island waters (Ref. 15).

3.3.3 Marine Fauna

3.3.3.1 Pelagic Fauna of Conservation Significance

Marine megafauna of conservation significance known from the west coast of Barrow Island include sea turtles and whales, notably green turtles and humpback whales, and sharks. Migratory seabirds and shorebirds may also occur, but the highest abundances of shorebirds occur on the south-eastern and southern coasts of Barrow Island (Ref. 31).

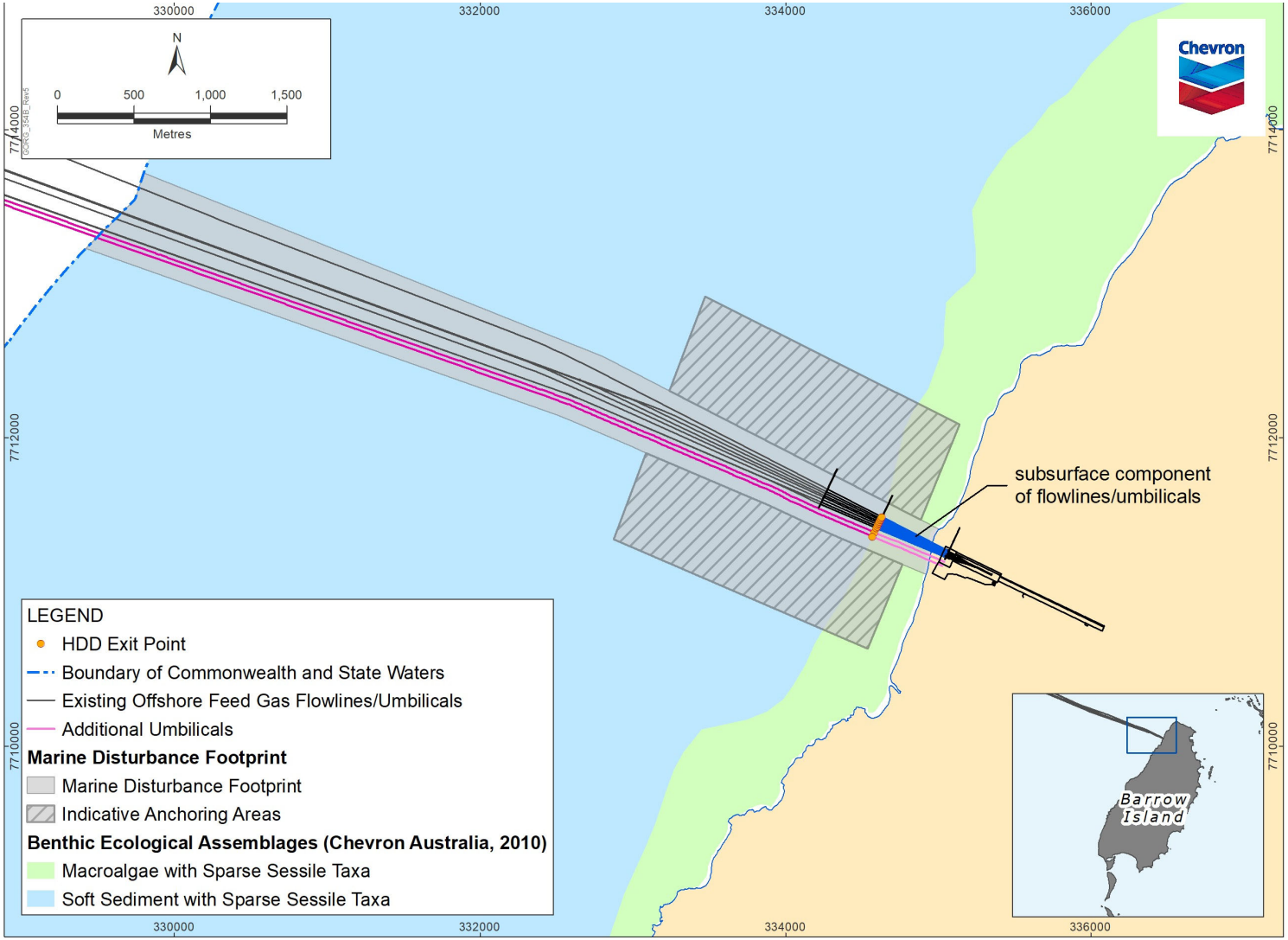


Figure 3-1: Benthic Habitats and Marine Disturbance Footprint Associated with the Offshore (State Waters) Umbilicals

Mapped nesting/internesting buffers (Biologically Important Areas [BIAs]) for loggerhead, flatback, green, and hawksbill turtles all overlap the MDF (Ref. 23), but only green turtles and, to a lesser extent, hawksbill turtles are known to nest on the west coast of Barrow Island. These turtle species are listed as Threatened under both State and Commonwealth legislation (Table 3–1). Barrow Island is a regionally important nesting area for green (and flatback) turtles, whilst hawksbill turtles nest at low densities around the Island (Ref. 24).

Table 3–1: Threatened Marine Turtles Likely to Occur Near the Umbilical Alignments

Common Name	Scientific Name	Conservation Status	Comments
Green Turtle	*Chelonia mydas*	Vulnerable	High density nesting on west coast of Barrow Island
Hawksbill Turtle	*Eretmochelys imbricata*	Vulnerable	Low density nesting on west coast of Barrow Island
Flatback Turtle	*Natator depressus*	Vulnerable	Nest on the east coast of Barrow Island
Loggerhead Turtle	*Caretta caretta*	Endangered	Do not nest on Barrow Island; major nesting at at Dirk Hartog Island, Muiron Island, and the beaches of North West Cape
Leatherback Turtle	*Dermochelys coriacea*	Vulnerable	Do not nest on Barrow Island; no major nesting has been recorded in Australia

Green turtles are the most abundant marine turtle species on the west coast of Barrow Island (Ref. 25). Green turtles tend to nest on the west and north-east coasts of Barrow Island where beaches are high energy, deep, steeply sloped, sandy and have an unobstructed foreshore approach (Ref. 26). The shore crossing at North Whites Beach is not a locally important green turtle nesting site because the shallow sand and limestone reef, including a large limestone shelf along the waterline, make the beach unsuitable for nesting (Ref. 26; Ref. 27). Whites Beach, ~500 m south of North Whites Beach, is commonly used as a nesting site. Turtle surveys have shown that green turtle nesting and track activity on North Whites Beach is significantly lower than other beaches (Ref. 26; Ref. 27).

The nesting period for green turtles on the west coast of Barrow Island is between November and February (Ref. 26), with numbers peaking during December and January (Ref. 28). Green turtle hatchlings emerge from the nests from summer to early autumn.

Green turtles also mate and forage close to Barrow Island during the summer breeding season. While most green turtles migrate away from the area after breeding, some appear to be resident at Barrow Island, remaining near the Island during the winter. Resident green turtles browse on the near-shore macroalgal-dominated platform reefs all along the west coast of Barrow Island when the sea is calm (Ref. 29).

Barrow Island is not considered a regionally important nesting site for hawksbill turtles. Hawksbill turtle nesting on Barrow Island typically occurs in low numbers on beaches that are small, shallow and characterised by coarse-grained sand or coral grit interspersed with rocks and beach wrack (Ref. 26). Although their peak nesting period is between October and November, hawksbill turtles have a seasonally diffuse nesting cycle and individuals may nest at any time throughout the year (Ref. 27).

The mapped migratory BIA for humpback whales and distribution BIA for blue whales overlap the umbilical installation alignments. However, listed Threatened or Migratory whale species, including the humpback whale which is seasonally abundant off the west coast of Barrow Island, are not expected to occur in large numbers in the shallow (<25 m) waters surrounding the umbilical installation activities. Humpback whale migration off the west coast of Barrow Island (Figure 3-2) is focused on the 200 m contour with the southerly migration more dispersed in waters of between 50 m and 200 m depth (Ref. 24; Ref. 30).

There are no BIAs in the vicinity of the umbilical alignments for any of the conservation significant shark species that may occur off the west coast of Barrow Island (Ref. 23).

Table 3–2: Threatened Whales Likely to Occur Near the Umbilical Alignments

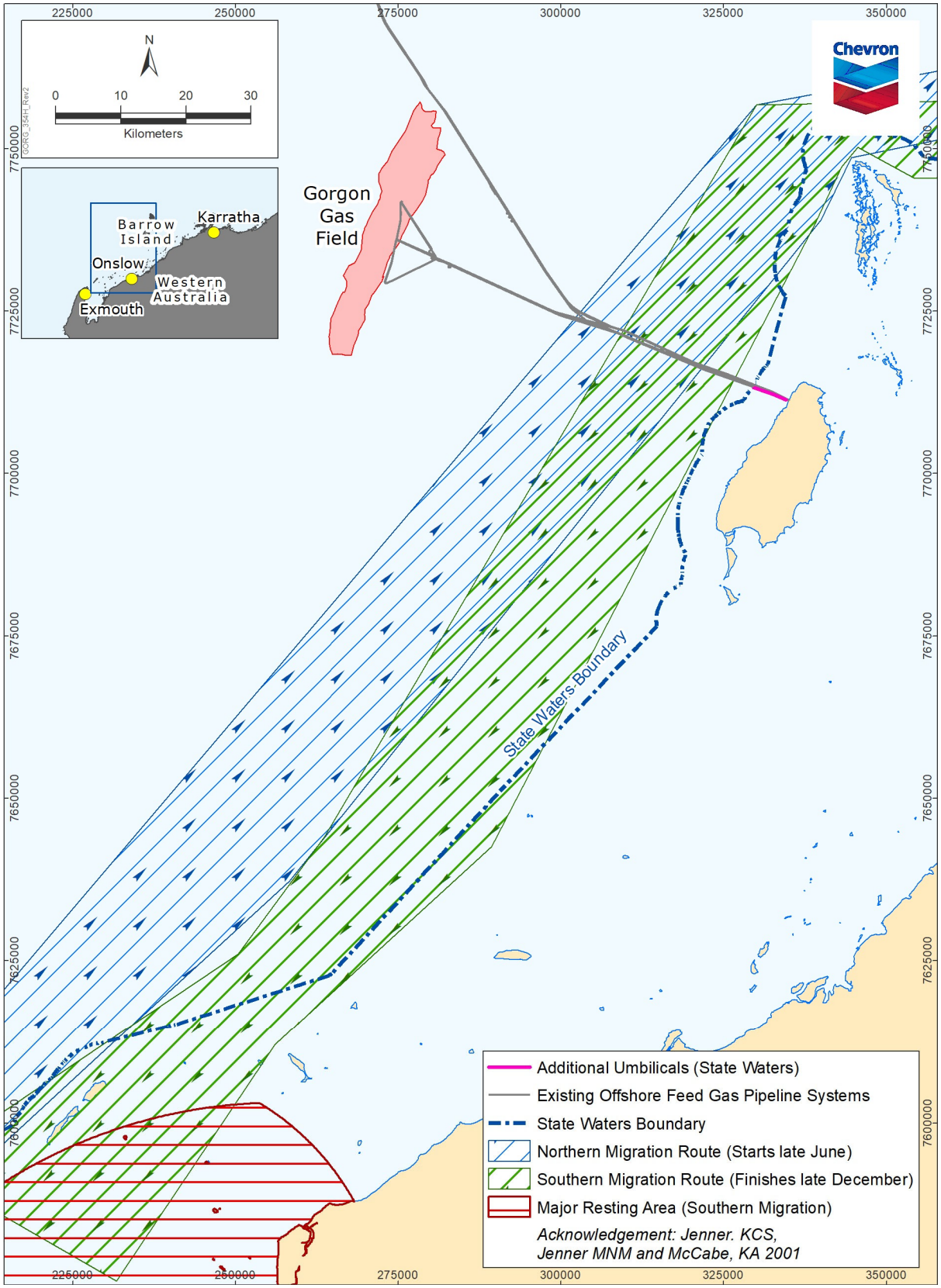
Common Name	Scientific Name	Conservation Status	Comments
Blue Whale	*Balaenoptera musculus*	Endangered[1,2]	• Cosmopolitan species that range from polar to tropical waters • Breed during winter and early spring, probably in deep water adjacent to tropical island groups • Migration off WA tends to pass along the shelf edge at depths between 500m to 1000m • Key feeding area in WA is the Perth Canyon (November–May) where the main prey is *Euphausia recurva*, the dominant euphausiid of WA found between latitudes 25° S and 35° S (between Shark Bay and Albany) • Not known to use the proposed installation area for feeding, breeding, or resting
Humpback Whale	*Megaptera novaeangliae*	NA[1,3] Conservation Dependent[2]	• Feed primarily in summer in Antarctic waters south of about 55° S • Known calving area in WA is the southern Kimberley between Broome and the northern end of Camden Sound • Migrate annually from Southern Ocean summer feeding grounds to subtropical winter calving grounds • Known to pass through the Barrow Island region between June and October on their annual migration

Notes:

1: Listed Threatened category under the EPBC Act (Cth)

2: Listed Threatened category under the BC Act (WA)

3: Removed in 2022 from the Threatened category under the EPBC Act (Cth)



Source: Jenner et al. *(2001)*

Figure 3-2: Regional Humpback Whale Migration Routes

3.3.3.2 Marine Avifauna and Habitat

Seabirds and shorebirds, including Threatened species (Table 3–3), may pass through the proposed installation area undertaking foraging activities, but given the distance from shore (>400 m) and lack of suitable roosting areas, sustained stays in the area are considered unlikely.

Mapped BIAs for listed marine avifauna that overlap the installation area exist for the fairy tern, which breeds on Barrow Island, two listed Migratory species of tern (roseate and lesser crested) and the listed Migratory wedge tailed shearwater. Wedge tailed shearwaters are known to breed on Double Island, off the east coast of Barrow Island, but there are no breeding sites for this species on the west coast.

Table 3–3: Threatened Seabirds Likely to Occur Near the Umbilical Alignments

Common Name	Scientific Name	Conservation Status	Comments
Australian fairy tern	*Sterna nereis nereis*	Vulnerable[1,2]	• Have significantly declined in eastern Australia • Present on Barrow Island throughout the year, with highest counts between November and April
Southern giant petrel	*Macronectes giganteus*	Endangered[1] Priority 4[3]	• Occur in Antarctic to subtropical waters, usually below a latitude of 60° S in the South Pacific and south-east Indian Oceans, or 53° S in the regions of Heard Island and Macquarie Island • Throughout the colder months, immatures and most adults disperse widely, with Antarctic colonies becoming completely deserted during winter • Circumpolar winter dispersal, extending north from 50° S to the Tropic of Capricorn (23° S) and sometimes beyond these latitudes

Notes:

1: Listed Threatened category under the EPBC Act (Cth)

2: Listed Threatened category under the BC Act (WA)

3:Priority fauna listed by DBCA (WA)

3.4 Socioeconomic Environment

3.4.1 Petroleum Development

Barrow Island is an operating oil field and the offshore waters of the North West Shelf are a significant petroleum production province. However, there is no petroleum infrastructure (apart from the existing FGPS) in the State waters along and surrounding the offshore umbilical alignments.

3.4.2 Shipping

Commercial shipping activity within 3 nm of Barrow Island is expected to be low, with vessels travelling to Exmouth or further south remaining seaward of State waters and the main shipping routes to and from Port Hedland and the Port of Dampier located east of the proposed area (see Figure 3-3).

3.4.3 Commercial Fishing

A number of State managed commercial fisheries are authorised to access waters surrounding Barrow Island. However, based on WA Department of Primary Industry and Resource Development (Fish Cube) data and consultation with the Western Australian Fishing Industries Council, low to no activity from these fisheries is expected in the vicinity of the offshore umbilical alignments.

3.4.4 Recreational Fishing

The majority of the regional population is located near the mainland coast, which means fishing, diving and other marine-based recreational pursuits are common. Small boat fishing is very popular in the Exmouth and Dampier areas, but significant numbers of recreational fishing vessels are unlikely to operate within the vicinity of the offshore umbilicals in State waters given the distance from the mainland.

3.4.5 Aquaculture

The offshore umbilical alignments are not within any aquaculture areas/zones. The nearest pearl farm lease is located in the sheltered waters of the Montebello Islands.

3.4.6 Tourism

The tourism industry is important in the region, but is oriented towards activities in the waters near the mainland or coastal islands. Access to and around the waters near the offshore umbilical alignments for tourism is unlikely.

3.4.7 Marine Conservation Reserves

The Montebello-Barrow Islands Marine Conservation Reserves are located between 60 and 100 km off the north-west coast of WA, ~1600 km north of Perth (Ref. 34). The Montebello-Barrow Islands Marine Conservation Reserves comprise:

- the Montebello Islands Marine Park, which includes the waters around the Montebello Islands
- the Barrow Island Marine Park, encompassing Biggada Reef, which is one of two examples of significant fringing reef that occur in the reserves, as well as Turtle Bay, a significant aggregation/breeding area for green turtles
- the Barrow Island Marine Management Area, which includes waters surrounding Barrow Island and some of the waters around the Lowendal Islands.

The offshore umbilical alignments are within an unzoned multi-use (conservation, recreational, scientific and commercial purposes) area of the Barrow Island Marine Management Area. The Barrow Island Marine Park on the west coast of the Island is (at its nearest) > 6 km to the south.

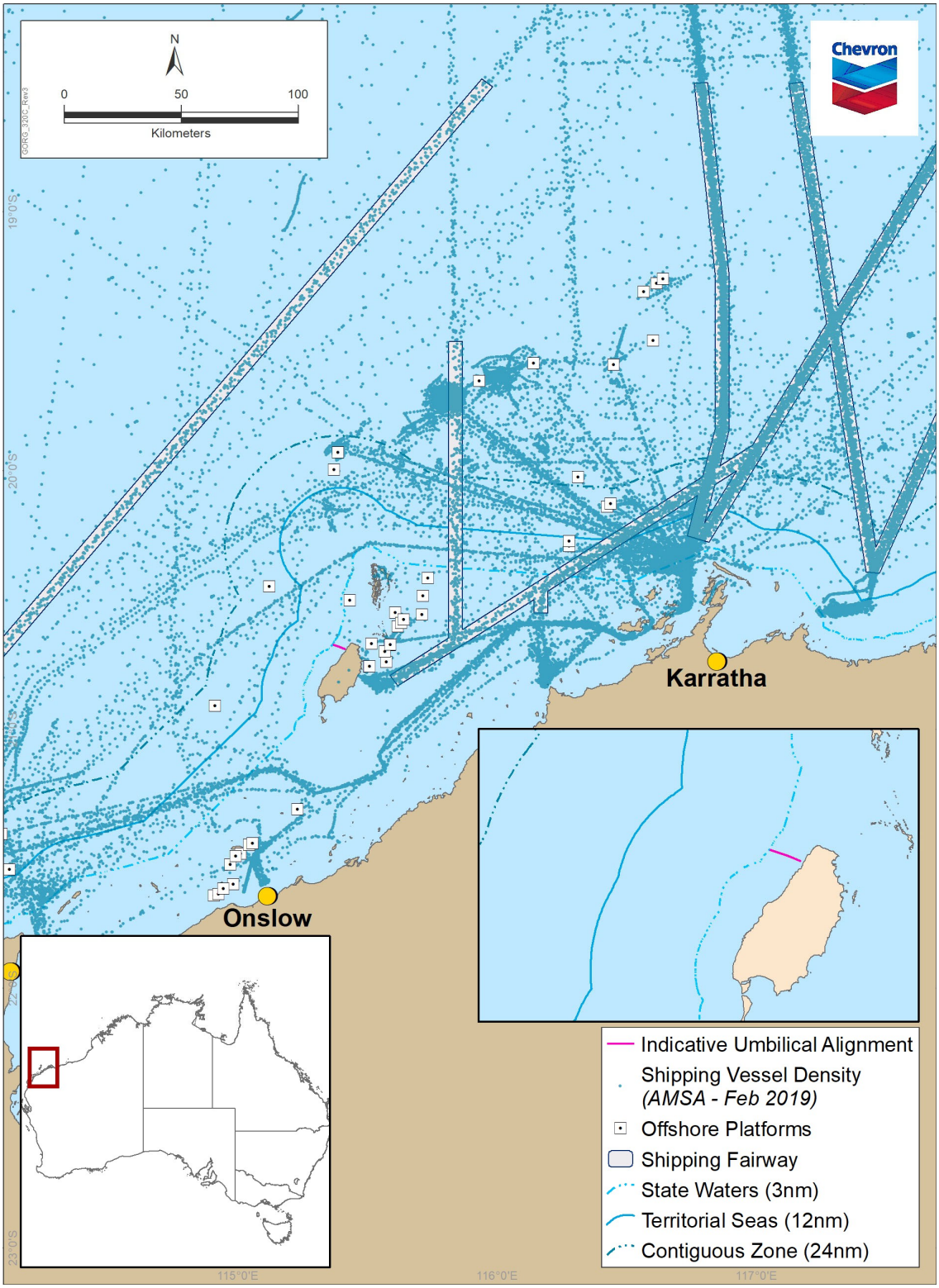


Figure 3-3: Shipping Traffic in the Region of the Additional Umbilicals

3.4.8 Cultural Heritage

Shipwrecks of historic interest and all shipwrecks older than 75 years are protected under the *Underwater Cultural Heritage Act 2018* (Cth), while pre-1900 shipwrecks are protected under the *Maritime Archaeology Act 1973* (WA).

No shipwreck sites or materials have been identified during the numerous surveys of the subsea FGPS route (Ref. 31) or via search of the Underwater Cultural Heritage Database (Ref. 36).

4 Risk Assessment

Risk is the combination of the potential consequences arising from an environmental stressor, together with the likelihood of the stressor occurring and resulting in the consequence. CAPL has developed an internal risk management process using the Chevron Integrated Risk Prioritization Matrix (Appendix A). An environmental risk assessment for offshore installation of the additional umbilicals was completed using the same methodology described in Section 5 of the OFGPIMP (Ref. 1).

4.1 Methodology

The main components of the internal CAPL risk assessment methodology include:

- **Specify causes:** Identify possible causes or conditions resulting in a stressor.
- **Determine potential consequences:** Determine the level of harm that could be associated with the stressor.
- **Identify and evaluate safeguards:** Identify design features and operating controls that manage the stressor or otherwise prevent exposures that can result in harm.
- **Apply the Integrated Risk Prioritization Matrix:** Using the Chevron Integrated Risk Prioritization Matrix (Appendix A), assign consequence magnitude and likelihood indices to obtain a risk priority ranking:
  - **Consequence magnitude index:** Maximum credible level of harm that could be associated with the stressor – safeguards *are not* taken into account.
  - **Likelihood index:** Expected frequency of the consequence magnitude occurring – safeguards *are* taken into account.
- **Recommend further study or risk mitigation:** Apply qualitative risk criteria and risk management guiding principles to guide further risk reduction actions, if required.

Using the Chevron Integrated Risk Prioritization Matrix (Appendix A), identified risks are categorised into four groups (Table 4–1), which determine the level of response and effort in managing the risks. If it is demonstrated that the cost[1] of implementing further risk reduction measures is disproportionate to the benefit gained, the risk is considered to be as low as reasonably practicable (ALARP).

Table 4–1: Risk Levels and Risk Tolerability

Risk Level	Description	Additional Risk Reduction
1, 2, 3, 4	Intolerable	Short-term, interim risk reduction required. Long-term risk reduction plan must be developed and implemented.
5	Tolerable (if ALARP and long-term risk reduction)	Risk is tolerable if reasonable safeguards / management systems are confirmed to be in place and additional long-term risk reduction is undertaken.
6	Tolerable (if ALARP)	Risk is tolerable if reasonable safeguards/management systems are confirmed to be in place.
7, 8, 9, 10	Risk Reduction Not Required	No further risk reduction required. Risk reduction at management/team discretion.

[1] Cost includes financial cost, time or duration, effort, occupational health and safety risks, or environmental impacts associated with implementing the control.

As indicated in Table 4–1, only risk levels 1 to 6 are considered to require risk treatment to reduce them to ALARP. However, all identified risks are further evaluated in relation to their potential impact on the receiving environment and proposed management measures or controls are described (see Section 4.2).

4.2 Outcomes

Stressors from activities associated with offshore installation of the additional umbilicals that were identified by the risk assessment as requiring management under this Addendum comprised:

- atmospheric emissions
- seabed disturbance
- artificial lighting
- underwater noise
- planned discharges (marine)
- physical interaction
- leaks and spills.

Evaluation of the risks to the environment from each of these stressors, along with the associated management measures, is provided in Section 5. The risk assessment found that with appropriate management, including the measures described in Section 5, the residual risk from the offshore installation of the umbilicals is tolerable and further risk reduction is not required.

5 Management Measures

This Section describes the management measures relevant to this Addendum that CAPL has developed to reduce the impacts from offshore umbilical installation activities as far as practicable and to ensure offshore umbilical installation activities do not cause Material or Serious Environmental Harm outside the Terrestrial and Marine Disturbance Footprints associated with those activities.

Management measures listed in Sections 5.1 to 5.7 correspond to stressors identified by the risk assessment (Section 4.2) from the activities described in Section 2, and include those that apply to the relevant matters of NES identified in Section 3. Note that management of some aspects/stressors is addressed on a Development-wide basis through other approved management systems, plans, and procedures and is not duplicated in this Addendum. These include:

- Wastes management – addressed by the Solid and Liquid Waste Management Plan (Ref. 13)
- Quarantine management – addressed by the Terrestrial and Marine Quarantine Management System (Ref. 35)

5.1 Atmospheric Emissions

Hazard	
Installation and support vessels will use fossil fuel to power engines, generators, cranes etc. As a result, combustion gases (CO_2, CO, NO_x, SO_2, VOCs, and particulate matter) will be generated. Additionally, vessels may carry ozone depleting substances (ODS), including halons, chlorofluorocarbons, and hydrochlorofluorocarbons, in onboard fire fighting, air conditioning and/or refrigeration systems that could be released during onboard maintenance.	
Potential Consequence Summary	**Ranking**
Exhaust emissions from vessels and onboard machinery during the installation period may cause locally elevated concentrations of air toxics with the potential for adverse effects on human health or fauna. Exhaust gases may also result in contribution to the reduction of the global atmospheric carbon budget. If allowed to escape, ODSs can affect the ozone layer in the upper atmosphere. Volumes held onboard that could potentially be released into the environment during construction are low. Offshore winds will rapidly disperse and dilute atmospheric emissions once they are discharged into the environment. Potential receptors are therefore limited to the construction workforce and fauna (e.g. seabirds) in the vicinity of the emission point. Given the localised, transient (mobile) and short term (overall) nature of effects and the limited number of receptors potentially affected, the worst case consequence is considered ***Incidental (6)***.	**Incidental (6)**

Management Measures
Performance Standards / Control Measures
Only low-sulfur (0.50 mass % concentration [m/m]) fuel oil will be used to minimise SOx emissions when available.
Prior to commencement of installation activities, the following will be verified, as per the Marine Safety Reliability & Efficiency (MSRE) process: • Vessels >400 T have valid IAPP certification and a current international energy efficiency (IEE) certificate. • Vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI.
Prior to commencement of installation activities, the following will be verified, as per the MSRE process: • All combustion equipment is maintained in accordance with the planned maintenance system (PMS) (or equivalent).

Management Measures
Chemicals are selected for use in accordance with the Hazardous Material Approval Procedure ABU – Standardised OE Procedure (OE-03.16.13), including: • No procurement from the list of ozone-depleting substances as defined in the Montreal Protocol.

Likelihood and Residual Risk Summary		
Likelihood	Installation vessels will progress along the umbilical alignments and the duration of activity at any one location is short. Given the open, dispersive nature of the area within which offshore emissions will occur, the potential for significantly elevated pollutant concentrations is limited. The probability that maintenance or accident will cause release of ODS during the short overall period of installation activities in State waters is very low. With the proposed management measures in place, the likelihood of atmospheric emissions due to the umbilical installation works reducing local air quality beyond relevant health standards or making a material contribution to regional or global GHG or ozone levels is considered ***Remote (5)***.	**Remote (5)**
Residual Risk	**Low (10)**	

5.2 Seabed Disturbance

Hazard	
Installation of the umbilicals and associated post-lay rock stabilisation will permanently affect the seabed within the direct installation footprint. Anchoring may cause temporary direct disturbance where the anchor and chains contact the seabed. Dropped objects or grounded vessels could disturb an area equivalent to the extent of contact. These installation activities, particularly rock placement, will also cause sediment to be temporarily suspended in the water column and subsequently settle onto adjacent areas.	
Potential Consequence Summary	**Ranking**
Disturbance to the seabed can destroy or reduce the geographical extent of benthic features that have conservation significance (e.g. shipwrecks, KEFs), reduce local ecosystem productivity (by disturbing benthic primary producers) and/or affect fauna through reduced/altered habitat values. Consequences could be elevated if the affected area represents unique or restricted habitat of importance to threatened fauna species. There are no KEFs along the proposed umbilical alignments and surveys have confirmed that there is very limited BPPH in the area (Ref. 15; Ref. 37). BIA for several marine turtle species extend over State waters off the entire north-west coast of Barrow Island (Ref. 23). The area of permanent displacement of the seabed within these BIA due to the umbilical installation is ~8.96 ha (~0.09 km^2). Anchoring will cause a short-term disturbance to the seabed, over a smaller area but within similar (unconsolidated sediments) habitat. Currie and Parry (Ref. 38) noted that soft sediment communities are able to recover within 14 months of mechanical disturbance. Vessel grounding impacts would also involve a limited area, but could potentially affect habitats more sensitive to disturbance (eg nearshore reefs) where recovery may be slower. The turbidity caused by umbilicals installation, including rock dumping activity, is expected to cause far-field suspended sediment concentrations of ~1 mg/L which will be hardly discernible above background levels, which are typically up to 5 mg/L during normal weather or higher during stormy conditions (Ref. 1). Suspended sediment concentrations in the immediate vicinity of the rock installation (10 mg/L) may reach levels where avoidance reactions of some fish species can be observed (Ref. 39). However, after the cessation of rock installation activities, which will last for a few days at any given location, the sediment concentrations in the water are expected to fall below background levels within a few hours. Therefore, the environmental impact is considered very short term. Compared to natural events such as storms and cyclones that occur off the west coast of Barrow Island, which often cause large amounts of sediment to be lifted into the water column over large areas, the turbidity generated from the installation activity represents only a minor source of localised resuspended sediment at any location.	***Major (3)***

Hazard	
Therefore, the potential worst-case consequence is considered to be localised and long-term loss of marine heritage values due to the umbilical stabilisation footprint. In accordance with the Integrated Risk Prioritization Matrix (Appendix A), the potential consequence is considered to be ***Major (3)***.	

Management Measures
Performance Standards / Control Measures
Umbilical installation and rock placement are confined to within the approved MDF, as defined in Coastal and Marine Baseline State and Environmental Impact Report: Offshore Feed Gas Pipeline System and Marine Component of the Shore Crossing (Ref. 15).
Anchoring will be restricted to within the MDF as defined in Coastal and Marine Baseline State and Environmental Impact Report: Offshore Feed Gas Pipeline System and Marine Component of the Shore Crossing (Ref. 15).
Anchoring will be undertaken in accordance with Chevron Marine Standard (Ref. 40).
Lost objects recovered where safe and practicable, and offers net environmental benefit
Minimise the loading of fine rock materials by contractual requirements for a rock particle sieve sizing and sampling regime to ensure rock particle sizing is met.
Pre-installation seabed survey to determine preferred alignment identifies any apparent shipwrecks
If any shipwreck or relics are discovered during the proposed activities, DCCEEW Maritime Heritage Section will be notified, including: • a detailed description of the remains of the shipwreck or the relic, which may include sonar images, electronic data, and/or digital photographs • a description of the place where the shipwreck or relic is located that is sufficiently detailed to allow it to be identified and relocated, including navigation data and datum information
Should any shipwreck or relics be discovered during the proposed activities, all Project vessels will be notified of the location.

Likelihood and Residual Risk Summary		
Likelihood	The probability of vessel grounding is inherently low and with the management applied to reduce the potential for anchor drag and/or vessel grounding, the area that will be temporarily affected by vessel installation activities is likely to be small. Fish and other mobile fauna (e.g. marine turtles) are unlikely to be at any risk of physical impact or long term disturbance due to turbidity caused by the installation of the umbilicals. Mobile fauna may avoid the area during the installation activities, but they are expected to move back into the impacted areas shortly after the completion of these activities. The umbilicals and associated rock berms are predicted to alter the seabed substrate over an area of ~0.09 km^2, or ~0.002% of its mapped extent in the Montebello/ Barrow Islands region, which is unlikely to adversely affect ecological function or fauna communities. Surveys undertaken to establish the impacts from installation of the Feed Gas Pipeline Systems found no changes in total fish numbers, species richness, fish length, or abundance of dominant species within macroalgal habitat at MDF sites between the baseline and the second year post-development (Ref. 22). The only apparent potential effects to fish were an increased abundance of two demersal species, possibly related to the increased habitat complexity provided by the rock stabilisation. The mapped BIAs around Barrow Island for marine turtles cover a range of subtidal substrates and there is no evidence to suggest the change from predominantly soft sands to hard substrate will reduce the area's value as habitat for these species. DCCEEW (Ref. 23) indicates the installed rock berms may provide additional foraging habitat for Hawksbill Turtles.	**Remote (5)**

	There are no known maritime heritage sites along the offshore umbilical alignments and the area will be subject to seabed survey before installation activities commence. Therefore, the likelihood of the installed umbilicals resulting in the long-term loss of heritage values is considered ***Remote (5)***.	
Residual Risk	**Low (7)**	

5.3 Artificial Lighting

Hazard	
Artificial light from installation vessels has the potential to alter the behaviour of marine fauna and reduce their chances of survival (e.g. through misorientation and exhaustion, or predation).	
Potential Consequence Summary	**Ranking**
Particular values and sensitivities considered at greatest risk of exposure to artificial light emissions were identified to be marine turtles and some seabirds (e.g. shearwaters). The Recovery Plan for Marine Turtles in Australia (Ref. 41) identifies light emissions as a key threat as it may disrupt critical behaviours, notably nesting (adults) and hatchling orientation and sea finding. The vessels are not expected to approach closer than ~400 m from the shore and impacts on nesting adults are not considered credible. Offshore installation vessel activities may coincide with the presence of feeding or inter-nesting turtles. However, there is no evidence or biological reason for light impacts on inter-nesting turtles (Ref. 42). Attraction to offshore vessel lighting would not affect hatchling sea-finding behaviour, but may locally aggregate hatchlings if/where there is light spill to the ocean, disrupting their dispersion to deeper waters and increasing predation risk. Studies conducted between 1992 and 2002 in the North Sea showed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Ref. 43), and that migratory birds can be attracted to lights on offshore platforms when travelling within a radius of 5 km from the light source (Ref. 44). Light spill into the ocean can alter foraging behaviour in some seabirds, which can in turn confer competitive advantage and have flow on effects to other birds. These temporary effects would be very localised. Monitoring of light emissions from a mobile offshore drilling unit (MODU), which is considered to provide a conservative indication of potential illumination from an installation vessel, indicates that light intensity (navigational lighting) attenuated to below 1.00 lux and 0.03 lux at distances of 300 m and 1.4 km, respectively (Ref. 45). Light intensities of 1.00 and 0.03 lux are comparable to natural light intensities experienced during deep twilight and during a quarter moon. Given the very short duration that installation activities will occur within State waters, the number of turtle hatchlings and/or foraging or migrating seabirds that might be affected by light from installation vessels is low, and the consequences to local populations of any temporary and localised alterations in behaviour are considered to be ***Incidental (6)***.	**Incidental (6)**

Management Measures
Performance Standards / Control Measures
Risk-based inspections of specified vessels will be undertaken before mobilisation to identify potential strategies to reduce artificial light spill from vessels.
Vessel contractor required to develop and implement a Lighting Management Procedure (LMP) that describes mitigation strategies to address the relevant outcomes of vessel inspection(s) and considers the following measures to reduce light emissions: • outside lighting on vessels to be kept to a minimum (i.e. navigational lights and lighting necessary for safety) • lighting to be switched off when not in use and automatic timers/sensors installed where practicable • the use of shielded light fittings, directed lights and/or screens where practicable

Management Measures
• temporary artificial lighting to be mounted as low as practicable and focused on areas being worked on • where colour definition is not required for safety or operational purposes, lighting types that are least disruptive to turtles • fitting of blinds or curtains on windows and portholes to block out internal light sources.

Likelihood and Residual Risk Summary		
Likelihood	An impact on turtles or seabirds would require light spill of sufficient intensity to cause behavioural changes to occur in areas where light sensitive fauna were present. The closest location to shore where works are expected to occur is ~400 m from North Whites Beach, and further from the nearest significant marine turtle nesting area at Whites Beach. The most important seabird and shorebird areas are located on the southern coasts of Barrow Island, with the nearest shearwater breeding >10 km away. Monitoring of seabird populations found no impacts attributable to the much larger Feed Gas Pipeline System construction program (Ref. 46) The potential for lighting to attract or disorientate turtle hatchlings is considered to be limited. Results of the Barrow Island Hatchling Orientation Monitoring Program during season 2010–2011 (Ref. 47) suggested that artificial light from construction activities at the HDD site and offshore areas did not result in hatchling orientation varying beyond that observed from baseline levels. The installation vessel will move along the umbilicals alignment during installation, with the duration of activity at any location and overall being very short (≤20 days). Therefore, the probability of attraction, entrapment and/or increased predation of fauna within the area of any light spill from the vessel is low. With the implementation of the lighting management measures proposed, the likelihood of vessel lighting resulting in adverse consequences to local populations of particular values and sensitivities, particularly turtle hatchlings and seabirds, is considered ***Unlikely (4)***.	**Unlikely (4)**
Residual Risk	**Low (9)**	

5.4 Underwater Noise

Hazard	
The generation of underwater sound from umbilical installation and stabilisation, including associated vessel and survey activity, has the potential to affect marine fauna through behavioural changes and physical injury.	
Potential Consequence Summary	**Ranking**
Impacts from underwater noise on noise-sensitive fauna may involve: • behavioural responses, including startle and/or avoidance of noise/ vibration sources and interruption of acoustic communications • auditory impairment, permanent threshold shift (PTS), mortality or physical damage. These impacts can have consequences on the fitness and/or survivability of individual animals, or on populations if important behaviours are interrupted over an extended period. The particular values and sensitivities with the potential to be exposed to sound emissions include: • Pygmy Blue Whale (distribution) • Humpback Whale (migration) • Green, Hawksbill, Loggerhead, Flatback Turtles (mating/nesting, internesting, foraging) Underwater noise measurements during rock placement by a fall-pipe rock installation vessel found vessel noise to be the dominant source of noise and it was concluded that there was no evidence that rock placement was contributing to the overall noise level (Ref. 48; Ref. 49).	***Minor (5)***

Hazard	
Noise levels and frequency characteristics of vessels depend on vessel size, speed and activity, with variation among vessels of similar classes. Vessels using thrusters heavily to maintain position are likely to generate highest underwater noise levels. Broadband noise from a support vessel maintaining its position to a drill rig by the bow thrusters was reported at ~182 dB re 1 µPa at source (Ref. 50). Therefore, the noise levels associated with the installation vessels are not expected to have the intensity to result in permanent acoustic damage to fauna. The sound sources for the subsea surveys typically operate at frequencies above those that are likely to affect whales and turtles, but the highest broadband vessel noise levels during installation (~182 dB re 1 µPa) could cause temporary hearing impairment (i.e. temporary threshold shift [TTS]) and/or have a short-term behavioural impact on animals in the vicinity of activity. Hearing effects would be restricted to very close proximity of the vessel, but levels that may generate behavioural responses in the most sensitive species (i.e. >120 dB re 1 µPa) may occur out to 3 or 4 km from the vessel (Ref. 50). Compared to the spatial extent of the BIAs for turtles and whales that overlap the Operational Area, this represents a very small proportion of available habitat and there are no seafloor or other restrictions that would prevent fauna locally avoiding elevated noise by moving to adjacent similar habitat. Given the very short duration of activity and the relatively small proportion of any noise-sensitive fauna population that might be affected, the potential worst-case consequence from localised and temporary increases in underwater noise is considered to be ***Minor (5)***.	

Management Measures
Performance Standards / Control Measures
Vessels and onboard equipment (e.g. DP systems) maintained in accordance with Contractor's PMS
Vessels will adhere to Part 8 of the EPBC Regulations 2000 and Division 2 of the BC Regulations 2018 where practicable for potential interactions with fauna, including: • establishing a caution zone around prescribed fauna defined as an area around the animal with a radius of 30 m for a whale shark, 100 m for a dugong or seal, 150 m for a dolphin and 300 m (or 100 m to the side) for a whale. Within the caution zone: • operate the vessel at a constant speed of less than 6 knots and minimise noise • post a lookout for fauna.
Fauna interaction requirements communicated to relevant project personnel, including vessel master and crew conducting bridge watch, prior to commencing activities

Likelihood and Residual Risk Summary		
Likelihood	While the Operational Area overlaps the mapped BIAs for Pygmy Blue and Humpback Whales, the main migration routes for these species are further offshore (Ref. 24; Ref. 30) and the probability that they will occur in substantive numbers in the shallower depths of State waters (i.e. <25 m) during the short period of installation activity is low. The seafloor along the umbilical alignments is predominantly bare, unconsolidated sediments which are unlikely to represent particular foraging habitat for turtles. The installation works will move along the umbilicals alignment during installation, with activity transient at any location and the overall duration very short (≤20 days). While inter-nesting turtles might occur in the area if installation activities coincide with the nesting season, the area around the vessel that might be avoided represents only a small proportion of the available habitat. With the implementation of the management measures proposed, the likelihood of installation noise resulting in adverse consequences to particular values and sensitivities, notably migrating whales and nesting/internesting turtles, is considered ***Unlikely (4)***.	**Unlikely (4)**
Residual Risk	**Low (8)**	

5.5 Planned Discharges (marine)

Hazard	
Liquid waste generated from the activity has the potential to cause a decline in water and sediment quality, toxicity to marine organisms, and can result in disruptions to or exclusions of other activities such as fishing and recreation.	
Potential Consequence Summary	**Ranking**
The impacts from discharge of liquid wastes to the marine environment depends on the chemical characteristics, rate and volume of discharge, and the capacity of the receiving environment to dissipate or assimilate the discharges such that concentrations remain below thresholds for adverse effects, which is largely influenced by local metocean conditions. Sewage and putrescibles contain nutrients, cooling water has elevated temperature and brine from onboard RO is typically 10% higher salinity than seawater. These discharges and deck drainage may also contain low concentrations of hydrocarbons or chemicals (e.g. chlorine, cleaning agents) that are toxic to marine life at high concentrations. Bilge water typically contains oils/greases from onboard engines. If inhibited seawater or RO water is released from the shore crossing casings (up to 300m^3 each), it is likely to contain corrosion inhibitors and biocides that are acutely toxic to marine biota, although the active constituents may be largely depleted by the time of release. Descaling chemicals typically contain acidification agents (eg citric acid or sulphamic acid) that may be used in low volumes (<1m^3). The volumes of vessel wastes generated during the installation works is related to the number of persons on board. While not yet defined, this is expected to involve the following approximate total daily discharge volumes: • 4-45 m^3 of sewage and greywater • 0.1-0.2 m^3 of putrescibles • 77 m^3 of brine Values and sensitivities identified with the potential to be present in the vicinity of discharges during marine installation works include: • migrating marine mammals (Humpback, Pygmy Blue Whales) • foraging and internesting marine turtles • foraging marine avifauna • resident dolphin populations. The west coast of Barrow Island is a high energy, open ocean environment where discharges can be expected to be rapidly dispersed. Given the short duration of activity at any one	**Minor (5)**

Hazard	
location, the low potential volumes of discharge and the absence of conservation significant sessile receptors (eg BPPH) along the umbilical alignments seaward of the HDD exit point, the consequences of any temporary and localised changes in water quality are considered to be ***Minor (5).***	

Management Measures
Performance Standards / Control Measures
All hazardous chemical discharges (including chemicals used in casing preservation) shall be assessed and deemed acceptable before use, in accordance with ABU Hazardous Materials Management Procedure (Ref. 51)
MARPOL compliant bilge and sewage systems present on vessels >400 T
In accordance with MARPOL: • sewage will not be discharged within 3 nm from land • bilge water will only be discharged if treated by OWTS to <15 ppm and vessel en-route
Vessels will have sufficient sullage capacity onboard to store sewage or bilge water for the period if/where discharge not permitted by MARPOL
Vessels and onboard equipment (e.g. OWTS) maintained in accordance with Contractor's PMS

Likelihood and Residual Risk Summary		
Likelihood	Under MARPOL regulations, sewage and putrescible wastes are not permitted to be discharged in State waters (<3 nm from land) and oily water is required to be treated to less than 15 ppm prior to discharge. The corrosion/biofouling inhibiting chemicals used for casing preservation and any chemicals planned for discharge (e.g. descalants) will be subject to CAPL's hazardous chemical assessment process to ensure potential impacts are minimised to ALARP. Discharge will occur at a location that does not support conservation significant benthic habitats and when the noise/movement associated with project activity (removal of seal plug) at the site makes it likely mobile fauna that could be affected will avoid the immediate vicinity of the discharge. Given the highly dispersive offshore environment, where ambient currents and waves facilitate dilution into the receiving water body, and the management proposed, the likelihood that the small volumes of treated seawater, greywater, cooling water and/or brine that may be discharged to the ocean during the short (<20 days) period of installation activity will cause adverse consequences to marine values and sensitivities is considered ***Unlikely (4)***.	**Unlikely (4)**
Residual Risk	**Low (8)**	

5.6 Physical Interaction

The presence of the installed umbilicals on the seabed and of vessels undertaking installation activities in the Operational Area may result in interaction with fauna and/or other users of the area, potentially resulting in:

- fauna injury or mortality due to collision with a moving vessel
- disruption to recreational or commercial maritime activities
- oil spill following vessel collision adversely affecting the marine environment.

The potential environmental impacts and risks associated with an oil spill are described in Section 5.7.

5.6.1 Fauna Collision

Hazard	
The movement of vessels during installation activity has the potential to cause injury or mortality of fauna due to collisions. Fauna could also be injured or killed if contacted by falling rocks during post-lay stabilisation.	
Potential Consequence Summary	**Ranking**
The species most at risk of impact from physical interaction are slow moving macrofauna, particularly those that spend considerable time at or near the surface. Exposure is limited to within the Operational Area and essentially restricted to along or within close proximity of the umbilical alignments. The particular values and sensitivities with the potential to be affected include: • Pygmy blue Whale (distribution) • Humpback Whale (migration) • Green, Hawksbill, Loggerhead, Flatback Turtles (mating/nesting, internesting, foraging) The seasonal variability in the presence of these species in the area restricts the potential for all of them to interact with the short duration of installation activities. Impacts to fauna from physical collision are strongly influenced by the speed of the vessel. Laist et al. (Ref. 52) identifies that larger vessels with reduced manoeuvrability moving in excess of 10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling faster than 14 knots. The installation vessels will generally be slow moving (<10 knots) or stationary during umbilical installation works. Given the very short duration of the installation activities (i.e. <20 days) and the limited area over which interaction might occur, the number of any species of fauna that might be injured or killed during the Activity is low. Effects at species or regional population levels are not credible. However, injury or mortality of one to a few individuals that may occur coincident with installation activity has the potential to temporarily reduce abundance of local populations. In accordance with the Integrated Risk Prioritization Matrix (Appendix A), the potential consequence is considered ***Minor (5)*** with no control measures in place**.**	**Minor (5)**

Management Measures
Performance Standards / Control Measures
Vessels will adhere to Part 8 of the EPBC Regulations 2000 and Division 2 of the BC Regulations 2018 where practicable for potential interactions with fauna, including: • establishing a caution zone around prescribed fauna defined as an area around the animal with a radius of 30 m for a whale shark, 100 m for a dugong or seal, 150 m for a dolphin and 300 m (or 100 m to the side) for a whale. Within the caution zone: • operate the vessel at a constant speed of <6 knots • post a lookout for fauna.
Fauna interaction requirements communicated to relevant project personnel, including vessel master and crew conducting bridge watch, prior to commencing activities
Collisions with cetaceans will be reported to DCCEEW via the online National Ship Strike database (https://data.marinemammals.gov.au/report/shipstrike) as soon as possible (but not later than 72 hours after the incident occurs)
Any detected injury or fatality attributed to the installation works of any marine species (including marine turtles) listed as Threatened or Migratory under the BC Act or the EPBC Act will be reported in accordance with Section 6.6.

Likelihood and Residual Risk Summary		
Likelihood	The Operational Area overlaps the mapped BIAs for Pygmy Blue and Humpback Whales, however, the main migration routes for these species are further offshore (Ref. 24; Ref. 30) and the probability that they will occur in substantive numbers in the shallower depths of State waters (i.e. <30 m) during the short period of installation activity is low. Green (and to a lesser	**Unlikely (4)**

	extent Hawksbill) turtles that are seasonally abundant off the north-west coast of Barrow Island are the species most likely to be encountered. The seafloor along the umbilicals alignment is predominantly bare, unconsolidated sediments which are unlikely to represent particular foraging habitat for Green (or other) turtles. The Recovery Plan for Marine Turtles in Australia (Ref. 41) recognises vessel strike as a cause of individual marine turtle mortality, but indicates it has not been shown to cause stock level declines. Turtles, cetaceans and other megafauna that may occur in the area are considered noise sensitive and can be expected to largely avoid vessel/installation activities. Vessel interaction procedures will be implemented that include restrictions on vessel speed, reducing both the likelihood of collision and the likelihood of injury/mortality in the event of collision. Only one marine fauna (turtle) casualty was recorded during the much larger marine construction program associated with installation of the existing Feed Gas Pipeline Systems at the same location. With the implementation of the management measures proposed, the likelihood of consequences to local populations of particular values and sensitivities, notably migrating whales and feeding/internesting turtles, from physical interaction with the very short (<20 days) duration offshore installation activity is considered ***Unlikely (4)***.	
Residual Risk	**Low (8)**	

5.6.2 Disruption to other users

Hazard	
The presence of the installed umbilicals, including rock berm, on the seafloor and the presence and/or movement of vessels during installation activity have the potential to displace or disrupt other users of the areas involved.	
Potential Consequence Summary	**Ranking**
The presence of installation vessels and associated requirement for other vessels to navigate around them, may temporarily and locally disrupt their activities in the area. Once installed, the ongoing presence of the rock berms, and its associated alteration to seabed characteristics, could permanently displace some uses (e.g. bottom trawling) or reduce the areas value for commercial purposes (e.g. fishing). There is little commercial fishing activity in the waters off Barrow Island that might be affected by the rock berms, and their presence would not impact the passage of recreational or tourism vessels transiting to nearby attractions (e.g. Montebello Islands). The installation activities are to be of very short duration and involve relatively few vessels, potentially restricting access to a very small proportion of the waters off Barrow Island in a location where there are no shallow water hazards or other obstructions that would prevent avoidance by other vessels. The consequences to any other users of having to navigate around the vessels and/or temporarily operate in an adjacent area of the ocean will be minimal. In accordance with the Integrated Risk Prioritization Matrix (Appendix A), the potential worst case consequence is considered ***Incidental (6)***.	**Incidental (6)**

Management Measures
Performance Standards / Control Measures
A 24-hour visual, radio, and radar watch will be maintained for vessels in the vicinity of the Operational Area in accordance with AMSA and/or Standards of Training, Certification and Watchkeeping (STCW2010) (1978 STCW Convention)
Minimum lighting required for safety and navigational purposes, in accordance with the *Navigation Act 1912* (Marine Orders Part 30 [Prevention of Collisions]), is on board and operational.

Management Measures
The AHS will be notified sufficiently in advance of (where practicable no less than four working weeks before) installation operations commencing to enable Notices to Mariners to be published
AMSA's JRCC will be notified 24–48 hours before operations commence to enable AMSA to distribute an AUSCOAST warning
The AHS will be provided with installed umbilical coordinates to enable identification on charts

Likelihood and Residual Risk Summary		
Likelihood	The offshore Operational Area has limited value to other users and the probability that other vessels would be operating near the umbilical installation alignments is low. By alerting other users to the presence of the installed umbilicals, and of the installation vessels during installation works, the potential for disturbance to activities of other users will be minimised. Given the very short duration of installation activities and the management measures proposed, the likelihood of consequences to other users is considered ***Remote (5)***.	**Remote (5)**
Residual Risk	**Low (10)**	

5.7 Leaks and Spills

The vessels use diesel (MDO or MGO) and carry fuel in onboard tanks. The largest volume of fuel carried in any tank on any vessel during the installation activities is expected to be ~335 m3. Vessel operations are also likely to involve the on-board storage of hydrocarbons, utility and hydraulic oils, and other chemicals. These materials are generally stored in containers holding less than 1 m^3. If ROV(s) are used in underwater surveys, they are likely to have hydraulic fluids in control lines.

No at-sea refuelling of vessels will occur in State waters. Therefore, two leak and spill scenarios are identified for vessel operations:

- single point failure (onboard [e.g. deck spill] or overboard [e.g. ROV leak])
- vessel collision (grounding or with another vessel).

5.7.1 Single Point Failure

Hazard	
A leak or spill caused by a single point failure that reaches the marine environment has the potential to result in changes to water quality, leading to potential toxicological effects on marine fauna.	
Potential Consequence Summary	**Ranking**
The particular values and sensitivities with the potential to be impacted by small volumes of hydrocarbons or other fluids are: • Humpback Whale migration • resident dolphin populations • foraging and inter-nesting marine turtles • marine avifauna. Given the small volumes involved, discharges are expected to disperse rapidly and any effects to water quality would be expected to be highly localised and short term. Marine fauna within the affected area may suffer short-term exposure, but the scale of impact would be limited due to the small volume and rapid natural dispersion of the materials	**Incidental (6)**

Hazard	
involved. In accordance with the Integrated Risk Prioritization Matrix (Appendix A), the potential consequences to particular values and sensitivities are considered ***Incidental (6)***.	

Management Measures
Performance Standards / Control Measures
All hydrocarbon and chemical storage with secondary containment or within bunded areas.
A complete inventory of all hazardous materials stored on the vessels will be maintained on board, together with current SDSs for each hazardous or dangerous goods substance
Marine vessels will have a current Shipboard Oil Pollution Emergency Plan (SOPEP)/Shipboard Marine Pollution Emergency Plan (SMPEP) as appropriate to class
Inductions/training provided to personnel responsible for handling or responding to spills of hazardous materials
Spill containment and recovery equipment (spill kits, scupper plugs) will be provided where spills are possible (e.g. where fuel, oil, or chemicals and hazardous waste are used or stored).
All spills will be recorded as per CAPL's Incident Investigation and Reporting Process (Ref. 83)
Spills will be contained and/or cleaned up in accordance with vessel SOPEP/SMPEP

Likelihood and Residual Risk Summary		
Likelihood	Vessel operations will be of short duration. Accidental on-board spills of small volumes of hydrocarbons or other fluids are expected to be infrequent and isolated events and, with the specified controls in place, the likelihood of such spills reaching the marine environment is further reduced. In addition, the potential for particular values and sensitivities to be sufficiently close to the release point at the time of release for exposure to cause impacts is limited. Therefore, the likelihood of single point failures resulting in the defined consequences is considered ***Unlikely (4)***.	**Unlikely (4)**
Residual Risk	**Low (9)**	

5.7.2 Vessel Collision

The grounding or collision of a marine vessel with the subsequent complete loss of a single full tank of fuel was identified to be the worst-case scenario for leaks and spills, and therefore was selected for hydrocarbon spill modelling. The spill material was assumed to be MDO with a maximum credible spill volume of 335 m^3. This equates to a Level 2 spill.

Vessel collision within State Waters is considered a credible hazard (although extremely unlikely) given the potential for more than one vessel to be working simultaneously in the Operational Area. Modelling was previously undertaken (Ref. 53) to indicate the potential impacts and risks associated with a vessel collision, with the inputs and results outlined below. Further detail on the methodology used for spill modelling and the interpretation of results, including the division of the EMBA into geographic 'areas' (Figure 5-2), is provided in Section 3.5 and Section 4 of the OFGPIMP (Ref. 1) respectively.

5.7.2.1 Modelling Inputs

Hydrocarbon Characteristics

MDO is a medium-grade oil used in the maritime industry (and classified as a Group 2 or Group 3 oil depending on its origin). It is characterised by a large

mixture of low- and semi- to low-volatile compounds (95%) and persistent hydrocarbons (5%). Key properties of a representative MDO are included in Table 5-1 and Table 5-2.

Table 5-1: Physical Characteristics: Representative MDO

Physical Characteristic	MDO
Density (kg/m^3)	829.1 (at 25 °C)
API	37.6
Dynamic viscosity (cP)	4.0 (at 25 °C)
Pour Point (°C)	-14
Oil Property Category	Group 2
Oil Persistence Classification	Persistent (Medium)

Table 5-2: Boiling Point Ranges of a Representative MDO

Characteristic	Volatiles (%)	Semi-volatiles (%)	Low volatiles (%)	Residual (%)
Boiling point (°C)	**<180**	**180–265**	**265–380**	**>380**
MDO	6.0	34.6	54.4	5.0

Not persistent **Persistent**

Location

It is not practicable for spill modelling to be undertaken at every potential spill location within the Operational Area. A release location was selected by considering locations that would:

- have the greatest potential environmental consequence to the receiving environment (closest to sensitive receptors)
- be considered at greater risk of a spill event.

A vessel collision scenario at the HDD marine exit point in an approximate water depth of 13 m was identified to represent the worst-case potential environmental consequence given the proximity to sensitive marine, subtidal, and shoreline values and sensitivities.

Volume

The modelling assumed release of up to 335 m^3 of MDO over six hours. AMSA Guidelines (Ref. 54) recommend consideration of maximum credible loss volumes is based on the largest volume carried in a single vessel fuel tank.

The volume used in the modelled scenario (335 m^3) is considered to provide a suitable representation of maximum credible tank volumes likely to be present during the implementation of activities covered under this Addendum.

5.7.2.2 Spill Modelling Results

Results generated by the stochastic spill modelling (Ref. 53) estimate the weathering and fate of MDO (Figure 5-1) and the extent of the EMBA (Figure 5-2), based on the thresholds described in Section 3.1. The results are summarised as follows:

Weathering and Fate of Hydrocarbons:

- Fifteen days after the spill occurs, the modelling indicates that evaporation to the atmosphere (up to 47.2%), or shoreline contact (up to 45.7%) were the primary fate pathways of the MDO, with the remaining hydrocarbons decaying via natural processes in the water column.
- A negligible portion of the MDO was predicted to remain on the water surface two days after the spill, with none remaining on the water surface after 15 days.
- Entrainment of MDO is predicted to be low (<10% of the total spill volume) under all seasonal conditions.

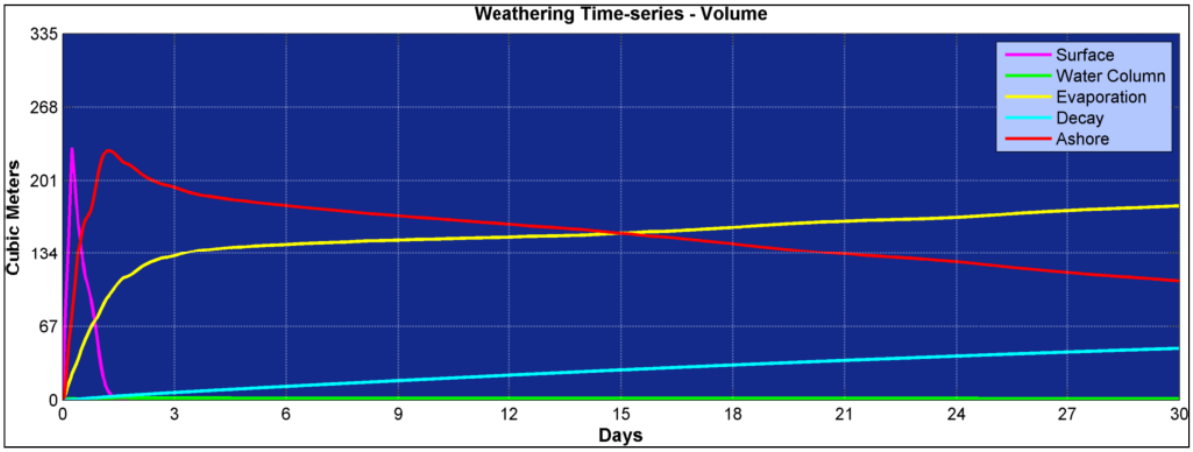


Figure 5-1: Weathering and Fate Curve for a 335 m3 Release of MDO

Surface Hydrocarbons:

- Surface exposures of >25 g/m^2 are predicted to occur up to 25 km from the release point, predominantly towards the west-south-west.
- Surface exposures of 10 g/m^2 to 25 g/m^2 are predicted to occur up to 66 km from the release point, predominantly towards the west-south-west.
- Surface exposures of 1g/m^2 to 10 g/m^2 are predicted to occur up to 124 km from the release point, predominantly towards the west-south-west.

Entrained Hydrocarbons

- No entrained exposures of >500 ppb (>48 000 ppb.hrs) were predicted to occur under any seasonal conditions.

- Exposures of 100–500 ppb (9600–48 000 ppb.hrs) were predicted to occur up to 18 km from the release site, affecting the Barrow and Montebello Islands Area and Offshore Area. The probability of these exposures occurring was <20% of the single spill simulations (under all seasonal conditions).
- Exposures of 10–100 ppb (960–9600 ppb.hrs) were predicted to extend up to 435 km from the release site.

Dissolved Hydrocarbons

- No dissolved aromatic concentrations were predicted to occur.

Shoreline Accumulation

- Barrow Island, the Lowendal Island Group, and the Montebello Island Group were the most likely areas to be exposed to shoreline contact, with minimum times to contact being less than one hour, 13 hours, and 24 hours respectively.
- The maximum volume predicted to reach shorelines was 231 m^3.
- Shoreline exposure was predicted to only affect the Barrow and Montebello Islands Area.
- The maximum predicted length of shoreline on Barrow Island exposed to oil at levels >100 g/m^2 was 21 km and 8 km at levels >1000 g/m^2.
- The maximum predicted length of shoreline contacted on the Montebello Islands at levels >100 g/m^2 was 16 km and at levels >1000 g/m^2 was 11 km.

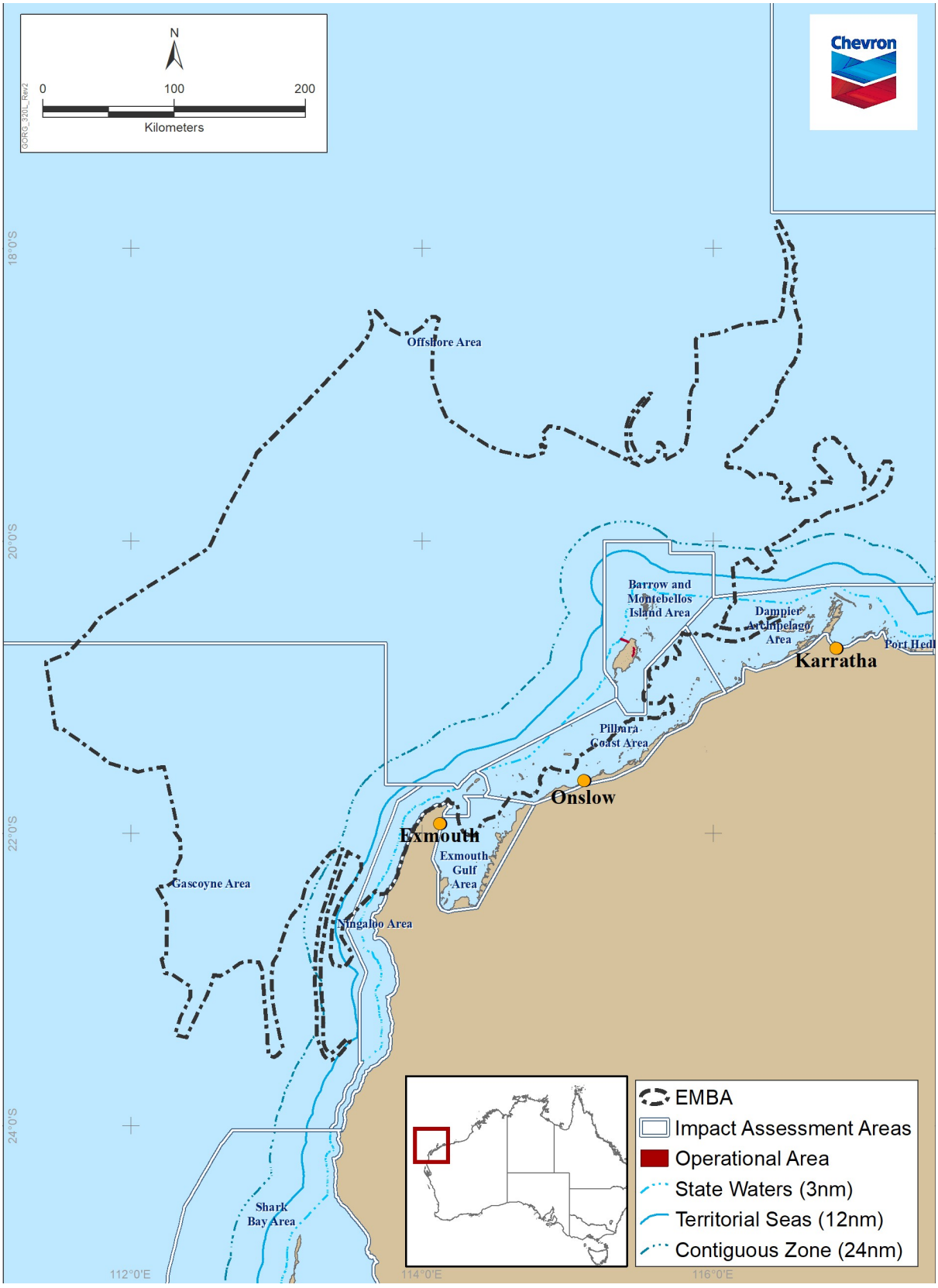


Figure 5-2: Extent of the EMBA Defined by Modelling of a Worst Case (Vessel Collision) Spill Scenario

5.7.2.3 Risk Assessment

A separate environmental consequence assessment has been undertaken for each hydrocarbon exposure pathway, specifically:

- surface
- entrained
- shoreline.

The only socioeconomic receptors identified as having particular value and sensitivity with the potential to be affected by vessel failure were commercial and recreational fisheries. Potential impacts to these fisheries are directly related to targeted fish stocks, and thus assessment of risk to these was based on impacts to fish and other marine fauna.

Hazard (Surface Exposure)	
A release of hydrocarbons as a result of a vessel failure presents a hazard to the marine environment due to the resulting surface oil slick. Scholten *et al.* (Ref. 55) indicate that a hydrocarbon layer 25 g/m^2 thick would be harmful for birds that contact a surface hydrocarbon slick. Engelhardt (Ref. 56), Clark (Ref. 57), Geraci and St. Aubin (Ref. 58), and Jenssen (Ref. 59) indicate that a hydrocarbon layer of greater than 10 g/m^2 would impart a lethal dose to an intersecting wildlife individual (including marine mammals). Peakall *et al.* (Ref. 60) stated that oil concentration <1 g/m^2 (~1 µm) was not harmful to seabirds, and represents a visual aesthetics threshold. Therefore, a spill scenario involving MDO has the potential to result in acute exposures to marine fauna where surface concentrations are >10 g/m^2.	
Potential Consequence Summary	**Ranking**
Upon release, MDO will spread out quickly on the sea surface and volatile components will evaporate rapidly. Spill modelling predicted that a negligible portion of the MDO was predicted to remain on the surface two days after the spill. Surface exposures >10 g/m^2 extended up to 66 km from the release site and overlapped the Offshore Area and Barrow and Montebello Islands Area (Ref. 53). Air-breathing marine fauna and seabirds are most at risk from surface exposures of MDO, either through contact or inhalation of the VOCs, which can result in irritation to skin and eyes or damage respiratory systems (Ref. 61; Ref. 62). Fouling of marine avifauna feathers can also result (Ref. 63). As such, the particular values and sensitivities with the potential to be affected by surface hydrocarbon exposures are: • migratory marine mammals (specifically Humpback Whale and Pygmy Blue Whale) • resident dolphin populations • marine turtle foraging and internesting • marine avifauna foraging • coral reef communities (intertidal). Although the potential for acute exposure is widespread, the interaction of mobile marine fauna with surface hydrocarbons is expected to be limited because weathering will limit the duration of exposure (Ref. 53). Therefore, exposures are expected to result in acute impacts to a small number of individuals but are unlikely to impact the viability of local populations. If a spill coincided with a period of coral fertilisation, the presence of surface hydrocarbons has the potential to foul coral larvae and/or interfere with settlement, which has the potential to result in reduced reproductive success (Ref. 64). Coral recruitment from other areas would be expected to occur so impacts are not expected to result in a measurable reduction in coral reef extent, although reduction in growth rates/health may be observed (Ref. 65; Ref. 66). In accordance with the Integrated Risk Matrix, widespread, short-term consequences are considered ***Major (3)***.	**Major (3)**

Hazard (Entrained Exposure)
Entrained hydrocarbons represent the dispersed insoluble oil droplets phase and pose a hazard to marine life that become entrained (i.e. juvenile fish, larvae, and plankton) with the oil plume, or via direct ingestion or the consumption of contaminated prey. OSPAR (Ref. 67) describes a dispersed oil threshold of 70.5 ppb, for PNEC for chronic exposure (typically >7 days). This PNEC is relevant to organisms likely to entrain in the plume and therefore remain with the plume for an extended period of time. An acute lethal entrained concentration of 700 ppb was derived by applying an acute-to-chronic factor of ten to the PNEC (in accordance with the water quality guidelines [Ref. 68). Therefore for this spill scenario, exposure to entrained thresholds >700 ppb (or 67 200 ppb.hrs) has the potential to result in acute impacts whilst exposures >70 ppb (or 6726 ppb.hrs) has the potential to result in chronic impacts.

Hazard (Entrained Exposure)	
Potential Consequence Summary	**Ranking**
Spill modelling predicted no entrained exposures >500 ppb and consequently there is no potential for acute exposure (>700 ppb) to occur. The potential for entrainment of MDO was found to be low, but some exposures >100 ppb were predicted to extend up to 18 km from the release location, and exposures of 10–100 ppb were predicted to extend up to 435 km, thus having the potential to elicit chronic effects at concentrations >70.5 ppb. Entrained hydrocarbons primarily affect the Barrow and Montebello Islands Area, but there is also some potential for entrained concentrations >70 ppb to reach the Offshore Area. Particular values and sensitivities with the potential to be affected by entrained hydrocarbons were identified as: • KEFs – continental slope demersal fish communities (high level of endemism) • commercial and recreational fisheries • subtidal coral reef communities. Given the mobility of marine fauna (e.g. marine mammals, marine turtles) that may be present in the area at the time of the spill, no chronic impacts or risks are expected because these fauna are unlikely to undergo prolonged exposure. Potential impacts to fish from prolonged entrained exposure are expected to be limited and localised to juvenile fish, larvae, and planktonic organisms. Given the naturally high mortality rates of juvenile fish, larvae, and plankton, any localised mortality associated with the spill are unlikely to result in any measurable reduction in finfish stock in subsequent years (Ref. 69). In addition, fish are able to tolerate low hydrocarbon levels, and elevated levels of hydrocarbons in fish tissue have been found to return to reference levels within six months (Ref. 70; Ref. 71; Ref. 72). Consequently, diverse fish assemblages and commercial and recreational fisheries are not expected to be impacted significantly in the long term. The potential for entrained MDO to contact and impact particular subtidal values and sensitivities such as coral reef communities in shallow, nearshore areas (e.g. subtidal corals at Biggada Reef on the west coast of Barrow Island) was also considered as several simulations predicted moderate entrained exposures. Coral tissues that are directly contacted by droplets entrained in the upper water column may experience some degree of impaired respiration and photosynthesis, potentially leading to reduced growth rates (Ref. 66), although such impacts are expected to be limited given the limited distribution of coral reef habitat off the west coast of Barrow Island and that small (<0.006 mm) hydrocarbon droplets have not been found to adhere to living corals or be ingested by them (Ref. 73). Based on the potential for widespread and long-term effects, the consequences were assessed. OSPAR (Ref. 67) describes a dispersed oil threshold of 70.5 ppb for PNEC for chronic exposure (typically >7 days). This PNEC is relevant to organisms likely to entrain in the plume and therefore remain with the plume for an extended period of time. An acute lethal entrained concentration of 700 ppb was derived by applying an acute-to-chronic factor of ten to the PNEC (in accordance with the water quality guidelines [Ref. 68]). Therefore, for this spill scenario, exposure to entrained thresholds >700 ppb (or 67 200 ppb.hrs) has the potential to result in acute impacts, while exposures >70 ppb (or 6726 ppb.hrs) have the potential to result in chronic impacts. Given the potential for entrainment of juvenile fish, larvae, and planktonic organisms, there is the potential for widespread but short-term impacts to fish and fisheries. There is also some limited potential for localised and long-term impacts to coral habitat, if contacted. As such, in accordance with the Integrated Risk Matrix, the consequences were assessed as ***Moderate (4).***	**Moderate (4)**

Hazard (Shoreline Loading Exposure)
Lin and Mendelssohn (Ref. 74) observed hydrocarbon loading on shorelines >1000 g/m^2 to significantly impact salt marsh or mangrove plants. Owens and Sergy (Ref. 75) indicated that shoreline loading between 100 and 1000 g/m^2 has the potential to coat shoreline habitats, with thresholds >100 g/m^2 sufficient to coat the benthic organisms and likely impact their survival and reproductive capacity (Ref. 76). Based on these scientific studies, a release of MDO has the potential to result in impacts to intertidal shoreline values exposed to shoreline loading >100 g/m^2, and mangrove shoreline values where shoreline loading is >1000 g/m^2.

Hazard (Shoreline Loading Exposure)	
Potential Consequence Summary	**Ranking**
Spill modelling predicts shoreline accumulation in the Barrow and Montebello Islands Area, with up to 8 km of the west coast of Barrow Island's shoreline exposed to shoreline accumulation concentrations >1000 g/m^2 and 21 km exposed to moderate hydrocarbon loading levels (>100 g/m^2). Therefore, the particular values and sensitivities with the potential to be affected by surface hydrocarbon exposures are: • mangroves • avifauna staging and nesting • marine turtle nesting. Spill modelling predicts that up to 2 km of shoreline containing mangroves in the Montebello Islands Group may be exposed to high shoreline accumulations levels (>1000 g/m^2) that could result in impacts to the health of the mangrove community as a result of exposure to the toxic volatile fraction and smothering of the pneumatophores by the more persistent components (Ref. 77; Ref. 78). Where mangroves are exposed to MDO, death or subsequent decay of mangrove trees may occur; rates of recovery will depend on the degree of MDO penetration into burrows and propagation root cavities (Ref. 69). Because the minimum time prior to contact is 24 hours, it can be assumed that some volatile toxic components will have weathered from the oil slick, with mangrove seedlings and saplings most susceptible to weathered oils (Ref. 79). Exposure of mangroves to high hydrocarbon loadings would likely have long-term effects on the habitat values of the mangrove community, including invertebrate communities, and potentially involve extended time frames (years) for recovery. Shoreline loading >100 g/m^2 has the potential to impact marine turtle nesting beaches and avifauna staging/nesting areas located on the west coast of Barrow Island and the Montebello Islands. Given that there are several significant staging and nesting areas for both avifauna and turtles across Barrow Island and the Montebello Islands, there is the potential to impact on these populations and affect species recruitment at a local population level. Therefore, there is the potential for long-term effects on species as local populations recover from interrupted recruitment. Thus impacts have been defined as having potential widespread long-term impacts to species. As such, in accordance with the Integrated Risk Matrix, the consequences were assessed as **Severe (2)**.	**Severe (2)**

Management Measures
Performance Standards / Control Measures
A 24-hour visual, radio, and radar watch will be maintained for vessels in the vicinity of the Operational Area in accordance with AMSA and/or Standards of Training, Certification and Watchkeeping (STCW2010) (1978 STCW Convention)
The AHS will be notified sufficiently in advance of (where practicable no less than four working weeks before) installation operations commencing to enable Notices to Mariners to be published
Risks of vessel collisions will be detailed and managed by a SIMOPS plan where required.
Marine vessels will carry on board a SOPEP (or equivalent) and spill containment and recovery equipment on board as per the SOPEP
In the event of a vessel-based spill emergency response will be in accordance with the SOPEP
Emergency spill response activities will be implemented in accordance with the Consolidated OPEP (Ref. 80) in the event of an emergency condition spill from a vessel collision
CAPL will ensure emergency response preparedness through emergency response training and exercises

Likelihood and Residual Risk Summary		
Likelihood	Between 2005 and 2012, 1200 marine incidents occurred in Australian waters, of which 73 were groundings and 37 were collisions (Ref. 81). The Gorgon and Jansz Feed Gas Pipelines are outside the controlled confines of the Barrow Island Port in areas where the density of vessel traffic is low. The likelihood of a vessel collision during the short duration of the installation	**Rare (6)**

	works with standard maritime practices implemented is inherently low. For a collision to cause the worst-case consequences described would require: • contact of sufficient force to pierce the vessel hull • the penetration of the hull coinciding with the largest fuel tank(s) location • the tank to contain 335m^3 of MDO and penetration low enough to cause this entire volume to be released, despite source control efforts • spill response to be ineffective in reducing impacts. With the control measures that will be implemented, the likelihood of the consequences occurring was determined to be ***Rare (6)***.	
Residual Risk	**Low (7)**	

6 Monitoring and Reporting

6.1 Overview

The numerous environmental reports required to record details such as the progress of work; monitoring of key physical and environmental factors; incidents, complaints and their status and resolution; compliance; and performance for the Gorgon Gas Development and Jansz Feed Gas Pipeline are outlined in Section 7.8 of the OFGPIMP (Ref. 1). This includes ongoing Environmental Performance Reporting and Compliance Reporting required under Ministerial Conditions.

6.2 Auditing

Internal and external auditing of the Gorgon Gas Development and Jansz Feed Gas Pipeline's environmental performance and compliance, including with the requirements of MS 800, MS 769, and EPBC Reference: 2003/1294 and 2008/4178, is described in Section 7.6 of the OFGPIMP (Ref. 1). A record of all audits and the audit outcomes is maintained. Actions arising from audits are tracked until their close-out.

An audit table is provided in Appendix B to assist with auditing for compliance with this Addendum to meet the reporting requirements for MS 800, MS 769, and EPBC Reference: 2003/1294 and 2008/4178 (see Section 6.5).

6.3 Inspections

Regular workplace inspections will be conducted during the offshore umbilical installation works and will include (but not necessarily be limited to) the items listed in Table 6–1.

Table 6–1: Inspection Requirements

Inspection Requirement	Responsibility
Vessel safety systems	Construction Contractor
Anchoring inspections	Construction Contractor
Bilge oil/water separators	Construction Contractor
Vessel deck drainage systems	Construction Contractor
Offshore housekeeping	Construction Contractor
Checking of vessels, plant and equipment for leaks and spills	Construction Contractor
Offshore hazardous materials storage, drainage and bunds	Construction Contractor
Offshore waste storage areas	Construction Contractor

6.4 Environmental Monitoring

The comprehensive marine monitoring program undertaken to address conditions of approval relevant to offshore pipeline installation activities is described in Section 7.7 of the OFGPIMP (Ref. 1). Marine monitoring undertaken prior, during, and after the (larger scale) installation activities for the existing FGPS to address the requirements of Condition 23.5 (ix) of MS 800, Condition 14.4.(xi) of MS 769, and Condition 16.5 (IX) of EPBC Reference: 2003/1294 and 2008/4178 found that there were no impacts outside the development footprint to any environmental elements monitored (Ref. 18, 19, 20, 21, 22). The requirements of these conditions have therefore been met and no additional monitoring of these

elements will be undertaken for the umbilical installation activities addressed by this Addendum.

6.5 Routine Reporting

Reports on environmental performance and compliance, which include the outcomes of audits, are provided annually in accordance with Ministerial Conditions, as described in Section 7.8 of the OFGPIMP (Ref. 1).

6.6 Incident Response and Reporting

CAPL has prepared the Emergency Management Standardised OE Process (Ref. 82) and Incident Investigation and Reporting Process (Ref. 83), which it internally requires its employees, contractors, etc. to follow in the event of environmental incidents. These processes will also be internally applied to environmental incidents identified in this Addendum, where appropriate.

The environmental incidents, reporting requirements and timing specific to this Addendum are provided in Table 6–2.

Table 6–2: Incident Reporting Requirements

Incident	Reporting to	Timing
Material or Serious Environmental Harm outside the Marine Disturbance Footprint (MDF)	DWER/DCCEEW	Within 48 hours of detection or as soon as reasonably practicable
Significant Impacts detected by the monitoring program on matters of National Environmental Significance attributable to the Gorgon Gas Development	DCCEEW	Within 48 hours of detection
Harm or mortality to Commonwealth EPBC Act Listed Marine Fauna (whether attributable to the Gorgon Gas Development or not)	DCCEEW	Within 24 hours of detection

The external reporting requirements for marine turtle incidents (injury or mortality) are described in the Long-term Marine Turtle Management Plan (LTMTMP; Ref. 84).

7 Performance Objectives and Standards

Environmental performance is 'the measurable results of an organisation's management of its environmental aspects' (Ref. 85). For the offshore umbilical installation activities within the scope of this Addendum, CAPL measures environmental performance through:

- **Environmental Performance Objectives** – the objectives of the OFGPIMP as defined by Condition 23.3 of MS 800, Condition 14.3 of MS 769 and Condition 16.3 of EPBC Reference: 2003/1294 and 2008/4178 (Section 1.3.1)
- **Environmental Performance Standards** – defined, in accordance with Schedule 2 of MS 800, as 'matters which are developed for assessing performance, not compliance, and are quantitative targets or where that is demonstrated to be not practicable, qualitative targets, against which progress towards achievement of the objectives of conditions can be measured'.

Performance standards specific to each aspect of the activities covered by this Addendum are detailed in Section 5. These standards have been developed specifically for assessing performance, not compliance, and so failure to meet the standards does not represent a breach of this Addendum. Rather, it indicates that an objective may not have been met and there may be a need for management action or review of this Addendum.

8 Review of this Addendum

At the completion of the offshore umbilical installation in State waters (including post-lay survey), this Addendum ceases to be in effect. Given the relatively short duration expected for the umbilical installation works, scheduled reviews of the Addendum are not anticipated. However, this Addendum will be reviewed in the event of a significant change to the activity described in Section 2, if a performance standard is not achieved or in the event a significant new or increased risk is identified.

9 Acronyms and Abbreviations

Table 9-1 defines the acronyms and abbreviations used in this document.

Table 9-1: Acronyms and Abbreviations

Acronym / Abbreviation	Definition
~	Approximately
ABU	Australian Business Unit
AC	Alternating current
Additional Support Area	Gorgon Gas Development Additional Construction, Laydown, and Operations Support Area
ALARP	As low as reasonably practicable
BC Act	Western Australian *Biodiversity Conservation Act 2016*
BIA	Biologically important area
CAPL	Chevron Australia Pty Ltd
CO_2	Carbon dioxide
Construction	Construction includes any Proposal-related (or action-related) construction and commissioning activities within the Terrestrial and Marine Disturbance Footprints, excluding investigatory works such as, but not limited to, geotechnical, geophysical, biological and cultural heritage surveys, baseline monitoring surveys and technology trials.
Cth	Commonwealth of Australia
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DMIRS	Western Australian Department of Mines, Industry Regulation and Safety
DP	Dynamic positioning
DPIRD	Department of Primary Industry and Resource Development
DWER	Department of Water and Environmental Regulation
EMP	Environmental Management Plan
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPBC Reference: 2003/1294	Commonwealth Ministerial Approval (for the Gorgon Gas Development) as amended or replaced from time to time
EPBC Reference: 2005/2184	Commonwealth Ministerial Approval (for the Jansz Feed Gas Pipeline) as amended or replaced from time to time
EPBC Reference: 2008/4178	Commonwealth Ministerial Approval (for the Revised Gorgon Gas Development) as amended or replaced from time to time.
EPBC Reference: 2011/5942	Commonwealth Ministerial Approval (for the Fourth Train Expansion) as amended or replaced from time to time.
FGPS	Feed Gas Pipeline System
Gorgon Gas Development	The Gorgon Gas Development as approved under MS 800 and MS 965, and EPBC References: 2003/1294 and 2008/4178 (as varied by the Commonwealth Environment Minister), as amended or replaced from time to time.
GHG	Greenhouse gas

Acronym / Abbreviation	Definition
GTP	Gas Treatment Plant
ha	Hectare
HDDMMP	Horizontal Directional Drilling Management and Monitoring Plan
HES	Health, Environment and Safety
HSE	Health, Safety and Environment
IMS	Impact Mitigation Strategy
IFC	Issued for construction
“	Inch
Jansz Feed Gas Pipeline	The Jansz Feed Gas Pipeline as approved in MS 769 and EPBC Reference 2005/2184 as amended or replaced from time to time.
Kg	Kilogram
kV	Kilovolt
km	Kilometre
L	Litre
LAT	Lowest astronomical tide
LNG	Liquefied Natural Gas
LTMTMP	Long-term Marine Turtle Management Plan
m	Metre
m^3	Cubic metre
m/m	Concentration of a solution by mass
mm	Millimetre
Marine Disturbance Footprint	The area of the seabed to be disturbed by construction or operations activities associated with the Marine Facilities listed in Condition 14.3 of MS 800 and Condition 12.3 of MS 769 (excepting that area of the seabed to be disturbed by the generation of turbidity and sedimentation from dredging and dredge spoil disposal) as set out in the Coastal and Marine Baseline State Report required under Condition 14.2 of MS 800 and Condition 12.2 of MS 769.
MDF	*See* Marine Disturbance Footprint
MEG	Mono-ethylene glycol
Migratory (*species*)	Species listed as Migratory under the Cth EPBC Act
MS	(Western Australian) Ministerial Statement
MS 1002	Western Australian Ministerial Statement 1002, issued for the Gorgon Gas Development Fourth Train Expansion Proposal, as amended from time to time.
MS 748	Western Australian Ministerial Statement No. 748 (for the Gorgon Gas Development) as amended from time to time [superseded by MS 800].
MS 769	Western Australian Ministerial Statement No. 769 (for the Jansz Feed Gas Pipeline) as amended from time to time.
MS 800	Western Australian Ministerial Statement No. 800, issued for the Revised and Expanded Gas Development, as amended from time to time. MS 800 supersedes the Gorgon Gas Development as originally approved by MS 748. The conditions of MS 800 also apply to the Additional Support Area under MS 965.
MS 865	Western Australian Ministerial Statement 865, issued to establish a restart mechanism for dredging, as amended from time to time.

Acronym / Abbreviation	Definition
MS 965	Western Australian Ministerial Statement No. 965, issued for the Additional Support Area, as amended from time to time. MS 965 applies the conditions of MS 800 to the Additional Support Area.
N/A	Not applicable
nm	Nautical mile
ODS	Ozone depleting substance
OE	Operational Excellence
OEMS	Operational Excellence Management System
OFGPIMP	Offshore Feed Gas Pipeline Installation Management Plan
PEC	Priority ecological community
PER	Public Environmental Review for the Gorgon Gas Development Revised and Expanded Proposal dated September 2008, as amended or supplemented from time to time.
Practicable	For the purposes of MS 800 and MS 769 means reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge.
QMS	Quarantine Management System
ROW	Right of way
ROV	Remotely operated vehicle
TAPL	Texaco Australia Pty Ltd
TDF	*See* Terrestrial Disturbance Footprint
Terrestrial Disturbance Footprint (TDF)	The area to be disturbed by construction or operations activities associated with the Terrestrial Facilities listed in Condition 6.3 of MS 800, including the Additional Support Area approved by MS 965, and Condition 6.3 of MS 769.
TEC	Threatened Ecological Community
Threatened (*species*)	Species listed as Threatened under the Cth EPBC Act or the WA BC Act
TSEMP	Terrestrial and Subterranean Environment Monitoring Program
WA	Western Australia

10 References

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

Table 10-1: References

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Appendix A Chevron Integrated Risk Prioritization Matrix

Chevron Integrated Risk Prioritization Matrix

Likelihood Descriptions & Index

Legend (where Likelihood is with confirmed safeguards and Consequence is without safeguards)

Risk Levels 1-4: Elevated Risk. Risk reduction required.

Risk Level 5: Risk reduction is required. If risk reduction action cannot be reasonably taken, BU management approval must be obtained

Risk Levels 6: Confirm that management systems are in place. Further risk reduction unless unreasonable.

Risk Levels 7-10: Manage risk. Further risk reduction at management discretion.

Likelihood Descriptions	Likelihood Indices		Decreasing Likelihood						
Expected to occur	1	Likely		6	5	4	3	2	1
Conditions may allow to occur	2	Occasional		7	6	5	4	3	2
Exceptional conditions may allow to occur	3	Seldom		8	7	6	5	4	3
Reasonable to expect will not occur	4	Unlikely		9	8	7	6	5	4
Has occurred once or twice in the industry	5	Remote		10	9	8	7	6	5
Rare or unheard of	6	Rare		10	10	9	8	7	6

Consequence Descriptions & Index (without safeguards)

Decreasing Consequence/Impact

Consequence Indices			6	5	4	3	2	1
			Incidental	Minor	Moderate	Major	Severe	Catastrophic
Consequence Descriptions	Workforce Health & Safety		One or more illness or injuries resulting in limited treatment	One or more illnesses or injuries requiring treatment but not severe	One or more severe illnesses or injuries	One to four illnesses with significant life shortening effects or fatalities	Multiple illnesses resulting in significant life shortening effects or multiple fatalities (5-50)	Multiple illnesses resulting in significant life shortening effects or multiple fatalities (>50)
	Public Health & Safety		One or more illness or injuries not resulting in treatment	One or more illness or injuries resulting in limited treatment	One or more illnesses or injuries requiring treatment but not severe	One or more severe illnesses or injuries	One to ten illnesses with significant life shortening effects or one to ten fatalities	Multiple illnesses resulting in significant life shortening effects or multiple fatalities (>10)
	Environment		Limited environmental impact	Localized, short term environmental impact	Localized, long-term environmental impact	Short-term, widespread environmental impact	Long-term, widespread environmental impact	Persistent, landscape scale environmental impact

Appendix B Compliance Reporting Table

Section No.	Actions
2.1	Each subsea umbilical will comprise a single sheathed bundle of up to ~250 mm in diameter containing electrical (up to ~132 kV) and fibre-optic cables.
2.1	Stabilisation will be provided primarily through subsequent placement of rock cover along the umbilical with grout/bulk bags or similar used if required near the HDD exit point.
2.1	The umbilicals do not contain any fluids and will not be subject to hydrotesting.
2.2	To the extent practicable, the additional umbilicals will be laid roughly parallel to (south of) the existing FGPS route, at a nominal offset distance of ~30 m from the nearest operating asset (i.e. the existing umbilicals).
2.2	Installation activities will occur within a corridor (also referred to as the 'Operational Area') centred on the umbilical and extending ~ 100 m either side of the umbilical.
2.4	To reduce the risk of introducing any non-indigenous species, any rock placed close to Barrow Island (within 500 m) will be subject to the requirements of the approved QMS (Ref. 35).
2.6	Installation is expected to involve one to three primary vessels operating 24 hours/day and powered by diesel (i.e. Marine Gas Oil or Marine Diesel Oil [MDO]).
2.6	The main installation activities will be undertaken by DP vessel(s). Anchoring will be restricted to within the previously approved anchoring area established for installation of the existing FGPS (Figure 3-1). There will be no anchoring in areas of coral habitat.
2.6	Vessels operating in proximity (within 2.5 km of the coastline) to Barrow Island will be subject to the requirements of the approved QMS (Ref. 35)
5.1	Only low-sulfur (0.50 mass % concentration [m/m]) fuel oil will be used to minimise SOx emissions when available.
5.1	Prior to commencement of installation activities, the following will be verified, as per the Marine Safety Reliability & Efficiency (MSRE) process: • Vessels >400 T have valid IAPP certification and a current international energy efficiency (IEE) certificate. • Vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI.
5.1	Prior to commencement of installation activities, the following will be verified, as per the MSRE process: • All combustion equipment is maintained in accordance with the planned maintenance system (PMS) (or equivalent).
5.1	Chemicals are selected for use in accordance with the Hazardous Material Approval Procedure ABU – Standardised OE Procedure (OE-03.16.13), including: • No procurement from the list of ozone-depleting substances as defined in the Montreal Protocol.
5.2	Umbilical installation and rock placement are confined to within the approved MDF, as defined in Coastal and Marine Baseline State and Environmental Impact Report: Offshore Feed Gas Pipeline System and Marine Component of the Shore Crossing (Ref. 15).
5.2	Anchoring will be restricted to within the MDF as defined in Coastal and Marine Baseline State and Environmental Impact Report: Offshore Feed Gas Pipeline System and Marine Component of the Shore Crossing (Ref. 15).
5.2	Anchoring will be undertaken in accordance with Chevron Marine Standard (Ref. 40).
5.2	Lost objects recovered where safe and practicable, and offers net environmental benefit
5.2	Minimise the loading of fine rock materials by contractual requirements for a rock particle sieve sizing and sampling regime to ensure rock particle sizing is met.

Section No.	Actions
5.2	Pre-installation seabed survey to determine preferred alignment identifies any apparent shipwrecks
5.2	If any shipwreck or relics are discovered during the proposed activities, DCCEEW Maritime Heritage Section will be notified, including: • a detailed description of the remains of the shipwreck or the relic, which may include sonar images, electronic data, and/or digital photographs • a description of the place where the shipwreck or relic is located that is sufficiently detailed to allow it to be identified and relocated, including navigation data and datum information
5.2	Should any shipwreck or relics be discovered during the proposed activities, all Project vessels will be notified of the location.
5.3	Risk-based inspections of specified vessels will be undertaken before mobilisation to identify potential strategies to reduce artificial light spill from vessels.
5.3	Vessel contractor required to develop and implement a Lighting Management Procedure (LMP) that describes mitigation strategies to address the relevant outcomes of vessel inspection(s) and considers the following measures to reduce light emissions: • outside lighting on vessels to be kept to a minimum (i.e. navigational lights and lighting necessary for safety) • lighting to be switched off when not in use and automatic timers/sensors installed where practicable • the use of shielded light fittings, directed lights and/or screens where practicable • temporary artificial lighting to be mounted as low as practicable and focused on areas being worked on • where colour definition is not required for safety or operational purposes, lighting types that are least disruptive to turtles • fitting of blinds or curtains on windows and portholes to block out internal light sources.
5.4	Vessels and onboard equipment (e.g. DP systems) maintained in accordance with Contractor's PMS
5.4	Vessels will adhere to Part 8 of the EPBC Regulations 2000 and Division 2 of the BC Regulations 2018 where practicable for potential interactions with fauna, including: • establishing a caution zone around prescribed fauna defined as an area around the animal with a radius of 30 m for a whale shark, 100 m for a dugong or seal, 150 m for a dolphin and 300 m (or 100 m to the side) for a whale. Within the caution zone: • operate the vessel at a constant speed of less than 6 knots and minimise noise • post a lookout for fauna.
5.4	Fauna interaction requirements communicated to relevant project personnel, including vessel master and crew conducting bridge watch, prior to commencing activities
5.5	All hazardous chemical discharges (including chemicals used in casing preservation) shall be assessed and deemed acceptable before use, in accordance with ABU Hazardous Materials Management Procedure (Ref. 51)
5.5	MARPOL compliant bilge and sewage systems present on vessels >400 T
5.5	In accordance with MARPOL: • sewage will not be discharged within 3 nm from land • bilge water will only be discharged if treated by OWTS to <15 ppm and vessel en-route
5.5	Vessels will have sufficient sullage capacity onboard to store sewage or bilge water for the period if/where discharge not permitted by MARPOL

Section No.	Actions
5.5	Vessels and onboard equipment (e.g. OWTS) maintained in accordance with Contractor's PMS
5.6.1	Vessels will adhere to Part 8 of the EPBC Regulations 2000 and Division 2 of the BC Regulations 2018 where practicable for potential interactions with fauna, including: • establishing a caution zone around prescribed fauna defined as an area around the animal with a radius of 30 m for a whale shark, 100 m for a dugong or seal, 150 m for a dolphin and 300 m (or 100 m to the side) for a whale. Within the caution zone: • operate the vessel at a constant speed of <6 knots • post a lookout for fauna.
5.6.1	Fauna interaction requirements communicated to relevant project personnel, including vessel master and crew conducting bridge watch, prior to commencing activities
5.6.1	Collisions with cetaceans will be reported to DCCEEW via the online National Ship Strike database (https://data.marinemammals.gov.au/report/shipstrike) as soon as possible (but not later than 72 hours after the incident occurs)
5.6.1	Any detected injury or fatality attributed to the installation works of any marine species (including marine turtles) listed as Threatened or Migratory under the BC Act or the EPBC Act will be reported in accordance with Section 6.6.
5.6.2	A 24-hour visual, radio, and radar watch will be maintained for vessels in the vicinity of the Operational Area in accordance with AMSA and/or Standards of Training, Certification and Watchkeeping (STCW2010) (1978 STCW Convention)
5.6.2	Minimum lighting required for safety and navigational purposes, in accordance with the *Navigation Act 1912* (Marine Orders Part 30 [Prevention of Collisions]), is on board and operational.
5.6.2	The AHS will be notified sufficiently in advance of (where practicable no less than four working weeks before) installation operations commencing to enable Notices to Mariners to be published
5.6.2	AMSA's JRCC will be notified 24–48 hours before operations commence to enable AMSA to distribute an AUSCOAST warning
5.6.2	The AHS will be provided with installed umbilical coordinates to enable identification on charts
5.7.1	All hydrocarbon and chemical storage with secondary containment or within bunded areas.
5.7.1	A complete inventory of all hazardous materials stored on the vessels will be maintained on board, together with current SDSs for each hazardous or dangerous goods substance
5.7.1	Marine vessels will have a current Shipboard Oil Pollution Emergency Plan (SOPEP)/Shipboard Marine Pollution Emergency Plan (SMPEP) as appropriate to class
5.7.1	Inductions/training provided to personnel responsible for handling or responding to spills of hazardous materials
5.7.1	Spill containment and recovery equipment (spill kits, scupper plugs) will be provided where spills are possible (e.g. where fuel, oil, or chemicals and hazardous waste are used or stored).
5.7.1	All spills will be recorded as per CAPL's Incident Investigation and Reporting Process (Ref. 83)
5.7.1	Spills will be contained and/or cleaned up in accordance with vessel SOPEP/SMPEP
5.7.2	A 24-hour visual, radio, and radar watch will be maintained for vessels in the vicinity of the Operational Area in accordance with AMSA and/or Standards of Training, Certification and Watchkeeping (STCW2010) (1978 STCW Convention)
5.7.2	The AHS will be notified sufficiently in advance of (where practicable no less than four working weeks before) installation operations commencing to enable Notices to Mariners to be published

Section No.	Actions
5.7.2	Risks of vessel collisions will be detailed and managed by a SIMOPS plan where required.
5.7.2	Marine vessels will carry on board a SOPEP (or equivalent) and spill containment and recovery equipment on board as per the SOPEP
5.7.2	In the event of a vessel-based spill emergency response will be in accordance with the SOPEP
5.7.2	Emergency spill response activities will be implemented in accordance with the Consolidated OPEP (Ref. 80) in the event of an emergency condition spill from a vessel collision
5.7.2	CAPL will ensure emergency response preparedness through emergency response training and exercises
6.3	Regular workplace inspections will be conducted during the offshore umbilical installation works and will include (but not necessarily be limited to) the items listed in Table 6–1.
6.6	The environmental incidents, reporting requirements and timing specific to this Addendum are provided in Table 6–2
8	However, this Addendum will be reviewed in the event of a significant change to the activity described in Section 2, if a performance standard is not achieved or in the event a significant new or increased risk is identified.