# Gorgon and Jansz–Io Drilling, Completions and Well Maintenance Program

# Environment Plan Summary

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# 1 Introduction

## 1.1 Overview

On behalf of the Gorgon Joint Venturers and Jansz–Io Joint Venturers, Chevron Australia Pty Ltd (CAPL) has developed the Gorgon Foundation Project (GFP), which comprises the Gorgon and Jansz gas fields, offshore production wells, and Feed Gas pipeline infrastructure. The GFP included the construction of a Gas Treatment Plant (GTP) on Barrow Island, and a domestic gas plant.

To maintain gas supply for the GTP, the Gorgon Stage 2 (GS2) Project will expand the subsea gathering network in the Gorgon and Jansz–Io gas fields. This will involve an additional drilling program, which was included in the previously accepted version of this document. Because the five-yearly revision of the in-force Environment Plan (EP) is due halfway through the GS2 drilling program, the EP has been resubmitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) to remove any potential compliance uncertainty throughout the course of the drilling, completions and well maintenance program.

This Environment Plan (EP) Summary has been prepared to meet Regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R) and summarises the information provided in the Gorgon and Jansz–Io Drilling, Completions and Well Maintenance Program EP accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

## 1.2 Scope

The scope of the EP includes drilling (and well completions), well intervention, and plug and abandonment activities undertaken by CAPL with either a Mobile Offshore Drilling Unit (MODU) or vessel within the 500 m safety exclusion zone at well locations within the Gorgon and Jansz–Io gas fields under production licences WA-36-L, WA-37-L and WA-39-L (Figure 1-1).

## 1.3 Titleholder Nominated Liaison Person

In accordance with Regulation 15(2) of the OPGGS(E)R, details of the titleholder's nominated liaison person are listed in Table 1-1.

**Table 1-1: Titleholder Liaison Person Contact Details**

| | |
|---|---|
| **Company Name** | Chevron Australia Pty Ltd |
| **Nominated Liaison Person** | John Connor |
| **Position** | Drilling and Completions (D&C) Manager |
| **Business Address** | QV1, 250 St Georges Terrace, Perth, WA, 6000 |
| **Telephone Number** | +61 8 9216 4254 |
| **Fax Number** | +61 8 9216 4223 |
| **Email Address** | austdrillingops@chevron.com |

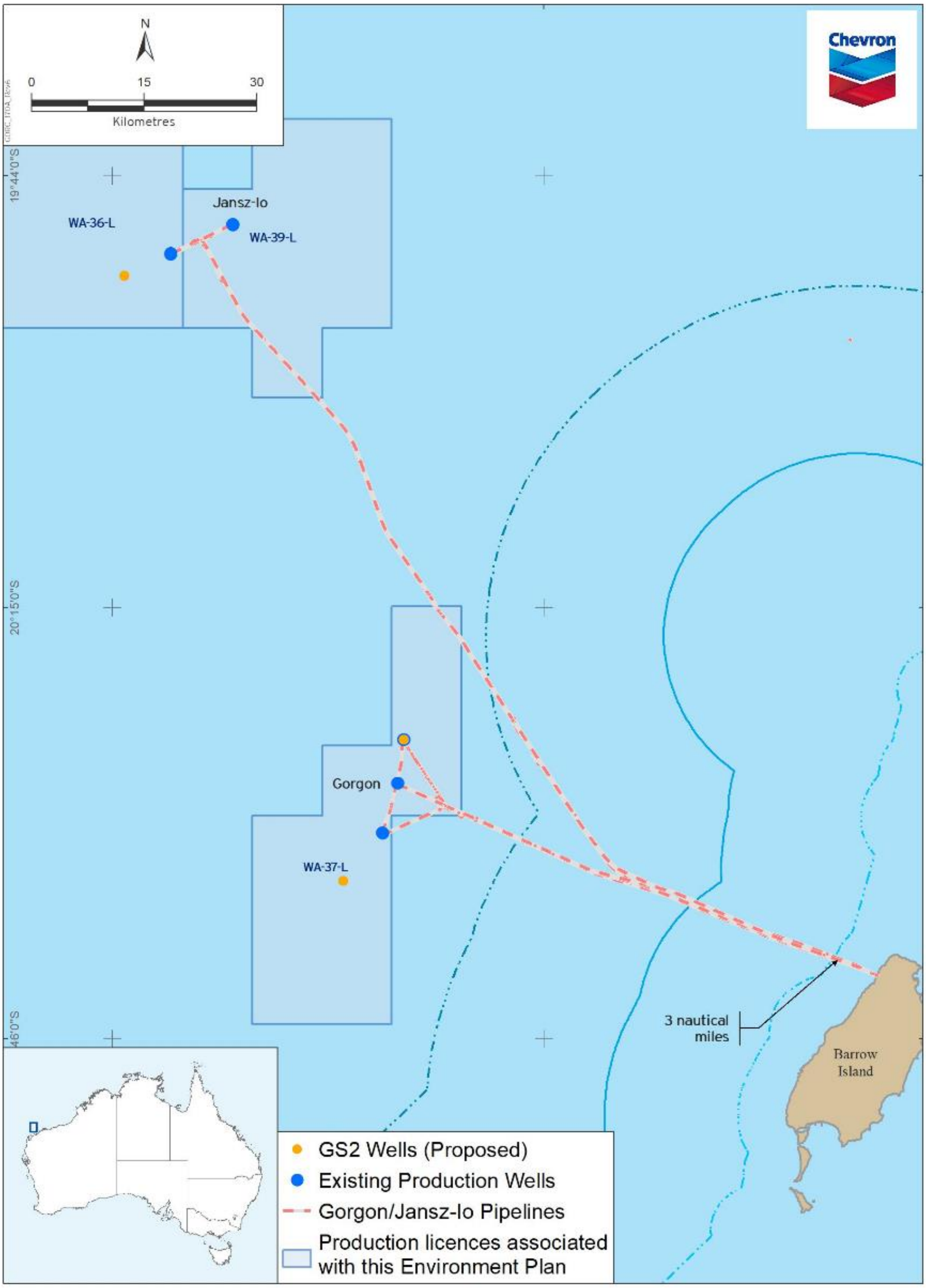


**Figure 1-1: Overview of Gorgon Infrastructure**

## 1.4 Stakeholder Engagement

CAPL applied the following methodology to undertake consultation for this activity:

- identify relevant stakeholders
- provide sufficient information to enable stakeholders to understand how this activity may affect their functions, interests, or activities
- assess the merit of any objections or claims raised by the stakeholders
- provide a response to the objection or claim, and ensure this is captured within the EP.

This methodology is based on:

- NOPSEMA Decision-Making Guideline – Criterion-10A(g) Consultation Requirements (Ref. 8)
- Australian Petroleum Production and Exploration Association (APPEA) Stakeholder Consultation and Engagement Principles and Methodology – Draft (Ref. 9).

### 1.4.1 Identification of Relevant Stakeholders

Since commencing the Gorgon Foundation Project, CAPL has developed and maintained a list of stakeholders who are considered relevant to the potential impacts and risks associated with the Gorgon Foundation Project.

Table 1-2 summarises the stakeholders considered relevant to this activity.

**Table 1-2: List of Relevant Stakeholders Consulted**

| Stakeholder Type | Functions, Interests / Activities, and Stakeholders Consulted |
|---|---|
| Commonwealth and State fisheries (and peak body associations) | This activity has the potential to impact on fish and thus potentially affect catch rates, which are a function of commercial fisheries. Based on the defined EMBA, these stakeholders were considered relevant:<br>• Western Australian Fishing Industry Council (WAFIC)<br>• Aquarium Specimen Collectors Association of WA<br>• Australian Southern Bluefin Tuna Industry Association<br>• Commonwealth Fisheries Association<br>• Pearl Producers Association<br>• Professional Specimen Shell Fishermen's Association<br>• Individual fishery licence holders within these fisheries:<br>o Mackerel Managed Fishery (State)<br>o Marine Aquarium Fish (State)<br>o Onslow Prawn Managed Fishery (State)<br>o Pilbara Line Fishery (State)<br>o Pilbara Trap Managed Fishery (State)<br>o Specimen Shell Managed Fishery (State)<br>o North West Slope Trawl Fishery (Commonwealth)<br>o Western Skipjack Tuna Fishery (Commonwealth)<br>o Western Tuna and Billfish Fishery (Commonwealth) |
| Recreational fishers (and peak body associations) | This activity has the potential to impact on fish and thus potentially affect catch rates, which are a function of recreational fisheries:<br>• Boating Industry Association WA<br>• RecFishWest<br>• various fishing clubs<br>• individual charter operators |

| Stakeholder Type | Functions, Interests / Activities, and Stakeholders Consulted |
|---|---|
| Other petroleum operators in the area | Hydrocarbon spills have the potential to result in exclusion zones and potential impacts to other operators in the region including:<br>• Quadrant Energy<br>• BHP Macedon<br>• Vermilion Energy<br>• Woodside Burrup Pty Ltd |
| Government agencies | Government agencies responsible for managing marine reserves, or for providing support in the event of a spill were considered relevant, including:<br>• WA Department of Transport (DoT)<br>• WA Department of Biodiversity, Conservation and Attractions (DBCA)<br>• WA Department of Mines, Industry Regulation and Safety (DMIRS)<br>• Commonwealth Department of Defence (DoD)<br>• Commonwealth DotEE<br>• Australian Border Force<br>• Australian Communications and Media Authority<br>• Australian Maritime Safety Authority (AMSA)<br>• Australian Hydrographic Service (AHS)<br>• Australian Fisheries Management Authority (AFMA)<br>• WA Department of Primary Industries and Regional Development (DPIRD)<br>• Commonwealth Department of Communications and the Arts<br>• Pilbara Port Authority |
| Other | • traditional owners of the local area |

### 1.4.2 Assessment of Merit of any Objections or Claims

Table 1-3 summarises the objections and claims made by relevant stakeholders, assesses their merits, and how the objection or claim has been managed in the EP.

### 1.4.3 Ongoing Consultation

Stakeholder notifications and ongoing consultation required for this activity is captured in Table 1-4.

**Table 1-3: Summary of Stakeholder Response and Objections and Claims**

| Date | Stakeholder | Objection or Claim | Assessment of Merits | Additional Actions |
|---|---|---|---|---|
| 15 May 2018 | AFMA | Requested CAPL consult with operators in the Western Tuna and Billfish Fishery, the North West Slope Fishery, the Western Deepwater Trawl Fishery, the Commonwealth Fishermen's Association, and WAFIC. | These fisheries and industry bodies were identified as relevant stakeholders (refer Table 1-2). CAPL confirmed engagement with these stakeholders. | Not applicable (N/A) |
| 30 May 2018 | DPIRD | Requested confirmation whether the program was a maintenance and well start-up or just maintenance campaign, as well as well depths and start date of drilling. | No objection or claim; just requested clarification | CAPL confirmed (6 June 2018) the current EP is being revised to incorporate the drilling and completion activities associated with the new wells and the ongoing maintenance of these wells over the life of the Gorgon Project. Drilling activities for the GS2 campaign are planned to commence from Q1 2019. Included GS2 well locations and corresponding water depths, noting the petroleum safety zone (PSZ) extending to 500 m from the existing Gorgon field wells (GFP) and equipment, as per the NOPSEMA Notice A556034. |
| 06 June 2018 | | Acknowledged response; no further clarifications required. | N/A | N/A |
| 29 May 2018 | AHS (DoD) | No objections to the program identified.<br>Noted that CAPL should be aware the area may contain unexploded ordinances.<br>Requested that the AHS is notified before commencing activities. | No objection or claim; just requested CAPL be aware of risks in the area | CAPL requested additional information (21 June 2018) regarding unexploded ordinance risks.<br>Requirement for ongoing notification included in Table 1-4. |
| 25 June 2018 | | Confirmed very low to nil likelihood of unexploded ordinances from their activities<br>Requested that CAPL notify the DoD at least 14 days before commencing activities: | No objection or claim; just requested ongoing consultation | Requirement for ongoing notification included in Table 1-4. |

| Date | Stakeholder | Objection or Claim | Assessment of Merits | Additional Actions |
|---|---|---|---|---|
| | | ADF.Airspace@defence.gov.au<br>Offshore.Petroleum@defence.gov.au. | | |
| 14 May 2018 | AMSA | Requested names and coordinates of the proposed wells. | No objection or claim; just requested clarification | CAPL committed to providing specific locations once finalised. |
| 16 May 2018 | | Attached vessel traffic plot for GS2 drilling campaign area, noting heavy vessel traffic along chartered shipping fairway passing through WA-39-L; cargo and tanker vessels through WA-37-L, WA-38-L, and WA-39-L.<br>Requested that the drilling vessel / MODU notify AMSA's Joint Rescue Coordination Centre (JRCC) through rccaus@amsa.gov.au (phone: 1800 641 792 or +61 2 6230 6811) for disseminating radio navigation warnings 24 to 48 hours before operations commence.<br>Contact AHS (datacentre@hydro.gov.au) at least four working weeks before operations commence for disseminating notices to mariners. | No objection or claim; just requested additional notifications | Requirement for ongoing notification included in Table 1-4.<br>CAPL provided details of exact well locations (6 June 2018) |
| 12 June 2018 | | Noted that based on specific locations, cargo and tanker vessels travelling to and from Onslow will be encountered in WA-37-L and WA-38-L and that some large vessels travel through WA-36-L, but also noted having a 500 m PSZ in place will help with navigational safety. Local and support vessel traffic will also be encountered in all production licences throughout the drilling campaign. | No objection or claim; just requested additional notifications | CAPL used the information in Section 5.1 to inform the risk and potential impact assessment. |

| Date | Stakeholder | Objection or Claim | Assessment of Merits | Additional Actions |
|---|---|---|---|---|
| 11 June 2018 | DMIRS | Advised that the fact sheet did not provide DMIRS with adequate information regarding the activity and the potential environmental impacts to State Waters and Lands. Pointed to the Consultation Guidance Note for DMIRS (Ref. 205), noting the level of information required for activities being undertaken offshore from WA. | The request for additional information has merit as the consultation guidance note dictates the level of information required to be provided to the state ministerial agency. | CAPL provided DMIRS with an EP summary meeting the requirements of DMIRS Consultation Guidance Note on 12 July 2018. |
| 12 June 2018 | DPIRD | Noted that their previous advice (including that on industry consultation) still holds and we have no additional information to add. | No objection or claim; just confirmation that previous advice is sufficient. | CAPL included information requested by DPIRD from a previous program into Section 5.6.4. |
| 29 August / 4 September 2018 | DoT | Whilst Section 1.2.1 states that the CAPL Support Team will be composed as per the IGN, the structure shows the inclusion of an additional person; the CAPL Support Team Leader. Chevron is welcome to provide a CAPL Support Team Leader as an eleventh person. Please clarify in the OPEP this person is additional to the Initial IMT Personnel requirement. | The request for additional information has merit as DoT are the control agency for spills in state waters. | Section 1.2.1 of the OPEP was updated to clarify that the CAPL Support Team Lead performs the function of the Petroleum Titleholder Deputy Incident Commander, as outlined in Appendix 3 of the OPIGN. Clarification has also been added that the 10 personnel provided to the DoT includes the CAPL Support Team Lead role. |
| | | The Initial IMT Personnel provided by Chevron (as shown in IGN Appendix 3) report to their respective DoT Section Heads as per normal chains of command. Please make this reporting structure clear in Figure 1.2. The CAPL Support Team Leader can supervise/monitor their employees as long as these additional measures do not adversely impact the normal chain of command or the effectiveness of their employees within the IMT. | | Figure 1-2 of the OPEP was updated so it is clear there is a direct reporting line from the CAPL Support Team to their respective DoT Section Heads (i.e. solid reporting line); and have an indirect reporting line to the CAPL Support Team Lead (i.e. dotted line). See updated Figure 1-2 below table. |
| | | The SMPC will not be mobilised to ECC as shown in Figure 3.1. A DoT Liaison Officer will be deployed to facilitate communication | | Figure 3-1 of the OPEP has been updated so that the text box states: |

| Date | Stakeholder | Objection or Claim | Assessment of Merits | Additional Actions |
|---|---|---|---|---|
| | | between DoT's SMPC and Incident Controller and Chevron's CMT Leader and Incident Controller. Amend in Figure 3.1 and throughout document. | | SMEEC notified and DoT Liaison Officer mobilised to ECC (if applicable). |
| | | Figure 4.1, CAPL EMT Hierarchy shown in in the Supporting Information should be restructured to show DoT as a Control Agency rather than a support agency. | | Figure 4-1 in the OPEP has been updated to include DoT MEER Unit as the first notification step for a Spill from petroleum or pipeline activity in or approaching State Waters. |
| | | Please state within the OPEP that the December 2017 IGN was used in its preparation. | | The December 2017 date for the OPIGN has been included in Section 1.2.1 of the OPEP and for that citation in the References. |
| | | Replace WA DoT Oil Spill Response Coordination (OSRC) with WA DoT Maritime Environmental Emergency Response (MEER); Figure 4.1 and throughout OPEP. | | OSRC has been replaced with MEER in Figure 4-1 of the OPEP.<br>Note SMPC has also been replaced with the new acronym SMEEC, from the SHP-MEE. |
| | | The WestPlan-MOP has now been replaced by WestPlan-MEE. In future documentation, the SMPC should be referred to as the SMEEC and WestPlan-MOP replaced with WestPlan-MEE.<br>Further correspondence 4 Sept 2018:<br>Please note that the correct terminology for the new State Hazard Plan is 'State Hazard Plan – Maritime Environmental Emergency (SHP-MEE)' - not WestPlan-MEE as stated in the previously attached OPEP review. | | The WestPlan-MOP has been replaced with SHP-MEE throughout the EP and OPEP |
| | | DoT requests more detailed information on minimum times to shoreline impact. | | Additional information regarding shoreline contact was provided to DoT (see below).<br>The predicted shortest time to shore per season for the modelled LOWC scenario is to the following key areas: |

| Date | Stakeholder | Objection or Claim | Assessment of Merits | Additional Actions |
|---|---|---|---|---|
| | | | | • Summer: 182 hours (7.6 days) – the coastline that correlates with the shortest-time in Summer is Cape Range National Park .<br>• Transitional: 376 hours (15.7 days) – the coastline that correlates with the shortest-time in Transitional is Cape Range National Park.<br>• Winter: 268 hours (11.2 days) – the coastline that correlates with the shortest-time in Winter is Cape Range National Park. |

**Table 1-4: Summary of Notifications and Ongoing Consultation**

| Stakeholder | Notification / Ongoing Consultation Requirement | Timing | Objective | Frequency |
|---|---|---|---|---|
| AHS (DoD) | Pre-start notification of activities commencing to:<br>ADF.Airspace@defence.gov.au<br>Offshore.Petroleum@defence.gov.au | At least 14 days before commencing activities | Inform DoD of activities to ensure these activities do not conflict with defence training | One-off – before commencing operations |
| AMSA | Notify AMSA's JRCC through rccaus@amsa.gov.au (phone: 1800 641 792 or +61 2 6230 6811) | 24 to 48 hours before commencing activities | Provide information to enable promulgation of radio-navigation warnings | One-off – before commencing operations |
| AHO | Contact AHO (datacentre@hydro.gov.au) at least four working weeks before operations commence for disseminating related notices to mariners | At least 4 working weeks before commencing activities | Provide information to enable dissemination of related notices to mariners | One-off – before commencing operations |
| DPIRD | Advanced notification of the activity | Four weeks before commencing each well program | Notification of commencement of well programs and types of activities to be completed, as requested by DPIRD | Once per well program, which may include intervention, abandonment and/or infill drilling campaign |

| Stakeholder | Notification / Ongoing Consultation Requirement | Timing | Objective | Frequency |
|---|---|---|---|---|
| WAFIC, DPIRD, AFMA, RecFishWest, Boating Industry Association of WA | Bi-annual update | Bi-annual | To provide a Gorgon Project update, and to seek stakeholder feedback | Bi-annual |
| Interested parties<br>Potentially affected parties<br>Government agencies | CAPL to advise of any new or significant changes to activities or impacts/risks within the scope of the EP, following an evaluation as per Section 6.1.2; that may potentially impact marine users. | Prior to new or significant changes to activities or impacts/risks occurring | Location, start and finish dates | As required |

# 2 Description of the Activity

## 2.1 Overview

### 2.1.1 Location

Currently, 18 production wells are operational within production licences WA-36-L, WA-37-L and WA-39-L; all are located off the Pilbara coast of WA (Figure 1-1). Production licence WA-37-L is located in the Gorgon gas field, ~130 km off the north-west coast of WA and 65 km north-west of Barrow Island. Production licences WA-36-L and WA-39-L are located in the Jansz–Io gas field ~215 km off the north-west coast of WA and 130 km north-west of Barrow Island. The 11 additional production wells associated with the GS2 program will occur within WA-36-L and WA-37-L.

The coordinates for the 18 existing production wells are listed in Table 2-1, with the indicative locations for the GS2 wells listed in Table 2-2.

**Table 2-1: Existing Production Well Locations**

| Existing Production | Latitude (south) | | | Longitude (east) | | | Water Depth |
|---|---|---|---|---|---|---|---|
| | degrees | minutes | seconds | degrees | minutes | seconds | |
| GOR-1C | 20° | 24′ | 28.372″ | 114° | 50′ | 56.841″ | 215 m |
| GOR-1D | 20° | 24′ | 28.611″ | 114° | 50′ | 57.734″ | 215 m |
| GOR-1E | 20° | 24′ | 29.171″ | 114° | 50′ | 58.313″ | 215 m |
| GOR-1F | 20° | 24′ | 30.019″ | 114° | 50′ | 58.543″ | 215 m |
| GOR-2B | 20° | 27′ | 36.535″ | 114° | 50′ | 31.386″ | 199 m |
| GOR-2C | 20° | 27′ | 37.095″ | 114° | 50′ | 31.964″ | 199 m |
| GOR-3B | 20° | 31′ | 11.275″ | 114° | 49′ | 25.845″ | 199 m |
| GOR-3C | 20° | 31′ | 11.835″ | 114° | 49′ | 26.424″ | 199 m |
| JZI-1B | 19° | 49′ | 36.51″ | 114° | 34′ | 13.94″ | 1338 m |
| JZI-1C | 19° | 49′ | 36.40″ | 114° | 34′ | 12.96″ | 1338 m |
| JZI-1D | 19° | 49′ | 35.44″ | 114° | 34′ | 12.47″ | 1338 m |
| JZI-1E | 19° | 49′ | 34.62″ | 114° | 34′ | 12.95″ | 1338 m |
| JZI-1F | 19° | 49′ | 33.97″ | 114° | 34′ | 12.93″ | 1338 m |
| JZI-2B | 19° | 47′ | 28.31″ | 114° | 38′ | 40.03″ | 1349 m |
| JZI-2C | 19° | 47′ | 28.40″ | 114° | 38′ | 41.00″ | 1349 m |
| JZI-2D | 19° | 47′ | 29.36″ | 114° | 38′ | 41.54″ | 1349 m |
| JZI-2E | 19° | 47′ | 30.17″ | 114° | 38′ | 41.01″ | 1349 m |
| JZI-2F | 19° | 47′ | 30.83″ | 114° | 38′ | 41.04″ | 1349 m |

**Table 2-2: Indicative Gorgon Stage 2 Well Locations**

| Proposed Production | Latitude (south) | | | Longitude (east) | | | Water Depth |
|---|---|---|---|---|---|---|---|
| | degrees | minutes | seconds | degrees | minutes | seconds | |
| GOR-1A | 20° | 24′ | 29.16″ | 114° | 50′ | 55.96″ | 216 m |
| GOR-1B | 20° | 24′ | 27.71″ | 114° | 50′ | 57.00″ | 216 m |
| GOR-1G | 20° | 24′ | 29.88″ | 114° | 50′ | 59.25″ | 215 m |

| Proposed Production | Latitude (south) | | | Longitude (east) | | | Water Depth |
|---|---|---|---|---|---|---|---|
| | degrees | minutes | seconds | degrees | minutes | seconds | |
| GOR-4C | 20° | 34′ | 38.61″ | 114° | 46′ | 38.40″ | 250 m |
| GOR-4D | 20° | 34′ | 38.34″ | 114° | 46′ | 37.51″ | 250 m |
| GOR-4E | 20° | 34′ | 37.79″ | 114° | 46′ | 36.95″ | 251 m |
| GOR-4F | 20° | 34′ | 36.94″ | 114° | 46′ | 36.69″ | 251 m |
| JZI-3C | 19° | 51′ | 11.42″ | 114° | 30′ | 54.64″ | 1314 m |
| JZI-3D | 19° | 51′ | 10.40″ | 114° | 30′ | 54.33″ | 1314 m |
| JZI-3E | 19° | 51′ | 9.69″ | 114° | 30′ | 54.97″ | 1315 m |
| JZI-3F | 19° | 51′ | 9.04″ | 114° | 30′ | 55.05″ | 1315 m |

### 2.1.2 Time Frame

Well intervention activities may be undertaken at any time during the operation of the facilities (nominally 30 years). It is expected that the 11 GS2 production wells will likely be drilled between 2019 and 2022.

Activities covered within the EP may be conducted 24 hours a day.

### 2.1.3 Operational Area

The operational area for the petroleum activity referred to in the EP is defined as the 500 m safety exclusion zone around the wells described in Table 2-1 and Table 2-2.

The transit activities of the MODU and support vessels outside this area is outside the scope of the EP and is managed under the Commonwealth *Navigation Act 2012*.

## 2.2 Drilling

### 2.2.1 MODU / Drill Ship Positioning

The rig chosen to complete activities under the EP may comprise a semisubmersible, drill ship, or intervention vessel (collectively termed MODU). The MODU selected to complete the activities within the EP will either be anchored over the well site or dynamically positioned (DP) using thrusters. The MODU has minimal movement capability when undertaking drilling activities, and thus has right-of-way over other vessels.

If the MODU is to use a mooring system, up to four anchors from each corner of the main deck will be placed by one of the support vessels. Anchors may be placed on the seabed and tested by the support vessels before the MODU arrives.

Transponders may be used to accurately position the MODU over the proposed well locations. Transponders are attached to clump weights and then lowered onto the seabed; the clump weights remain on the seabed after the transponders are retrieved.

For the EP, CAPL considers the MODU to be defined as a facility where it meets the definition provided under Clause 4 of the OPGGS Act.

### 2.2.2 Well Design and Drilling

An indicative overview of the drilling design and process is described in this Section. This process is subject to change, depending on individual well design requirements and location of the well. Any changes to well design must be reflected in the WOMP and any changes would be evaluated against the activity as described in the EP.

Note: Well engineering uses imperial measurements and thus measurements in this and subsequent sections are provided in inches.

#### 2.2.2.1 Gorgon

The drilling methodology proposed uses a combination of sea water with high-viscosity gel sweeps, water-based muds (WBM), and non-aqueous drill fluids (NADFs) as outlined in Table 2-3.

**Table 2-3: Summary of the Gorgon Wells Base Case Drilling Methodology**

| Hole Size | Casing Size | Cuttings Discharge Location | Fluid Type to Drill Section |
|---|---|---|---|
| 42" (1067 mm) | 36" (914 mm) | Seabed (riserless) | Sea water with high-viscosity sweeps |
| 26" (660 mm) | 20" (508 mm) | Seabed (riserless) | Sea water with high-viscosity sweeps |
| 17½" (444 mm) | 14" (355 mm) | Sea surface | WBM (contingency – NADF) |
| 12¼" × 13½" (311 mm x 343 mm) | 10¾" (273 mm) | Sea surface | NADF |
| 8¾" (222 mm) | 7" (178 mm) | Sea surface | NADF |

#### 2.2.2.2 Jansz–Io

The drilling methodology proposed uses a combination of sea water with high-viscosity gel sweeps, WBMs, and NADFs as outlined in Table 2-4.

**Table 2-4: Summary of the Jansz–Io Wells Base Case Drilling Methodology**

| Hole Size | Casing Size | Cuttings Discharge Location | Fluid Type to Drill Section |
|---|---|---|---|
| 42" (1067 mm) | 36" (914 mm) | Seabed (riserless) | Sea water with high-viscosity sweeps |
| 26" (660 mm) | 20" (508 mm) | Seabed (riserless) | Sea water with high-viscosity sweeps |
| 17½" (444 mm) | 13⅝" (346 mm) | Sea surface | WBM (contingency – NADF) |
| 12¼" (311 mm) | 9⅝" (273 mm) | Sea surface | NADF |
| 08½" × 9⅞" (216 × 251 mm) | Open-hole Gravity Pack (OHGP) | Sea surface | WBM |

### 2.2.3 Drilling Fluids and Cuttings Handling and Disposal

Both the 42" and 26" hole sections are to be drilled with sea water and high-viscosity gel sweeps, with cuttings circulated to the seabed. High-viscosity sweeps comprise ~90% sea water, with the remaining 10% made up of drilling fluid additives that are either completely inert in the marine environment, naturally occurring benign materials, or readily biodegradable organic polymers with a very fast rate of biodegradation in the marine environment. Drilling additives typically used include sodium chloride, potassium chloride, bentonite (clay), cellulose polymers, guar gum, barite, and calcium carbonate.

Once the top-hole section is complete, installation of the riser and BOP provides a conduit back to the MODU, forming a closed circulating system. As such, solids control equipment removes cuttings from drilling fluids before being recycled and circulated back to the MODU. Solids control equipment may include:

- vibrating screens (shale shakers)
- centrifuge

- cuttings dryer.

Various shaker screens can be used to adjust the mesh size, thereby optimising fluid recovery rates. Cuttings are expected to range from very fine to very coarse (<1 cm diameter) after separation from the drilling fluid.

Cuttings are expected to comprise predominantly claystone, marl, and calcilutite from the upper sections of the wellbore, and sandstone and siltstone from the lower sections. An indicative average cuttings volume of 680 $m^3$ (Gorgon), 441 $m^3$ (Jansz–Io) (based on the volume of the planned wells) is expected to be generated per well, but actual volumes will depend on the final depth of each well.

Throughout the drilling program several different fluids are to be run through the closed circulation system including, but not limited to, NADF, WBM, sea water, and kill-weight brine. During the displacement of one fluid to another, both fluids will mix. This mixture may be discharged depending on its content. Drilling fluids are supplied to CAPL by a business partner (contractor) who is required to ensure and demonstrate that heavy metal constituents (mercury and cadmium) of kill-weighting fluid (barite) meets contract specifications.

### 2.2.4 Cementing Operations

On completion of the upper-hole sections, a casing is to be inserted and the annulus between the casing and the hole sealed with cement. For the conductor and surface casing, a cementing product is pumped until returns are observed at the seabed.

On liner cement jobs, occasionally small quantities of cement products and spacer may be circulated (discharged) out of the well from above the top of the liner.

Wherever possible, the cement line flush volumes are included in the planned cement jobs. When a job is completed, the cement unit is cleaned and the residual cement discharged overboard. The discharge volumes of residual cement products are ~1 $m^3$.

In the rare event that the cement products become contaminated, the entire volume (~48 $m^3$) may need to be discharged to sea.

### 2.2.5 Pressure-control Equipment Installation and Function Testing

A BOP is to be used for the drilling and completion program to provide an additional barrier to prevent a LOWC. The BOP is installed after completion of the top-hole sections. Once installed, regular function and pressure tests are undertaken; function tests will be undertaken weekly except in exceptional circumstances. Function testing is undertaken by activating the hydraulic control system aboard the MODU to pressurise / activate the rams within the BOP stack.

The BOP control system discharges water-based hydraulic control fluids into the sea upon operation. A full function test, which closes and opens all rams and annulars, discharges ~2500 L of diluted control fluid. The control fluid is a water-soluble product and is diluted to 1–3% with potable water. The fluid is fully biodegradable and expected to readily disperse after discharge from the BOP.

Note: Pressure-control equipment other than a BOP may be used for well intervention works; however, the activities are not considered to be any different. During well intervention function testing, an additional small volume release of subsea hydraulic fluid would be expected via actuation of valves on the Christmas tree; however, these are not expected to be any different to those captured in the Gorgon Operations EP (Ref. 3).

### 2.2.6 Well Suspension Following Drilling or Between Lower and Upper Completions

After completion of drilling operations and before well completion, a retrievable suspension packer is to be installed in the well. The suspension packer provides a secondary barrier, which isolates the formation and ensures well integrity is maintained while the wells are temporarily suspended.

Following installation of the suspension packer, a wellhead cap may be installed to provide mechanical protection to the wellhead and protect it from marine growth. To inhibit marine growth or corrosion, a biocide and corrosion inhibitor are injected into or placed within the wellhead cap. The wellhead cap can hold ~210 L of dilute corrosion / biocide mixture at a ratio of ~3 L corrosion inhibitor, 0.25 L biocide, and 207 L water. At this stage, there is no release to the environment; however, when the well cap is removed, the fluid is discharged to the environment.

### 2.2.7 Run Well Completions

Proposed well completions for both Gorgon and Jansz–Io are described in the following subsections.

#### 2.2.7.1 Gorgon

A tubing head spool will be run through the water column and landed on the well head. The BOP will then be connected to the tubing head spool, the suspension plug retrieved, and a wellbore cleanout performed. Perforation guns will then be run into the production liner, spaced out, and left in the well. Finally, the 7″ × 7⅝″ upper completion will be run, and the tubing hanger landed in the tubing head spool. The well will then be displaced to packer fluid, the packer will be set, and then various testing will be done. Once testing is complete, the well will be perforated and two slickline plugs will be set in the well. BOPs are then recovered to surface.

#### 2.2.7.2 Jansz–Io

A tubing head spool will be run through the water column and landed on the well head. The BOP will then be connected to the tubing head spool and the suspension packers retrieved. The 8½″ × 9⅞″ reservoir section will then be drilled using a reservoir drill-in fluid (RDIF) through the Jansz sandstone. The RDIF will be built with minimal low gravities and fines using special sized $CaCO_3$ for enhanced fluid loss control. At TD, the well will be displaced with solids-free RDIF and brine before the gravel pack operations are carried out. WBM will be re-used but may be discharged at the end of the drilling campaign.

The well will be gravel packed and a fluid loss device installed and closed ahead of temporarily suspending the well with suspension plugs. The well will subsequently be re-entered, the suspension plugs will then be removed, and the upper completion installed. The big-bore 9⅝″ upper completion will be run, and the tubing hanger landed in the tubing hanger spool. The well will then be displaced to packer fluid and the tubing displaced to a treated dilute brine system with an oxygen scavenger, biocide, and hydrate inhibitor (monoethylene glycol [MEG]). The packer will be set, and then various testing will be conducted. Once testing is finished, the well will be temporarily suspended with two slickline plugs set in the well and the BOPs recovered to surface.

The wells may be suspended after gravel packing and clean-up operations depending on the project schedule, which may change. If the well is suspended after the gravel packing operations, a reservoir isolation valve is closed and tested as the primary barrier. The packer will be set and tested as the secondary barrier.

### 2.2.8 Vertical Subsea Tree Installation

The subsea tree may be installed from either a MODU or support vessel.

Before installing the subsea tree, the well locations are surveyed using a remotely operated vehicle (ROV). The survey verifies that both the tubing head spool and work area are free from obstruction and that the subsea tree installation can begin.

Following the ROV survey, the tubing head spool cap is removed in preparation for running the subsea tree. At this stage, the previously injected or placed biocide and corrosion inhibitor is exposed from within the tubing head spool and may be further diluted by sea water. As previously described, the volume of diluted chemical would be ~3 L of corrosion inhibitor and 0.25 L of biocide.

The tubing head spool is then cleaned (using mechanical means [brush] or seawater jetting via a ROV) in preparation for installing the tree. If brushing or jetting does not adequately clean any potential calcareous deposit from the tubing head spool, a cap with the capability for injecting/jetting a small volume of acid (~10 L) may be used as a contingency to further clean the wellhead.

Once the tubing head spool is prepared and made ready, the subsea tree is deployed from within a safe lift area (SLA). After the subsea tree is suspended within the SLA, it is lowered to ~40 m above the seabed. From this position, it is then moved above the tubing head spool for installation.

When the subsea tree engages with the tubing head spool, the tree cap lock is pressurised, locking the tree in position on the tubing head spool. There may be a small discharge (~10 L) of control fluid at this point; however, no further discharges are expected.

After installation, function testing is carried out to confirm the pressure integrity of the subsea tree to tubing head spool and valve functionality. An overpull test is undertaken to verify the tree is secured in position. Valve functionality testing will discharge small volumes of control fluids (~30 L per test) to the sea.

### 2.2.9 Wellbore Clean-up and Flowback

Wellbore and casing clean-up is required at various stages of the drilling activity to ensure the contents of the well are free of contaminants before the next stage of drilling. A clean-up pill train (cleaning agent) and other chemicals may be used to remove residual fluids (including NADF) from the wellbore.

During the clean-up process, fluids are circulated back to the MODU, and, if required, analysed before they are discharged overboard. Any displaced fluid that has the potential to contain NADF is analysed for residual hydrocarbons before discharge overboard.

Wells may be subject to a flowback at the end of the completions phase (although this is not currently planned). Further information on flowback is provided in Section 2.4.2.

## 2.3 Logging

The well will be evaluated using ‘logging while drilling’ techniques and mud logging. Wireline logging and formation testing/sampling may be done based on the results of the primary evaluation tools.

Wireline evaluation may be undertaken to determine rock and fluid properties of the targets. A suite of standard wireline logs may be run, including gamma ray, neutron-density, resistivity, sonic, acquisition of pressures and samples, vertical seismic profiling (VSP), and side-wall coring. Currently no VSP activities are planned, however these activities have been provided for in the EP.

## 2.4 Well Intervention Activities

Well intervention generally occurs within the wellbore and includes activities such as:

- slickline / wireline / coil-tubing operations
- well testing and flowback
- well workovers (mechanical or hydraulic).

For the EP, it is assumed that intervention on a single well may be required once a year, but intervention activities may be more frequent depending on well performance.

During intervention activities, local control of the Christmas trees may be required. Valve actuation of the trees may be required, which will result in small releases of subsea control fluids to be released to the environment (see Section 2.2.5). Intervention activities also include removing marine fouling by mechanical or acid soaking, resulting in the release of marine-fouling debris and small amounts of acid to the environment. When retrieving intervention tooling, small volumes of wellbore fluids may be displaced back into the well using nitrogen gas. The nitrogen will then be vented to the environment

In addition, various other activities (as described in Section 2.2) may also be conducted during well intervention activities.

### 2.4.1 Slickline / Wireline / Coil-Tubing Operations

In slickline / wireline / coil-tubing operations, a wire (slickline), braided cable (wireline), or a long metal pipe (coil tubing) is lowered into the well to run tools in and out of the wellbore. Before conducting these operations and entering the wellbore, pressure-control equipment is calibrated and pressure tested to ensure that control of the well is maintained once it is opened. The well may also be controlled by using overbalanced drilling fluids if required. Although equipment may be located outside the well (resulting in fugitive releases associated with greasing the slickline and wireline), all slickline / wireline / coil-tubing operations occur within the contained environment of the wellbore.

Slickline / wireline / coil-tubing operations can be conducted from a support vessel or MODU. For the EP, all slickline / wireline / coil-tubing activities are provided for; the types of tasks associated with this activity include (but are not limited to):

- setting and retrieving mechanical isolation barriers
- reservoir surveillance via logging / VSP
- well performance surveillance
- perforating casings
- determining depth
- detaching production packers and anchoring mechanisms (to enable upper completions to be pulled)
- repairing well components
- reinstating wells (return to operations).

During well reinstatement, all well intervention barriers (such as pressure-control equipment / isolation plugs) are removed, before handing over the operational control of the well to the CAPL Operations Team.

### 2.4.2 Well Testing and Flowback

CAPL has no plan to conduct scheduled well testing or well flowback activities. However, these tasks may need to be done depending on the results of the maintenance program or well performance. For the EP, the types of tasks associated with well testing and flowback may include (but are not limited to):

- wellbore clean-up
- reservoir gas venting
- well reinstatement (return to operations).

If a well is underperforming, or surveillance indicates debris is contained within the well, the contents of the wellbore may be flowed to a MODU then vented or flared. As the gas produced from the Gorgon and Jansz–Io fields comprises ‘dry’ gas, condensate drop-out from the flare boom is not expected.

During flowback, initial unloading of the well displaces the well fluids (i.e. suspension / completion fluids). These are discharged overboard—the gas content makes it too dangerous to filter or treat them. Once the brines are unloaded, the gas stream is sent to flare via the production separator.

After the objectives of the well testing and flowback are achieved, the flow is stopped and the well may be cleaned using a brine that can include several chemicals, such as biocide and surfactant.

Before well reinstatement, the contents of the wellbore (brine) may be recirculated, with its contents discharged overboard as required.

### 2.4.3 Well Workovers

Well workovers are required if tubing must be pulled from the well and replaced. For the EP, a workover may be required if:

- the production tubing fails, resulting in a loss of production fluids into the annulus
- the upper or lower completion is damaged.

For the EP, the types of tasks associated with well workovers may include (but are not limited to):

- removing production tubing (and associated equipment)
- replacing horizontal or vertical subsea trees
- wellbore clean-up
- replacing tubing (and associated equipment)
- venting / flaring
- pumping fluids down the wellbore
- well reinstatement (return to operations).

If production tubing needs to be replaced, the production packers are detached and the tubing is pulled. The well is then cleaned using a brine that may include several chemicals (e.g. biocide, surfactant). Once clean, new tubing is installed and various completion equipment (such as down-hole gauges, a tubing-retrievable safety valve, production packer to anchor the tubing) will be run in the production tubing string.

Before reinstating the well, the contents of the wellbore (brine) are recirculated and stored in portable storage tanks (in a process similar to that described in Section 2.4.2).

## 2.5 Well Abandonment

Once no longer required for use, wells must be abandoned in accordance with the requirements of the OPGGS Act and industry best practice.

On abandonment, the surface casing, conductor, and wellhead may be cut off below the seabed and recovered; however, the abandonment methodology has not yet been determined. However, the general process for removal comprises

- Remove corrosion cap from the wellhead
- Install and pressure test BOP
- Isolate the reservoir (deep set slick line plug)
- Cut / perforate casing / production tubing
- Install permanent reservoir barrier

- Perforate the well casing / tubing
- Install permanent surface barrier
- Remove BOP stack
- Severe and remove surface casing and wellhead
- Conduct post operation ROV survey.

## 2.6 Support Operations

Support vessels, which are based out of the Port of Dampier, support well intervention and drilling activities as required. The vessels are selected to ensure they can efficiently fulfil these functions:

- support anchoring operations (if required)
- supply food, fuel, bulk products, drilling fluids, and drilling materials (crane and bunkering operations)*
- collect waste
- assist in emergency response situations
- monitor the 500 m radius safety exclusion zone around the MODU and intercept errant vessels.

** Several different materials required for the campaign will be transferred from vessels to the MODU in bulk. Cement, barite and bentonite are transported as dry bulk to the MODU by support vessels and pneumatically blown to the MODU storage tanks using compressed air. The dry bulk storage tanks on the MODU vent excess compressed air to atmosphere. This venting process carries small amounts of solids, which is discharged below the MODU. Based upon previous programs it is estimated that during each transfer a loss in the order of 0.005% is expected to be recorded. In volume terms that equates to approximately 4mT for the entire GS2 drilling program.*

To achieve these functions, support vessels of different sizes and capabilities are used.

The MODU is serviced by helicopters, with an expected flight frequency of five times per week (on average). Helicopters will primarily be used for passenger transfers/crew changes and minor supplies.

In addition, the MODU and support vessels will routinely discharge waste streams that include sewage, greywater, food waste, brine (from freshwater makers), ballast water, and cooling water.

# 3 Description of the Environment

The Environment that May Be Affected (EMBA) by this activity was identified using ecological and socioeconomic impact thresholds from spill modelling undertaken for an emergency condition (LOWC event).

To enable a systematic description of the environment and allow further consideration of consequence and sensitivity to impacts and risks arising from the petroleum activity and emergency conditions, the operational area and wider EMBA were overlaid on to geographic areas, termed Impact Assessment Areas (IAAs). Delineation of the IAAs is based on government management plans, the ecological and social values of each area, and the presence of receptors, including the extent of marine protected areas. The IAAs with the potential to be exposed to thresholds above both ecological and socioeconomic impact thresholds include:

- Offshore
- Barrow and Montebello Islands
- Pilbara Coast
- Ningaloo
- Gascoyne
- Shark Bay.

Nature and scale was used to determine the level of detail required to describe the existing environment, in accordance with NOPSEMA's Environment Plan Content Guidelines (Ref. 5; N04750-GN1344). Because the operational area has the greatest potential to be affected by the petroleum activity, a regional overview and detailed description of the existing environment for this area is summarised in Sections 3.1 to 3.2.

Section 3.4 summarises the particular values and sensitivities within the remaining IAAs (as identified in CAPL's Description of the Environment document (Ref. 6; ABU140700357).

## 3.1 Regional Overview

The Integrated Marine and Coastal Regionalisation of Australia (IMCRA) is an ecosystem-based classification of Australia's marine and coastal environments that has been developed by the Commonwealth Government as a regional framework for planning resources development and biodiversity protection (Ref. 19). The IMCRA divides Australia's marine environment into 41 provincial bioregions; a 'bioregion' is a biogeographical area defined by similar ecological characteristics.

The Gorgon and Jansz–Io production licences are located within the vast North-west Marine Region, which encompasses the Commonwealth Waters from the WA/Northern Territory border in the north to the waters off Kalbarri in the south. The Marine Bioregional Plan for the North-west Marine Region (Ref. 20) aims to strengthen the operation of the EPBC Act in the region by improving the way the marine environment is managed and protected. The bioregional plan outlines the conservation values of the region, the associated pressures affecting those values, the priorities and strategies to address the pressures, and useful advice for industry planners looking to undertake activities in the region (Ref. 20). Information in the bioregional plan has been referenced in this Section where relevant.

The North-west Marine Region is further divided into eight provincial bioregions based on fish, benthic habitat, and oceanographic data at a scale that is useful for regional conservation planning and management (Ref. 20). The Gorgon and Jansz–Io production licences are located within the Northwest Shelf Province and Northwest Province (see Figure 3-1). Table 3-1 summarises these provincial bioregions.

**Table 3-1: Description of Provincial Bioregions**

| Bioregion | Area Description |
|---|---|
| Northwest Shelf Province | Offshore waters primarily on the continental shelf between North West Cape and Cape Bougainville, encompassing much of the area commonly known as the North West Shelf. Water depths range from 0 m to ~200 m (Ref. 20). |
| Northwest Province | Offshore waters between Exmouth and Port Hedland, occurring entirely on the continental slope. Water depths are predominantly between 1000 m and 3000 m (Ref. 20). |

### 3.1.1 Marine Environment

#### 3.1.1.1 Marine Habitats

The operational area is located within a single Key Ecological Feature (KEF)—the Continental slope demersal fish communities (Figure 3-2).

**Continental Slope Demersal Fish Communities**

Demersal fish assemblages within the Northwest Province, specifically the continental slope between North West Cape and the Montebello Trough, are characterised by high endemism and species diversity with more than 500 fish species, of which 76 species are considered to be endemic. The value of this KEF is described as having high levels of endemism (Ref. 8).

This KEF is considered valuable because it provides areas of hard substrate, and therefore may provide sites for higher diversity and enhanced species richness relative to surrounding areas of predominantly soft sediment. It also may facilitate increased availability of nutrients in particular locations off the Pilbara coast by disrupting internal waves, thus facilitating enhanced vertical mixing of water layers. Enhanced productivity may attract opportunistic feeding by larger marine life including Humpback Whales, Whale Sharks, and large pelagic fish (Ref. 8).

However, as described above, surveys undertaken near the GS2 wells indicate hard substrate is expected to be absent with the operational area dominated by soft sediment communities. Thus, no specific features are known to be present within the operational area that support the values associated with this KEF.

CAPL has conducted extensive surveys within the production licences to understand the nature and composition of the seabed sediments, and thus provide accurate bathymetry for geohazard assessment and engineering design. These surveys comprise high-resolution geophysical surveys, which are supported by seabed sampling campaigns. Data from these surveys have been interpreted to characterise benthic substrate; the benthic habitat within the operational area comprises soft substrate (see Figure 3-3 and Figure 3-4).

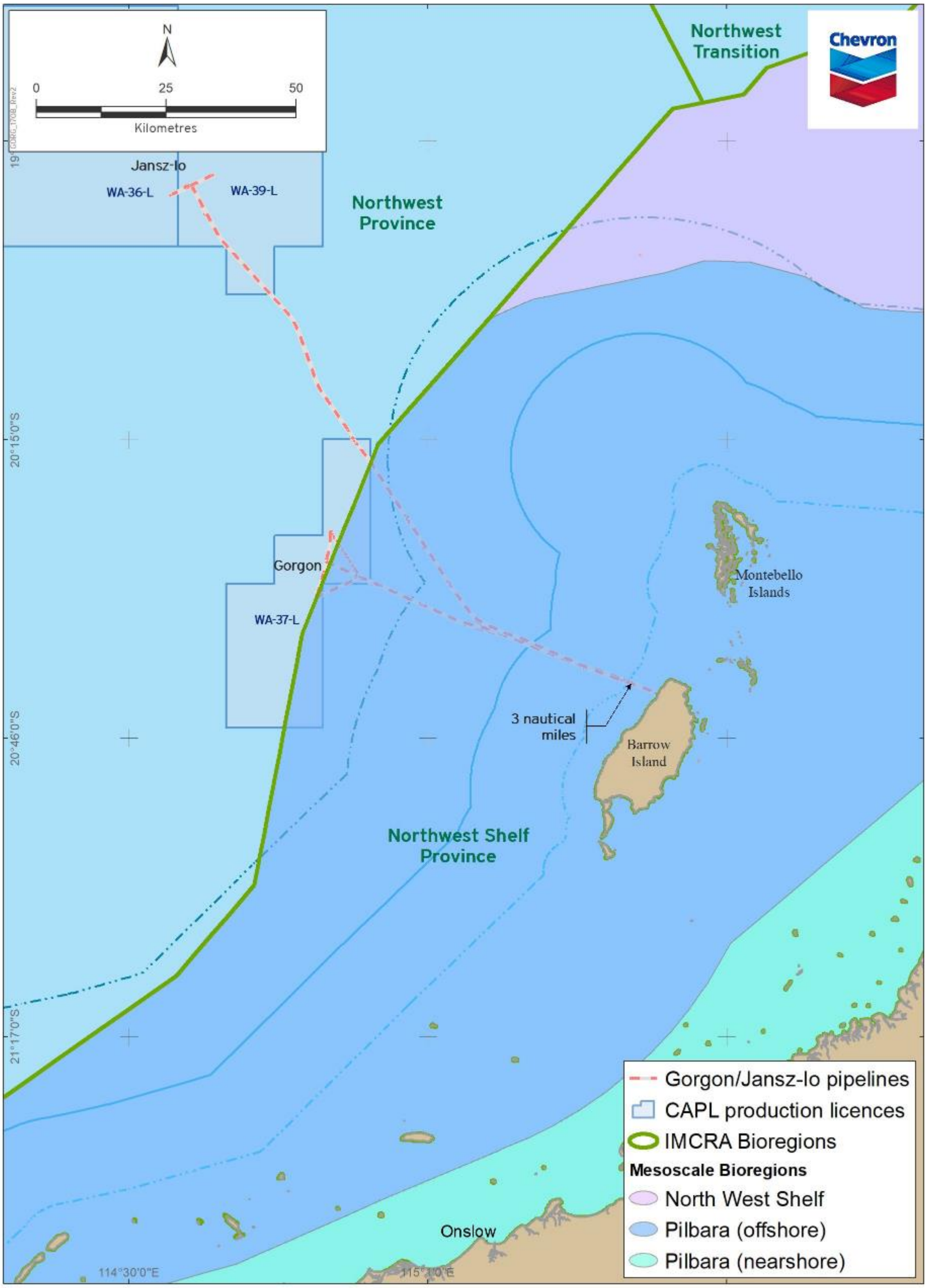


**Figure 3-1: Production Licences and Marine Regions**

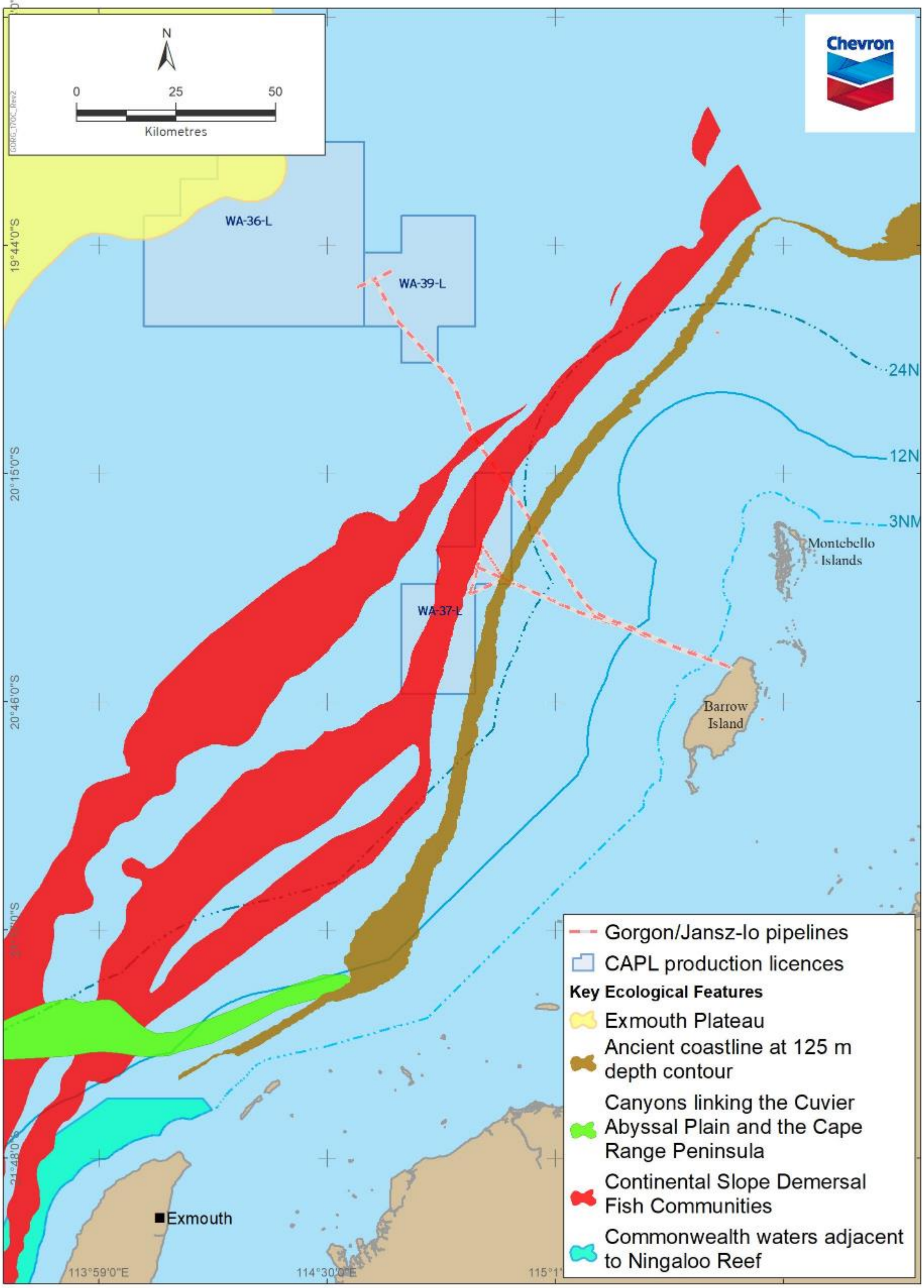


**Figure 3-2: Production Licences and Proximity to KEFs**

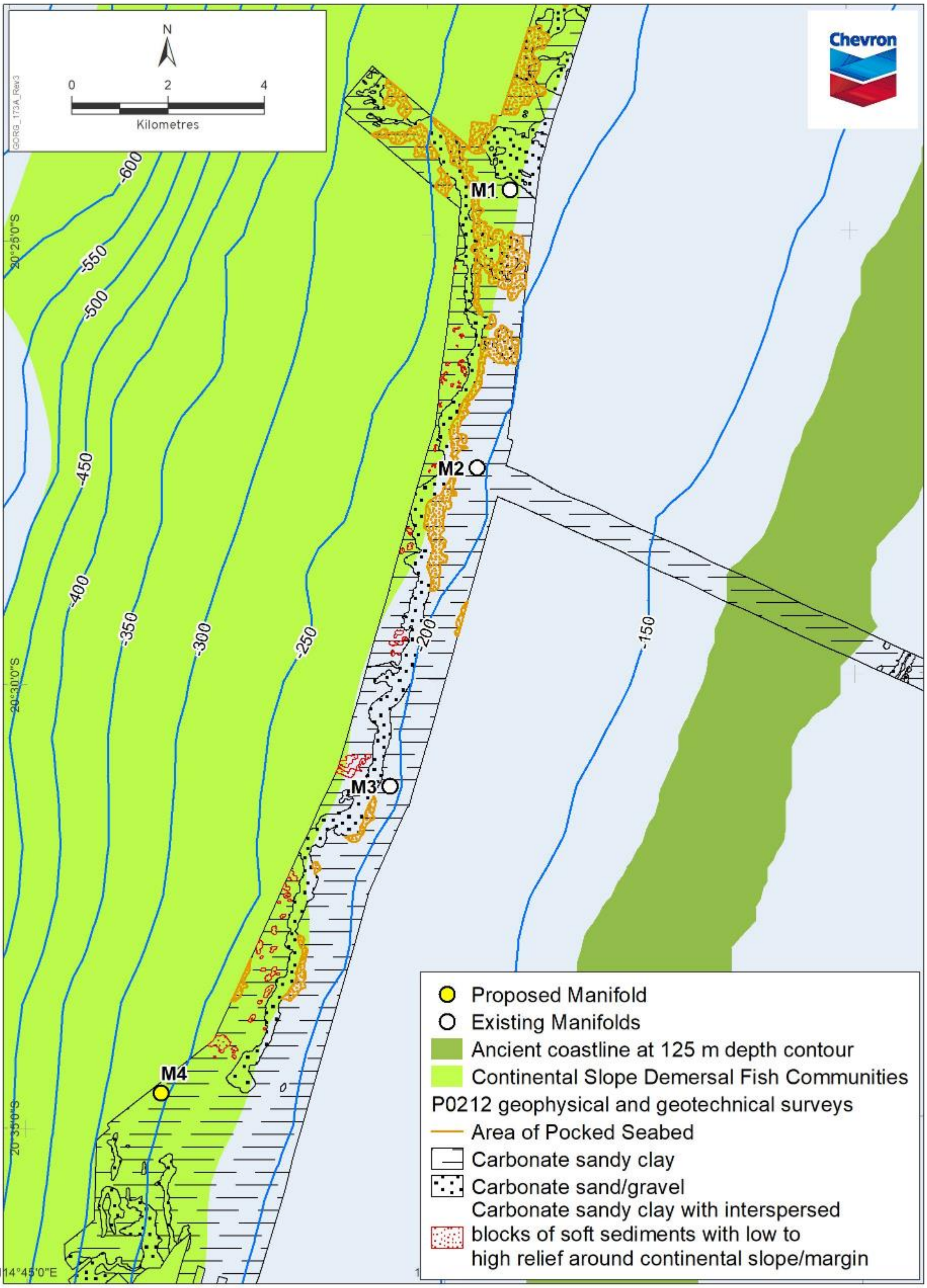


**Figure 3-3: GS2 (Gorgon) Well Locations, Benthic Habitat, and Proximity to KEFs**

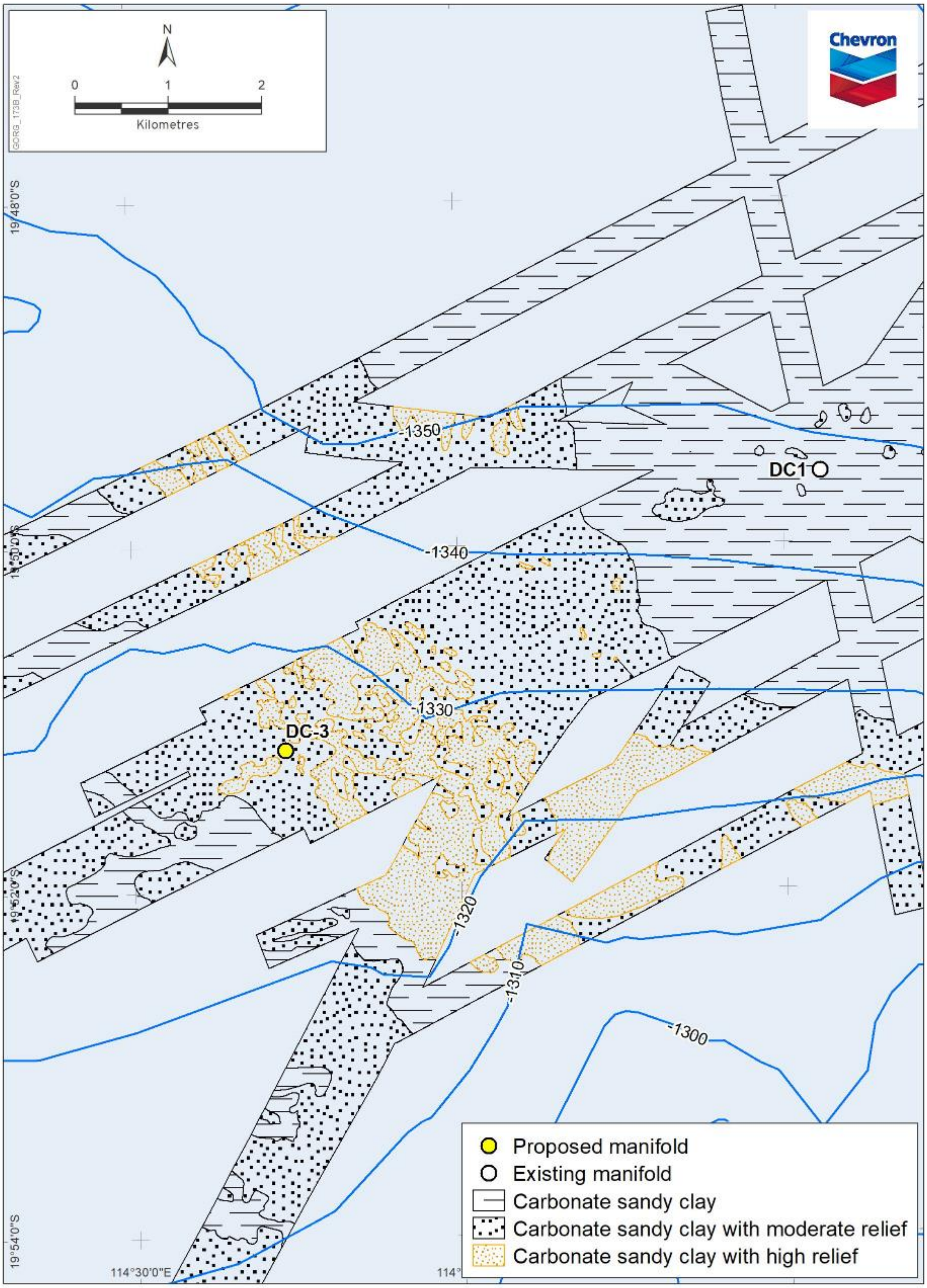


**Figure 3-4: GS2 (Jansz–Io) Well locations and Benthic Habitat**

#### 3.1.1.2 Marine Fauna

A search of the protected matters database for the Production Licences (Ref. 16; Ref 17) indicated that several Threatened or Migratory species may be present within the operational area. These are described in the various subsections below.

**Marine Mammals**

operational area, including:

- Humpback Whale
- Blue Whale (including Pygmy Blue Whale)
- Sei Whale
- Fin Whale
- Antarctic Minke Whale
- Bryde's Whale
- Killer Whale
- Sperm Whale
- Spotted Bottlenose Dolphin.

As there are no known feeding, calving, and resting areas within the operational area, most of these species are expected to be transient. However, the operational area intersects the Pygmy Blue Whale Migration Biologically Important Area (BIA), and Humpback Whale Migration BIA.

The Pygmy Blue Whale uses north-west WA waters as a key migratory route between summer foraging grounds off south-west WA and breeding grounds in equatorial regions. Pygmy Blue Whales migrate north from April to August and south from September to November.

Humpback Whales migrate north annually (from June to October) between their feeding grounds in Antarctic waters and their calving grounds in Pilbara/Kimberley waters (Ref. 21). Northbound Humpback Whales tend to remain in, or within, 200 m water depth, while southbound whales tend to come closer to Barrow Island and generally occur between 50 m and 200 m water depth (Ref. 22).

**Reptiles**

Five Threatened or Migratory species of marine turtles may be present within the operational area, including:

- Green Turtle
- Hawksbill Turtle
- Flatback Turtle
- Loggerhead Turtle
- Leatherback Turtle.

All five species are listed as Vulnerable, with Loggerhead Turtles also listed as Endangered, under the EPBC Act. Some turtle species may be found foraging throughout the water column all year round in the North West Shelf waters within the operational area (Ref. 27; Ref. 28; Ref. 29).

Barrow Island and the Montebello Islands (including a 60 km buffer zone) provides critical habitat for the Flatback Turtle. The operational area is outside this 60 km buffer, described in the Recovery Plan for Marine Turtles in Australia – July 2017–2027 (known as the Turtle Recovery Plan) as critical habitat (Ref. 30); however, a BIA associated with Flatback Turtle internesting behaviours overlaps the operational area.

During internesting periods, marine turtles (including Flatbacks) are more sedentary (Ref. 31), only travelling within 5 km of the nesting coastline (Ref. 32). Because of the distance of the operational area from the nearest coastline (65 km from the Montebello Islands coastline), marine turtles are not expected to practice internesting behaviour near the operational area.

Several sea snake species were identified via the EPBC search as having the potential to be present in the operational area. However, Cogger (Ref. 33; Ref. 34) states that most sea snakes have shallow benthic feeding patterns and are rarely observed in water >30 m deep. Therefore, sea snakes are not expected to be common within the operational area, which has water depths of >200 m.

**Fishes, including Sharks and Rays**

A number of Threatened or Migratory fish, shark, and ray species may be present within the operational area, including:

- Grey Nurse Shark
- Great White Shark
- Shortfin Mako Shark
- Longfin Mako Shark
- Whale Shark
- Green Sawfish
- Dwarf Sawfish
- Narrow Sawfish
- Giant Manta Ray
- Reef Manta Ray.

Although no BIAs were identified for these species, a BIA associated with the Whale Shark (listed as migratory) was identified close to the operational area and as such has been considered and described. The Whale Shark BIA is associated with its foraging behaviours northward from Ningaloo along the 200 m isobath.

The operational area overlaps small areas of the continental slope demersal fish communities. Fish communities of the upper slope (225 m to 500 m depth) and mid-slope (750 m to 1000 m depth) display a high degree of endemism, supporting more than 508 fish species, of which up to 76 are endemic (Ref. 36). The high number of species is believed to be associated with areas of enhanced biological productivity because of the interaction between seasonal currents and seabed topography. Spawning grounds and nursery areas for commercial and recreational fish species are not known to occur close to the operational area.

A number of pipefish, pipehorse, and seahorse species (solenostomids and syngnathids) were identified via the EPBC search as having the potential to be present in the operational area (Ref. 16). Almost all syngnathids live in nearshore and inner shelf habitats, usually in shallow coastal waters, among seagrasses, mangroves, coral reefs, macroalgae-dominated reefs, and sand or rubble habitats (Ref. 37; Ref. 38; Ref. 39; Ref. 40). Although two species have been identified in the North-west Marine Region in deeper waters (Winged Seahorse [*Hippocampus alatus*] and Western Pipehorse [*Solegnathus* sp. 2] (Ref. 41), these species were not identified by the matters of national environmental significance search for the production licences. Based on this information and the lack of appropriate habitat within the operational area, solenostomids and syngnathids are not expected to be common within the operational area.

**Seabirds and Shorebirds**

A number of Threatened or Migratory seabirds or shorebirds may be present within the operational area, including:

- Common Noddy
- Common Sandpiper
- Curlew Sandpiper
- Eastern Curlew
- Australian Fairy Tern
- Lesser Frigatebird
- Osprey
- Pectoral Sandpiper
- Red Knot
- Sharp-tailed Sandpiper
- Southern Giant Petrel
- Streaked Shearwater.

Although no BIAs were identified for these species, a single BIA associated with the Wedge-tailed Shearwater (listed as Migratory but not picked up in the protected matters search) was identified to overlap the operational area and as such has been considered. The Wedge-tailed Shearwater BIA is associated with its breeding / foraging behaviours and indicates that the species has a wide breeding and foraging distribution. Because no suitable breeding habitat exists for this species within the operational area, it is expected that this species would use the area for foraging only.

#### 3.1.1.3 Shoreline Habitats

No shoreline habitats occur within the operational area.

#### 3.1.1.4 Air Quality

Air quality in the operational area is largely at background levels due to the area's relative remoteness. The closest facility to the operational area is CAPL's Wheatstone Offshore Processing Platform.

## 3.2 Socioeconomic Environment

### 3.2.1 Commercial Shipping

Commercial shipping intersects the operational area, as detailed in the Offshore IAA description in Section 5.2 of the Description of the Environment document (Ref. 18).

Consultation with AMSA noted that heavy vessel traffic will be encountered travelling along the charted shipping fairway, which passes through WA-39-L (Figure 3-5). AMSA also noted that cargo and tanker vessels travelling to and from Onslow may be encountered in WA-37-L and WA-39-L. Local and support traffic will also be encountered in all production licences throughout the drilling campaign.

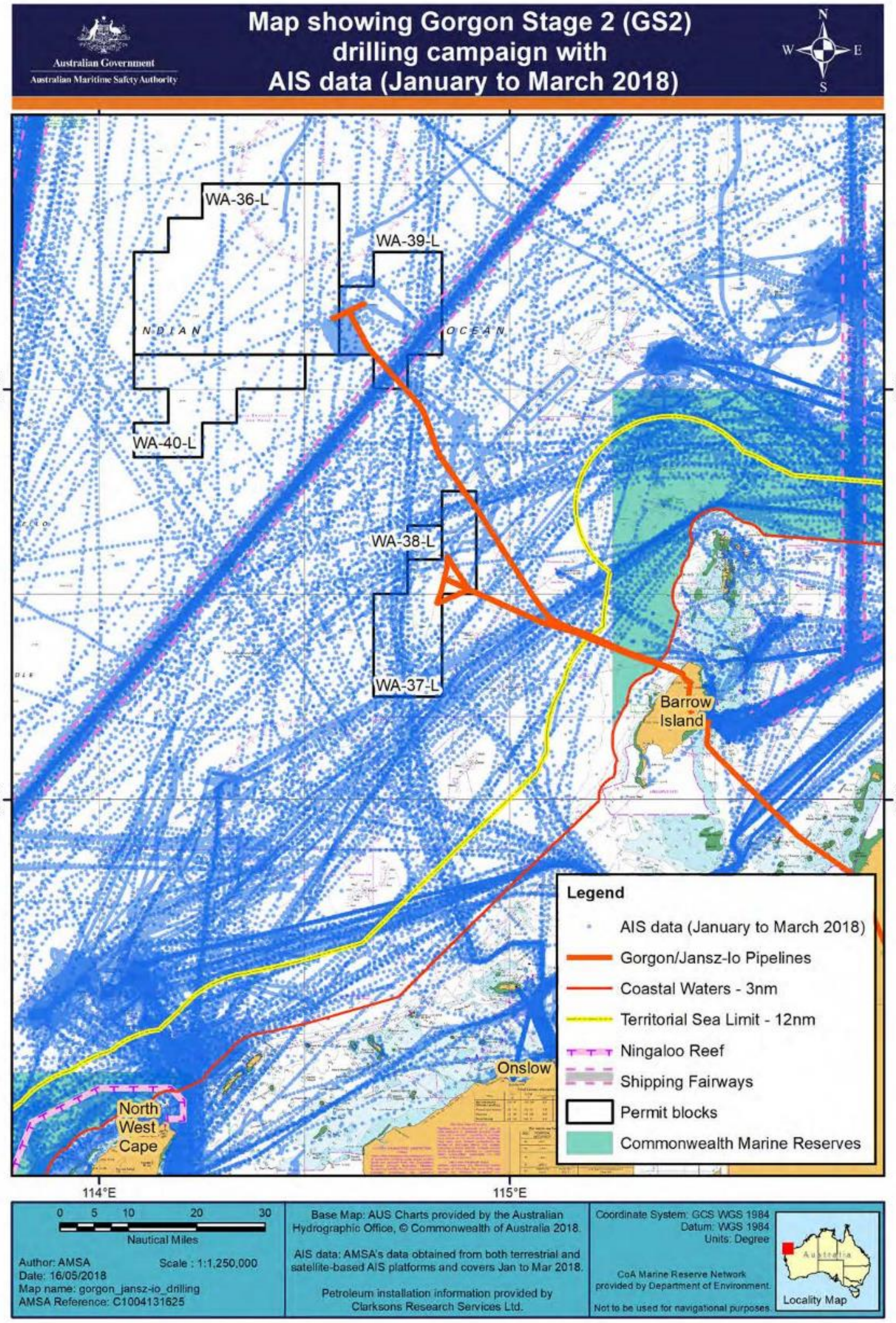


**Figure 3-5: Shipping Data for Gorgon Production Licences**

### 3.2.2 Commercial Fishing and Aquaculture

Several State and Commonwealth fisheries intersect the operational area.

Detailed information regarding all commercial fisheries and aquaculture operations is provided in Sections 5.3 and 5.4 of the Description of the Environment document (Ref. 18).

Table 3-2 lists the State and Commonwealth fisheries that may intersect the operational area.

**Table 3-2: State and Commonwealth Managed Fisheries**

| State Managed Fisheries | Commonwealth Managed Fisheries |
|---|---|
| • Pilbara Line Fishery<br>• Pilbara Trap Managed Fishery<br>• Onslow Prawn Managed Fisheries<br>• Mackerel Managed Fishery<br>• Specimen Shell Managed Fishery<br>• Marine Aquarium Fish Managed Fishery | • North West Slope Trawl Fishery<br>• Western Skipjack Tuna Fishery<br>• Western Tuna and Billfish Fishery |

### 3.2.3 Marine-based Tourism and Recreation

No significant marine-based tourism and recreation activities are known to occur in the operational area.

### 3.2.4 Cultural Heritage

The Register of Aboriginal Sites indicates that numerous Aboriginal cultural heritage sites occur within coastal areas of the WA mainland and islands, but no known sites or artefacts are listed within the operational area (Ref. 49).

Relevant European cultural heritage sites are listed in the National Heritage Lists, Register of National Estate World, Commonwealth Heritage Lists, and Places of Historic Significance to Australia. According to these lists, no known sites or artefacts occur within the operational area.

No known wrecks occur within the operational area according to the Australian National Shipwreck Database (Ref. 50).

## 3.3 Particular Values and Sensitivities

The particular values and sensitivities identified for the operational area are:

- continental slope demersal fish communities and associated habitat (KEF)
- whale migration (Humpback, Blue, and Pygmy Blue)
- foraging Whale Sharks
- Flatback Turtle (internesting)
- Wedge-tailed Shearwater (breeding / foraging)
- commercial fisheries and shipping.

## 3.4 Particular Values and Sensitivities within the Wider EMBA

Based on the ecological and socioeconomic hydrocarbon impact thresholds, a summary of the values considered to be potentially at risk are described in Table 3-3 to Table 3-10.

### Table 3-3: Particular Values and Sensitivities – Marine Habitat (Coral)

| IAA | Coral |
| --- | --- |
| Barrow and Montebello Islands | • The best-developed communities are the fringing reefs located west and south-west of the Montebello Islands and the bombora and patch reefs on the eastern edge of the Montebello and Lowendal Islands.<br>• High diversity of hard corals in relatively undisturbed intertidal and subtidal reefs.<br>• Ancient Coastline at 125 m depth contour. |
| Gascoyne | • No values identified. |
| Ningaloo | • Ningaloo Reef is the largest fringing coral reef in Australia, with the most diverse communities occurring in the fringing barrier reef (high energy) and lagoonal areas (low energy).<br>• High diversity of corals with >300 species from 54 genera, accounting for 50% of Indian Ocean coral species. |
| Offshore | • Glomar Shoals, Ancient Coastline at 125 m, and Rankin Bank (60–70 km north of the Montebello Islands), which provide an area of reefs that reach water depths with parts as shallow as 20 m. |
| Pilbara Coast | • No values identified. |
| Shark Bay | • No values identified. |

### Table 3-4: Particular Values and Sensitivities – Marine Habitat (Seagrass)

| IAA | Seagrass |
| --- | --- |
| Barrow and Montebello Islands | • No values identified. |
| Gascoyne | • No values identified. |
| Ningaloo | • No values identified. |
| Offshore | • No values identified. |
| Pilbara Coast | • Seagrass beds are patchily distributed along the coastal region between Exmouth Gulf and Cape Preston. These patches are typically low cover; however, they are potentially important for Dugongs within the area. |
| Shark Bay | • Contains the largest seagrass meadows in the world (4800 $km^2$), which are also some of the most species-rich. These seagrass beds are a vital component of the Shark Bay World Heritage Area listing. |

### Table 3-5: Particular Values and Sensitivities – Marine Fauna (Dugongs)

| IAA | Dugongs |
| --- | --- |
| Barrow and Montebello Islands | • No values identified. |
| Gascoyne | • No values identified. |
| Ningaloo | • No values identified. |
| Offshore | • N/A. Not expected to occur in the Area. |
| Pilbara Coast | • Significant aggregations of Dugongs known to frequently occur in the shallow waters of this Area. |
| Shark Bay | • Abundance and distribution of Dugongs identified in Shark Bay is of international significance. The Dugong population in the Area has been identified as a natural feature for World Heritage listing. Significant seasonal |

| IAA | Dugongs |
|---|---|
| | variation of habitat use within Shark Bay by Dugongs has been observed, as a consequence of changing water temperatures.<br>• Foraging areas occur within both Denham Sound and the Eastern Gulf Zone of Shark Bay. Areas of 'high level' use due to high-density seagrass beds have been identified east of Faure Island (October to April) and north-east of Peron Peninsula (June to November). |

### Table 3-6: Particular Values and Sensitivities – Marine Fauna (Whales and Dolphins)

| IAA | Whales and Dolphins |
|---|---|
| Barrow and Montebello Islands | • Area forms part of the Humpback Whale migration route for the northern and southern migration. Usage is seasonally high from July to October.<br>• Female Humpback Whales and their calves have been recorded using the sheltered waters west of Trimouille Island in the Montebello Islands Group as a resting area during their southerly migration.<br>• Area forms part of the Pygmy Blue Whale (listed as Endangered) migration route for the northern and southern migration. Movement on the southern migration is close to the coast in the Exmouth–Montebello Islands area. |
| Gascoyne | • Area forms part of the Humpback Whale migration route for the northern and southern migration. Usage is seasonally high from July to October.<br>• Area forms part of the Pygmy Blue Whale migration route. Usage is seasonally high (April to August on their northerly migration and September to November on their southern migration). |
| Ningaloo | • Area forms part of the Humpback Whale migration route for the northern and southern migration. Usage is seasonally high from July to October.<br>• Area forms part of the Pygmy Blue Whale migration route. Usage is seasonally high from April to August (northern migration) and from September to November (southern migration). |
| Offshore | • Area forms part of the Humpback Whale migration route for both the northern and southern migration. Usage is seasonally high from July to October.<br>• Area forms part of the Pygmy Blue Whale (listed as Endangered) migration route. Usage is seasonally high. |
| Pilbara Coast | • Area forms part of the Humpback Whale migration route for the northern and southern migration. Usage is seasonally high, with the northern migration from July to August, and the southern migration from August to October. |
| Shark Bay | • Area forms part of the Humpback Whale migration route, with Humpback Whales passing through the Shark Bay Area. Usage is seasonally high from July to October, with Humpback Whales mostly skirting the islands west of Shark Bay.<br>• Northward-facing embayment's have been identified as important for Humpback Whale resting areas during winter.<br>• Area forms part of the Pygmy Blue Whale migration route. Usage is seasonally high (April to August on their northerly migration and September to November on their southern migration).<br>• The Area supports a substantial population of bottlenose dolphins (2000–3000 minimum estimate). Substantial numbers of Australian Humpback Dolphins use the western area of Shark Bay. |

### Table 3-7: Particular Values and Sensitivities – Marine Fauna (Pinnipeds)

| IAA | Seals |
|---|---|
| Barrow and Montebello Islands | N/A. Not expected to occur in the Area. |

| IAA | Seals |
|---|---|
| Gascoyne | The specific objectives of the recovery plan that are relevant to petroleum activities include:<br>• mitigate the impacts of marine debris on Australian Sea Lion populations<br>• investigate and mitigate other potential threats to Australian Sea Lion populations, including disease, vessel strike, pollution, and tourism. |
| Ningaloo | N/A. Not expected to occur in the Area. |
| Offshore | N/A. Not expected to occur in the Area. |
| Pilbara Coast | N/A. Not expected to occur in the Area. |
| Shark Bay | The specific objectives of the recovery plan that are relevant to petroleum activities include:<br>• mitigate the impacts of marine debris on Australian Sea Lion populations<br>• investigate and mitigate other potential threats to Australian Sea Lion populations, including disease, vessel strike, pollution, and tourism. |

**Table 3-8: Particular Values and Sensitivities – Marine Fauna (Reptiles)**

| IAA | Reptiles |
|---|---|
| Barrow and Montebello Islands | • The Area includes important habitat for Flatback Turtle rookeries (nesting: November to March) on the east coast of Barrow Island, Montebello Islands, Hermite Island, and Varanus Island.<br>• The Area includes important habitat for nesting and internesting Hawksbill Turtles, particularly at Varanus Island, Ah Chong Island, South East Island, and the Lowendal Island Group.<br>• Barrow Island and the Montebello Islands are important for Green Turtle nesting, foraging, and internesting behaviour. Barrow Island provides critical nesting and internesting habitat for Green Turtles. Summer mating aggregations occur west of Barrow Island and within the Montebello Islands Group south of North-west Island and east of Trimouille Island. A large summer aggregation of unknown purpose also occurs west of Hermite Island.<br>• The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 23) indicates that:<br>o Barrow Island and the Montebello Islands (and 20 km radius buffer) provide critical habitat for the Green Turtle<br>o Barrow Island and the Montebello Islands (and 60 km radius buffer) provide critical habitat for the Flatback Turtle<br>o the Montebello Islands (including Ah Chong Island, South East Island, and Trimouille Island) and Lowendal Islands (including Varanus Island, Beacon Island, and Bridled Island) (and 20 km radius buffer) provide critical habitat for the Hawksbill Turtle. |
| Gascoyne | • No values identified. |
| Ningaloo | • Significant numbers of marine turtles are known to occur in this Area, particularly at the Muiron Islands and Ningaloo Reef.<br>• Important habitat for nesting and internesting Loggerhead Turtles occurs along the Ningaloo and Jurabi coasts and the Muiron Islands. Important nesting and internesting habitat for Loggerhead Turtles at Gnaraloo Bay.<br>• The Area includes an important habitat for internesting Hawksbill Turtles along the Ningaloo and Jurabi coasts. This Area is believed to be a major rookery for this species. The Hawksbill Turtle population is significant as the WA populations are the largest remaining in the Indian Ocean.<br>• A high density of Green Turtles is present within the Area. Important habitat for nesting and internesting Green Turtles occurs at North and South Muiron Island and the North West Cape. |

| IAA | Reptiles |
|---|---|
| | • The northern part of the Area includes important habitat for internesting Flatback Turtles.<br>• The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 23) indicates that:<br>o the North West Cape and Ningaloo Coast (and 20 km radius buffer) provide critical habitat for the Green Turtle<br>o Muiron Islands and Ningaloo Coast (and 20 km radius buffer) provide critical habitat for the Loggerhead Turtle. |
| Offshore | • No values identified. |
| Pilbara Coast | • The Area includes important habitat at Thevenard Island for Hawksbill Turtle nesting. Sholl Island is major Hawksbill Turtle rookery.<br>• Thevenard Island (south coast) is also important for nesting Flatback Turtles, with high usage of beaches where dune height is low. Waters surrounding Thevenard Island and Onslow are important habitat for internesting Flatback Turtles.<br>• The Area includes important habitat for foraging behaviour by Hawksbill, Green, and Flatback Turtles; this includes the string of islands between Cape Preston and Onslow. Key feeding grounds occur around the Mary Anne and Great Sandy island groups.<br>• Aggregations of male Green Turtles occur before the nesting season around the Mangrove Islands, north-east of Onslow. Serrurier Island is a major nesting area for Green Turtles, with surrounding waters used for foraging.<br>• The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 23) indicates that:<br>o Serrurier Island and Thevenard Island (and 20 km radius buffer) provide critical habitat for the Green Turtle<br>o coastal islands from Cape Preston to Locker Island (and 60 km radius buffer) provide critical habitat for the Flatback Turtle<br>o Sholl Island (and 20 km radius buffer) provides critical habitat for the Hawksbill Turtle. |
| Shark Bay | • The Area is important for nesting and internesting Loggerhead Turtles at Dirk Hartog, Bernier, and Dorre Islands. This is Australia's largest nesting colony of Loggerhead Turtles (nesting: October to March) with 70% of Loggerhead Turtles in WA nesting at Turtle Bay (Dirk Hartog Island), Shelter Bay (in South Passage), and Dorre Island.<br>• Green Turtle nesting (October to February) is only known at Turtle Bay (Dirk Hartog Island) and infrequently on the Peron Peninsula. Bernier and Dorre Islands are the southerly extent of the Green Turtle breeding range.<br>• The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 23) indicates that Dirk Hartog Island (and a 20 km radius buffer) provides critical habitat for the Loggerhead Turtle. |

**Table 3-9: Particular Values and Sensitivities – Marine Fauna (Fish, Rays, and Sharks)**

| IAA | Fish Sharks and Rays |
|---|---|
| Barrow and Montebello Islands | • Ancient Coastline at 125 m depth contour.<br>• Continental slope demersal fish communities. |
| Gascoyne | • Demersal slope and associated fish communities of the Central Western Province.<br>• Mesoscale eddies – high productivity for primary producers and associated seabird, fish, and marine mammal diversity.<br>• Perth Canyon and adjacent shelf break, and other west coast canyons. |

| IAA | Fish Sharks and Rays |
|---|---|
| | • Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula.<br>• Continental slope demersal fish communities.<br>• Exmouth Plateau – high productivity for primary producers and associated seabird, fish, and marine mammal diversity.<br>• Wallaby Saddle – high productivity for primary producers and associated seabird, fish, and marine mammal diversity. |
| Ningaloo | • Ningaloo Reef is important for Whale Shark (listed as Vulnerable) aggregation, which occurs annually between March and August in the waters of the Ningaloo Marine Park, frequently close to the Ningaloo Reef front, both in the lagoon and outside it. This aggregation behaviour is only known to occur in a few places in the world.<br>• Commonwealth Waters adjacent to Ningaloo Reef.<br>• Continental slope demersal fish communities.<br>• Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula. |
| Offshore | • The Whale Shark (listed as Vulnerable) is known to occur in this Area, where important foraging habitat exists for this species.<br>• Glomar Shoals – high productivity for primary producers and associated seabird, fish, and marine mammal diversity.<br>• Ancient Coastline at 125 m depth contour.<br>• Continental slope demersal fish communities.<br>• Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula.<br>• Exmouth Plateau – high productivity for primary producers and associated seabird, fish, and marine mammal diversity. |
| Pilbara Coast | • No values identified |
| Shark Bay | • Demersal slope and associated fish communities of the Central Western Province.<br>• Mesoscale eddies – high productivity for primary producers and associated seabird, fish, and marine mammal diversity. |

**Table 3-10: Particular Values and Sensitivities – Marine Fauna (Seabirds and Shorebirds)**

| IAA | Seabirds and Shorebirds |
|---|---|
| Barrow and Montebello Islands | • The Montebello/Lowendal/Barrow Island (Double Island) Region has significant rookeries for 15 seabird species. Seven listed migratory birds occur in the Area, with known breeding populations of Roseate Tern, Caspian Tern, Lesser Crested Tern, Bridled Tern, and Wedge-tailed Shearwater.<br>• Regionally significant for Fairy Tern and Sooty Oystercatcher.<br>• The largest breeding colony of Roseate Terns in WA is located on the Montebello Islands.<br>• Double Island is a regionally significant rookery for Bridled Terns and Wedge-tailed Shearwaters.<br>• The south/south-east of Barrow Island is nationally significant for shorebird foraging habitat. |
| Gascoyne | • No values identified. |
| Ningaloo | • The Muiron Islands are important nesting sites for the Wedge-tailed Shearwater and various other seabirds.<br>• This area overlaps foraging areas adjacent to important breeding areas for migratory seabirds (specifically the Wedge-tailed Shearwater). |

| IAA | Seabirds and Shorebirds |
|---|---|
| Offshore | • No values identified. |
| Pilbara Coast | • No values identified. |
| Shark Bay | • The Shark Bay area is nationally and internationally important for several shorebird species that use intertidal mudflats in the Area. |

# 4 Environmental Risk Assessment Methodology

In accordance with Regulation 13(5) of the OPGGS(E)R, this Section summarises the methodology used to identify and assess the environmental impacts and risks associated with the activities described in Section 2.

The risk assessment for the EP was undertaken in accordance with CAPL's Health, Environment, and Safety (HES) Risk Management Process (Ref. 34) using the Chevron Corporation Integrated Risk Prioritization Matrix (Figure 4-1). This approach generally aligns with the processes outlined in ISO 31000:2009 Risk Management – Principles and Guidelines (Ref. 33) and Handbook 203:2012 Managing Environment-Related Risk (Ref. 123).

The risk assessment process and evaluation involved consultation with environmental, health, safety, commissioning, start-up, operations, maintenance, and engineering personnel. Risks considered and covered in the EP were identified and informed by:

- experience gained during previous stages of the Gorgon Project
- expertise and experience of CAPL personnel involved in Operations
- stakeholder engagement (Section 1.4).

The impact and risk assessment process comprised these tasks:

- identifying and describing the petroleum activity
- identifying particular environmental values
- identifying relevant environmental aspects
- identifying relevant environmental hazards
- evaluating impacts and risk
    - consequence evaluation
    - control measure identification and ALARP evaluation
    - likelihood evaluation
    - quantifying the level of risk
- risk and impact acceptance
- environmental performance outcomes, standards, and measurement criteria.

After describing the activity and identifying the environmental values, aspects, and hazards, the potential consequences were assessed and evaluated. Consequence is defined using the Integrated Risk Prioritization Matrix (Figure 4-1). The level of consequence is determined by the potential level of impact based on:

- the spatial scale or extent of potential hazards of the environmental aspect within the receiving environment
- the nature of the receiving environment (from Section 3) (within the spatial extent), including proximity to sensitive receptors, relative importance, and sensitivity or resilience to change
- the impact mechanisms (cause and effect) of the environmental hazard within the receiving environment (e.g. persistence, toxicity, mobility, bioaccumulation potential)
- the duration and frequency of potential effects and time for recovery
- the potential degree of change relative to the existing environment or to criteria of acceptability.

Chevron

# Chevron Integrated Risk Prioritization Matrix

**For the Assessment of HES & Asset Risks from Event or Activity**

**Legend**

*Legend applies to identified HES risks (see guidance documents for additional explanations)*

- **1, 2, 3, 4 - Short-term, interim risk reduction required. Long term risk reduction plan must be developed and implemented.**
- **5 - Additional long term risk reduction required. If no further action can be reasonably taken, SBU management approval must be sought to continue the activity.**
- **6 - Risk is tolerable if reasonable safeguards / management systems are confirmed to be in place and consistent with relevant requirements of the Risk Mitigation Closure Guidelines.**
- **7, 8, 9, 10 - Manage risk. No further risk reduction required. Risk reduction at management / team discretion.**

**Likelihood Descriptions & Index** (with confirmed safeguards)

| Likelihood Descriptions | Likelihood Indices | | Decreasing Likelihood | 6 Incidental | 5 Minor | 4 Moderate | 3 Major | 2 Severe | 1 Catastrophic |
|---|---|---|---|---|---|---|---|---|---|
| Event can reasonably be expected to occur in life of facility | 1 | Likely | | 6 | 5 | 4 | 3 | 2 | 1 |
| Conditions may allow the event to occur at the facility during its lifetime, or the event has occurred within the Business Unit | 2 | Occasional | | 7 | 6 | 5 | 4 | 3 | 2 |
| Exceptional conditions may allow consequences to occur within the facility lifetime, or has occurred within the OPCO | 3 | Seldom | | 8 | 7 | 6 | 5 | 4 | 3 |
| Reasonable to expect that the event will not occur at this facility. Has occurred several times in the industry, but not in the OPCO | 4 | Unlikely | | 9 | 8 | 7 | 6 | 5 | 4 |
| Has occurred once or twice within 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 |
| **Safety** | **Workforce:** Minor injury such as a first-aid. *AND* **Public:** No impact | **Workforce:** One or more injuries, not severe. *OR* **Public:** One or more minor injuries such as a first-aid. | **Workforce:** One or more severe injuries including permanently disabling injuries. *OR* **Public:** One or more injuries, not severe. | **Workforce:** (1-4) Fatalities *OR* **Public:** One or more severe injuries including permanently disabling injuries. | **Workforce:** Multiple fatalities (5-50) *OR* **Public:** multiple fatalities (1-10) | **Workforce:** Multiple fatalities (>50) *OR* **Public:** multiple fatalities (>10) |
| **Health** (Adverse effects resulting from chronic chemical or physical exposures or exposure to biological agents) | **Workforce:** Minor illness or effect with limited or no impacts on ability to function and treatment is very limited or not necessary *AND* **Public:** No impact | **Workforce:** Mild to moderate illness or effect with some treatment and/or functional impairment but is medically managable *OR* **Public:** Illness or adverse effect with limited or no impacts on ability to function and medical treatment is limited or not | **Workforce:** Serious illness or severe adverse health effect requiring a high level of medical treatment or management *OR* **Public:** Illness or adverse effects with mild to moderate functional impairment requring medical treatment. | **Workforce** (1-4): Serious illness or chronic exposure resulting in fatality or significant life shortening effects OR **Public:** Serious illness or severe adverse health effect requiring a high level of medical treatment or management. | **Workforce** (5-50): Serious illness or chronic exposure resulting in fatality or significant life shortening effects *OR* **Public** (1-10): Serious illness or chronic exposure resulting in fatality or significant life shortening effects. | **Workforce** (>50): Serious illness or chronic exposure resulting in fatality or significant life shortening effects *OR* **Public** *(>10):* Serious illness or chronic exposure resulting in fatality or significant life shortening effects. |
| **Environment** | Impacts such as localized or short term effects on habitat, species or environmental media. | Impacts such as localized, long term degradation of sensitive habitat or widespread, short-term impacts to habitat, species or environmental media | Impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species or environmental media | Impacts such as significant, widespread and persistant changes in habitat, species or environmental media (e.g. widespread habitat degradation) . | Impacts such as persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species. | Loss of a significant portion of a valued species or loss of effective ecosystem function on a landscape scale. |

**The above legend applies only to HES risks, where risk levels 1-6 are actionable and mandatory.**
**For risks that may result in facility damage, business interruption, loss of product, the "Assets" category below should be used.**
**Asset risk reduction is at the discretion of management. Under no circumstances may a direct or indirect translation of Asset loss to HES consequences, or between any discrete categories of HES consequences be inferred.**

**Consequence Descriptions & Index** (without safeguards)

| Consequence Indices | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|
| | Incidental | Minor | Moderate | Major | Severe | Catastrophic |
| **Assets** (Facility Damage, Business Interruption, Loss of Product) | Minimal damage. Negligible down time or asset loss. Costs < $100,000. | Some asset loss, damage and/or downtime. Costs $100,000 to $1 Million. | Serious asset loss, damage to facility and/or downtime. Costs of $1-10Million. | Major asset loss, damage to facility and/or downtime. Cost >$10 Million but <$100 Million. | Severe asset loss or damage to facility. Significant downtime, with appreciable economic impact. Cost >$100MM but <$1billion. | Total destruction or damage. Potential for permanent loss of production. Costs >$1billion |

**This matrix is endorsed for use across the Company.**
**It is not a substitute for, and does not override any relevant legal obligations.**
**Under no circumstances should any part of this matrix be changed or modified, adapted or customized.**
**This matrix identifies health, safety, environmental and asset risks and is to be used only by qualified and competent personnel.**
**Where applicable it is to be used within the Riskman2 structure and governance of an OE Risk Management Process. If applied outside of these Processes, it is also mandatory to manage identified intolerable risks and comply with the Risk Mitigation Closure Guidelines.**

**Figure 4-1: Chevron Corporation Integrated Risk Prioritization Matrix**

## 4.1 Control Measure Identification and ALARP Evaluation

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

In alignment with NOPSEMA's ALARP Guidance Note (Ref. 38; GN0166), CAPL's D&C Team have adapted the approach developed by Oil and Gas UK (Ref. 37) for use in an environmental context to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (Figure 4-2). Specifically, the framework considers impact severity and several guiding factors:

- activity type
- risk and uncertainty
- stakeholder influence.

A Type A decision is made if the risk is relatively well understood, the potential impacts are low, activities are well practised, and there is no significant stakeholder interest. However, if good practice is not sufficiently well-defined, additional assessment may be required.

A Type B decision is made if there is greater uncertainty or complexity around the activity and/or risk, the potential impact is moderate, and the risk generates several concerns from stakeholders. In this instance, established good practice is not considered sufficient and further assessment is required to support the decision and ensure the risk is ALARP.

A Type C decision typically involves sufficient complexity, high potential impact, uncertainty, or stakeholder interest to require a precautionary approach. In this case, relevant good practice still has to be met, additional assessment is required, and the precautionary approach applied for those controls that only have a marginal cost benefit.

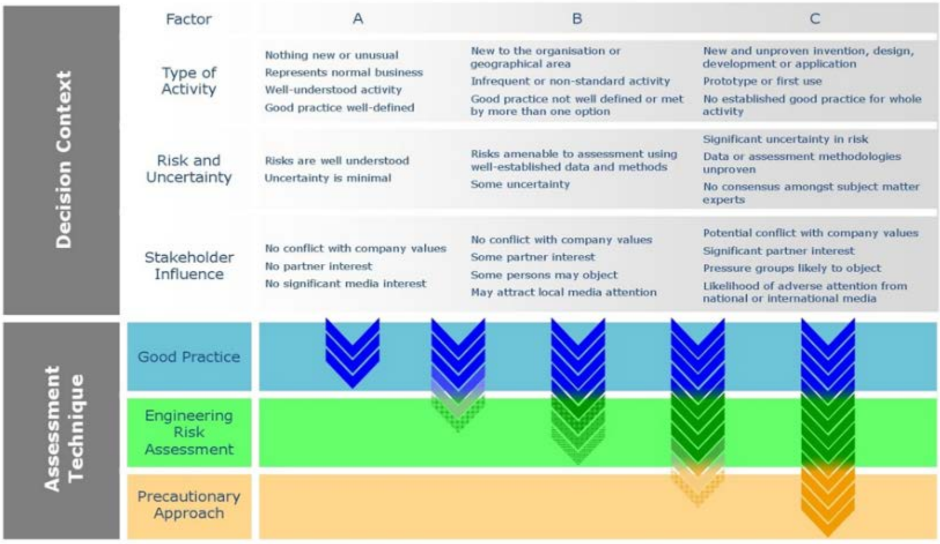


**Figure 4-2: ALARP Decision Support Framework**

*(Source: Ref. 36)*

## 4.2 Risk and Impact Acceptance Criteria

NOPSEMA provides guidance on demonstrating that impacts and risks will be of an acceptable level (Ref. 38). This guidance indicates that an 'acceptable level' is the level of impact or risk to the environment that may be considered broadly acceptable with regard to all relevant considerations including:

- principles of ecologically sustainable development (ESD)
- legislative and other requirements (including laws, policies, standards, conventions)
- matters protected under Part 3 of the EPBC Act, consistent with relevant policies, guidelines, Threatened species recovery plans, plans of management, management principles etc.
- internal context (e.g. consistent with titleholder policy, culture, and company standards)
- external context (the existing environment and stakeholder expectations)
- defined level of acceptability.

These principles generally align with Chevron Corporations RiskMan2 procedure, which states that a level of potential impact or risk is acceptable where:

- world-class performance can be achieved (as indicated by applying best applicable industry practices and standards that are consistent with titleholder policy, culture, and company standards)
- all practicable control measures have been identified to protect people and the environment (including those identified via consultation with relevant persons)
- all regulatory and statutory requirements are to be implemented (including an assessment of whether the activity is consistent with the principles of ESD outlined in section 3A of the EPBC Act; and the precautionary principle set out in section 391 of the EPBC Act)
- a determination that all reasonable risk reduction measures have been taken.

Table 4-1 outlines the criteria that CAPL have used to demonstrate that impacts and risks from each of the identified aspects are acceptable.

**Table 4-1: Acceptability Criteria**

| Acceptability Test | How Applied |
|---|---|
| Principles of ESD | Is there the potential to affect biological diversity and ecological integrity? (Consequence Level between Moderate [4] and Catastrophic [1])<br>Do activities have the potential to result in permanent/ irreversible; medium- to large- scale; moderate- to high-intensity environmental damage? |
| | If yes: Is there significant scientific uncertainty associated with aspect? |
| | If yes: Are there additional measures to prevent degradation of the environment from this aspect? |
| Relevant environmental legislation and other requirements | Confirm that the management of impacts and risks is consistent with relevant Australian environmental management laws and other regulatory and statutory requirements. |
| Internal context | Confirm that all good practice control measures have been identified for this aspect through CAPL's management systems and that the management of impacts and risks is consistent with company policy, culture, and standards. |
| External context | What objections and claims regarding this aspect have been made, and how have they been considered / addressed? |
| Defined acceptable level | For environmental impacts arising from planned aspects / activities, is the consequence less than Severe – 2 (i.e. is the Consequence ranked between 3 and 6)? |

| Acceptability Test | How Applied |
|---|---|
| | For potential environmental impacts and risks, is the risk level ranked lower than 4 (i.e. between 5 and 10)? |

# 5 Environmental Risk Assessment and Management Strategy – Petroleum Activity

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

## 5.1 Physical Presence (Marine Users and Marine Fauna)

<table>
<tr><th colspan="2">Cause of Aspect</th></tr>
<tr><td colspan="2">These activities were identified as having the potential to result in the physical interaction with either marine fauna or other marine users within the operational area:<br>• Well abandonment<br>• MODU positioning<br>• Support operations.</td></tr>
<tr><th colspan="2">Hazard</th></tr>
<tr><td colspan="2">Physical interaction has the potential to result in:<br>• injury or death of marine fauna;<br>• a disruption to commercial activities.</td></tr>
<tr><th>Potential Consequence Summary</th><th>Ranking</th></tr>
<tr><td>Injury or death of marine fauna<br>Surface-dwelling macrofauna are the species most at risk from this hazard and thus are the focus of this evaluation. As identified in Section 3.1.1.2, several whale species listed as either Threatened and/or Migratory under the EPBC Act have the potential to occur within the operational area. Because no known feeding, calving, and resting areas exist within the operational area, most of these species are expected to be transient.<br>These BIAs overlap or are located adjacent to the operational area as defined in the EP:<br>• Pygmy Blue Whale (migration)<br>• Humpback Whale (migration)<br>• Whale Shark (foraging)<br>• Flatback Turtle (internesting).<br>Limited data exists on potential ‘at risk’ fauna such as turtles and Whale Sharks, possibly due to lack of collisions being noticed and lack of reporting; however, marks observed on animals show that strikes have occurred (Ref. 61). Cetaceans were the focus of this evaluation as they provide a representative case to enable an evaluation of consequence to be undertaken.<br>Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels and facilities. The reaction of whales to the approach of a vessel varies—some species remain motionless when near a vessel, while others are curious and often approach ships that have stopped or are slow moving; they generally do not approach, and sometimes avoid, faster-moving ships (Ref. 62).<br>Collisions between larger vessels with reduced manoeuvrability and large, slow-moving cetaceans occur more frequently where high vessel traffic and cetacean habitat occurs (Ref. 63). Laist et al. (Ref. 64) found that larger vessels with reduced manoeuvrability moving >10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling faster than 14 knots. Vessels typically used to support drilling activities do not have the same limitations on manoeuvrability and would not be moving at these speeds when conducting activities within the scope of the EP.<br>There have been recorded instances of cetacean deaths in Australian waters (e.g. a Bryde’s Whale in Bass Strait in 1992) (Ref. 63), although the data indicate such deaths</td><td>Incidental (6)</td></tr>
</table>

| | |
|---|---|
| are more likely to be associated with container ships and fast ferries. Mackay (Ref. 65) reports that four fatal and three non-fatal collisions with Southern Right Whales were recorded in Australian waters between 1950 and 2006, with one fatal and one non-fatal collision reported between 2007 and 2014.<br>If a fauna strike occurred and resulted in death, it is not expected to have a detrimental effect on the overall population; this event would result in a limited local degradation of the environment (expected individual impacts) but is not expected to affect any populations. | |
| **Disruption to commercial activities**<br>As identified in Section 3.2.2, several commercial fisheries have licences that overlap the operational area associated with the EP. Consultation with AMSA suggest that a larger number of vessels may be encountered within the Jansz–Io production licences due to the presence of a shipping fairway; however, other vessels may be encountered within any of the production licences.<br>Stakeholder engagement, along with annual fishing records, indicates that the proposed activities or presence of the additional production wells are not expected to result in an impact to commercial operations (via loss of catches or damage to fishing equipment)<br>However, relatively small numbers of fishing vessels are likely to be encountered near the operational area with even fewer expected to trawl near the wells. The most credible impact to other marine users would be the minor deviation of commercial vessels around the MODU. The safety exclusion zone is only 500 m, so any required deviation is not expected to impact on the functions, interests, or activities of other marine users (as confirmed from stakeholder consultation records).<br>Consequently, any impacts would be practically indistinguishable, with little to no potential impacts to, or concerns from, affected external stakeholders. | **Incidental (6)** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans – The Australian Guidelines for Whale and Dolphin Watching (Ref. 67)<br>o Vessel Master<br>o Marine Fauna Observations<br>o Fauna observation actions<br>o Fauna interaction management actions<br>o Incident reporting<br>• Commonwealth Navigation Act 2012<br>o petroleum safety zones<br>o pre-start notifications<br>• CAPL's Marine Safety Reliability and Efficiency (MSRE) Standardised OE Process (Ref. 66)<br>o Vessel crew<br>o Navigational equipment | **Consequence** | Incidental (6) |
| | | **Likelihood** | Seldom (3) |
| | | **Risk Level** | Low (8) |

## 5.2 Light Emissions

<table>
<tr><th colspan="2">Cause of Aspect</th></tr>
<tr><td colspan="2">These activities were identified as having the potential to result in the generation of light emissions:<br>• Wellbore clean-up and flowback (flaring activities)<br>• Support operations (navigational and work lighting).<br>Monitoring undertaken by Woodside (Ref. 68) indicates that light density (navigational lighting) attenuated to below 1.00 lux and 0.03 lux at distances of 300 m and 1.4 km, respectively, from a MODU. Light densities of 1.00 and 0.03 lux are comparable to natural light densities experienced during deep twilight and during a quarter moon. For this assessment, it is conservatively assumed that within a distance of 1.4 km, there is the potential to attract marine species.</td></tr>
<tr><th colspan="2">Hazard</th></tr>
<tr><td colspan="2">A change in ambient light levels resulting in a localised light glow may impact receptors by:<br>• acting as an attractant to light-sensitive species (e.g. seabirds, fish), in turn affecting predator–prey dynamics.</td></tr>
<tr><th>Potential Consequence Summary</th><th>Ranking</th></tr>
<tr><td>Acting as an attractant to light-sensitive species<br>There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding, or breeding behaviours of cetaceans. Cetaceans predominantly use acoustic senses rather than visual sources to monitor their environment (Ref. 69), so light is not considered a significant factor in cetacean behaviour or survival.<br>Light may attract many species of fish, reptiles, and seabirds. Two BIAs associated with marine fauna species known to be sensitive to light emissions overlap (or are adjacent to the wells within the Gorgon field (17 wells in total under the EP):<br>• Wedge-tailed Shearwater (breeding / foraging) (listed as Migratory but not identified by the protected matters search)<br>• Flatback Turtle (internesting).<br>Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Ref. 70) and that lighting can attract birds from large catchment areas (Ref. 71). These studies indicate that migratory birds are attracted to lights on offshore platforms when travelling within 5 km from the light source, but their migratory paths are unaffected outside this zone (Ref. 72).<br>As the operational area is (at its closest) 65 km north-west of Barrow Island (the closest coastline), only a small number of Threatened or Migratory listed seabird species would be expected to be present in this area. The operational area is outside the 60 km buffer from Barrow Island and the Montebello Islands, described in the Turtle Recovery Plan as critical habitat (Ref. 30). It is not expected that light emissions acting as an attractant to a small number of individual seabirds would result in any impact to the individual or to the greater population.<br>Pendoley (Ref. 73) discovered that in the absence of illumination from the moon, glow from tower flares may influence the orientation of turtles at close range (30–100 m). Based on findings from Pendoley (Ref. 73) and Hick (Ref. 74), it is expected that light emissions from this activity would result in a very small exposure area, which for this evaluation is conservatively determined to be within 500 m of the MODU, and thus the number of marine turtles exposed would be limited.<br>The Recovery Plan for Marine Turtles in Australia (Ref. 30) identifies light emissions as a key threat, because it disrupts critical behaviours. However, this Recovery Plan notes that critical behaviours are focused on nesting behaviours (near coast), as well as disrupting hatchling orientation and sea-finding behaviours of hatchlings. Given the distance offshore and limited exposure associated with this activity (0.007% exposure to the BIA assuming 500 m exposure footprint per well [0.79 km$^2$] and noting light emissions are only present for one well at a time, and a BIA area of 11 309 km$^2$), light emissions are not expected to affect the critical behaviours discussed in the Turtle Recovery Plan. If individual internesting turtles were attracted to the light, it is not</td><td>N/A</td></tr>
</table>

| | |
|---|---|
| expected that this would significantly alter sensitive behaviours that would lead to individual or greater population impacts due to the distance offshore.<br>Based on the distance to critical nesting habitat (65 km to Barrow Island and ~69 km to the Montebello Islands from the closest [Gorgon] wells), limited sensitivities, and expected outcome that the limited exposure will not result in any impacts at an individual or population level, no further evaluation of this aspect has been undertaken. | |

## 5.3 Underwater Sound

| Cause of Aspect | |
|---|---|
| These activities were identified as having the potential to result in the generation of underwater sound emissions:<br>• well evaluations (VSP)<br>• support operations (MODU operations)<br>• support operations (vessel operations)<br>• support operations (helicopter operations). | |
| **Hazard** | |
| The generation of underwater sound has the potential to affect marine fauna through:<br>• localised and temporary fauna disturbance<br>• auditory impairment, Permanent Threshold Shift (PTS).<br>The particular values and sensitivities with the potential to be exposed to sound emissions include these BIAs, which overlap the operational area for the Gorgon wells (comprising 17 wells, of all types):<br>• Humpback Whale (migration BIA)<br>• Pygmy Blue Whale (migration BIA)<br>• Flatback Turtle (internesting BIA)<br>• Continental slope demersal fish communities (KEF). | |
| **Potential Consequence Summary** | **Ranking** |
| **Localised and temporary behavioural disturbance – Pulsed**<br>**Whales**<br>The United States (US) National Marine Fisheries Service (NMFS) guidance for pulsed sound (such as VSP) to prevent temporary thresholds shifts in hearing in marine mammals is 180 dB re 1 µPa SPL RMS with disturbance likely at 160 dB re 1 µPa SPL RMS (Ref. 80).<br>Although there is the potential for a larger number of cetaceans to be present during migration periods, modelling indicates that any adverse impact would have to occur close to the acoustic source. As such, it would only ever be expected that a small number of individuals would be close enough to the acoustic source, as VSP is not a daily activity and is undertaken at selected wells over several days.<br>If migrating cetaceans were present, it is not expected that exposure to these sound levels would result in a significant change to migration behaviours that would result in further impact at both individual or local population levels. As such, the only potential impacts expected would be short-term effects to individuals.<br>**Turtles**<br>McCauley et al. (Ref. 81) reported that exposure to airgun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa RMS, with turtles observed to increase their swimming activity at received sound levels of ~166 dB re 1 µPa RMS. The operational area overlaps a BIA for Flatback Turtles displaying internesting behaviours, but it is at the outer limit of this area (i.e. the 60 km buffer). Because VSP modelling shows noise output is unlikely to exceed 160 dB re 1 µPa @ 1 m at distances >350 m, exposure would only be expected to a small number of individuals (based on exposure to 0.003% of the BIA assuming a 350 m exposure footprint [0.38 $km^2$] and a BIA area of 11 309 $km^2$). Thus, any potential disturbance would result in short-term effects to species.<br>**Fish** | **Incidental (6)** |

| | |
|---|---|
| Given a lack of observational data for impacts to fish from seismic/VSP sources, Popper et al. (Ref. 82) proposed qualitative indicators of relative risk of effects indicating that ~207 dB re 1 µPa SPL peak has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity.<br>As indicated by the modelling, it is not expected that VSP activities would exceed the levels required to result in recoverable hearing impacts on fish. Therefore, this aspect has not been evaluated further. | |
| **Localised and temporary behavioural disturbance – Continuous**<br>**Whales**<br>Using the NMFS guidance for non-pulsed sound, such as vessel noise, a behavioural disturbance limit of 120 dB re 1 µPa RMS has been adopted (Ref. 80). Richardson et al. (Ref. 62) and Southall et al.(Ref. 83) indicate that behavioural avoidance of baleen whales may onset from 140 to 160 dB re 1 µPa RMS or possibly higher.<br>McCauley (Ref. 76; Ref 78) indicates that continuous noise sources from MODU and vessel operations are expected to fall below 120 dB re 1 µPA RMS within 4 km of the MODU / vessel. However, if a DP MODU or drill ship is used, this may be extended to 10 km from the MODU / Vessel (Ref. 201). Hearing damage in marine mammals from shipping noise has not been widely reported (Ref. 84). Although there is the potential for a larger number of cetaceans to be present within 10 km of the operational area during migration periods, given the sparse open-water environment, it is not expected that exposure to these sound levels would result in a significant change to migration behaviours that would result in further impact at individual or local population levels. Therefore, the only potential impacts expected would be short-term effects to individuals.<br>**Turtles**<br>McCauley et al. (Ref. 81) reported that exposure to airgun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa RMS, with turtles observed to increase their swimming activity at received sound levels of ~166 dB re 1 µPa RMS. Although pulsed sounds are expected to result in different impacts, in lieu of appropriate information for continuous sound emissions, CAPL has used 166 dB re 1 µPa RMS as a conservative threshold for evaluating this hazard. Because noise levels generated from vessel operations have the potential to be ~182 dB re 1 µPa, continuous noise emissions have the potential to result in behavioural impacts.<br>The operational area is on the outer limits of the Flatback Turtle internesting BIA (60 km buffer of critical breeding habitat associated with Barrow Island and the Montebello Islands). Because sound levels from vessel operations (or worst-case DP MODU) are known to be well below impact thresholds 10 km from the vessel/ MODU, conservatively ~<2.7% of the BIA would be expected to be exposed (assuming a 10 km exposure footprint [314.16 $km^2$] and a BIA area of 11 309 $km^2$) to noise emissions above levels that would result in behavioural impacts. Thus, any potential disturbance would result in short-term effects to species.<br>**Fish**<br>Due to a lack of observational data on impacts to fish from continuous sources, Popper et al. (Ref. 82) proposed qualitative indicators of relative risk of effects indicating that ~207 dB re 1 µPa SPLpeak has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity. Behavioural impacts in fish are expected to be limited to an initial startle reaction before behaviours either return to normal, or result in fish moving away from the area (Ref. 85).<br>Thrusters from vessels were identified as being the highest continuous sound source for offshore operations, which have been measured to have a peak output of ~182 dB re 1 µPa. No exposures are expected from continuous sources that would be expected to result in recoverable injuries, and thus any behavioural impacts would be temporary. | **Incidental (6)** |
| **Auditory impairment, Permanent Threshold Shift (PTS) – Pulsed and Continuous**<br>**Whales**<br>The criteria set by Southall et al. (Ref. 83) suggests that to cause an instantaneous injury to cetaceans (including porpoises) resulting in a permanent loss in hearing, the sound must exceed 230 dB re 1 µPa (SPLpeak). Consequently, it is not expected that any | **N/A** |

activities under the EP would result in auditory impairment to whales; therefore, this is not discussed further.

**Turtles**

Sound levels that could cause auditory impairment or PTS onset are considered possible at 180 dB re 1 µPa SPL(Ref. 80). Although VSP modelling shows noise output has the potential to exceed 160 dB re 1 µPa @ 1 m within 350 m of the source, studies have identified that avoidance behaviours are expected to occur before sounds exceed the levels that would be expected to result in auditory impairment or PTS (Ref. 86; Ref. 87). Consequently, it is not expected that any activities under the EP would result in auditory impairment to turtles; therefore, this is not discussed further.

**Fish**

Popper et al. (Ref. 82) propose qualitative indicators of the relative risk of effects indicating that ~207 dB re 1 µPa SPLpeak has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity; thus, peak levels would need to be above this to cause auditory impairment. Due to the nature of the proposed activities and sound monitoring completed from similar offshore vessel operations, CAPL does not expect its activities to exceed the thresholds described above that could result in auditory impairment or permanent injury to fish.

Therefore, this potential impact is not considered further.

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • EPBC Act Policy Statement 2.1 – Interaction between Offshore seismic exploration: Part A:<br>o Marine Fauna Observer<br>o Pre-start procedures<br>o Start-up procedures<br>o Shutdown procedures<br>o Operations procedures<br>o Low-visibility / night-time procedures<br>o Planned maintenance system (PMS). | **Consequence** | Incidental (6) |
| | | **Likelihood** | Rare (5) |
| | | **Risk Level** | Low (10) |

## 5.4 Physical Presence – Seabed

| Cause of Aspect |
|---|
| These activities were identified as having the potential to result in disturbance of the seabed:<br>• MODU positioning (anchoring)<br>• Well Abandonment |
| **Hazard** |
| Seabed disturbance has the potential to impact on receptors (including benthic habitats and assemblages, and demersal fish) through:<br>• alteration of benthic habitat<br>• localised and temporary increase in turbidity near the seabed. |

| Potential Consequence Summary | Ranking |
|---|---|
| **Alteration of benthic habitat (anchoring)**<br>The area of benthic habitat disturbed for each well from anchoring can be ~13 000 $m^2$ (Ref. 195). The wells located within the Jansz–Io gas field (known as the Jansz wells) are not within a KEF. Wells within the Gorgon gas field (including seven of the GS2 wells) are located within a single KEF:<br>• Continental slope demersal fish communities. | **Incidental (6)** |

| | |
|---|---|
| Although this KEF has been identified as having the potential to be exposed, as described in Section 3.1.1.1, benthic habitat is expected to comprise soft sediment infauna communities that are widespread and homogenous in the region.<br>Any impact will be limited to the immediate vicinity of the well locations, and thus the extent of potential impact is considered to be localised. As described in Section 3.1.1.1, CAPL has conducted extensive surveys within the production licences to understand the nature and composition of the seabed sediments, and the benthic habitat within the operational area has been shown to comprise soft substrate.<br>Assuming a 13 000 $m^2$ disturbance area and the potential for seven wells to be located within the KEF (Note: The KEF has an area of 33 182 $km^2$) alteration of benthic habitat from anchoring is expected to be limited to incidental disturbance of soft sediment communities. However, due to limited use in the area, similarity of surrounding habitat, and lack of sensitive benthic habitats, it is expected that short-term recovery would occur. There are minimal pressures on this value and the damage would only occur within a small area. Therefore, because there is the potential for short-term localised impact, the potential impact is determined as Incidental (6). | |
| **Localised and temporary increase in turbidity near the seabed**<br>Benthic fauna may be disturbed by the temporary increase in turbidity near the seabed as a result of seabed disturbance. The area of seabed disturbance is limited for each well, and the area of increased turbidity is likely to be a very small and localised around the disturbance points.<br>Impacts of increased turbidity on marine organisms as a result of dredging were extensively examined by CAPL during construction phases of the Gorgon and Wheatstone projects. Specifically, dredging for both projects and rock placement along the Wheatstone Trunkline and portions of the Gorgon and Jansz Feed Gas pipelines have been undertaken; extensive monitoring programs of water quality and benthic receptors have tracked changes in water quality and organism response.<br>Dredging for the Gorgon Project moved ~7 million $m^3$ of sand and calcrete material, while the Wheatstone Project moved ~31 million $m^3$ of sand and underlying rock. Both projects described alterations to water quality as a result of dredging (Ref. 88). However, neither project detected any significant impacts of dredging and altered water quality on coral assemblages (coral cover of whole assemblage), nor on non-coral assemblages including filter feeder (sponges cover etc.), macroalgae (cover), and seagrass (cover, seed, and shoot density). Turbidity monitoring programs implemented during construction activities indicated plumes were highly localised and resulted in only short-term exposures (Ref. 89; Ref. 90; Ref. 91). Post-installation monitoring indicates no changes above natural variation (Ref. 91).<br>The nature and scale of the petroleum activity covered by the EP is significantly smaller than that of the dredging programs, which recovered after seabed disturbance. In addition to the location of the wells and lack of sensitive benthic features, turbidity resulting from the described activities is not expected to result in any environmental impacts and hence is not discussed further. | **N/A** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • Benthic Surveys<br>• Section 72 of the OPGGS Act and the Department of Industry, Innovation and Science's *Offshore petroleum decommissioning guideline*, January 2018<br>  o Removal of well head from abandoned well<br>• Regulation 13 (4) of the OPGGS(E)R<br>  o Ongoing Consultation | **Consequence** | Minor (5) |
| | | **Likelihood** | Unlikely (4) |
| | | **Risk Level** | Low (8) |

## 5.5 Atmospheric Emissions

| Cause of Aspect | |
|---|---|
| These activities were identified as having the potential to result in air emissions:<br>• Well testing and flowback<br>• Well intervention<br>• Well workovers<br>• Support operations – MODU operations<br>• Support operations – vessel operations. | |
| **Hazard** | |
| Generation of atmospheric emissions has the potential to result in:<br>• chronic effects to sensitive receptors from localised and temporary decrease in air quality from diesel combustion and other atmospheric emissions such as venting. | |
| **Potential Consequence Summary** | **Ranking** |
| Venting during well workovers or well testing and flowback would be undertaken intermittently over several days. Volumes released are controlled so that only small amounts are released at any given time. Given the slow release rates and volumes associated with this activity, it is not expected to generate exposures significant enough to result in impacts to any identified environmental receptors.<br>Modelling was undertaken for nitrogen dioxide ($NO_2$) emissions from MODU power generation for another offshore project (Ref. 92). $NO_2$ is the focus of the modelling because it is considered the main (non-greenhouse) atmospheric pollutant of concern, with larger predicted emission volumes compared to other pollutants, and because of the potential for $NO_2$ to impact on human health (as a proxy for environmental receptors). Results of this modelling indicate that on an hourly average, there is the potential for an increase in ambient $NO_2$ concentrations of 0.0005 ppm within 10 km of the source and an increase of less than 0.1 µg/m$^3$ (0.00005 ppm) in ambient $NO_2$ concentrations more than 40 km away.<br>The Australian Ambient Air Quality National Environmental Protection (Air Quality) Measures (NEPM) recommends that hourly exposure to $NO_2$ is <0.12 ppm and annual average exposure is <0.03 ppm. Modelling from another drilling program indicated that even the highest hourly averages (0.00039 ppm or 0.74 µg/m$^3$) were restricted to a distance ~5 km from the MODU (Ref. 92).<br>Any exposure from these operations would be expected to be below NEPM standards; therefore, no further evaluation of this aspect was undertaken. | **N/A** |

## 5.6 Planned Discharge

### 5.6.1 Planned Discharge – Drilling Fluids and Cuttings

| Cause of Aspect |
|---|
| This activity has the potential to result in planned discharges of drilling cuttings and adhered drilling fluids:<br>• Drilling fluids and cuttings handling and disposal |
| **Hazard** |
| A planned discharge of drilling cuttings and fluids has the potential to result in effects to marine fauna and habitat through:<br>• increased turbidity of the water column<br>• smothering seabed habitat and altering seabed substrate<br>• potential chemical toxicity in the water column and sediment<br>• accumulative impact from previous drilling program. |

| Potential Consequence Summary | Ranking |
| --- | --- |
| **Increased turbidity of the water column**<br>The particular values and sensitivities with the potential to be exposed to increased turbidity in the water column include:<br>• Humpback Whale (migration BIA)<br>• Pygmy Blue Whale (migration BIA)<br>• Whale Shark (foraging)<br>• Flatback Turtle (internesting BIA)<br>• Continental slope demersal fish communities (KEF).<br>The environmental receptors with the potential to be exposed, and considered to be most sensitive to an increase in turbidity levels from this release, include pelagic fish (and larvae) associated with the continental slope demersal fish communities in the area around the well locations.<br>Planned discharge of cuttings and adhered fluids from the surface will occur intermittently during drilling. Neff (Ref. 93) states that although the total volumes of muds and cuttings discharged to the ocean during the drilling of a well are large, the impacts in the water column environment are minimal, because discharges of small amounts of materials are intermittent.<br>When cuttings are discharged to the ocean, the larger particles, which represent ~90% of the mass of the mud solids, form a plume that settles quickly to the bottom (or until the plume entrains enough sea water to reach neutral buoyancy). Hinwood et al. (Ref. 94) indicate that larger particles of cuttings and adhered muds (90–95%) fall to the seabed close to the release point.<br>The American Chemistry Council (Ref. 95) found that as NADF adhered to cuttings, the cuttings tended to clump together in particles that rapidly settle to the seabed, suggesting that synthetic-based mud-coated cuttings tend to be less likely to increase water column turbidity.<br>About 10% of the mass of mud solids forms another plume in the upper water column that drifts with prevailing currents away from the platform and is diluted rapidly in the receiving waters (Ref. 93; Ref. 96). Hinwood et al. (Ref. 94) and Neff (Ref. 93) note that within 100 m of the discharge point, a drilling cuttings and fluid plume released at the surface will have diluted by a factor of at least 10 000; whilst Neff (Ref. 93) states that in well-mixed ocean waters (as is likely to be the case within the operational area), drilling mud is diluted by more than 100-fold within 10 m of the discharge point.<br>Neff (Ref. 93) states that there is a large body of knowledge indicating a discharge of cuttings with adhered fluids dilutes rapidly, and uses several case studies from different regions to support this. Dispersion is influenced by two factors: fluid type (particle size) and ocean current speed. In the reference cases, water-based fluids were used and surface current speeds were ~0.2 m/s (between 0.15 and 0.3 m/s). As currents in the operational area are ~0.3–0.4 m/s (Ref. 97), and WBMs are expected to cause the largest turbidity risk for this program, the dispersion extents in Neff (Ref. 93) are considered representative for this program.<br>Using the widely-accepted dilution factor of 10 000 (Ref. 93), cuttings (and adhered fluids) are expected to reach 100 mg/L within 100 m of the MODU. Using a conservative ocean current speed of 0.1 m/s (which is well below average current speeds in the operational area), these discharges are expected to disperse to 100 mg/L within ~16 minutes.<br>The area potentially impacted by turbidity was conservatively set at 500 m from the MODU. That is, it is expected that 500 m away from the MODU, turbidity concentrations are below impact thresholds (at this distance, these discharges are expected to disperse within ~83 minutes). Jenkins and McKinnon (Ref. 98) reported that levels of suspended sediments >500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods greater than 96 hours. Jenkins and McKinnon (Ref. 98) also indicate that levels of 100 mg/L are likely to affect the larvae of several marine invertebrate species, and that fish eggs and larvae are more vulnerable to suspended sediments than older life stages. | **Incidental (6)** |

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| Consequently, any impact to fish larvae would be limited due to the small exposure footprint, high natural mortality of larvae (Ref. 99), and dispersive characteristics of the open water in the operational area. Impacts to the other identified values and sensitivities are not expected. Although the Turtle Recovery Plan (Ref. 30) identifies chemical and terrestrial discharges as a key threat, acute impacts were associated with indirect events via destruction of seagrass habitat. The operational area is outside the 60 km buffer, described in the Turtle Recovery Plan as critical habitat. The operational area does intersect with a Flatback Turtle BIA; however, this BIA is for internesting, not foraging, behaviours. Based on the understanding that benthic environments within the operational area comprise soft sediment communities, and the operational area is not a foraging area for Flatback Turtles, impacts to marine turtles are not expected.<br>Considering the relatively short-lived nature of the intermittent plumes, and that concentrations of suspended solids rapidly dissipate with the prevailing currents, the potential impacts on fish and their larvae are expected to be minimal. Thus, there is the potential for localised, short-term impact on species resulting in an Incidental (6) consequence. | |
| **Smothering and alteration of the seabed**<br>The values and sensitivities with the potential to be exposed to smothering and alteration of the seabed include:<br>• Continental slope demersal fish communities (KEF).<br>Although this value and sensitivity has the potential to be exposed, as described in Section 3.1.1.1, benthic habitat is expected to comprise soft sediment infauna communities that are widespread and homogenous in the region.<br>Hinwood et al. (Ref. 94) explain that the main environmental disturbance from discharging drilling cuttings and fluids is associated with the smothering and burial of sessile benthic and epibenthic fauna. Neff (Ref. 96) suggests that synthetic-based mud-coated cuttings tend to clump and settle rapidly as large particles over a small area near the discharge point and tend not to disperse rapidly, indicating that when drilling with synthetic-based muds, extent of dispersion is expected to decrease, but thickness of cuttings piles is expected to increase.<br>In collaboration with the University of Western Australia, the University of Sydney, and the University of Wollongong, CAPL has previously engaged the South East Asian Scientific and Environmental ROV Partnership Using Industrial Technology (SEA SERPENT) to conduct benthic surveys of the operational area. These surveys were conducted on various wells from 2010 in water depths between 200 m and 1000 m. Specifically, surveys were undertaken of the GOR-3C well, which is one of the existing production wells covered by the EP (i.e. within the operational area). GOR-3C is located in WA-37-L, with a water depth of 198 m, and was drilled with both water-based fluids and NADF, and is representative of the Gorgon wells. This benthic survey was conducted 34 days after drilling commenced.<br>The survey completed at GOR-3C is considered suitable to provide an indication of the potential extent of seabed deposition in the operational area, because the water depths from the survey location are similar and current speeds are also comparable. The outcomes from these surveys were:<br>• For all well locations (including GOR-3C), the benthic environment was consistently identified as flat, featureless, with fine sediment.<br>• The extent of cuttings piles were consistently observed within a 50 to100 m radius from the wellhead.<br>• Multivariate data analysis of pre- and post-spud surveys reveals no significant difference between the benthic activities of organisms under differing spoil conditions, indicating there is little (if any) impact to soft sediment benthic organisms.<br>The benthic surveys undertaken by CAPL indicate that a heavy cover of drilling cuttings and fluids are found within 20 m of the well, with moderate cover generally within 50 to 100 m, and light cover more than 100 m from the well (Ref. 100). In addition, these surveys observed that light drill spoil did not cause benthic infauna to have to re-establish their burrows, which indicates exposures further than 100 m are not expected to result in any smothering impacts (Ref. 100). These findings are supported by other studies around the world that indicate biological effects from seabed communities associated with the deposition of NADF cuttings are limited to ~500 m from a well site | **Minor (5)** |

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| (Ref. 101,;Ref. 102; Ref. 103; Ref. 104; Ref. 105). Therefore, an impact area of 500 m was conservatively set.<br>Neff (Ref. 96) found that recolonisation of synthetic-based, mud-cuttings piles in cold-water marine environments began within one to two years of ceasing discharges, once the hydrocarbon component of the cutting piles biodegraded. Additional studies indicate that benthic infauna and epifauna recover relatively quickly, with substantial recovery in deepwater benthic communities within three to ten years (Ref. 106). The surveys at GOR-3C identified that even after 34 days of spud, bioturbation was observed in those areas covered by moderate drill spoil, indicating recovery is expected to occur rapidly for these wells (Ref. 100).<br>These studies were associated with cold, deepwater environments, but recovery processes in the operational area are expected to be similar. Although effectiveness and recovery time may differ, those species present in soft sediment are well adapted to changes in substrate, especially burrowing species (Ref. 107), therefore recovery is expected to be quicker. A 10-year duration is considered suitable for providing a conservative indication of habitat recovery from this activity.<br>This indicates there is the potential for smothering impacts over an area of ~0.79 $km^2$ per well (based on cutting piles with a 500 m radius).<br>Because seven of the GS2 production wells are located within this KEF, there is a total potential disturbance area of 5.53 $km^2$. Based on the spatial area covered by the continental slope demersal fish communities (KEF) (~33 182 $km^2$), there is the potential to disturb ~0.016% of the KEF during the GS2 drilling program. However, any disturbance is expected to be limited to soft sediment infauna communities. These communities are known to recover over a longer period of time (Ref. 85), therefore the potential impacts associated with this program are considered to be limited to localised long-term degradation of habitat and thus Minor (5). | |
| **Potential sediment chemical toxicity**<br>The values and sensitivities with the potential to be exposed to chemical toxicity from cuttings with adhered drilling fluids include:<br>• Continental slope demersal fish communities (KEF).<br>Although this value and sensitivity has the potential to be exposed, as described in Section 3.1.1.1, benthic habitat is expected to comprise soft sediment infauna communities that are widespread and homogenous in the region.<br>Some components of NADF are potentially bioaccumulative. Although there is potential for bioaccumulation, Melton et al. (Ref. 108) reason that the ability of organisms to oxidise and expel aromatics means that while hydrocarbons may be bioavailable, they are not expected to bioconcentrate.<br>As per the previous risk evaluation above, the extent of seabed disturbance from these planned discharges is ~500 m. This is consistent with the results from the International Association of Oil and Gas Producers (Ref. 109), which indicates NADF cuttings discharges in water depths <300–400 m are usually deposited on sediments within 100 to 200 m from the discharge point. An impact area of 500 m was conservatively set.<br>When studying the impacts of drilling in Bass Strait, Terrens et al. (Ref. 105) observed biological effects within 100 m of the drilling site shortly after drilling; recovery of seabed communities across the area were reported within four months. Terrens et al. (Ref. 105) reported that after 11 months NADF was not detectable in sediments, indicating that recovery of the seabed is through a combination of dispersion and biodegradation. Neff (Ref. 96) found that recolonisation of synthetic-based, mud-cuttings piles in cold-water marine environments began within one to two years of ceasing discharges, once the hydrocarbon component of the cutting piles biodegraded. Additional studies indicate that benthic infauna and epifauna recover relatively quickly, with substantial recovery in deepwater benthic communities within three to ten years (Ref. 106). These studies were associated with cold, deepwater environments, but the recovery processes are expected to be similar. Although effectiveness and recovery time may differ, the species present in soft sediment are well adapted to changes in substrate, especially burrowing species (Ref. 107); therefore, recovery is expected to be quicker.<br>In addition to degradation of drilling fluids, physical dispersion of drilling cuttings and fluids can be expected, given the influence of subsea currents in the area. Exposure duration is conservatively estimated at ~10 years. Consequently, a conservative | **Minor (5)** |

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| recovery duration of 10 years is used for evaluating the potential impacts and risks associated with this activity.<br>Based on the understanding that there is the potential for biological impacts within 500 m of the well location, these discharges are expected to have toxicity impacts on benthic infauna. This indicates there is the potential for chemical toxicity impacts over an area of ~0.79 $km^2$ per well (based on cutting piles with a 500 m radius) within the identified KEF. Because seven of the GS2 production wells are located within this KEF, there is a total disturbance footprint of 5.53 $km^2$. Based on the spatial area covered by the continental slope demersal fish communities (KEF) (~33 182 $km^2$), there is the potential to disturb ~0.016% of the KEF (for the whole GS2 production drilling campaign).<br>However, benthic infauna within soft sediment communities are not considered to be restricted to the operational area and are well represented in the wider region. These communities are known to recover from chemical toxicity effects and consequently, the potential impacts associated with this program are considered to be localised long-term degradation of habitat and therefore Minor (5). | |
| **Potential chemical toxicity to fauna in the water column**<br>The values and sensitivities with the potential to be exposed to chemical toxicity in the water column include:<br>• Humpback Whale (migration BIA)<br>• Pygmy Blue Whale (migration BIA)<br>• Flatback Turtle (internesting BIA).<br>The toxicity of widely used synthetic-based fluids (NADF) to zooplankton is considered low, with acute toxicity >10 000 ppm for nonaqueous-based fluids and drilling fluids (Ref. 110). As WBMs are inherently less toxic, the impact threshold for NADF was used for this evaluation. Neff (Ref. 93) states that in well-mixed ocean waters (as is likely to be the case within the drilling area), drilling mud is diluted by more than 100-fold within 10 m of the discharge point, indicating that, following dilution, concentrations would be well below acute impact levels. This is further demonstrated by Melton et al. (Ref. 108), who used modelling to demonstrate that WBM and NADF cuttings and solids within the water column fall below the United States Environment Protection Agency (USEPA) minimum 96-hour LC50 for drilling fluids within the first few metres of a surface discharge point. The surface current speed used to build the model was 0.17 m/s. Currents in the region are ~0.3–0.4 m/s; therefore, this assessment is considered suitable (Ref. 97).<br>Knowing that drilling fluids dilute 100-fold within 10 m of the discharge (Ref. 74), and assuming the concentration of drilling fluids upon release is 100% or 1 000 000 ppm, it is expected that concentrations of drilling fluid would fall below acute toxicity thresholds (10 000 ppm) within 10 m from the MODU.<br>Using a conservative ocean current speed of 0.1 m/s (Note: Currents in the region can be well above this [Ref. 97]), these discharges are expected to disperse to 10 000 ppm within two minutes.<br>Various other studies support the understanding that only organisms very close to the discharge point will be exposed to chemical concentrations above toxicity thresholds (Ref. 111; Ref. 112; Ref. 113; Ref. 114; Ref. 108). However, a conservative impact area (at which chemical concentrations are expected to result in an impact) of 500 m was set; at this distance these discharges are expected to disperse within ~83 minutes.<br>None of the BIAs suggest sedentary behaviour would occur within the operational area. Consequently, only transient marine fauna would have the potential to be exposed to these discharges. Because no specific thresholds are available for the identified values and sensitivities, and because the concentrations of drilling fluid would fall below acute toxicity thresholds (10 000 ppm) for species even more sensitive to changes in water quality, any impact to values and sensitivities would be negligible. Even with the conservative impact area set for this discharge, exposures to transient individuals would be limited and are expected only for short durations. Consequently, any potential impact is expected to be limited to transient individuals, with recoverable concentrations resulting in localised, short-term impacts on species or a potential Incidental (6) consequence. | **Incidental (6)** |
| **Cumulative impact from previous Gorgon drilling program** | **Minor (5)** |

As described in the various evaluations above, it was concluded that the only hazards with the potential for longer-term impacts were associated with:

- potential sediment chemical toxicity
- smothering and alteration of the seabed.

These were both deemed to have a localised impact footprint of ~0.79 $km^2$ per well, based on a conservative distance of potential impact.

Of the existing 18 production wells completed in 2014, only the eight Gorgon wells were drilled within the continental slope demersal fish communities (KEF), giving a total area of potential impact of 6.32 $km^2$ (or ~0.019% of the total KEF area). Although recovery is expected to have started, full recovery of the area is expected to take a longer time (~10 years); for more information, see the consequence evaluation above for potential sediment chemical toxicity and smothering and alteration of the seabed.

The additional seven GS2 production wells to be drilled within the KEF will increase the disturbance footprint from eight to 15 wells, resulting in a total disturbance to a single KEF of 11.85 $km^2$.

Based on the spatial area covered by the Continental slope demersal fish communities (KEF), there is the potential for a cumulative disturbance footprint of ~0.035% of the total KEF.

Impacts to other identified values and sensitivities are not expected. Although the Turtle Recovery Plan (Ref. 30) identifies chemical and terrestrial discharges as a key threat, acute impacts are associated with indirect events via destruction of seagrass habitat. The operational area is outside the 60 km buffer described in the Turtle Recovery Plan. Although a Flatback Turtle BIA intersects the operational area, it is associated with internesting, not foraging, behaviours. Based on the understanding that benthic environments within the operational area comprise soft sediment communities, and the operational area is not a foraging area for Flatback Turtles, impacts to marine turtles are not expected.

Because the communities expected to be impacted are known to recover over a longer period of time (Ref. 106), and given the cumulative disturbance footprint accounts for ~0.035% of the KEF, the potential cumulative impacts associated with this program are considered to be limited to localised long-term degradation of habitat and therefore Minor (5).

| Decision Context | Summary of Control Measures | Risk Level Summary | |
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| B | • Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development (Ref. 4) – Drilling Fluids and Drilled Cuttings Guidance / CAPL's Offshore Drilling Fluid Guidelines (Ref. 115) chemical selection process<br>o Chemical selection process<br>o Chemicals used in top-hole section to exclude NADF<br>o No overboard discharge of whole NADF<br>o Reduce toxicity in NADF by limiting heavy metal concentrations in barite<br>o Solids control equipment / operator<br>o Monitor % Synthetic on Cuttings (SOC)<br>o submerged caisson<br>• USEPA Guidelines and Standards for Synthetic-Based Drilling Fluids and other Non-Aqueous Drilling Fluids (Ref. 192)<br>o monitor % residual oil in tank wash before discharge | **Consequence** | Minor (5) |
| | | **Likelihood** | Unlikely (4) |
| | | **Risk Level** | Low (8) |

### 5.6.2 Planned Discharge – Cement

| Cause of Aspect | |
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| These activities have the potential to result in planned discharges of cement:<br>• Cementing operations (during drilling and well abandonment)<br>• Support operations (fugitive releases during supply of dry cement to the MODU). | |
| **Hazard** | |
| Planned discharge of cement has the potential to result in effects to marine fauna through:<br>• increased turbidity of the water column<br>• smothering benthic habitat, resulting in the alteration of benthic substrate<br>• potential chemical toxicity in the water column. | |
| **Potential Consequence Summary** | **Ranking** |
| **Increased turbidity of the water column**<br>Modelling of cement discharges for another offshore project (Ref. 92) was used because it provides an appropriate (but conservative) comparison of the potential extent of exposure from this activity. The modelling considered significantly larger slurry discharge than would occur for this drilling program; i.e. 2 T per event at a rate of 1.3 $m^3$/hour (equivalent to ~78 $m^3$/hour).<br>Two hours after the start of discharge, plume concentrations were determined to be between 5 and 50 mg/L with the horizontal and vertical extents of the plume ~150 m and 10 m, respectively (Ref. 92). Five hours after ceasing the discharge, modelling indicates that the plume will have dispersed to concentrations <5 ppm (Ref. 92).<br>The values and sensitivities with the potential to be exposed to increased turbidity in the water column include:<br>• Humpback Whale (migration BIA)<br>• Pygmy Blue Whale (migration BIA)<br>• Whale Shark (foraging BIA)<br>• Flatback Turtle (internesting BIA)<br>• Continental slope demersal fish communities (KEF).<br>The environmental receptors with the potential to be exposed, and considered to be most sensitive to an increase in turbidity levels from this release, include pelagic fish (and larvae) associated with the continental slope demersal fish communities in the area around the well locations.<br>Jenkins and McKinnon (Ref. 98) reported that levels of suspended sediments >500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods greater than 96 hours. Jenkins and McKinnon (Ref. 98) also indicate that levels of 100 mg/L are likely to affect the larvae of a number of marine invertebrate species and that fish eggs and larvae are more vulnerable to suspended sediments than older life stages.<br>The discharges associated with this activity are expected to be intermittent surface discharge of cement from flushing lines and equipment (with volumes from ~1 $m^3$, fugitive emissions during transfer operations (with volumes from 20 mT), or failed cement jobs (with volumes ~47 $m^3$). Particular values and sensitivities are not expected to be exposed for extended periods of time given their transient nature and the lack of sedentary marine fauna behaviours in the operational area. With the expected rapid dispersion, there is limited potential for receptors to be exposed to levels above impact thresholds for the duration that would result in an impact.<br>Based on the estimated discharge volumes identified for this drilling program, and the potential impact thresholds as identified by Jenkins and McKinnon (Ref. 98), this discharge is expected to result in a localised and short-term exposure or Incidental (6) consequence. | **Incidental (6)** |
| **Smothering and alteration of the seabed** | **Incidental (6)** |

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| Most cement discharges that will occur during this activity will be at the seabed during cementing of the conductor and surface casing strings. The potential impacts of smothering from a surface release are expected to be significantly less, due to small volumes, intermittent nature of these discharges, and high potential for dispersal by ocean currents.<br>Other studies have indicated that cement from upper-hole sections displaced to the seabed may affect the seabed around the well to a radius of ~10 m to 50 m from the well, resulting in the potential for disturbance of 0.007 $km^2$ per well.<br>Seven of the GS2 production wells are located within a single KEF (Continental slope demersal fish communities) and have the potential to be exposed to smothering and alteration of the seabed.<br>Benthic habitat is expected to comprise soft sediment infauna communities that are widespread and homogenous in the region. At an estimated disturbance footprint of 0.007 $km^2$ per well for these seven wells results in a potential disturbance footprint of approximately 0.0001% of the whole KEF.<br>Once cement overspill from cementing activities hardens, the area directly adjacent to the well (10–50 m) will be altered, resulting in the destruction of seabed habitat within this area. This impact on soft sediment communities is not expected to affect the diversity or ecosystem function in this area and thus is only considered a localised impact.<br>Cement discharges may result in a localised alteration of seabed substrate within a habitat that is considered homogenous and not overly sensitive. Given the relatively small footprint associated with the subsea release of cement and very small proportion of the KEF potentially impacted by the GS2 campaign (0.0001%), this impact is considered to result in localised impact to habitat with an Incidental (6) consequence. | |
| **Potential chemical toxicity**<br>The potential for toxicity is associated with the chemical additives that are added to cement mixtures; therefore, toxicity associated with the discharge of cement is limited to the subsurface release of cement (not discharge of dry cement).<br>Terrens et al. (Ref. 105) suggest that once the cement has hardened, the chemical constituents are locked into the hardened cement. Consequently, the extent of this hazard is limited to the waters directly adjacent to the displaced subsea cement (expected to be 10–50 m from the well [see above] or pelagic waters within 150 m of the well (Ref. 92) following the surface discharge of cement slurry from washing the cement unit.<br>The values and sensitivities with the potential to be exposed to chemical toxicity include:<br>• Humpback Whale (migration BIA)<br>• Pygmy Blue Whale (migration BIA)<br>• Flatback Turtle (internesting BIA)<br>• Continental slope demersal fish communities (KEF).<br>Seven of the GS2 production wells are located within these sensitivities. The environmental receptors with the potential to be exposed, and considered to be most sensitive to chemical toxicity from this release, include pelagic fish (and larvae) associated with the continental slope demersal fish communities in the area around the well locations.<br>Because cement is expected to harden within a few hours, and because exposure to in-water concentrations are expected to be limited due to the rapid dispersion and dilution through the water column, the potential for acute or chronic effects, although possible, will be limited, and potential impacts will result in a localised, short-term impact to species or habitat – Incidental (6). | **Incidental (6)** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | | **Consequence** | Incidental (6) |

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| | • CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 117)<br>o chemical selection process<br>• Drilling and cementing procedures | **Likelihood** | Unlikely (4) |
| | | **Risk Level** | Low (9) |

### 5.6.3 Planned Discharge – Cooling and Brine Water

| **Cause of Aspect** | |
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| These activities have the potential to result in planned discharges of cooling and brine waters:<br>• Support operations – MODU operations<br>• Support operations – vessel operations. | |
| **Hazard** | |
| Planned discharge of cooling and brine waters has the potential to result in effects to fauna through:<br>• increased water temperature<br>• increased water salinity<br>• potential chemical toxicity in the water column. | |
| **Potential Consequence Summary** | **Ranking** |
| **Increased temperature**<br>Modelling of continuous wastewater discharges (including cooling water) undertaken by Woodside for its Torosa South-1 drilling program in the Scott Reef complex found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being <1 °C above ambient within 100 m (horizontally) of the discharge point, and 10 m vertically (Ref. 68).<br>The environmental receptors with the potential to be exposed to an increase in temperature are transient marine fauna, including whales, sharks, fish, and reptiles. The expected spatial exposure to BIAs associated with these values and sensitivities comprised:<br>• Humpback Whale (migration) – <0.00001% of the BIA<br>• Blue Whale and Pygmy Blue Whale (migration) – <0.00009% of the BIA<br>• Whale Shark (foraging) – <0.00001% of the BIA<br>• Flatback Turtle (internesting) – <0.0002% of the BIA.<br>Marine mammals and fish passing through the area are able to actively avoid entrainment in any heated plume (Ref. 119), and reptiles and sharks are expected to behave similarly. Because marine mammals are not poikilothermic, they are less sensitive to slight changes in water temperature. Although temperature is important for regulating the metabolic process in both marine reptiles and sharks, the Whale Shark has considerable body mass, and thus has sufficient thermal mass to tolerate the limited temperature increases in the unlikely event it was exposed to cooling water discharges. High temperatures discharges can negatively impact the feeding behaviour of marine turtles (Ref. 120); however, the BIA associated with Flatback Turtles is not associated with foraging. Increases in water temperature can induce marine turtle movement (Ref. 120), indicating that potential impacts (other than avoiding the area) are not expected to occur.<br>Given the open nature of the receiving environment, the intermittent nature of the discharge, and the limited exposure to sensitive features, CAPL determined that a discharge of cooling water within the operational area was not expected to result in an impact to the identified values and sensitivities; therefore, this hazard is not evaluated further. | **N/A** |
| **Increased salinity**<br>Brine water will sink through the water column where it will rapidly mix with receiving waters and be dispersed by ocean currents. As such, any potential impacts are expected to be limited to the source of the discharge where brine concentrations are highest. This is confirmed by studies that indicate effects from increased salinity on planktonic | **N/A** |

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| communities in areas of high mixing and dispersion are generally limited to the point of discharge only (Ref. 121).<br>The environmental receptors with the potential to be exposed to an increase in salinity are transient marine fauna including whales, sharks, fish, and reptiles found in surface waters around the MODU at the well locations.<br>Changes in salinity can affect the ecophysiology of marine organisms. However, most marine species can tolerate short-term fluctuations (~20–30%) in salinity (Ref. 122). Because pelagic species with the potential to be exposed are mobile, it is expected that, at worst, they would be subjected to slightly elevated salinity levels (~10–15% higher than sea water) for a very short time, which they are expected to be able to tolerate.<br>A literature review on the effects of desalination plant brine concluded:<br>• there is currently no information to suggest brine discharge has a negative effect on cetacean health (Ref. 123)<br>• that no studies have been undertaken into the impact of increased salinity on marine turtles (Ref. 124).<br>However, because shallower waters are less saline (Ref. 20), and because turtles are known to move between surface and seabed waters with no impacts, it is reasonable to assume that exposure to a temporary change in salinity from brine discharge is not expected to result in an impact.<br>Given the open nature of the receiving environment, the intermittent nature of the activity, and the lack of sensitive features that would result in sedentary behaviour, this hazard is not evaluated further. | |
| **Potential chemical toxicity**<br>Scale inhibitors and biocide used to avoid fouling of pipework in the heat exchange and desalination process are inherently safe at the low dosages used; they are usually consumed in the inhibition process, with little or no residual chemical concentration remaining upon discharge.<br>The environmental receptors with the potential to be exposed to changes in water quality resulting in toxic effects from chemicals are transient marine fauna, including whales, sharks, fish, and reptiles found in surface waters around the MODU at the well locations.<br>Larger pelagic species are mobile; at worst, it is expected that they would be subjected to very low levels of chemicals for a very short time as they swim near the discharge plume. As transient species, they are not expected to experience any chronic or acute effects. Given the open nature of the receiving environment, the intermittent nature of the activity, and the lack of sensitive features that would result in sedentary behaviour, this hazard is not evaluated further. | **N/A** |

### 5.6.4 Planned Discharge – Ballast Water (and Biofouling)

| Cause of Aspect | |
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| These activities have the potential to result in planned discharges of ballast water:<br>• Support operations – MODU operations<br>• Support operations – vessel operations.<br>Note: These activities also have the potential to result in biofouling, resulting in the same hazard. Consequently, both biofouling and ballast water discharge are evaluated below. | |
| **Hazard** | |
| Planned discharge of ballast water or biofouling has the potential to introduce a marine pest that has the potential to destroy the ecology of marine habitats by outcompeting native species. | |
| **Potential Consequence Summary** | **Ranking** |
| **Destruction of marine habitat ecology**<br>Invasive Marine Pests (IMPs) are likely to have little or no natural competition or predators, thus potentially outcompeting native species for food or space, preying on native species, or changing the nature of the environment. It is estimated that | **Major (3)** |

| | |
|---|---|
| Australia has more than 250 established marine pests, and it is estimated that approximately one in six introduced marine species becomes pests (Ref. 125).<br>The marine habitat values and sensitivities with the potential to be impacted by the introduction of an IMP include:<br>• Continental slope demersal fish communities (KEF).<br>Although this KEF has been identified as having the potential to be exposed, as described in Section 3.1.1.1, benthic habitat is expected to comprise soft sediment infauna communities.<br>Once established, some pests can be difficult to eradicate (Ref. 126) and therefore there is the potential for a long-term or persistent change in habitat structure. It has been found that highly disturbed environments (such as marinas) are more susceptible to colonisation than open-water environments, where the number of dilutions and the degree of dispersal are high (Ref. 127).<br>The nature of the marine habitats near the operational area indicate that establishment would be difficult due to the water depths, lack of hard substrates, and the presence of soft sediment communities.<br>However, if an IMP was introduced, and if it did colonise an area, it may result in a widespread colony. Therefore, there is the potential for a widespread, but irreversible, impact to habitat resulting in a Major (3) consequence. | |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| B | • Commonwealth Biosecurity Act 2015:<br>o Maritime Arrivals Reporting System (MARS)<br>• Australian Ballast Water Management Requirements (Ref. 102):<br>o exchange of MODU ballast water outside Australian waters<br>o report ballast water discharges<br>o maintain a ballast water record system<br>• Commonwealth *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* enacts the Marine Order Part 98 (Marine pollution – anti-fouling systems):<br>o Anti-fouling certificate<br>• National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Ref. 209)<br>o Biofouling Risk Assessment<br>• Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) MPEC.207(62) 2011 (Ref. 129)<br>o biofouling management plan<br>o biofouling record book | **Consequence** | Major (3) |
| | | **Likelihood** | Remote (5) |
| | | **Risk Level** | Low (7) |

### 5.6.5 Planned Discharge – Sewage, Greywater, and Food Wastes

| Cause of Aspect | |
|---|---|
| These activities have the potential to result in planned discharges of sewage, greywater, and food wastes:<br>• Support Operations – MODU operations<br>• Support Operations – vessel operations. | |
| **Hazard** | |
| Discharge of sewage, greywater, and food wastes results in potential impacts to marine fauna by:<br>• changing the water quality through nutrient enrichment and increased biological oxygen demand (BOD)<br>• impacting predator / prey dynamics. | |
| **Potential Consequence Summary** | **Ranking** |
| **Changes to the water quality through nutrient enrichment and increased BOD**<br>Monitoring of sewage discharges for another offshore project (Ref. 68), determined that a 10 $m^3$ sewage discharge reduced to ~1% of its original concentration within 50 m of the discharge location. In addition, monitoring at distances 50, 100, and 200 m downstream of the platform and at five different water depths confirmed that discharges were rapidly diluted and no elevations in water quality monitoring parameters (e.g. total nitrogen, total phosphorous, and selected metals) were recorded above background levels at any station.<br>The values and sensitivities with the potential to be exposed to changes in surface water quality include:<br>• Humpback Whale (migration BIA) | **N/A** |

| | |
|---|---|
| • Pygmy Blue Whale (migration BIA)<br>• Whale Shark (foraging BIA)<br>• Flatback Turtle (internesting BIA)<br>• Continental slope demersal fish communities (KEF).<br>Studies into the effects of nutrient enrichment from offshore sewage discharges indicate that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed areas (Ref. 130) and suggest that zooplankton composition and distribution in areas associated with sewage dumping grounds are not affected. In addition, regardless of receptor sensitivity to BOD, Black et al. (Ref. 131) state that the BOD of treated effluent is not expected to lead to oxygen depletion in the receiving waters.<br>Due to the rapid rate of mixing and dispersion identified during modelling of sewage releases (Ref. 68), no values or sensitivities are expected to be impacted by this activity and consequently this hazard is not evaluated further. | |
| **Impact to predator / prey dynamics**<br>The overboard discharge of sewage and macerated food waste creates a localised and temporary food source for scavenging marine fauna or seabirds, whose numbers may temporarily increase as a result, thus increasing the food source for predatory species.<br>However, the rapid consumption of this food waste by scavenging fauna, and physical and microbial breakdown, ensures that the impacts of food waste discharges are insignificant and temporary; receptors that may potentially be in the water column are not impacted.<br>The values and sensitivities with the potential to be affected by changes in predator–prey dynamics include:<br>• Wedge-tailed Shearwater (breeding / foraging BIA)<br>• Continental slope demersal fish communities (KEF).<br>Given the distance from shore (>65 km), these incidental discharges are not expected to influence foraging behaviours of seabirds (specifically the Wedge-tailed Shearwater), and thus are not considered further.<br>As described above, plankton communities are not affected by sewage discharges. Consequently, impacts to Whale Shark foraging behaviours are not expected, and thus are not considered further.<br>Although fish are likely to be attracted to these discharges, any attraction and consequent change to predator–prey dynamics is expected to be limited to close to the release, with localised impacts to species. Any increased predation is not expected to result in more than a short-term, localised impact on species, therefore the consequence is considered Incidental (6). | **Incidental (6)** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • AMSA Marine Order Part 96 (Sewage)<br>  o MARPOL-approved sewage treatment plant<br>• AMSA Marine Order 95 (Marine pollution prevention – garbage)<br>  o Food waste macerated<br>• Planned maintenance system (PMS) | **Consequence** | Incidental (6) |
| | | **Likelihood** | Remote (5) |
| | | **Risk Level** | Low (10) |

### 5.6.6 Planned Discharge – BOP Control Fluids

| Cause of Aspect | |
|---|---|
| This activity has the potential to result in planned discharges of control fluids:<br>• Pressure-control equipment installation and function testing (during drilling and well abandonment) | |
| **Hazard** | |
| The planned release of control and hydraulic fluids have the potential to result in:<br>• acute and chronic toxicity to marine fauna. | |
| **Potential Consequence Summary** | **Ranking** |
| **Acute and chronic toxicity to marine fauna**<br>Pressure-control equipment (including BOP) uses hydraulics to operate the equipment. The water-based hydraulic control fluid comprises ~3% active ingredient concentrations (Section 2.2.5). Modelling undertaken for another offshore drilling project indicates that a release of BOP fluids during function testing is expected to reach a dilution of 3000 times within a maximum displacement plume of 98 m (Ref. 92). Based on this information, it is expected concentrations of BOP control fluid would be ~10 ppm within 100 m of the BOP. Using a conservative ocean current speed of 0.1 m/s (Note: Currents in the region can be up to 0.3–0.4 m/s [Ref. 97]), fluids would be expected to travel 100 m (and thus reach concentrations of 10 ppm) in ~16 minutes.<br>The values and sensitivities with the potential to be exposed to changes in water quality near the seabed include:<br>• Continental slope demersal fish communities (KEF).<br>Seven of the GS2 production wells are located within this KEF.<br>Given the small volumes associated with this discharge and limited exposure times due to rapid dilution, any potential impact to this aspect is expected to be localised and short term, resulting in an Incidental (6) consequence. | **Incidental (6)** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 117)<br>o Chemical selection process | **Consequence** | Incidental (6) |
| | | **Likelihood** | Remote (5) |
| | | **Risk Level** | Low (10) |

### 5.6.7 Planned Discharge – Completion Brines

| Cause of Aspect | |
|---|---|
| These activities have the potential to result in planned discharges of completion fluids, including proppant:<br>• Run well completion (during drilling)<br>• Wellbore clean-up and flowback (during drilling)<br>• Other well intervention and abandonment activities. | |
| **Hazard** | |
| The planned release of completion fluids and proppant has the potential to result in:<br>• Turbidity, acute and chronic toxicity to marine fauna. | |
| **Potential Consequence Summary** | **Ranking** |
| **Turbidity, acute and chronic toxicity to marine fauna**<br>The volume of one wellbore and subsequent discharge volume would be ~3500 bbl (based on the designs of the existing production wells). The change to water quality | **Incidental (6)** |

| | |
|---|---|
| is expected to be localised; drilling discharges have previously been identified to dissipate no more than 100 m from the drilling site (Ref. 112; Ref. 114).<br>The values and sensitivities with the potential to be exposed to decreased water quality from completion fluids include:<br>• Humpback Whale (migration BIA)<br>• Pygmy Blue Whale (migration BIA)<br>• Whale Shark (foraging BIA)<br>• Flatback Turtle (internesting BIA)<br>• Continental slope demersal fish communities (KEF).<br>Seven of the GS2 production wells are located within these values and sensitivities.<br>As this is an intermittent batch discharge (estimated to have a total duration of ~24 hours over several days per well), any exposure will be short term, due to rapid dilution from ocean currents.<br>Given the transient nature of the particular values and sensitivities, any exposure would be limited in duration. Consequently, any exposure to the identified values and sensitivities would be expected to result in impacts to individuals and/or localised impacts to species, and thus is considered to have an Incidental (6) consequence. | |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 117)<br>o Chemical selection process<br>• CAPL's Offshore Drilling Fluid Guidelines (Ref. 115)<br>o Verification of hydrocarbon content prior to discharge | **Consequence** | Incidental (6) |
| | | **Likelihood** | Unlikely (4) |
| | | **Risk Level** | Low (9) |

## 5.7 Accidental Release

### 5.7.1 Waste

| Cause of Aspect |
|---|
| These activities have the potential to result in an unplanned release of waste to the environment:<br>• Support operations – MODU operations<br>• Support operations – vessel operations.<br>Because waste is generated on board support vessels and the MODU, inappropriate storage has the potential to result in release to the environment. |
| **Hazard** |
| The potential environmental impacts associated with the accidental release of waste are:<br>• marine pollution resulting in injury and entanglement of marine fauna and seabirds. |

| Potential Consequence Summary | Ranking |
|---|---|
| If hazardous / non-hazardous waste is lost overboard, the extent of exposure is isolated to that waste.<br>Marine fauna most at risk from marine pollution include marine reptiles and seabirds, through ingestion or entanglement. Ingestion or entanglement has the potential to limit feeding / foraging behaviours and thus can result in marine fauna deaths.<br>However, given the restricted exposures and limited quantity of marine pollution expected from this program, it is expected that any impacts from marine pollution would only result in a localised, short-term impact to individuals and not have a | **Incidental (6)** |

| | | | |
|---|---|---|---|
| detrimental effect on the overall population, and thus have a consequence level of Incidental (6). | | | |
| **Decision Context** | **Summary of Control Measures** | **Risk Level Summary** | |
| A | • AMSA Marine Order Part 95 (Marine pollution prevention – garbage) and Marine Order Part 94 (Packaged harmful substance)<br>o Garbage / waste management plan<br>o Garbage record book<br>• API Recommended Practice 14G (Ref. 159)<br>o Accidental release / waste management training / induction | **Consequence** | Incidental (6) |
| | | **Likelihood** | Unlikely (4) |
| | | **Risk Level** | Low (9) |

### 5.7.2 Single-point Failure

| **Cause of Aspect** |
|---|
| These activities have the potential to result in single-point failure of chemicals, muds, diesel, and other no$_x$ious liquids:<br>• MODU operations<br>• Support vessel operations.<br>Hydrocarbon spills resulting from single-point failure typically occur because of:<br>• failure or mechanical breakdown of equipment used to store or transfer hydrocarbons<br>• incorrect storage and/or absence of bunding around hydrocarbons<br>• human error.<br>Single-point failures (overboard) resulting in hydrocarbons reaching the environment may occur from minor hydrocarbon spills. Activities with the potential for single-point failures include:<br>• seabed ROV survey (hose failure)<br>• inadequate hazardous waste management (loss of containment)<br>• general servicing and routine operations.<br>A range of hydrocarbons are likely to be present during the drilling program; however, the maximum credible volume associated with a single-point failure is estimated to be ~1 m$^3$. |
| **Hazard** |
| A single-point failure has the potential to expose marine fauna to a reduction in water quality, resulting in acute or chronic toxicity. |

| **Potential Consequence Summary** | **Ranking** |
|---|---|
| A loss of containment resulting in the release of ~1 m$^3$ (diesel or chemicals) to the marine environment was identified as the largest representative discharge for this group of spill and leak scenarios.<br>Given the low potential volumes, a loss of containment would likely result in small spatial extent on the water surface and some entrainment in the water column.<br>The values and sensitivities with the potential to be exposed to decreased water quality from hydrocarbon spills include:<br>• Humpback Whale (migration BIA)<br>• Blue Whale and Pygmy Blue Whale (migration BIA)<br>• Whale Shark (foraging BIA)<br>• Flatback Turtle (internesting BIA)<br>• Continental slope demersal fish communities (KEF).<br>The most sensitive receptors to this type of event are expected to be surface-dwelling species and whales. However, given the small volumes, and transient nature of identified values and sensitivities, only individual fauna passing directly | **Incidental (6)** |

| | |
|---|---|
| though the released substance would be expected to be temporarily affected, thus the potential impact is localised. Therefore, the potential consequence is considered to result in localised and short-term impacts – Incidental (6). | |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • AMSA's Marine Order Part 91, Marine pollution prevention – oil<br>o Shipboard Oil Pollution Emergency Plan (SOPEP)<br>• API Recommended Practice 14G (Ref. 6)<br>o Accidental release / waste management training / induction<br>• Permit System | **Consequence** | Incidental (6) |
| | | **Likelihood** | Seldom (3) |
| | | **Risk Level** | Low (8) |

### 5.7.3 Loss of Containment During Transfer

| Cause of Aspect |
|---|
| These activities have the potential to result in spills of chemicals, muds, diesel, and other no$_x$ious liquids:<br>• MODU operations – crane transfers and bunkering operations<br>• Support vessel operations – crane transfers and bunkering operations.<br>Causes of spills overboard during transfer activities include:<br>• hose or connection failure (due to equipment condition or failure of the vessel to keep stationary)<br>• failure to align valves correctly during transfer to tanks<br>• overfilling tanks on MODU<br>• overfilling aviation fuel tank on fuel unit or bulk storage tank of the MODU<br>• dropped objects from crane transfers.<br>AMSA (Ref. 133) suggests the maximum credible spill volume from a refuelling incident with continuous supervision is approximately the transfer rate × 15 minutes. Assuming failure of dry-break couplings and a ~200 m$^3$/h transfer rate (based on previous operations), this equates to an instantaneous spill of ~50 m$^3$.<br>Assuming the same equipment is used to complete bulk transfers of any bulk liquid (such as NADF), a similar volume (50 m$^3$) could be expected for an accidental release of drilling fluid during transfer. This is considered conservative because transfer rates are typically slower than the peak transfer rates (described above). |
| **Hazard** |
| An accidental bulk release of drilling muds, chemicals, and fuel (hydrocarbons) has the potential to affect marine fauna through:<br>• potential chemical toxicity in the water column. |

| Potential Consequence Summary | Ranking |
|---|---|
| A loss of 50 m$^3$ of diesel or chemicals upon release would be expected to result in changes to water quality in both surface waters and the pelagic environment.<br>The environmental impacts associated with a larger loss of diesel fuel are considered in Section 5.7.7. The environmental impacts associated with an accidental release of 50 m$^3$ of diesel will be less than those associated with a loss of diesel from a vessel collision and thus are not evaluated further.<br>The potential environmental impacts associated with an accidental release of drilling fluid are considered in Section 5.7.4. As described in Section 2.2.3, it is anticipated that the total volume of NADF discharged through adhered cuttings per well is ~248 m$^3$. Neff (Ref. 96) suggests that synthetic-based mud-coated cuttings tend to clump and settle rapidly as large particles over a small area near the discharge point and tend not to disperse rapidly; therefore, the impact evaluation | **Minor (5)** |

| | |
|---|---|
| completed in Section 5.6.1 is considered suitable for this risk and is not evaluated further. An accidental release of drilling muds (~50 m$^3$) is not expected to be significantly different from that described for the planned release of drilling fluids and thus is not evaluated further. Further consideration is provided for a larger NADF loss in Section 5.7.4.<br>The values and sensitivities with the potential to be exposed to decreased water quality from an accidental release of chemicals (~50 m$^3$) include:<br>• Humpback Whale (migration BIA)<br>• Blue Whale and Pygmy Blue Whale (migration BIA)<br>• Whale Shark (foraging BIA)<br>• Flatback Turtle (internesting BIA)<br>• Continental slope demersal fish communities (KEF).<br>Seven of the GS2 production wells are located within these values and sensitivities.<br>Given the small volumes and transient nature of identified values and sensitivities, there is only the potential to impact individuals; to be affected, fauna would need to pass directly through any fluid almost immediately it is released.<br>Therefore, any potential impact from such an event is expected to result in localised, short-term impacts to individuals, thus the consequence level was determined as Incidental (6). | |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • Guidelines for Offshore Marine Operations (GOMO) 0611-1401 (Ref. 7)<br>o Bulk transfer process<br>o Hoses and connections<br>o PMS<br>• CAPL Offshore Drilling Fluid Guidelines (Ref. 115)<br>o NADF checklist | **Consequence** | Minor (5) |
| | | **Likelihood** | Remote (5) |
| | | **Risk Level** | Low (9) |

### 5.7.4 Failure of Slip Joint Packer / Marine Riser

| Cause of Aspect |
|---|
| These activities have the potential to result in a failure of the slip joint packer/marine riser, resulting in an accidental release of NADF:<br>• Drilling – Well Design and Drilling.<br>A failure of the slip joint packer or marine riser typically occurs by:<br>• MODU stabilisation, resulting in accidental BOP disconnect from riser<br>• human error.<br>If the riser is disconnected accidentally or in an emergency, there is the potential for the entire volume of the riser and drill string (up to 265 m$^3$ of NADF) to be lost to the environment.<br>If the slip joint packer failed, the volume lost is expected to be ~30 bbl, which would be slowly released at the sea surface. |
| **Hazard** |
| An accidental release of NADF has the potential to result in effects to marine fauna and habitat through:<br>• smothering seabed habitat and altering seabed substrate<br>• potential chemical toxicity in the water column and sediment. |

| Potential Consequence Summary | Ranking |
|---|---|
| **Smothering and alteration of the seabed** | **Minor (5)** |

| | |
|---|---|
| The impacts and risks associated with drilling fluids smothering and altering the seabed were evaluated to be no larger than those described in Section 5.6.1. The risk evaluation (as described in Section 2.2.3) is considered suitable because the estimated total volume of NADF discharged through adhered cuttings per well is ~248 $m^3$. Neff (Ref. 96) suggests that synthetic-based mud-coated cuttings tend to clump and settle rapidly as large particles over a small area near the discharge point and tend not to disperse rapidly; therefore, the impact evaluation completed in Section 5.6.1 on the planned discharge of drilling cuttings is considered suitable for this risk and is not evaluated further. | |
| **Potential chemical toxicity to fauna in the sediment**<br>The impacts and risks associated with chemical toxicity to fauna in the sediment were evaluated to be no larger than those described in Section 5.6.1. The risk evaluation (as described in Section 2.2.3) is considered suitable because the estimated total volume of NADF discharged through adhered cuttings per well is ~248 $m^3$. Neff (Ref. 96) suggests that synthetic-based mud-coated cuttings tend to clump and settle rapidly as large particles over a small area near the discharge point and tend not to disperse rapidly; therefore, the impact evaluation completed in Section 5.6.1 on the planned discharge of drilling cuttings is considered suitable for this risk and is not evaluated further. | **Minor (5)** |
| **Potential chemical toxicity to fauna in the water column**<br>The impacts and risks associated with chemical toxicity to fauna in the water column were evaluated to be no larger than those described in Section 5.6.1 . The risk evaluation (as described in Section 2.2.3) is considered suitable because the estimated total volume of NADF discharged through adhered cuttings per well is ~248 $m^3$. Neff (Ref. 96) suggests that synthetic-based mud-coated cuttings tend to clump and settle rapidly as large particles over a small area near the discharge point and tend not to disperse rapidly; therefore, the impact evaluation completed in Section 5.6.1 on the planned discharge of drilling cuttings is considered suitable for this risk and is not evaluated further. | **Incidental (6)** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development (Ref. 4)) – Drilling Fluids and Drilled Cuttings Guidance / CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 117)<br>o Chemical Selection Process<br>• Riser analysis conducted<br>• External riser inspections<br>• PMS | **Consequence** | Minor (5) |
| | | **Likelihood** | Unlikely (4) |
| | | **Risk Level** | Low (8) |

### 5.7.5 Loss of Containment (GFP Infrastructure)

| Cause of Aspect |
|---|
| Anchoring or lifting near live GFP infrastructure has the potential to result in a loss of containment event from that infrastructure. The activities associated with this event include:<br>• MODU / drill ship positioning (anchoring)<br>• Support operations – MODU operations<br>• Support operations – vessel operations.<br>Spill modelling for a 530 $m^3$ gas condensate release from a major pipeline defect was modelled for the Gorgon Operations EP (Ref. 3).<br>The hazards and risk assessments below are separated into the three pathways of hydrocarbon exposure (surface exposure, in-water exposure, and shoreline exposure). |

<table>
<tr><th colspan="2">Hazard</th></tr>
<tr><td colspan="2">The potential environmental impact associated with surface hydrocarbon exposures (>10 g/m²) from a loss of containment event (major defect from existing infrastructure) is:<br>• marine pollution resulting in acute and chronic impacts to marine fauna and seabirds.<br>Modelling indicates that surface exposures greater than the impact threshold 10 g/m² may extend up to 7.8 km from the release site and overlap the Offshore and Barrow and Montebello Island IAAs.<br>The potential environmental impacts associated with surface hydrocarbon exposures (>1 g/m²) from a LOWC event are:<br>• marine pollution resulting in impacts to marine-based tourism from reduced visual aesthetic.<br>Modelling indicates that hydrocarbon exposures greater than the impact threshold of 1 g/m² are only expected to occur within the Offshore or Barrow and Montebello Island IAAs.</td></tr>
<tr><th>Potential Consequence Summary</th><th>Ranking</th></tr>
<tr><td>Marine pollution resulting in acute and chronic impacts to marine fauna and seabirds<br>Modelling indicates that for all seasons approximately 65% of the total spill volume is expected to evaporate within the first 24 hours, with only a negligible portion of visible condensate remaining on the surface within seven days (Ref. 134). Modelling also predicts a minimum time to shore of 21 hours, indicating that most of the volatiles would evaporate by the time surface exposures reach nearshore locations.<br>Air-breathing fauna and seabirds are most at risk from surface exposures due to the high volatile components. Therefore, the particular values and sensitivities with the potential to be affected by surface hydrocarbon exposures are:<br>• Humpback Whale (migration BIA)<br>• Pygmy Blue Whale (migration BIA)<br>• Whale Shark (foraging)<br>• Flatback Turtle (internesting BIA)<br>• Seabirds (foraging).<br>Because of the potential extent of moderate surface exposures, there is the potential for widespread exposure to marine fauna (whales, turtles, Whale Sharks, and seabirds). Therefore, there is the potential for acute exposures to result in marine fauna casualties.<br>However, weathering indicates that the duration associated with a surface slick (of moderate concentration) is limited, and therefore exposure to marine fauna above concentrations that may result in acute impacts is also limited. Therefore, if this event was to result in marine fauna casualties, it is expected that impacts would only occur at an individual level (given the limited duration) and would be unlikely to impact local populations.<br>This event is expected to result in widespread, short-term impacts to species. Therefore, the potential consequence is considered Minor (5).</td><td>Minor (5)</td></tr>
<tr><th colspan="2">Hazard</th></tr>
<tr><td colspan="2">The potential environmental impacts associated with in-water hydrocarbon exposures from a Loss of containment event are:<br>• marine pollution resulting in acute and chronic impacts to marine habitats and marine fauna</td></tr>
<tr><td>Marine pollution resulting in acute and chronic impacts to marine habitats and marine fauna<br>Marine fauna with gill-based respiratory systems are expected to have higher sensitivity to exposures of entrained contaminants. Therefore, the receptors most susceptible to dissolved hydrocarbons are fish.<br>Fish are an integral component of several particular values and sensitivities with the potential to be affected by a major defect:<br>• Whale Shark (foraging BIA)<br>• Continental slope demersal fish communities (KEF).</td><td>Moderate (4)</td></tr>
</table>

| | |
|---|---|
| The particular values and sensitivities with the potential to be exposed to entrained concentrations (<700 ppb) are mobile transient fauna that are not expected to remain within entrained hydrocarbon plumes for an extended time. Therefore, no acute impacts or risks associated with entrained exposures from a major defect are expected. Any impacts from this exposure are expected to result in localised short-term effects to limited small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability and recruitment of fish. Consequently, diverse fish assemblages and commercial and recreational fisheries are not expected to be significantly impacted.<br>In addition to ecological receptors, several shipwrecks of importance have been identified as having the potential to be exposed to entrained hydrocarbons.<br>Where marine artefacts are exposed to hydrocarbons, research indicates that the local ecology of microorganisms has the potential to change (Ref. 135). Should this occur, there is the potential for:<br>• increased biodeterioration from changes to microbial communities (Ref. 136)<br>• effects to coral / other communities using the shipwreck as hard substrate (Ref. 137).<br>Microorganisms are known to cause problems in the conservation of cultural heritage because of their biodeteriorative potential (Ref. 138). Current research indicates that microorganisms corroded the metal more quickly when it was exposed to either oil alone or oil plus dispersants (the chemicals used in clean-up efforts (Ref. 136). Consequently, spilt oil could result in the deterioration of marine artefacts and thus is considered to result in localised but irreversible habitat loss. Therefore, the potential consequence is considered Moderate (4). | |
| **Hazard** | |
| The potential environmental impact associated with shoreline hydrocarbon exposures from this loss of containment event is:<br>• marine pollution resulting in acute and chronic impacts to marine fauna and seabirds | |
| Modelling of this scenario indicates that shoreline exposures would only occur within the Barrow and Montebello Island IAA, with a minimum time to shore of 21 hours and with peak volumes ashore expected to be 778.6 g/m$^2$.<br>These volumes have the potential to coat marine benthic epifauna. Therefore, marine fauna that use shorelines for nesting and breeding, along with intertidal vegetation (specifically mangrove communities), have a higher risk from exposure to shoreline hydrocarbon accumulation. Thus, the particular values and sensitivities with the potential to be affected by shoreline hydrocarbon exposures are:<br>• Turtle (nesting BIA / critical habitat)<br>• Bird nesting and foraging.<br>Although the volumes ashore are not expected to be significant, coating of fauna could occur across several shorelines (limited to the Barrow and Montebello Islands IAA). Because several significant nesting areas for seabirds and turtles occur across the Barrow and Montebello Islands IAA, there is the potential to impact on nesting populations, which has the potential to affect species recruitment at a local population level.<br>Therefore, there is the potential for long-term effects on species while local populations recover from interrupted recruitment. Thus, impacts have potential widespread long-term impacts to species.<br>Therefore, the potential consequence associated with shoreline hydrocarbon exposure is considered Moderate (4). | **Moderate (4)** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| B | • Chevron Marine Standard (Ref. 139)<br>o Mooring analysis and Anchoring procedures<br>• NOPSEMA Accepted Safety Case<br>• Emergency Operating Procedure – Loss of Containment (Hazardous or Environmental Release) Operating Procedure – Gorgon Operations (Ref. 140)<br>o Emergency Shutdown<br>• OPGGS(E)R<br>o OPEP (Ref. 10) | **Consequence** | Moderate (4) |
| | | **Likelihood** | Unlikely (4) |
| | | **Risk Level** | Low (7) |

### 5.7.6 Loss of Well Control

| Cause of Aspect |
|---|
| A LOWC event typically occurs by:<br>• well intervention<br>• dropped objects<br>• intersection with shallow gas<br>• human error.<br>The hazards and risk assessments below are separated into the three pathways of hydrocarbon exposure (surface exposure, in-water exposure, and shoreline exposure). |
| **Hazard** |
| The potential environmental impact associated with surface hydrocarbon exposures (>10 g/m$^2$) from a LOWC event is:<br>• marine pollution resulting in acute and chronic impacts to marine fauna and seabirds.<br>Modelling indicates that hydrocarbon exposures greater than the impact threshold of 10 g/m$^2$ are only expected to occur within the Offshore IAA.<br>The potential socioeconomic impact associated with surface hydrocarbon exposures (>1 g/m$^2$) from a LOWC event is:<br>• marine pollution resulting in impacts to marine-based tourism from reduced visual aesthetic.<br>Modelling indicates that hydrocarbon exposures greater than the impact threshold of 1 g/m$^2$ are expected to occur within any of the IAAs. |

| Potential Consequence Summary | Ranking |
|---|---|
| **Marine pollution resulting in acute and chronic impacts to marine fauna and seabirds**<br>**Whales**<br>Whales passing through surface hydrocarbon slicks can be physically impacted through contact, ingestion, and inhalation (Ref. 133; Ref. 156). Baleen whales skim the surface to feed and may ingest hydrocarbons, potentially fouling baleen fibres (Ref. 157). Direct contact may result in skin and eye irritation, burns to mucous membranes of the eyes and airways, and increased susceptibility to infection (Ref. 146). Whales surfacing in the slick are vulnerable through inhaling evaporated volatiles. For the short period that they persist, vapours from the spill are a significant risk to cetacean health, with the potential to damage mucous membranes of the airways and the eyes, which will reduce the health and potential survivability of an animal. Inhaled volatile hydrocarbons are transferred rapidly to the bloodstream and may accumulate in tissues (Ref. 146). | **Incidental (6)** |

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| Whales migrate through the Offshore IAA, and if the spill coincided with the migration, exposure to hydrocarbon concentrations >10 g/m² to a proportion of the migrating population may occur.<br>Typically, the worst impacts would be associated with fresh spills or leaks with the risk of impact declining rapidly as the fluid weathers (>24 hours). Therefore, the potential for environmental impacts would be limited to a relatively short period following the release. Given the mobility of whales, only a small proportion of the migrating population would surface in the affected areas, resulting in short-term and localised consequences, with no long-term population viability effects. Therefore, the potential impacts of surface exposure to whales from a hydrocarbon release is ranked as Incidental (6). | |
| **Turtles**<br>Turtles can be exposed to hydrocarbons as they surface, resulting in direct contact with the skin, eyes, and other membranes, inhalation of vapours, or ingestion (Ref. 158). Several aspects of turtle biology and behaviour place them at particular risk, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations (Ref. 157). Oil effects on turtles can include impacts to the skin, blood, digestive, and immune systems, and increased risk of death from oiling.<br>Turtles may be present in internesting areas of the Offshore IAA and thus exposed to hydrocarbon concentrations >10 g/m² in these areas. Surfacing turtles at all life stages may be exposed; however, the surface slick is likely to be in patches, rather than continuous and subject to weathering once the lighter, more toxic hydrocarbon fractions have been volatilised. Therefore, the potential for environmental impacts would be limited to a relatively short period after the release, and only to a proportion of the population in the affected areas; impacts are not predicted to affect turtle populations in any of the IAAs, and the potential impacts are widespread and short term; ranked as Minor (5). | **Minor (5)** |
| **Seabirds**<br>Birds that rest at the water's surface or surface-plunging birds are particularly vulnerable to surface hydrocarbons (Ref. 145; Ref. 157). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 148). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 148).<br>Birds foraging within the Offshore IAA may be exposed to hydrocarbon concentrations >10 g/m² and even 25 g/m². However, because of the distance from shore where these exposures would be expected, only individual transient birds would be expected to be exposed, rather than larger congregations. Given the high sensitivity of birds to surface hydrocarbon phases, a hydrocarbon release has the potential to cause widespread, short-term impacts, which are ranked as Minor (5). | **Minor (5)** |
| **Marine pollution resulting in impacts to marine-based tourism from reduced visual aesthetic**<br>Modelling indicates that hydrocarbon exposures >1 g/m² are expected to occur within most of the IAAs identified in Section 3.<br>The Ningaloo, Shark Bay, and Pilbara Coast IAAs have tourism and recreation values that can be affected by surface hydrocarbon exposure. A visible sheen may be observed in these IAAs and residue may persist in nearshore areas. This has the potential to reduce the visual amenity of the area for tourism, and discourage recreational activities, with short-term and localised consequences, which are ranked as Incidental (6). | **Incidental (6)** |
| **Hazard** | |
| The potential environmental impacts associated with in-water hydrocarbon exposures from a LOWC event are:<br>• marine pollution resulting in acute and chronic impacts to marine habitats and marine fauna<br>• reduction in commercially targeted marine species resulting in impacts to commercial fishing and aquaculture.<br>Modelling indicates that hydrocarbon exposures greater than the impact threshold (Entrained [11 760 ppb.hr] or Dissolved [576 ppb.hr]) have the potential to occur within these IAAs: | |

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| • Offshore<br>• Barrow and Montebello Islands.<br>Table 3-10 lists the particular values and sensitivities with the potential to be exposed in these areas. | |
| **Marine pollution resulting in acute and chronic impacts to marine habitats and marine fauna** | |
| **Coral**<br>Wave-induced turbulence associated with waves breaking over coral reef crests will increase the entrainment of hydrocarbons into the water column. Exposure of entrained hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Ref. 159). Dissolved hydrocarbons are known to cause high coral mortality through direct physical contact (Ref. 159).<br>Given the predicted times for exposure (at least 7 days), it is expected that weathering of the volatiles will have occurred before exposure; however, exposure to parts of the coral reefs may have acute toxic impacts, resulting in damage to parts of these values. Contact with coral reefs may lead to reduced growth rates, tissue decomposition, and poor resistance and death of sections of reef (Ref. 160). Dissolved and entrained exposures have the potential for localised and long-term impacts to coral reefs in the Barrow and Montebello Islands, Ningaloo and Shark Bay IAA, and are ranked as Minor (5). | **Minor (5)** |
| **Seagrass**<br>Seagrass make up the most important benthic habitats of the Shark Bay IAA but are also present in other coastal locations and may be exposed to water column hydrocarbons in the event of a hydrocarbon release. Dissolved and entrained hydrocarbons have the potential to effect seagrass through toxicity impacts. However, a layer of mucilage is present on most species, preventing the penetration of toxic aromatic fractions (Ref. 210). Seagrasses do not appear to be significantly vulnerable to oil impacts, because 50–80% of their biomass is in their rhizomes, which are buried in sediments and thus less likely to be adversely impacted by hydrocarbons. Seagrasses may undergo photosynthetic stress because of exposure to oil; however, full recovery has been documented in relatively short time frames; i.e. <10 hours after the exposure period (Ref. 210).<br>Given that the exposure is predicted to be in patches rather than a continuous plume, impacts to seagrass in the identified IAAs are anticipated to be long term (plants can regrow within one or two years) and localised, without threatening large regions. Therefore, consequences from dissolved/entrained exposure are ranked as Minor (5). | **Minor (5)** |
| **Whales**<br>Migrating whales, which may be present in the Offshore, Barrow and Montebello Island, Ningaloo and Gascoyne IAAs, may be exposed to entrained hydrocarbons above PNEC (11 760 ppb.hr) and to higher dissolved hydrocarbon concentrations. Note: Impact thresholds of 11 760 ppb.hr are more relevant for small, immobile organisms. Exposure to whales at these concentrations is not expected to cause significant impacts.<br>Exposure to entrained hydrocarbons can result in physical coating as well as ingestion (Ref. 146). Such impacts are associated with ‘fresh’ condensate; the risk of impact declines rapidly as the condensate weathers. Therefore, the potential for environmental impacts would be limited to a relatively short period after the release and would need to coincide with migration to result in exposure to a large number of individuals. However, such exposure is not anticipated to result in long-term population viability effects.<br>A proportion of the migrating population of whales in affected IAAs could be affected for a single migration event, which could result in short-term and localised consequences, which are ranked as Incidental (6). | **Incidental (6)** |
| **Whales Sharks and Great White Sharks**<br>Whale Sharks are also known to forage in the Barrow and Montebello Islands, Ningaloo, Gascoyne and Offshore IAAs and exposure to entrained hydrocarbons above PNEC (11 760 ppb.hr) may occur in the Offshore IAA. Note: Impact thresholds | **Incidental (6)** |

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| of 11 760 ppb.hr are more relevant for small, immobile organisms. Exposure to Whale Sharks at these concentrations is not expected to cause significant impacts.<br>As identified in the recovery plan for the White Shark (Ref. 47), the 'indicative distribution' and 'known distribution' of this species may intersect entrained thresholds above 11 760 ppb.hr.<br>Whale Sharks, sharks, and fish have the potential for exposure to hydrocarbons through entrained and dissolved fractions. Potential effects include damage to the liver and lining of the stomach and intestine, and toxic effects on embryos (Ref. 161).<br>Although these concentrations will have a lower toxicity (because the volatile components evaporate within days), the physical presence of persistent components of the hydrocarbons have the potential to accumulate in the gills. Therefore, the potential impacts to Whale Sharks and Great White Sharks are localised and long term, and are ranked as Incidental (6). | |
| **Turtles**<br>Turtles, which may be present in the Offshore, Barrow and Montebello Island, Ningaloo, Gascoyne and Shark Bay IAAs, may also be exposed to entrained hydrocarbons above PNEC (11 760 ppb.hr) and to higher dissolved hydrocarbon concentrations. Note: Impact thresholds of 11 760 ppb.hr are more relevant for small, immobile organisms. Exposure to turtles at these concentrations is not expected to cause significant impacts.<br>Turtles can be impacted where condensate is fresh, with direct oiling of eyes and other membranes occurring when swimming (Ref. 158); the risk of impacts decrease as the volatiles weather.<br>Foraging or nesting turtles may also be exposed to concentrations of dissolved hydrocarbons above impact thresholds in the IAAs identified above, however, any exposure within the Barrow and Montebello Islands, Ningaloo, and Shark Bay IAAs would be limited because of the patchiness of hydrocarbon exposures in this area.<br>Given the rapid weathering of the volatile components, condensate spills have the potential for localised, short-term impacts to turtles, with no potential impacts at a population level in any IAA, and are ranked as Incidental (6). | **Incidental (6)** |
| **Fish communities**<br>Fish community values include various features identified as KEFs (including but not limited to) the ancient coastline, Continental slope demersal fish communities, and Exmouth Plateau.<br>Adult fish exposed to low hydrocarbon concentrations are likely to metabolise the hydrocarbons and excrete the derivatives, with studies showing that fish can metabolise petroleum hydrocarbons and that accumulated hydrocarbons are released from tissues when the fish is returned to hydrocarbon-free sea water (Ref. 162). Several fish communities in these areas are demersal (i.e. living closer to the seabed) where concentrations of entrained hydrocarbons will be lower; any impacts are expected to be highly localised.<br>Subsurface hydrocarbons could potentially result in acute exposure to marine biota such as juvenile fish, larvae, and planktonic organisms, although impacts are not expected cause population-level impacts. There is the potential for localised and short-term impacts to fish communities, and thus the consequences are ranked as Incidental (6). | **Incidental (6)** |
| **Reduction in commercially targeted marine species resulting in impacts to commercial fishing and aquaculture**<br>Several commercial fisheries operate in the IAAs (Ref. 18), and overlap the spatial extent of the water column hydrocarbon predictions.<br>Although exposures >11 760 ppb.hr have the potential to affect the recruitment of targeted commercial and recreational fish species, no known important spawning areas were identified that have the potential to be impacted (Ref. 18). Consequently, any acute impacts are expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Impacts from entrained/dissolved exposure are unlikely to | **Incidental (6)** |

| | |
|---|---|
| manifest at a fish population viability level. The consequence to commercial fisheries is assessed as localised and short term, and ranked as Incidental (6). | |
| **Hazard** | |
| The potential environmental impacts associated with shoreline hydrocarbon exposures from a LOWC event are:<br>• marine pollution resulting in acute and chronic impacts to marine fauna and seabirds<br>• reduction in amenity resulting in impacts to tourism and recreation.<br>Modelling indicates that all IAAs are at risk of shoreline exposures greater than the impact threshold (100 g/m$^2$) in the event of a worst-case spill event. | |
| **Marine pollution resulting in acute and chronic impacts to marine fauna and seabirds** | |
| **Coral**<br>Modelling predicts that intertidal coral reefs in the Ningaloo and Barrow and Montebello Islands IAAs have the potential to be exposed to shoreline hydrocarbons at concentrations >100 g/m$^2$. The coral reef marine values in these IAAs are regionally significant. The most significant reefs around Barrow Island are Biggada Reef (west coast), Dugong Reef (south-east coast), and Batman Reef (south-east coast), with fringing reefs to the west and south-west of the Montebello Islands (Ref. 163). The Ningaloo coast has extensive fringing coral reefs.<br>Direct contact of hydrocarbons to intertidal coral can cause smothering, resulting in a decline in metabolic rate, and may cause varying degrees of tissue decomposition and death. A range of impacts may also result from toxicity, including partial mortality of colonies, reduced growth rates, bleaching, and reduced photosynthesis (Ref. 159; Ref. 164).<br>Therefore, the potential consequence can be direct smothering and toxic effects to sections of coral reef in the IAAs mentioned above. Given the potential volumes ashore, and extent of moderate and high shoreline loading thresholds potentially contacting the regionally significant coral reefs of the Ningaloo IAA and Barrow and Montebello Islands IAA from a LOWC event, widespread and long-term effects can occur. The potential consequence to coral from shoreline exposure caused by a hydrocarbon release is ranked as Moderate (4). | **Moderate (4)** |
| **Mangroves**<br>Regionally significant mangrove communities are located within the Barrow and Montebello Islands IAA, and have the potential to be impacted by hydrocarbon concentrations above impact thresholds (1000 g/m$^2$).<br>Shoreline hydrocarbons can have smothering and toxic effects on mangroves. Acute and chronic impacts to the health of mangrove communities can occur via pneumatophore smothering and exposure to the toxic volatile fraction of the hydrocarbons (Ref. 165).<br>Given the value and sensitivity of mangrove communities in this IAA, and the potential for acute impacts (due to predicted exposures), there is the potential for long-term and widespread consequences, which are ranked as Moderate (4). | **Moderate (4)** |
| **Turtles**<br>The Ningaloo, Pilbara Coast, Barrow and Montebello Islands, Gascoyne, and Shark Bay IAAs include important nesting habitats for turtles (Ref. 18). Turtles are potentially vulnerable to the effects of oil at all life stages (eggs, hatchlings, juveniles, and adults). Turtles can be exposed to hydrocarbons externally through contact, or internally (by ingesting oil, consuming prey containing oil, or inhaling volatile compounds) (Ref. 158). Shoreline hydrocarbons can impact turtles at nesting beaches when they come ashore, with exposure to skin and cavities such as eyes, nostrils, and mouth. Eggs may also be exposed during incubation, potentially resulting in increased egg mortality and detrimental effects on hatchlings. Hatchlings may be particularly vulnerable to toxicity and smothering as they emerge from the nests and make their way over the intertidal area to the water (Ref. 158).<br>Turtle nesting habitats have the potential to be exposed to shoreline hydrocarbons that have experienced sufficient weathering and evaporation of volatiles. The volumes ashore are highest in the Barrow and Montebello Islands IAA; therefore, | **Minor (5)** |

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|---|---|
| impacts may occur to nesting adult turtles and hatchlings as they traverse the intertidal area, resulting in potential smothering and acute impacts to some hatchlings over a nesting season.<br>Given the extent of the shoreline exposure potentially intersecting turtle habitats, acute effects may occur particularly to hatchlings; however, impacts to turtle population viability are not expected. Therefore, consequences to turtles from shoreline loading at the affected IAAs have the potential to be widespread and short term, and are ranked as Minor (5). | |
| **Seabirds**<br>Ningaloo and the Barrow and Montebello Islands IAAs include important bird nesting sites and rookeries. Birds coated in hydrocarbons can suffer from damage to external tissues (including skin and eyes), as well as internal tissue irritation in their lungs and stomachs (Ref. 157). Toxic effects may also result when hydrocarbon is ingested as the bird attempts to preen its feathers (Ref. 147).<br>Shorebirds foraging and feeding in intertidal zones, particularly in mudflats and intertidal areas of the IAAs, are at potential risk of exposure to shoreline hydrocarbons, potentially causing acute affects to numerous birds. However, impacts to bird population viability are not predicted, and the impacts to birds in the affected IAAs from shoreline loading have the potential to be widespread but short term. Therefore, the potential consequence is ranked as Minor (5). | **Minor (5)** |
| **Heritage**<br>Most values that comprise heritage areas (intertidal coral reef systems, turtle and seabird nesting areas and diversity, and tourism and recreation) are assessed individually above and below. Consequently, they are not assessed further; potential impacts to heritage values are ranked as **Moderate (4)** – see ***Coral***. | **Moderate (4)** |
| **Reduction in amenity resulting in impacts to tourism and recreation**<br>Modelling predicts the spatial extent of shoreline exposure to include the Ningaloo, Shark Bay, and Pilbara Coast IAAs, which include tourism and recreation values.<br>These areas include, the Montebello Marine Park, Gascoyne Marine Park, Ningaloo Marine Park and Shark Bay Marine Park. Of these marine parks the Ningaloo Marine Park and Shark Bay Marine Park are identified as key tourist destinations of local, state, national, and international significance. These marine parks, along with other areas of the coastline within the IAAs provide a major component of the local economy with the Pilbara and Shark Bay IAAs also including key coastal tourism areas.<br>Shoreline loading can impact the visual amenity of coastal areas and limit beach access for users, impacting tourism and recreation activities.<br>Small areas of the values in these IAAs may be exposed to shoreline loading, which could potentially result in short-term and localised disturbance to marine tourism and recreation activities; therefore, the consequences are ranked as Incidental (6). | **Incidental (6)** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| B | • CAPL's Well Construction Chevron Project Development and Execution Process (CPDEP) Standard Operating Procedure (SOP) (Ref. 166)<br>o well proposal and formation evaluation<br>o well construction CPDEP process.<br>• CAPL's Wellsafe SOP (GS-021 Wellsafe; Ref. 167)<br>o MODU certification<br>o well design and plan certification<br>• Part 5 of the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011<br>o WOMP<br>• OPGGS(E)R<br>o OPEP (Ref. Ref. 10)<br>o CAPL ABU OSMP (Ref. 172)<br>o stakeholder consultation<br>• Well Program<br>• PMS | **Consequence** | Moderate (4) |
| | | **Likelihood** | Remote (5) |
| | | **Risk Level** | Low (8) |

### 5.7.7 Vessel Collision

| Cause of Aspect | |
|---|---|
| A vessel collision typically occurs as a result of:<br>• loss of DP<br>• navigational error, or<br>• foundering due to weather.<br>Grounding is not considered credible due to the water depths and absence of submerged features in the operational area. | |
| **Hazard** | |
| The potential environmental impact associated with surface hydrocarbon exposures from a vessel collision event is:<br>• marine pollution resulting in acute and chronic impacts to marine fauna and seabirds.<br>Based on the impact thresholds, modelling indicates that hydrocarbon exposures >10 g/m$^2$ are only expected to occur within the Offshore IAA. | |
| **Potential Consequence Summary** | **Ranking** |
| **Marine pollution resulting in acute and chronic impacts to marine fauna and seabirds**<br>Due to similar volatile hydrocarbon properties, weathering, fate, and characteristics between MDO and condensate fluids, and considering the modelling results, the potential impacts are similar to those described and assessed in Section 5.7.5.<br>The predicted worst-case consequences are slightly lower for an MDO loss of containment due to smaller volumes and shorter release duration.<br>The worst-case consequence for surface hydrocarbon exposure was evaluated (Section 5.7.5) to be Minor (5). | **Minor (5)** |

| Decision Context | Summary of Control Measures | Risk Level Summary | |
|---|---|---|---|
| A | • CAPL's Marine Safety Reliability and Efficiency Standardised Operational Excellence (OE) Process (Ref. 116)<br>o vessel crew<br>o navigational equipment<br>• AMSA's Marine Order Part 91, Marine Pollution Prevention – oil<br>o SOPEP<br>• OPGGS(E)R<br>o OPEP (Ref. 10)<br>o CAPL ABU OSMP (Ref. 172)<br>• Commonwealth Navigation Act 2012<br>o Pre-start notifications | **Consequence** | Minor (5) |
| | | **Likelihood** | Unlikely (4) |
| | | **Risk Level** | Low (8) |

## 5.8 Spill Response

The OPEP (Ref. 10) outlines specific emergency response options and tactics to respond effectively to an oil spill that occurs during petroleum activities under the EP, in accordance with the OPGGS(E)R 2009. This OPEP has been updated to include the worst-case spill event defined within the EP.

In assessing the emergency event response capability to be implemented, CAPL has developed a response capability analysis that examines:

- response capability systems and processes
- response feasibility and effectiveness
- response capability equipment and facilities
- response capability personnel and resourcing.

Oil spill response may include one or more response techniques and will consider a range of factors including the location, nature, and scale of a spill, and the ecological and socioeconomic receptors that are at risk.

The response techniques considered appropriate for the EP include:

- Source Control – Using various techniques to stop the flow of oil to the marine environment
- Monitoring, Evaluation, and Surveillance (MES)
- Chemical Dispersants – Applying chemicals to enhance the natural dispersion of oil into the water column
- Containment and Recovery (CAR) – Using mechanical or manual techniques to confine, collect, recover, and store oil
- Shoreline Protection – Using protective or deflective booming tactics to protect at risk receptors
- Shoreline Clean-up – Removing oil that has stranded on a shoreline
- Oiled Wildlife Response (OWR) – Capturing and relocating / treating marine fauna that has been oiled or is at risk of being oiled.

Table 5-1 summarises the preliminary screened response options that may be implemented for these emergency events.

**Table 5-1: Results of Preliminary Screening of Event Response Options**

| ITOPF Class-ification | Response Options | | | | | | |
|---|---|---|---|---|---|---|---|
| | Source Control | MES | Chemical Dispersants* | CAR | Shoreline Protection | Shoreline Clean-up | OWR |
| Group I (LOWC) | Primary | Primary | Primary | Secondary | Primary | Primary | Primary |
| Group II (MDO) | Primary | Primary | Possible | Possible | Possible | Possible | Possible |

Response Options: Primary Secondary Possible

** Chemical dispersants may be used on residual, persistent components of hydrocarbon fluids after a net environment benefit analysis (NEBA) has been completed and before use, and if the response option meets technical requirements (CAPL-preferred dispersants, >20 m water depth, etc.). Efficacy testing indicates that dispersant use is only viable within 1 to 2 days of release (Ref. 202). Because aerial dispersant can be deployed within two days, and because treatment from aerial platforms is more efficient and effective than disposal from marine platforms, vessel dispersant was not selected for use in the EP.*

### 5.8.1 Source Control

Source control equipment can be mobilised in an efficient and timely manner because CAPL has developed plans and maintains contracts to ensure this capability is readily available. The time it takes to implement source control strategies is limited by the critical path components for equipment mobilisation, specifically the capping stack and MODU mobilisation. Table 5-2 summarises the Source Control response capability; Table 5-3 lists the performance standards in place to ensure preparedness is maintained.

**Table 5-2: Source Control Capability**

| | |
|---|---|
| **Response Capability** | CAPL has Perth-based drilling and subsea experts who can be called into the EMT to provide expertise for LOWC events. For every drilling or production well, CAPL designs a relief well before any drilling program starts, so as to reduce the relief well drilling time frame in the unlikely event of a LOWC.<br>**Service Providers**<br>CAPL has access to external experts, specialised services, and providers for capping stack deployment and relief well drilling. Specifically, these companies support the requirement for:<br>• 2 capping stack engineers<br>• 2 tool hands<br>• 8 ROV operators<br>• 12 rigging operators<br>• 2 survey personnel.<br>**Contracts with Wild Well Control (WWC)**<br>CAPL maintains contracts with WWC for specialist response personnel to provide expertise on LOWC scenarios. This allows activation and mobilisation of WWC equipment and personnel from key global locations within 24 hours.<br>**Oil Spill Response Limited (OSRL) Membership**<br>CAPL maintains membership to OSRL, under three agreements for emergency response and subsea capability and equipment. These are:<br>• The OSRL 'Service Level Agreement (Doc No. OSRL 129, Issued 09 June 2016)' gives CAPL access to 50% of available OSRL personnel and equipment.<br>• The OSRL 'Supplementary Agreement in respect to Capping Devices & Toolkits (CW1046766)' is based on an annual well nomination that gives CAPL access to |

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| | the Subsea Well Intervention System (SWIS) equipment, including capping stack and ancillary equipment in Singapore.<br>• The 'Supplementary Agreement in respect of the Global Strategic Dispersant Stockpile between Oil Spill Response (Dispersants) Limited and Chevron Response Company Limited (28 October 2013, Doc No. OSRL2102)' gives CAPL access to 100% of OSRL's global dispersant stockpile of >5000 $m^3$.<br>• The 'Supplementary Agreement in respect of Offset Installation Equipment' between Oil Spill Response (Capping) Limited and Chevron Response Company Limited (13 May 2014, Doc No. SWRP0003_SWIS)' gives CAPL access to the Offset Installation Equipment maintained by OSRL.<br>It is estimated that the capping stack package can be activated and mobilised to the Pilbara within 22 days.<br>CAPL is signatory to the APPEA MOU for Mutual Aid for sharing response equipment and expertise, which enables access to drilling rigs/MODUs used by other signatories in the event of an emergency such as a LOWC.<br>**Logistics Contractors (Vessel)**<br>CAPL has access to several vessel providers through contract arrangements that could be used for spill response. At the time of writing the EP, vessel contractors included Mermaid Marine, Bhagwan Marine, Go Marine, Maersk Supply Service, DOF Subsea, DOF Management, Toll Energy and Marine, and Jetwave Marine.<br>These contracts have a call-off facility and can be activated within hours of EMT mobilisation. However, noting the vessel specifications for transporting the Offshore Installation Equipment (OIE) to the operational area. CAPL will monitor both vessels capable of transport and deployment during drilling activities where the use of OIE could be required to ensure that knowledge of available vessels is maintained. |

**Table 5-3: Source Control Performance Outcomes and Standards**

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| Maintain source control response preparedness throughout the duration of this activity | CAPL will maintain its OSRL Service Level Agreement for the duration of this activity | Records confirm CAPL has a service level agreement in place with OSRL |
| | CAPL will maintain its OSRL Supplementary Agreement:<br>• Supplementary Agreement in respect to Capping Devices & Toolkits (CW1046766)<br>• Global Strategic Dispersant Stockpile for the duration of this activity. | Records confirm CAPL has both supplementary agreements in place with OSRL |
| | CAPL will maintain its MOU for Mutual Aid with APPEA to enable access to MODUs for the duration of this activity | Records confirm CAPL has an MOU in place with APPEA to enable access to MODUs |
| | CAPL and Chevron Corporate will maintain contracts with specific contractors to provide source control support, including:<br>• WWC<br>• Oceaneering | Records confirm CAPL has contracts in place with WWC and Oceaneering |
| | CAPL will maintain the ABU Capping Stack and Subsea First Response Toolkit Logistics and Mobilization Plan (ABU141100263) | Records confirm the ABU Capping Stack and Subsea First Response Toolkit Logistics and Mobilization Plan (ABU141100263) is in force and maintained as required. |

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| | CAPL will maintain access to offset installation equipment in accordance with the ABU Subsea Well Response Plan (ABU170701001) | Records confirm CAPL has maintained access to offset installation equipment in accordance with the ABU Subsea Well Response Plan (ABU170701001) for the duration of the program. |
| | CAPL will monitor the availability vessels capable of transport and deployment during drilling activities where the use of OIE could be required | Records confirm CAPL has monitored the availability vessels capable of transport and deployment during drilling activities where the use of OIE could be required. |
| | CAPL will develop a mobilisation plan for the OIE prior to drilling and where the use of OIE could be required | Records confirm CAPL has developed a mobilisation plan for the OIE prior drilling activities where the use of OIE could be required |

### 5.8.2 Subsea Dispersant Injection (SSDI)

If successful, SSDI is likely to significantly decrease the volume of surface and shoreline hydrocarbons, as well as provide a safer environment for source control and capping stack operations. However, it will result in large volumes of dispersed/entrained hydrocarbons throughout the water column, with greater concentrations around the well area; these volumes will decrease with time and distance from the release point. Table 5-4 summarises SSDI capability; Table 5-5 lists the performance standards in place to ensure preparedness is maintained.

**Table 5-4: SSDI Capability**

| | |
|---|---|
| **Response Capability** | **Subsea Intervention (SFRT and Dispersant)**<br>CAPL maintains membership with AMOSC, which, via the AMOSC Executed Agreement, gives access to the Perth-based Subsea First Response Toolkit (SFRT). The SFRT can be activated and mobilised to the Pilbara area within 12 days. SFRT membership also allows access to 500 $m^3$ of dispersant stored in Henderson.<br>In addition to this, CAPL maintains the Supplementary Agreement with OSRL in respect of the Global Strategic Dispersant Stockpile (28 October 2013, Doc No. OSRL2102), which gives CAPL access to 100% of OSRL's global dispersant stockpile of >5000 $m^3$.<br>**Service Providers (Personnel)**<br>CAPL maintains contracts with specialist oil spill contractors including AMOSC (up to 60 Core Group members), OSRL (15-person response team for deployment within 24 hours) and The Response Group (up to 25 EMT support specialists). In addition, CAPL can access National Plan (Ref. 191) resources and personnel through DoT and AMSA; this includes trained aerial observers from fire and rescue agencies around Australia.<br>**Logistics Contractors (Vessel)**<br>CAPL has access to several vessel providers through contract arrangements that could be used for spill response. At the time of writing the EP, vessel contractors included Mermaid Marine, Bhagwan Marine, Go Marine, Maersk Supply Service, DOF Subsea, DOF Management, Toll Energy and Marine, and Jetwave Marine.<br>These contracts have a call-off facility and can be activated within hours of EMT mobilisation. Vessels near the North West Shelf (i.e. Onslow, Barrow Island, Dampier) can be deployed within 24 hours. If CAPL is undertaking a subsea program at the time (i.e. pipeline inspection, well intervention, or production drilling), the vessels involved in these work scopes may be able to help. Tugs at either LNG Plant located on Barrow Island and Wheatstone/Onslow and may be able to be deployed within six hours to help with response operations; actual deployment time depends on marine vessel movements occurring at the time.<br>Through existing contracts, other vessels could be mobilised from locations with large numbers of vessels on standby (e.g. Singapore). Based on a conservative speed of 11 knots, it is anticipated that vessels could travel from Singapore to Dampier within 8 days. |

**Table 5-5: SSDI Performance Outcomes and Standards**

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| Maintain SSDI response preparedness throughout the duration of this activity | CAPL will maintain its contracts with vessel brokers for the duration of this activity | Records confirm CAPL has contracts in place with vessel brokers |
| | CAPL will maintain its membership with AMOSC for the duration of this activity | Records confirm CAPL has a membership with AMOSC which enables access to the SFRT via the AMOSC Executed Agreement |
| | Chevron Corporation will maintain its contract with the Response Group for the duration of this activity | Records confirm Chevron Corporation has a contract with the Response Group |
| | CAPL will maintain its OSRL Service Level Agreement for the duration of this activity | Records confirm CAPL has a service level agreement in place with OSRL |
| | CAPL will maintain its OSRL Supplementary Agreement in respect of the Global Strategic | Records confirm CAPL has the supplementary agreement in place with OSRL |

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| | Dispersant Stockpile for the duration of this activity | |

### 5.8.3 Offshore Response

Using aerial dispersant spraying (ADS) and containment and recovery (CAR) following a hydrocarbon spill enhances natural dispersion, creating a larger surface area for biodegradation to occur, therefore reducing concentrations at a higher rate. Table 5-6 summarises ADS and CAR capability; Table 5-7 lists the performance standards in place to ensure preparedness is maintained.

**Table 5-6: ADS / CAR Capability**

| | |
|---|---|
| **ADS Response Capability** | **CAPL**<br>CAPL has an Asia–Pacific Regional Response Team (RRT) and World-wide Response Team (WWRT) with specialists throughout Asia who can be mobilised to Perth within 24 to 48 hours for a large, complex operation.<br>**Specialist Contractors**<br>CAPL maintains contracts with specialist oil spill contractors including AMOSC (up to 60 Core Group members), OSRL (15-person response team for deployment within 24 hours), and The Response Group (up to 25 EMT support specialists). In addition, CAPL can access National Plan (Ref. 191) resources and personnel through DoT and AMSA, including trained aerial observers from fire and rescue agencies around Australia.<br>The AMOSC Services Agreement provides access to equipment stocks located in Exmouth (chemical dispersant), Perth (large dispersant stocks), and Geelong (chemical dispersant)<br>The AMSA & AMOSC & Aerotech First Response Joint Standard Operating Procedure (JSOP) provides access to the National Plan (Ref. 191) FWADC capability to support dispersant spraying for offshore and nearshore operations. Mobilisation to Exmouth can be arranged within ~24 hours (aircraft can arrive sooner but trained support personnel are required to implement this capability).<br>The OSRL Service Level Agreement provides access to OSRL and Global Response Network (GRN) resources located in Singapore, Bahrain, and Southampton, including stocks of dispersant used for surface dispersant spraying.<br>The OSRL 'Supplementary Agreement in respect of the Global Strategic Dispersant Stockpile between Oil Spill Response (Dispersants) Limited and Chevron Response Company Limited (28 October 2013, Doc No. OSRL2102) gives CAPL access to 100% of OSRL's global dispersant stockpile, which comprises >5000 $m^3$ of dispersant. |
| **CAR Response Capability** | **CAPL**<br>CAPL has an Asia–Pacific RRT and WWRT with specialists throughout Asia who can be mobilised to Perth within 24 to 48 hours for a large, complex operation.<br>**Specialist Contractors**<br>CAPL maintains contracts with specialist oil spill contractors including AMOSC (up to 60 Core Group members), OSRL (15-person response team for deployment within 24 hours), and The Response Group (up to 25 EMT support specialists). In addition, CAPL can access National Plan (Ref. 191) resources and personnel through DoT and AMSA, including trained aerial observers from fire and rescue agencies around Australia.<br>The AMOSC Services Agreement provides access to equipment stocks located in Exmouth (skimmers and boom), Perth (skimmers and boom), and Geelong (skimmers and boom). |

| | |
|---|---|
| | The Waste Management and Disposal Services Agreement provides CAPL with access to a dedicated waste management and disposal contractor to handle, transport, and dispose of response-generated waste for CAR response activities.<br>**Logistics Contractors (Vessel)**<br>CAPL has access to several vessel providers through contract arrangements that could be used for spill response. At the time of writing the EP, vessel contractors included Mermaid Marine, Bhagwan Marine, Go Marine, Maersk Supply Service, DOF Subsea, DOF Management, Toll Energy and Marine, and Jetwave Marine.<br>These contracts have a call-off facility and can be activated within hours of EMT mobilisation. Vessels near the North West Shelf (i.e. Onslow, Barrow Island, Dampier) can be deployed within 24 hours. If CAPL is undertaking a subsea program at the time (i.e. pipeline inspection, well intervention, or production drilling), the vessels involved in these work scopes may be able to help. Tugs at either LNG Plant located at Barrow Island and Wheatstone/Onslow and may be able to be deployed within six hours to help with response operations; actual deployment time depends on marine vessel movements occurring at the time.<br>Through existing contracts, other vessels could be mobilised from locations with large numbers of vessels on standby (e.g. Singapore). Based on a conservative speed of 11 knots, it is anticipated that vessels could travel from Singapore to Dampier within 8 days.<br>**Logistics Services Agreements**<br>The logistics services agreements CAPL has with various contractors (including Toll Logistics, Sadlier Transport, and PWC Logistics) provides access to a range of marine- and land-based logistics providers to supply onshore support services for transporting and tracking equipment and resources. |

**Table 5-7: ADS / CAR Control Performance Outcomes and Standards**

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| Maintain ADS response preparedness throughout the duration of this activity | CAPL will maintain its AMOSC Services Agreement for the duration of this activity | Records confirm CAPL has a services agreement in place with AMOSC |
| | CAPL will maintain its access to fixed-wing aircraft via the JSOP for the duration of this activity | Records confirm CAPL has access to fixed-wing aircraft via the JSOP |
| | CAPL will maintain its OSRL Service Level Agreement for the duration of this activity | Records confirm CAPL has a service level agreement in place with OSRL |
| | CAPL will maintain its OSRL Supplementary Agreement in respect of the Global Strategic Dispersant Stockpile for the duration of this activity | Records confirm CAPL has the supplementary agreement in place with OSRL |
| | Chevron Corporation will maintain its contract with The Response Group for the duration of this activity | Records confirm Chevron Corporation has a contract with The Response Group |
| Maintain CAR response preparedness throughout the duration of this activity | CAPL will maintain its AMOSC Services Agreement for the duration of this activity | Records confirm CAPL has a services agreement in place with AMOSC |
| | CAPL will maintain its OSRL Service Level Agreement for the duration of this activity | Records confirm CAPL has a service level agreement in place with OSRL |
| | CAPL will maintain its contracts with vessel brokers for the duration of this activity | Records confirm CAPL has contracts in place with vessel brokers |

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| | CAPL will maintain contracts with logistic providers for the duration of this activity | Records confirm CAPL has contracts in place with logistics providers |
| | CAPL will maintain its Oil Spill Response Waste Management Guidance note (ABU140200023) for the duration of the program | Records confirm CAPL's Oil Spill Response Waste Management Guidance note (ABU140200023) is in-force and updated as required through the duration of the program |

### 5.8.4 Nearshore Response

#### 5.8.4.1 Shoreline Protection (SPD)

SPD is a technique for preventing hydrocarbons from reaching the shore. Table 5-8 summarises SPD capability; Table 5-9 lists the performance standards in place to ensure preparedness is maintained.

**Table 5-8: SPD Capability**

| | |
|---|---|
| **Response Capability** | **CAPL**<br>Both Barrow Island and the Wheatstone LNG Plant maintain an initial first-strike response capability for nearshore SPD operations. Based upon these capabilities, CAPL can deploy (within 12 to 24 hours of an emergency event) resources and On-site Response Team (ORT) personnel, which currently comprise:<br>• 12 Oil Spill Responders (OSRs)<br>• five shoreline protection packages.<br>CAPL has an Asia–Pacific RRT and WWRT, with specialists throughout Asia who can be mobilised to Perth within 24 to 48 hours for a large, complex operation.<br>**Specialist Contractors**<br>CAPL maintains contracts with specialist oil spill contractors including AMOSC (up to 60 Core Group members), OSRL (15-person response team for deployment within 24 hours), and The Response Group (up to 25 EMT support specialists). In addition, CAPL can access National Plan (Ref. 191) resources and personnel through DoT and AMSA, including trained aerial observers from fire and rescue agencies around Australia.<br>The AMOSC Services Agreement provides access to equipment, personnel, and AMOSC Core Group members through mutual aid arrangements. The AMOSC agreement also provides access to additional capacity within 72 hours to expand SPD activities from CAPL's initial capability (if required), based on AMOSC stocks in Geelong and National Plan (Ref. 191) equipment available through AMSA and DoT.<br>The OSRL Services Agreement provides access to OSRL and GRN resources located in Singapore, Bahrain, and Southampton, including SPD and deflection equipment.<br>**Logistics Contractors (Vessel)**<br>CAPL has access to several vessel providers through contract arrangements that could be used for spill response. At the time of writing the EP, vessel contractors included Mermaid Marine, Bhagwan Marine, Go Marine, Maersk Supply Service, DOF Subsea, DOF Management, Toll Energy and Marine, and Jetwave Marine.<br>These contracts have a call-off facility and can be activated within hours of EMT mobilisation. Vessels near the North West Shelf (i.e. Onslow, Barrow Island, Dampier) can be deployed within 24 hours. If CAPL is undertaking a subsea program at the time (i.e. pipeline inspection, well intervention, or production drilling), the vessels involved in these work scopes may be able to assist. Tugs at either LNG Plant located at Barrow Island and Wheatstone/Onslow may be able to be deployed within six hours to help with response operations; actual deployment time depends on marine vessel movements occurring at the time. |

| | |
|---|---|
| | Through existing contracts, other vessels could be mobilised from locations with large numbers of vessels on standby (e.g. Singapore). Based on a conservative speed of 11 knots, it is anticipated that vessels could travel from Singapore to Dampier within 8 days.<br>**Logistics Services Agreement**<br>The logistics services agreements CAPL has with Toll Logistics, Sadlier Transport, and PWC Logistics provide access to a range of marine- and land-based logistics providers to supply onshore support services for transporting and tracking equipment and resources.<br>Agreements (with Coates Hire, PWC Logistics, Sadlier, ATCO) also enable access to set up remote camps, accommodation, catering, communications, and medical services to supply nearshore and onshore response operations. A small camp (up to 20 people) could be established in the Pilbara within ~96 hours, depending on specific requirements and location.<br>The Waste Management and Disposal Services Agreement provides CAPL with access to a dedicated waste management and disposal contractor to handle, transport, and dispose of response-generated waste for SPD response activities. |

**Table 5-9: SPD Control Performance Outcomes and Standards**

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| Maintain SPD response preparedness throughout the duration of this activity | CAPL will maintain first-strike SPD capability as detailed in Table 5-8 comprising at least:<br>• three OSRs<br>• three shoreline protection packages | Records confirm CAPL have required first-strike SPD capability |
| | CAPL will maintain its AMOSC Services Agreement for the duration of this activity | Records confirm CAPL has a services agreement in place with AMOSC |
| | CAPL will maintain its Waste Management and Disposal Services Agreement with a suitable contractor for the duration of this activity | Records confirm CAPL has a waste management and disposal services agreement in place |
| | CAPL will maintain its OSRL Service Level Agreement for the duration of this activity | Records confirm CAPL has a service level agreement in place with OSRL |
| | CAPL will maintain its MOU with AMSA to enable access to personnel and equipment for the duration of this activity | Records confirm CAPL has an MOU in place with AMSA |
| | CAPL will maintain contracts with vessel brokers for the duration of this activity | Records confirm CAPL has contracts in place with vessel brokers |
| | CAPL will maintain contracts with logistic providers for the duration of this activity | Records confirm CAPL has contracts in place with logistics providers |
| | CAPL will maintain access to its Asia–Pacific RRT and WWRT | Records confirm CAPL has will maintained access to its Asia–Pacific RRT and WWRT |
| | CAPL will maintain its Oil Spill Response Waste Management Guidance note (ABU140200023) for the duration of the program | Records confirm CAPL's Oil Spill Response Waste Management Guidance note (ABU140200023) is in-force and updated as required through the duration of the program |

#### 5.8.4.2 Shoreline Clean-up (SHC)

SHC encompasses a range of techniques to clean the shoreline following hydrocarbon contact and pollution. Table 5-9 summarises SHC capability; Table 5-11 lists the performance standards in place to ensure preparedness is maintained.

**Table 5-10: SHC Capability**

| | |
|---|---|
| **Response Capability** | **CAPL**<br>Both Barrow Island and the Wheatstone LNG Plant maintain an initial first-strike response capability for SHC operations. Based upon these capabilities, CAPL can deploy (within 12 to 24 hours of an emergency event) resources and ORT personnel, which currently comprise:<br>• 12 OSRs<br>• six shoreline clean-up packages.<br>CAPL has an Asia–Pacific RRT and WWRT, with specialists throughout Asia who can be mobilised to Perth within 24 to 48 hours for a large, complex operation.<br>**Specialist Contractors**<br>The AMOSC Services Agreement provides access to equipment, personnel, and AMOSC Core Group members through mutual aid arrangements. The AMOSC agreement also provides access to additional capacity (within 72 hours, if required) to expand SHC activities from CAPL's initial capability, based on AMOSC stocks in Geelong and National Plan (Ref. 191) equipment available through AMSA and DoT.<br>The OSRL Services Agreement provides access to OSRL and GRN resources located in Singapore, Bahrain, and Southampton, including SHC equipment.<br>The Waste Management and Disposal Services Agreement provides CAPL with access to a dedicated waste management and disposal contractor to handle, transport, and dispose of response-generated waste for SHC response activities.<br>**Logistics Services Agreement**<br>The logistics services agreements CAPL has with contractors (including Toll Logistics, Sadlier Transport, and PWC Logistics) provide access to a range of marine- and land-based logistics providers to supply onshore support services for transporting and tracking equipment and resources.<br>Agreements (with other contractors such as Coates Hire, PWC Logistics, Sadlier, ATCO) also enable access to set up remote camps, accommodation, catering, communications, and medical services to supply nearshore and onshore response operations. A small camp (up to 20 people) could be established in the Pilbara within ~96 hours, depending on specific requirements and location.<br>**Labour Hire Contractors**<br>CAPL has arrangements in place with external service providers (AirSwift, Hays, etc.) who can deploy up to 500 support personnel to Exmouth, Karratha, and Onslow within 24 hours.<br>**Logistics Contractors (Vessel)**<br>CAPL has access to several vessel providers through contract arrangements that could be used for spill response. At the time of writing the EP, vessel contractors included Mermaid Marine, Bhagwan Marine, Go Marine, Maersk Supply Service, DOF Subsea, DOF Management, Toll Energy and Marine, and Jetwave Marine.<br>These contracts have a call-off facility and can be activated within hours of EMT mobilisation. Vessels near the North West Shelf (i.e. Onslow, Barrow Island, Dampier) can be deployed within 24 hours. If CAPL is undertaking a subsea program at the time (i.e. pipeline inspection, well intervention, or production drilling), the vessels involved in these work scopes may be able to assist. Tugs at either LNG Plant located at Barrow Island and Wheatstone/Onslow may be able to be deployed within six hours to help with response operations; actual deployment time depends on marine vessel movements occurring at the time.<br>Through existing contracts other vessels could be mobilised from locations with large numbers of vessels on standby (e.g. Singapore). Based on a conservative |

| | |
|---|---|
| | speed of 11 knots, it is anticipated that vessels could travel from Singapore to Dampier within 8 days. |

**Table 5-11: SHC Control Performance Outcomes and Standards**

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| Maintain SHC response preparedness throughout the duration of this activity | CAPL will maintain first-strike SHC capability as detailed in Table 5-10 comprising at least:<br>• three OSRs<br>• three SHC packages. | Records confirm CAPL have required first-strike SHC capability |
| | CAPL will maintain its AMOSC Services Agreement for the duration of this activity | Records confirm CAPL has a services agreement in place with AMOSC |
| | CAPL will maintain its Waste Management and Disposal Services Agreement with a suitable contractor for the duration of this activity | Records confirm CAPL has a waste management and disposal services agreement in place |
| | CAPL will maintain its OSRL Service Level Agreement for the duration of this activity | Records confirm CAPL has a service level agreement in place with OSRL |
| | CAPL will maintain its MOU with AMSA to enable access to personnel and equipment for the duration of this activity | Records confirm CAPL has an MOU in place with AMSA |
| | CAPL will maintain its contracts with vessel brokers for the duration of this activity | Records confirm CAPL has contracts in place with vessel brokers |
| | CAPL will maintain contracts with logistic providers for the duration of this activity | Records confirm CAPL has contracts in place with logistics providers |
| | CAPL will maintain access to its Asia–Pacific RRT and WWRT | Records confirm CAPL has will maintained access to its Asia–Pacific RRT and WWRT |
| | CAPL will maintain its contracts and arrangements with labour hire companies in place for the duration of this activity | Records confirm CAPL has arrangements in place with labour hire companies |
| | CAPL will maintain its Oil Spill Response Waste Management Guidance note (ABU140200023) for the duration of the program | Records confirm CAPL's Oil Spill Response Waste Management Guidance note (ABU140200023) is in-force and updated as required through the duration of the program |

#### 5.8.4.3 Oiled Wildlife Response (OWR)

Oiled Wildlife response (OWR) requirements were defined using indicative OWR levels (as defined by the DBCA Oiled Wildlife Response Levels, in the Western Australian Oiled Wildlife Response Plan [WAOWRP; Ref. 178]). Table 5-12 summarises OWR capability; Table 5-13 lists the performance standards in place to ensure preparedness is maintained.

### Table 5-12: OWR Capability

| | |
|---|---|
| **Response Capability** | **CAPL**<br>If monitoring and evaluation of the spill indicates oiled wildlife are reported as injured, observed, or at risk of being contacted, CAPL will mobilise these people and equipment:<br>• one Oiled Wildlife Advisor to supervise operations with relevant government agencies (i.e. DBCA) and in accordance State- and region-specific OWR plans<br>• one fauna package to capture and transport potentially affected wildlife (e.g. birds, turtles) from the Montebello Islands Group<br>• one fauna package to the west coast of Barrow Island to capture and treat potentially affected wildlife (e.g. birds, turtles).<br>Although these resources can mobilise within 12 hours of EMT activation, deterministic modelling indicates shoreline exposures are expected by week 7; therefore, there is sufficient time for mobilisation.<br>**Service Providers**<br>The WAOWRP is a joint state-level plan produced by the former Department of Parks and Wildlife (now DBCA) and AMOSC on behalf of the petroleum industry.<br>**Specialist Contractors**<br>Third-party service provider capability will be mobilised under the WAOWRP (Ref. 178), initially from State Response Team support at Exmouth and Onslow, then AMOSC Core Group and OSRL Responders as required. These resources can be mobilised within 48 hours.<br>CAPL is a Participating Member of AMOSC, which provides access to AMOSC equipment, personnel, and AMOSC Core Group members through mutual aid arrangements. The AMOSC Services Agreement also provides access to an extra two fauna packages on the mainland and trained oiled wildlife specialists per operation. These resources can be mobilised within 72 hours. AMOSC can help mobilise ongoing response capability (post-impact capture, rehabilitation, carcass recovery) to Karratha within three days. |

### Table 5-13: OWR Control Performance Outcomes and Standards

| Environmental Performance Outcome | Environmental Performance Standards | Measurement Criteria |
|---|---|---|
| Maintain OWR response preparedness throughout the duration of this activity | CAPL will maintain its AMOSC Services Agreement for the duration of this activity | Records confirm CAPL has a services agreement in place with AMOSC |
| | CAPL will maintain its MOU with AMSA to enable access to personnel and equipment for the duration of this activity | Records confirm CAPL has an MOU in place with AMSA |
| | CAPL will maintain its contracts and arrangements with labour hire companies in place for the duration of this activity | Records confirm CAPL has arrangements in place with labour hire companies |
| | CAPL will maintain access to its Asia–Pacific RRT and WWRT | Records confirm CAPL has maintained access to its Asia–Pacific RRT and WWRT. |

# 6 Management Approach

To meet the requirements of the OPGGS(E)R, Division 2.3, Regulation 14, *Implementation strategy for the environment plan*, this Section summarises the management approach documented in the EP as the Implementation Strategy, which identifies the systems, practices, and procedures used to ensure the environmental impacts and risks of the activities are continuously reduced to ALARP.

## 6.1 Systems, Practices, and Procedures

CAPL's operations are managed in accordance with the Operational Excellence Management System (OEMS), which is a comprehensive management framework that supports the corporate commitment to protect the safety and health of people and the environment. This framework ensures a systematic approach to environmental management, with the environmental aspects of each project addressed from project conception, throughout project planning, and as an integral component of implementation, as shown in Figure 6-1.

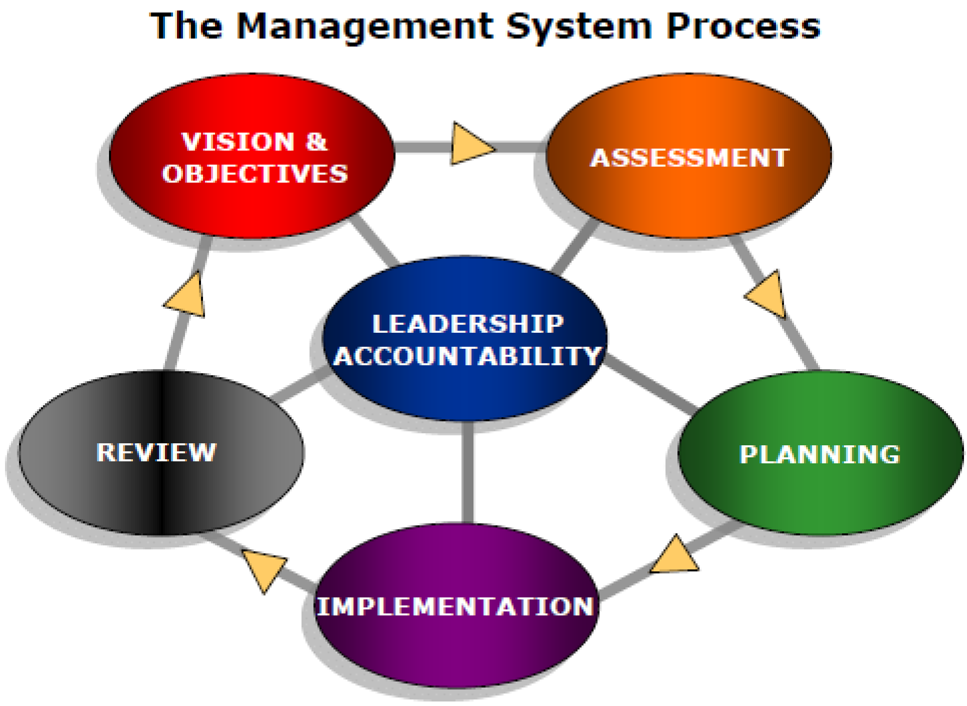


**Figure 6-1: CAPL OEMS Process Overview**

Under the OEMS are 13 elements that enable implementation of CAPL's activities in a manner that is consistent with its Operational Excellence Policy 530. Of the elements described under the OEMS, those relevant to the EP are detailed in Table 6-1. The following subsections summarise the key processes that help demonstrate how CAPL is effective in reducing environmental impacts and risks to ALARP and an acceptable level.

A few of the key processes within the EP are summarised further in the subsections below.

**Table 6-1: OEMS Elements Relevant to this Activity**

| OEMS Element | Element Description | Key Processes Relevant to this Activity |
|---|---|---|
| Safe Operations (OE-03) | Operate and maintain facilities to prevent injuries, illness, and incidents | • (OE-03.01.01) HES Risk Management – ABU Standardised OE Process (Ref. 53)<br>• (OE-03.09.01) Marine Safety Reliability and Efficiency – ABU Standardised OE Process (Ref. 66)<br>• (OE-03.06.02) Managing Safe Work (MSW) – ABU Standardised OE Process (Ref. 180)<br>• (OE-03.16.01) Hazardous Communication Process (Ref. 181)<br>• (ABU151100648) Hazardous Materials Environmental Assessment Tool (Ref. 117) |
| Management of Change (OE-04) | Manage both permanent and temporary changes to prevent incidents | • (OE-04.00.01) Management of Change for Facilities and Operations – ABU Standardised OE Process (Ref. 182) |
| Incident Investigation (OE-09) | Investigate and identify root causes of incidents to reduce or eliminate systemic causes to prevent future incidents | • (OE-09.00.01) Incident Investigation and Reporting – ABU Standardised OE Process (Ref. 183) |
| Community and Stakeholder Engagement (OE-10) | Reach out to the community and engage in open dialogue to build trust | • (OE-10.00.01) Community and Stakeholder Engagement – ABU Standardised OE Process (Ref. 184) |
| Emergency Management (OE-11) | Prevention is the first priority, but be prepared to respond immediately and effectively to all emergencies involving wholly owned or operated CAPL assets | • (OE-11.01.01) Emergency Management Process (Ref. 185) |
| Compliance Assurance (OE-12) | Verify conformance with OE requirements in applicable company policy and government laws and regulations | • (OE-12.01.19) Compliance Assurance Audit Program ABU Standardised OE Procedure (Ref. 186)<br>• (OE-12.01.18) Compliance Assurance Management of Instances of Potential Noncompliance (Ref. 187) |

## 6.2 Management of Change for Facilities and Operations

The Management of Change for Facilities and Operations Process (Ref. 182) manages changes to facilities, operations, products, and the organisation so as to prevent incidents, support reliable and efficient operations, and keep unacceptable risks from being introduced into CAPL's business.

In conjunction with the HES Risk Management Process, this process is followed to document and assess the impact of changes to activities described in Section 2. These changes will be addressed to determine if there is potential for any new or increased environmental impact or risk not already provided for in the EP. If these changes do not trigger relevant petroleum regulations, as detailed below, the EP will be revised, and changes recorded within the EP without resubmission.

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

- starting any new activity, or any significant modification to, change, or new stage of an existing activity, not provided for in the EP
- changing an instrument holder for, or operator of, the activity

- the occurrence of a significant new environmental impact or risk, or significant increase in an existing environmental impact or risk, not provided for in the EP
- the occurrence of a series of new environmental impacts or risks, or a series of increases in existing environmental impacts or risks, which, taken together, amount to the occurrence of a significant new environmental impact or risk, or a significant increase in an existing environmental impact or risk, not provided for in the EP.

## 6.3 Compliance Assurance Audit Program ABU Standardised OE Procedure

The Compliance Assurance Audit Program ABU Standardised OE Procedure (OE-12.01.19; Ref.186) addresses the establishment of audit programs to verify the effectiveness of controls and the extent to which requirements are met by CAPL.

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

Typically, routine inspections (such as HES inspections) will be worksite-based and conducted weekly where activities under the EP are being undertaken. Audits will focus on both in-field activities (such as site audits) and/or administrative processes (such as desktop audits of relevant information), and carried out at least annually (for the calendar year where activities under the EP are proposed). If no activities are proposed for the calendar year, no audits will be conducted.

Based on the activities captured in this scope, CAPL will conduct site-based inspections every week for production drilling or workover / well intervention activities.

Audit protocols and inspection checklists will be followed for all audits and inspections, and actions will be tracked until closure. Audit findings and corrective actions are recorded and tracked as described in Section 6.4.

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

## 6.4 Compliance Assurance Management of Instances of Potential Non-Compliance

The Compliance Assurance Management of Instances of Potential Non-Compliance Procedure (OE-12.01.18; Ref. 187) applies to instances where the requirements of the EP have not been met. This process is used if audit findings identify that activities within the scope of the EP are not being implemented in accordance with the risk and impact control measures stated in Section 5.

Audit findings and corrective actions are recorded and tracked within a CAPL compliance assurance database for timely closure of actions. Audit findings that identify a breach of an environmental performance outcome or environmental performance standard will be reported in accordance with the regulations.

Any suggested changes to activities or control measures arising from audit findings or instances of potential non-compliance will be subject to a management of change process.

## 6.5 ABU Oil Spill Exercise Schedule

The ABU Multi-Year Exercise Schedule (MYES) describes the schedule of training and exercise required for all emergency events. The MYES incorporates the ABU Oil Spill Exercise Schedule for oil spill training, drills, and exercises.

The objective for the MYES is to test and maintain the capability to respond to emergency events. The exercises aim to test:

- notification, activation, and mobilisation of the ORT and EMT
- efficiency and effectiveness of equipment deployment
- efficiency and effectiveness of communication systems
- Gorgon's ability to effectively operate within an ERO.

The proposed testing schedule is a live document that is subject to change. The MYES outlines the proposed testing arrangements to be completed, including the exercise types (listed in Table 6-2) and proposed level of response to be tested (Table 6-3) that may be used to meet defined objectives. At least one test for each Level will be conducted each year.

**Table 6-2: Exercise Types**

| Exercise Type | Details |
|---|---|
| Notification Exercise | Test the procedures to notify and activate the EMTs, support organisations, and regulators |
| Tabletop Exercise | Normally involves interactive discussions of a simulated scenario amongst members of an EMT, but does not involve the mobilisation of personnel or equipment |
| Drill | Involves the conduct of field activities such as equipment deployment, shoreline assessment, monitoring etc. |
| Functional Exercise | Involves at least one EMT being activated to establish command, control, and coordination of a serious emergency event. Often more complex as it simulates several different aspects of an oil spill incident and may involve third parties |

**Table 6-3: Exercise Levels**

| Exercise Level | Details |
|---|---|
| Level 1 – ORT | • Each ORT is required to hold a minimum of two exercises per year per shift<br>• May be held in conjunction with a Level 2 EMT exercise<br>• Designed to evaluate the ability of ORTs to implement the Gorgon Emergency Management System as it applies to ORTs. ORTs are also encouraged to conduct as many exercises as they want each year that do not include the ERT or a Level 2 EMT |
| Level 2 – EMT | • Exercises may include the participation of an ORT and may be held in conjunction with a Level 3 EMT exercise<br>• Usual duration – one to two hours<br>• Designed to evaluate a Level 2 EMT's ability to notify and activate team members, set up a Level 2 EMT Emergency Command Centre, and implement the Gorgon Emergency Management System as it applies to Level 2 EMTs |
| Level 3 – EMT | • Each exercise may include the participation of a Level 2 EMT and/or ORT<br>• Usual duration – three to six hours<br>• Designed to evaluate the EMT's ability to notify and activate team members, transfer command to a Level 3 EMT Emergency Command Centre, and implement the Gorgon Emergency Management System as it applies to incident escalation |

The MYES outlines the process for evaluating training, drills, and exercises against defined objectives, and incorporating lessons learned. An after-action report is generated for all Level 2 and Level 3 exercises, which is used during spill exercises to assess the effectiveness of the exercise against its objectives and to record recommendations. Relevant actions are then assigned to the responsible party where they are tracked to completion using internal processes. Exercise planners must refer to previous recommendations for continual review and improvement.

Response arrangements as detailed in the EP and the OPEP (Ref. 10) must be tested:

- when they are introduced
- when they are significantly amended
- not later than 12 months after the most recent test
- if a new location for the activity is added to the EP after the response arrangements have been tested, and before the next test is conducted: test the response arrangements in relation to the new location as soon as practicable after it is added to the EP
- if a facility becomes operational after the response arrangements have been tested and before the next test is conducted: test the response arrangements in relation to the facility when it becomes operational.

## 6.6 Environment Plan Review

In accordance with Regulation 19 of the OPGGS(E)R, CAPL will submit a proposed revision of the EP at least 14 days before the end of a five-year period that commences on the date the EP is accepted by NOPSEMA.

Additional triggers for review of the EP include:

- pre-mobilisation review – before commencing any activity under the EP
- changes to listings, status, and/or management instrumentation communicated via the species information and EPBC Act Policy updates

Where a change to the EP from one of these reviews is identified, it will be evaluated in accordance with Section 6.2, and if required by Regulation 17 of the OPGGS(E)R, resubmitted to NOPSEMA for assessment, or revised and reissued for use accordingly.

The Description of Environment document (Ref. 18) will be reviewed annually to include any relevant changes to source documents, such as State/Commonwealth Management Plans, threatened species recovery instruments (Recovery Plans / conservation advice), EPBC status, or new published research. Any suggested changes to the description of environment or risk assessment arising from this review will be subject to a management of change process in accordance with Section 6.2.

Learnings from this activity will be captured during environmental performance audits and inspections, (or other feedback from daily reports, informal feedback provided, tool boxes etc) and managed in the same manner as audit findings or corrective actions. That is, they will be managed by the Audit findings and corrective actions are recorded and tracked within CAPLs compliance assurance database. Actions to address the learning will be delegated and the process maintained through to close out of the matter. Where actions result in a suggested change to the EP, they will be subject to a management of change process in accordance with Section 6.2.

Specific OPEP review requirements are described in Section 9.0 of the OPEP (Ref. 10).

# 7 Abbreviations and Definitions

Table 7-1 lists definitions for the terms and abbreviations used in this document.

**Table 7-1: Abbreviations and Definitions**

| Acronym / Abbreviation | Definition |
|---|---|
| @ | at |
| ~ | Approximately |
| < | Less than / fewer than |
| > | Greater than / more than |
| °C | Degrees Celsius |
| µg | Microgram |
| µm | Micrometre |
| ABU | Australian Business Unit |
| ADS | Aerial Dispersant Spraying |
| AFMA | Australian Fisheries Management Authority |
| AHO | Australian Hydrographic Office |
| AHS | Australian Hydrographic Service |
| AIIMS | Australasian Inter-service Incident Management System |
| AIS | Automatic Identification System (for ships) |
| ALARP | As low as reasonably practicable |
| AMOSC | Australian Marine Oil Spill Centre |
| AMOSPlan | Australian Industry Cooperative Oil Spill Response Arrangements |
| AMSA | Australian Maritime Safety Authority |
| API | American Petroleum Institute |
| APPEA | Australian Petroleum Production and Exploration Association |
| AUSCOAST | Australian Coastal (weather warning) |
| bbl | Barrel |
| BCF | Bioconcentration factors |
| BIA | Biologically Important Area |
| BOD | Biological Oxygen Demand |
| BOP | Blowout Preventer |
| $CaCO_3$ | Calcium carbonate |
| Caisson | A large watertight chamber used for construction under water |
| CAPL | Chevron Australia Pty Ltd |
| CAR | Containment and Recovery |
| CCR | Central Control Room |
| Cd | Cadmium |
| Cefas | Centre for Environment, Fisheries and Aquaculture Science (UK) |
| CMT | Crisis Management Team |
| Commonwealth | Commonwealth of Australia |

| Acronym / Abbreviation | Definition |
|---|---|
| Commonwealth Waters | Waters stretching from three to 200 NM from the Australian coast |
| cP | Centipoise |
| CPDEP | Chevron Project Development and Execution Process |
| CRI | Cuttings reinjection |
| D&C | Drilling and Completions |
| DAWR | Commonwealth Department of Agriculture, Water and Resources |
| dB re 1 µPa | Decibels relative to one micropascal; a unit for measuring underwater sound |
| DBCA | Western Australian Department of Biodiversity, Conservation and Attractions (formerly the Department of Parks and Wildlife) |
| DC-1, DC-2, etc. | Drill Centres |
| DMIRS | Western Australian Department of Mines, Industry Regulation and Safety (formerly the Department of Mines and Petroleum) |
| DoD | Commonwealth Department of Defence |
| DoT | Western Australian Department of Transport |
| DotEE | Commonwealth Department of the Environment and Energy (formerly Department of Sustainability, Environment, Water, Population and Communities) |
| DP | Dynamic positioning / dynamically positioned |
| DPIRD | Western Australian Department of Primary Industries and Regional Development (formerly Department of Fisheries) |
| $EC_{50}$ | A concentration or dose that yields biological effects in 50% of test animals/species |
| EMBA | Environment that may be affected |
| EMT | Emergency Management Team |
| EP | Environment Plan |
| EPBC | Environment Protection and Biodiversity Conservation |
| ERO | Emergency Response Organisation |
| ESD | Ecologically Sustainable Development |
| FMT | Flow Management Tool |
| FWADC | Fixed Wing Arial Dispersant Contract |
| GFP | Gorgon Foundation Project |
| GOMO | Guidelines for Offshore Marine Operations |
| GRN | Global Response Network |
| GS2 | Gorgon Stage 2 |
| GTP | Gas Treatment Plant |
| h | Hour |
| ha | Hectare |
| HES | Health, Environment, and Safety |
| Hg | Mercury |
| HMA | Hazard Management Agency |

| Acronym / Abbreviation | Definition |
|---|---|
| HMEAT | Hazardous Material Environmental Assessment Tool |
| Hz | Hertz |
| IAA | Impact Assessment Area |
| IAP | Incident Action Plan |
| IC | Incident Commander |
| IMCRA | Integrated Marine and Coastal Regionalisation of Australia |
| IMG | Incident Management Guide |
| IMO | International Maritime Organization |
| IMP | Invasive Marine Pests |
| ITOPF | International Tanker Owners Pollution Federation |
| IUCN | International Union for Conservation of Nature |
| JRCC | Joint Rescue Coordination Centre |
| JSOP | Joint Standard Operating Procedure |
| KCl | Potassium chloride |
| KEF | Key Ecological Feature |
| kg | Kilogram |
| kHz | Kilohertz |
| km | Kilometre |
| L | Litre |
| lb | Pound (weight) |
| $LC_{50}$ / $LD_{50}$ | A concentration or dose found to be lethal in 50% of a group of species |
| LNG | Liquefied Natural Gas |
| Log pow | partition coefficient |
| LOWC | Loss of well control |
| lux | A standard for measuring light; equal to the amount of visible light per square metre incident upon a surface |
| m | Metre |
| m/s | Metres per second |
| M1, M4, etc. | Manifold names |
| $m^3$ | Cubic metre |
| MARPOL | The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 |
| MARS | Maritime Arrivals Reporting System |
| MDO | Marine Diesel Oil |
| MEG | Monoethylene glycol |
| MEPC | Marine Environment Protection Committee |
| MES | Monitoring, Evaluation, and Surveillance |
| MFO | Marine Fauna Observer |
| mg | Milligram |

| Acronym / Abbreviation | Definition |
|---|---|
| mm | Millimetre |
| MMscf | Million standard cubic feet |
| MMscfd | Million standard cubic feet per day |
| MODU | Mobile Offshore Drilling Unit |
| MOU | Memorandum of Understanding |
| MSRE | Marine Safety Reliability and Efficiency |
| MSW | Managing Safe Work |
| mT | Metric Tonne |
| MYES | Multi-Year Exercise Schedule |
| N/A | Not Applicable |
| NaBr | Sodium bromide |
| NaCl | Sodium chloride |
| NADF | Nonaqueous Drilling Fluid |
| NEBA | Net Environmental Benefit Analysis |
| NEPM | National Environmental Protection Measures |
| NM | Nautical mile |
| NMFS | National Maine Fisheries Service |
| $NO_2$ | Nitrogen dioxide |
| NOPSEMA | National Offshore Petroleum Safety and Environmental Management Authority |
| NPT | Non-productive Time |
| OC | On-scene Commander |
| OCNS | Offshore Chemical Notification Scheme |
| OE | Operational Excellence |
| OEMS | Operational Excellence Management System |
| OGUK | Oil and Gas United Kingdom |
| OHGP | Open-hole Gravity Pack |
| OPEP | Oil Pollution Emergency Plan |
| Operational Area | Area in which the petroleum activities will occur |
| OPGGS Act | Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* |
| OPGGS(E)R | Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 |
| OPS1, OPS2, etc. | Operational Study 1, 2, etc. |
| ORT | On-site Response Team |
| OSCA | Oil Spill Control Agents |
| OSMARC | Oil Spill Management and Response Capability Model |
| OSMP | Operational and Scientific Monitoring Plan |
| OSR | Oil Spill Responder |
| OSRL | Oil Spill Response Limited |

| Acronym / Abbreviation | Definition |
|---|---|
| OSTM | Oil Spill Trajectory Modelling |
| Overpull | Amount of force that must be exerted on a pipe to pull it upward, above and beyond its own weight, due to drag and other forces |
| OWR | Oiled Wildlife Response |
| P&ID | Piping and Instrumentation Drawing |
| PGPA | Policy, Government and Public Affairs |
| PIC | Person in Charge |
| PMS | Planned Maintenance System |
| PNEC | Predicted No-effect Concentration |
| ppb | Parts per billion |
| ppb.hr | Parts per billion per hour |
| ppm | Parts per million |
| Proppant | A solid material (e.g. sand, treated sand, or ceramic materials) designed to keep an induced hydraulic fracture open, during or following a fracturing treatment |
| PSZ | Petroleum Safety Zone |
| PTS | Permanent Threshold Shift |
| Q1, Q2, etc. | Three-month quarter of a calendar year |
| RDIF | Reservoir Drill-in Fluid |
| RiskMan2 | Chevron Corporation's HES Risk Management Process |
| RMR | Riserless Mud Recovery System |
| RMS | Root Mean Square |
| ROV | Remotely Operated Vehicle |
| RPS APASA | RPS Asia Pacific Applied Science Associates (company) |
| RRT | Regional Response Team |
| SCI1, SCI2 etc. | Scientific Study 1, 2, etc. |
| SCM | Supply Chain Manager |
| SFRT | Subsea First Response Toolkit |
| SHC | Shoreline Clean-up |
| SIMAP | Spill Impact Mapping and Analysis Program |
| SIMOPS | Simultaneous Operations |
| SLA | Safe Lift Area |
| SOC | Synthetic on Cuttings |
| SOP | Standard Operating Procedure |
| SOPEP | Shipboard Oil Pollution Emergency Plan |
| SPD | Shoreline Protection |
| SPL | Sound Pressure Level |
| SSDI | Subsea Dispersant Injection |
| State Waters | The marine environment within three nautical miles of the Western Australian coast (including islands) |

| Acronym / Abbreviation | Definition |
|---|---|
| STP | Sewage Treatment Plant |
| SWIS | Subsea Well Intervention System |
| T | Tonne |
| TAPL | Texaco Australia Pty Ltd |
| TD | Total Depth |
| Territorial Sea | The Territorial Sea is a belt of water not exceeding 12M in width measured from the territorial sea baseline |
| TRG | Tactical Response Guide |
| TVD | True Vertical Depth |
| US | United States |
| USEPA | United States Environmental Protection Agency |
| VSP | Vertical Seismic Profiling |
| WA | Western Australia |
| WAFIC | Western Australian Fishing Industry Council |
| WAOWRP | Western Australian Oiled Wildlife Response Plan |
| WBM | Water-based Muds |
| WestPlan–MEE | WA State Hazard Plan – Maritime Environmental Emergencies |
| WHS | Wheatstone |
| WOMP | Well Operations Management Plan |
| WWC | Wild Well Control |
| WWRT | World Wildlife Response Team |

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