Chevron

Wheatstone Project

Wheatstone Well Intervention and Infill Drilling Environment Plan Summary

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Contents

Tables

Figures

1 Introduction

1.1 Overview

Chevron Australia Pty Ltd (CAPL) Wheatstone Liquefied Natural Gas (LNG) assets (Wheatstone Project) will produce hydrocarbon fluids from offshore wells, transport fluids through flowlines to the Wheatstone Platform for initial processing, then transport gas and condensate through a pipeline to the onshore gas plant at Ashburton North, near Onslow, Western Australia (WA) for further processing. Resultant LNG and condensate will be exported by vessels to the international market, and gas will also be made available to the domestic market via a tie-in with the existing Dampier to Bunbury Natural Gas Pipeline.

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 Wheatstone Well Intervention and Infill Drilling 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 drilling exclusion zone at well locations within the Wheatstone and Iago fields under production licences WA-46-L, WA-47-L, and WA-48-L (see 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

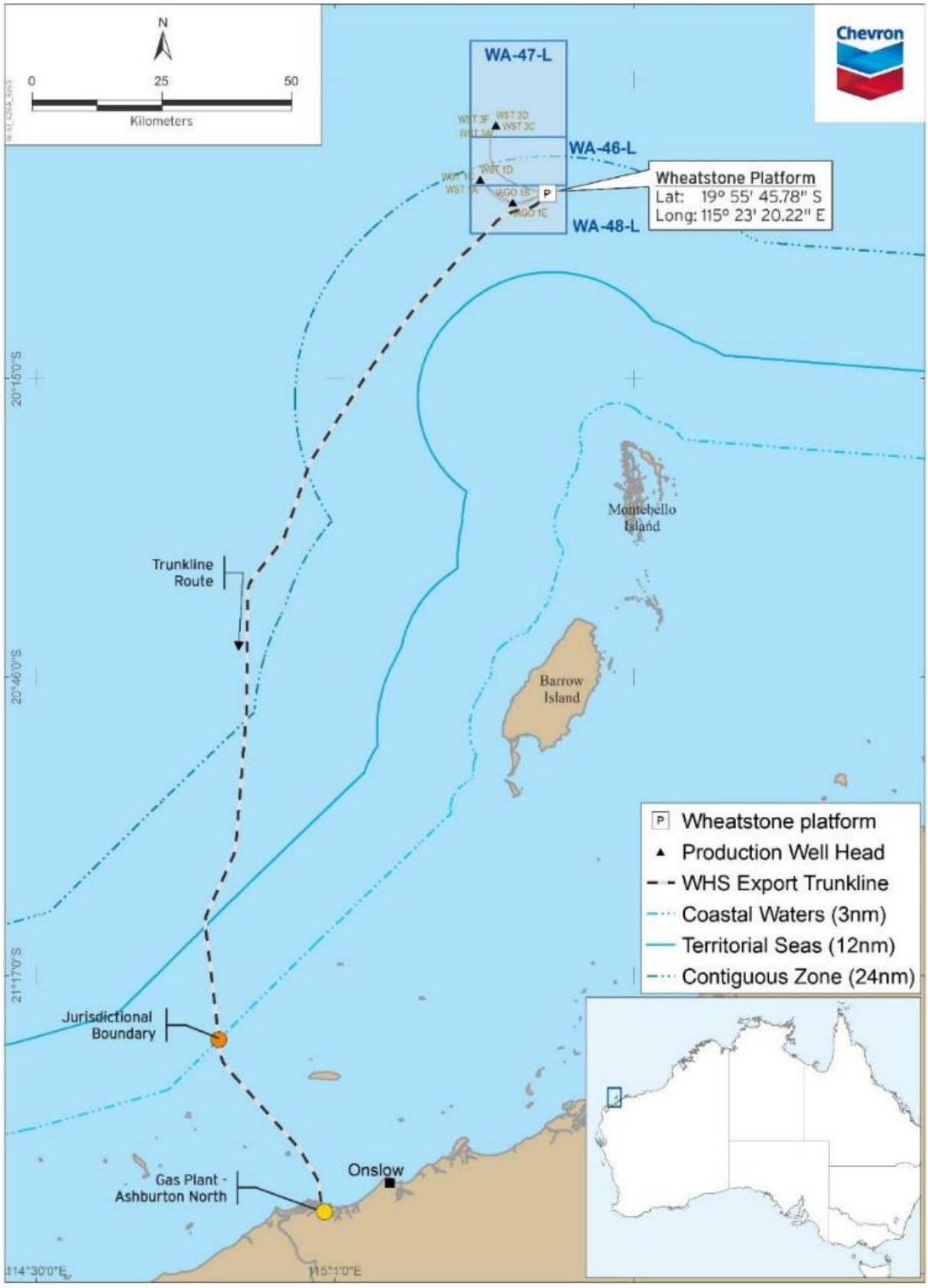

Figure 1-1: Overview of Wheatstone Infrastructure

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. 115)
- Australian Petroleum Production and Exploration Association (APPEA) Stakeholder Consultation and Engagement Principles and Methodology – Draft (Ref. 116).

1.4.1 Identification of Relevant Stakeholders

Since starting the Wheatstone Project, CAPL has developed and maintained a list of stakeholders considered relevant to the potential impacts and risks associated with the 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 affect the catch rates of commercial fisheries. Based on impacts to fish occurring in the Offshore, Barrow and Montebello Islands, and Ningaloo Impact Assessment Areas (IAAs), these stakeholders were considered relevant: • Western Australian Fishing Industry Council (WAFIC) • Aquarium Specimen Collectors Association of WA • Australian Southern Bluefin Tuna Industry Association • Commonwealth Fisheries Association • Pearl Producers Association • Professional Specimen Shell Fishermen's Association • Individual fishery licence holders within these fisheries: o Mackerel Managed Fishery (State) o Marine Aquarium Fish (State) o Onslow Prawn (State) o Pilbara Line Fishery (State) o Pilbara Trap Managed Fishery (State) o Pilbara Fish Trawl Interim Managed Fishery (State) o Specimen Shell Managed Fishery (State) o Exmouth Gulf Prawn Fishery (State) o Nickol Bay Prawn Fishery (State) o Pilbara Developing Crab Fishery (State) o Sea Cucumber Fishery (State) – as a holder of other fishery licences o North West Slope Trawl Fishery (Commonwealth) o Western Skipjack Tuna Fishery (Commonwealth) o Western Tuna and Billfish Fishery (Commonwealth) o Southern Bluefin Tuna Fishery (Commonwealth)

Stakeholder Type	Functions, Interests / Activities, and Stakeholders Consulted
Recreational fishers (and peak body associations)	This activity has the potential to impact on fish and thus affect the catch rates of recreational fishers, including: • Boating Industry Association WA • recfishwest • various fishing clubs • individual charter operators
Equity holders and 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: • Quadrant Energy • BHP Macedon • KUFPEC • Vermilion Energy • Woodside Burrup Pty Ltd
Government agencies	Government agencies responsible for managing marine reserves, or responsible for providing support in the event of a spill were considered relevant, including: • WA Department of Transport (DoT) • WA Department of Biodiversity, Conservation and Attractions (DBCA; formerly Parks and Wildlife) • WA Department of Mines, Industry Regulation and Safety (DMIRS; formerly Mines and Petroleum) • Commonwealth Department of Defence • Commonwealth Department of the Environment and Energy (DotEE) • Australian Border Force • Australian Maritime Safety Authority (AMSA) • Australian Hydrographic Service (AHS) • Australian Fisheries Management Authority (AFMA) • WA Department of Primary Industries and Regional Development (DPIRD) (formerly Fisheries) • Commonwealth Department of Communications and the Arts • Pilbara Port Authority • Shire of Ashburton
Other	• Onslow Chamber of Commerce and Industry • Onslow Community Reference Group • Onslow Salt • cattle stations in the local area • 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
30 Mar 2017	Mannie Shea – WAFIC	Expressed disappointment in language regarding proposed Petroleum Safety Zones (PSZs)	Concern was noted; however, not relevant to current EP	Continue to engage WAFIC regarding outcome of PSZ Application under assessment with NOPSEMA CAPL engaged with WAFIC as part of the PSZ application for the Wheatstone structures and wells which was subsequently accepted by NOPSEMA on 12 June 2017 and subsequently, no further action is required.
31 Mar 2017	Oscar Moreira – AHS	Acknowledged receipt	Not applicable (N/A)	N/A
03 Apr 2017	Jason Ross – Australian Border Force	Advised of correct process and contact for future correspondence	N/A	Update database and advise internal stakeholders for future consultation
06 Apr 2017	Luke Pugsley – AMSA	• Advised of correct process and contact for future correspondence • Requested future notifications and the opportunity to comment on future drilling activity impacts • Requested provision of gazetted information regarding PSZs	• N/A • No specific objection or claim. This is considered to be a trigger for ongoing consultation • No specific objection or claim but is a component of an existing control measure not resulting in any categorical change	• None identified • Request included in Table 1-4 • Requested information included in Section 5.1 and Table 1-4.
01 May 2017	Hans Kemps – DPIRD	Acknowledged receipt and requested time frame of EP submission	Request was noted and estimated time frame was provided	Update database of new location of the department
02 May 2017	Oscar Moreira – AHS	Acknowledged receipt	N/A	N/A
02 May 2017	Meredith Clark – AMSA	• Requested future notifications and the opportunity to comment on future drilling activity impacts	• No specific objection or claim. Considered as a trigger for ongoing consultation	• Request included in Table 1-4

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
		• Requested gazetted information regarding current application for PSZs (both AHS datacentre and Notice to Mariners) • Requested MODU and support vessels to notify Joint Rescue Coordination Centre (JRCC) for AUSCOAST warnings 24 to 48 hours before commencing operations	• No specific objection or claim but is a component of an existing control measure • No specific objection or claim but is a component of an existing control measure	• Captured in control measures in Section 5.1 • Captured in control measures in Section 5.1
19 May 2017	Hans Kemps – DPIRD	• Requested ongoing consultation regarding the EP • Provided advice on stakeholders to be engaged	Request was noted and ongoing consultation will continue with DPIRD and relevant industry stakeholders	• Response provided to DPIRD on 08 Jun 2017. • Include ongoing consultation requirements in Table 1-4
		• Requested collection of baseline marine data to compare against any post-spill data	CAPL has an operational and scientific monitoring program (OSMP) in place that includes a range of spill impact comparison strategies, including the potential use of pre-impact baseline data, spatial reference comparison, and proxy indicator monitoring comparison. This OSMP also outlines the baseline data that CAPL may use for comparison if a spill results from this activity.	None required
		• Requested that specific strategies are developed to protect spawning and nursery grounds in event of a spill • Notified CAPL of fish species spawning activities	The impacts and risks to juvenile fish, larvae, and planktonic organisms associated with commercial species from oil spills is evaluated in the EP. The EP includes an impact assessment on key receptors (including the potential impacts to fisheries, fish, and fish habitat) and considers measures to ensure impacts associated with the activities are reduced to as low as reasonably practicable (ALARP) in accordance with relevant legislation and regulations. The OSMP that would be implemented in the event of an oil spill will ensure that impacts to commercial species are	Impacts and risks evaluated in Section 5.7.5 of the EP. Strategies (including the implementation of the Oil Pollution Emergency Plan [OPEP] and OSMP) are also included in Section 5.7.5.

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
			monitored. The OSMP includes sampling of fish tissue (including gonads), and the flexibility to adjust monitoring priorities according to stakeholder input.	
		Requested application of DPIRD's biofouling assessment tool or use of a suitable biofouling management plan	There is merit in this objection / claim in that it is acknowledged that biofouling is a potential pathway for the introduction of an invasive marine pest (IMP) from this activity. CAPL confirmed that it will implement Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species (Ref. 113) as proposed by the DPIRD.	Control measure included in Section 5.6.4 of the EP
		Requested inclusion of DPIRD response in CAPL's assessments, and provide a copy to DPIRD.	Request was noted and provided	None required
19 Jun 2017	Hans Kemps – DPIRD	Responded to CAPL response on 08 Jun 2017: • In response to CAPL query whether the two additional fisheries are deemed critical by DPIRD: DPIRD stated it is that it is up to CAPL to liaise with WAFIC and the fisheries to determine relevance. • In response to CAPL query for spatial data for spawning grounds and nursery areas identified by DPIRD: DPIRD stated the data is not collated and to refer to published status reports.	A gap assessment was conducted that compared commercial fishing permits (including those fisheries listed by DPIRD) to the relevant oil spill modelling impact thresholds.	Additional fisheries identified as relevant stakeholders have been included in Section 1.4.1 and Section 3.2.2, and were engaged.
29 Jun 2017	Hans Kemps – DPIRD	Further comments on CAPL response from 08 June 2017: • DPIRD stated that vessel traffic between State Waters to the MODU in Commonwealth Waters should follow DPIRD's guidance.	This is considered outside the scope of the EP, thus no additional control measures were identified. However, CAPL confirmed that mobilisation of non-transient marine vessels (including MODUs) requires all vessel wetsides to be free of marine pests, achieved by evidence of recent wetsides	Response provided to DPIRD on 10 July 2017

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
		• If the MODU transits from international waters, DPIRD recommends a once-off marine pest monitoring of the MODU ~75 days after arrival.	cleaning, application of anti-foul coating, and limited time in known high-risk waters, or an in-water inspection by an approved DPIRD marine biologist prior to entering WA waters.	
7 Aug 2017	Lisa Dumbrell – WA Department of Mines, Industry Regulation, and Safety (DMIRS)	Requested further information on the petroleum activity, oil spill risk to State Waters or land, and notification arrangements relevant to the State.	There is merit in this request for further information, as spill modelling does predict potential impact to State waters and/or land.	Additional information was provided to DMIRS on 20 September 2017, in accordance with the DMIRS Consultation Guidance Note (Ref. 140)
21 Sep 2017	Lisa Dumbrell – DMIRS	• Acknowledged receipt of additional information, and that no further information is required. • Reminder to issue DMIRS with a commencement and cessation notification of each well.	• Noted. • Notification requirements have been included as ongoing consultation.	Commencement and cessation notification to DMIRS has been included in Section 1.5.5 of the EP.
31 Aug 2017	Jade Herwig – DoT	• DoT advised that the OPEP Summary document provided on 31 Aug 2017 is no longer sufficient, following new DoT consultation guidance (Ref. 141) released in late August 2017. DoT now require the entire OPEP and a concordance table against the requirements of Appendix 5 of the guidance. • Advised that consultation will take at least four weeks. • Stated they have no record of receiving EP Fact Sheet on 1 May 2017.	• There is merit in this request, noting that the guidance was only released a few days before the submission of the OPEP Summary. • CAPL provided confirmation the EP Fact Sheet was sent to Matt Verney on 1 May 2017.	The entire OPEP (Rev. 4.4) and a supporting information document (including a concordance table with Appendix 5) was provided to DoT on 1 Sep 2017.
3 Oct 2017	Jade Herwig – DoT	• DoT provided comments on Rev. 4.4 of the OPEP. Key comments included: o Control agencies o Dispersant use o OPIGN commitments o Cost recovery arrangements	DoT's comments were addressed – either the comments were incorporated, or further information was provided to DoT. CAPL amended the OPEP accordingly, to Rev. 4.5. they all had merit and thus a summary of th response for each comment is provided below.	CAPL provided a Response to DoT Comments and Rev. 4.5 of the OPEP to DoT on 11 Oct 2017.

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
		These are summarised below.		
		There are a number of references throughout the Start-Up and Operations Oil Pollution Emergency Plan, Rev. 4.4 (OPEP) where references to the use of State Response Team, National Response Team personnel and Department of Transport (DoT) equipment are stated. The OPEP must ensure that while these resources may be available, they are not to be relied on as Chevron must have sufficient capacity to respond to an oil spill using their own sourced personnel and equipment.	Noted. DoT resources and capability are included in the OPEP as oil spill response agency support services, and as DoT's role as Control Agency in State Waters.	None identified
		There are references to AMSA being the Controlling Agency for vessel spills in State waters which are inconsistent with WestPlan – Marine Oil Pollution, please amend.	Amended. Section 1.2.1 of the OPEP now clarifies AMSA is the control agency for vessel spills in Commonwealth Waters only, and that DoT is the control agency for vessel-based spills in State waters.	Updated Section 1.2.1 of the OPEP
		Table 4-1 appears to only detail notification to the DoT if the spill is from a vessel. Please ensure that notifications to DoT for all spills entering, occurring in, or with the potential to enter, State waters is clearly identified.	Amended. Table 4-1 in the OPEP now states reporting requirements to DoT apply to: *Spill to State Waters (including ports and inland waters), or with the potential to enter State waters.*	Updated Table 4-1 in the OPEP
		Dispersant is detailed as a potential response option. Has any testing on the amenability of dispersant on the potential hydrocarbon spill types been done? If so, what were the results and what types of dispersants are proposed for use? Are there any pre-determined areas where dispersant would not be considered an option?	Noted. CAPL has identified a short list of four dispersants based on predicted effectiveness along with availability and inclusion on the National Plan OSCA Register as these products have passed efficiency and toxicity testing and are permitted for use within Australian waters. These dispersants are Slickgone NS, Slickgone EW, Corexit 9527, and Finassol 52.	None identified

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
			CAPL have committed within the NOPSEMA-accepted Wheatstone Start-Up and Operations Environmental Plan (WSO-COP-00001) to complete dispersant efficacy testing with National Plan Oil Spill Control Agents on condensate within 12 months of steady state production operations to inform dispersant selection and use processes and/or understand the effectiveness of dispersants on condensate. During a response, the use of dispersants would be dependent on outcomes of the Operational NEBA, as stated in Section 6.3.2 of the OPEP for all response strategies, and specifically for areas <20 m deep, as stated in Table 7-8.	
		Table 7-8 details that 'CAPL Australia recommends not applying dispersant within the 20 m bathymetry contour to avoid sensitive receptors, unless NEBA confirms a net environmental benefit.' Would a NEBA be conducted if dispersant is considered as a possible response option outside of the 20 m bathymetry contour? Please note that this specific question has been asked previously of Chevron.	Noted. Section 6.3.2 in the OPEP commits to conducting an operational NEBA throughout the response. This will occur throughout all response strategies including dispersant application, regardless of water depths. Section 7.3 also commits to conducting a NEBA prior to dispersant application. Table 7-8 seeks to clarify that application of dispersant in waters <20 m is not recommended, with the caveat unless NEBA confirms it is worthwhile / will avoid impacting sensitive receptors. It does not infer that NEBA won't be undertaken for areas with >20 m water depth.	None identified
		Provide confirmation that Chevron will provide all necessary resources, including the initial 10 personnel to the DoT Incident Management Team, as per the DoT Offshore	Noted. CAPL held a consultation with Ray Buchholz, Matt Verney and Steven Wenban on 20 July 2017 where the CAPL	• Updated Section 1.2.1 of the OPEP

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
		Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (August 2017) (IGN) in the event of a spill entering State waters. While provision of personnel is eluded to (e.g. in Figure 1-2) it is not clear what this involves exactly and it is not clear that all the requirements in the IGN will be adhered to.	multijurisdictional EM concept of approach and management team model was presented and discussed. CAPL were directed to refer to the DoT OPIGN content and position CAPL's liaison team model schematic and narrative, thereby negating any requirements to prescribe the content of the OPIGN Annexes. The text in italics has been included in Section 1.2.1 of the OPEP: *'CAPL, in accordance with the guidance provided in the DoT OPIGN, will provide a Liaison Element Team to the DoT IMT…'* The additional narrative below linked the specifics of the OPIGN to the CAPL model and concept. '*The composition of the team will be determined between the SMPC / DoT IMT IC and the CAPL Perth EMT IC, based on the severity of the spill and commensurate with the level of introduced risk'* This was agreed to offer both CAPL the opportunity to project a consistent model and approach in its submissions and DoT the confidence that it was in accordance with guidance provided in the DoT OPIGN and the discussion during the consultation.	• Further clarification required (see consultation record 17–24 Oct 2017 below)
		Please make reference to the cost recovery arrangements in place for marine oil pollution incidents.	Amended. The following statement has been included in Section 1.2.1: *CAPL will comply with legislative requirements regarding cost recovery for oil pollution incidents that may occur as a result of the petroleum activities under the EPs.* Note under section 571(2) of the *Offshore Petroleum and Greenhouse Gas Storage*	Updated Section 1.2.1 of the OPEP

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
			Act 2006, titleholders are required to have sufficient financial assurance to meet the costs, expenses, and liabilities that may arise in connection with carrying out petroleum activities, particularly in the event of a major oil spill, as a prior condition of acceptance of an environment plan. CAPL provided this financial assurance to NOPSEMA in June 2017 as part of the submission of the EP (and this associated OPEP), which was calculated using the APPEA methodology.	
		The OPEP refers to the use of Tactical Response Guides (TRG). If Chevron could send through any TRG's available, it would be great for DoT to have on record.	Noted. TRGs have previously been provided to DoT. In the event that the current list of TRGs are revised or added to, CAPL will provided these to DoT.	None identified
17–24 Oct 2017	Jade Herwig – DoT	DoT accepted all of CAPL's responses to their comments, with the exception of the commitment that CAPL would provide a Liaison Element Team to the DoT IMT, in accordance with the OPIGN, in terms of the personnel provided by CAPL. These objections are provided below.	The personnel to be provided to the DoT IMT under the OPIGN perform IMT functions, not only 'liaison'. The OPEP was amended accordingly, in Rev. 4.6. All objections had merit and thus a summary of the response is provided below.	• An exchange of emails between DoT and CAPL agreed upon wording to be used in the OPEP. • CAPL provided Rev. 4.6 of the OPEP to DoT on 14 Nov 2017.
		It would be useful to include in Table 4-1 a reference to the DoT Maritime Environmental Emergency Response (MEER) Unit (no longer called the Oil Spill Response Coordination Unit), and remove references of notifications only from the Vessel Master (in case of spill being reported from the rig etc.).	Noted	None identified
		Confirmed that the meeting held on the 20 July 17 discussed elements of potential deviations from the OPIGN in regards to the GAB Project and the unique position that that project entailed with potential impacts across multiple States. The outcomes from that	Noted CAPL, in accordance with the guidance provided in the OPIGN, will provide a CAPL Support Team to the DoT IMT, which will include a CAPL Support Team Leader for supervision and oversight of the CAPL	Updated Section 1.2.1 of the OPEP

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
		meeting did not apply to Chevron activities in WA State waters or adjacent Commonwealth waters. As a result, Chevron will need to ensure that all the requirements from the OPIGN are incorporated into the OPEP and Chevron's response structures. This includes the requirement to provide the DoT IMT with a minimum of 10 personnel that would be required to fulfil those roles as outlined in Appendix 2 of the OPIGN and which would involve both functional and liaison roles. In addition, there are incorrect references such as the SMPC undertaking a Deputy Incident Commander role. Please ensure that the OPEP removes references to statements that are not in accordance with the requirements of the OPIGN and makes clear reference to those requirements that Chevron are expected fulfil.	personnel. The original composition of the CAPL Team will be 10 personnel, as stated in Appendix 2 of the OPIGN. The ongoing composition of the team will be determined between DoT and CAPL, based on the severity of the spill and commensurate with the level of introduced risk. The CAPL Support Team model is shown in Figure 1-2	

Table 1-4: Summary of Notifications and Ongoing Consultation

Stakeholder	Notification / Ongoing Consultation Requirement	Timing	Objective	Frequency
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
AHS	Advanced notification of the activity for: • Notice to Mariners	Four weeks before commencing each well program	Notice to Mariners	Once per well program, which may include intervention, abandonment, and/or infill drilling campaign
AMSA JRCC	Advanced notification of the activity for:	24–48 hours before commencing each well program	AUSCOAST Warning	Once per well program, which may include intervention,

Stakeholder	Notification / Ongoing Consultation Requirement	Timing	Objective	Frequency
	• AUSCOAST Warnings			abandonment, and/or infill drilling campaign
NOPSEMA	Notifying start of an activity	10 days before commencing each well program	Official notification of commencement of the activities under OPGGS(E) Regulation 29	Once per well program, which may include intervention, abandonment, and/or infill drilling campaign
	Notifying end of an activity	10 days after completing each well program	Official notification of cessation of the activities under OPGGS(E) Regulation 29	Once per well program, which may include intervention, abandonment, and/or infill drilling campaign
DMIRS	Pre-start notification confirming the start date of the each of the proposed Campaign 2 wells	One week before commencing Campaign 2 drilling	Notification of commencement of Campaign 2 drilling, as requested by DMIRS	Once
	Cessation notification upon completion of Campaign 2 well program	One week post-completion of Campaign 2 drilling	Notification of commencement of Campaign 2 drilling, as requested by DMIRS	Once
Onslow Community Reference Group (CRG)	Onslow CRG meeting	Scheduled CRG meetings	Overall Wheatstone Project/Onslow/CAPL update and community feedback	Quarterly or otherwise aligned with Onslow CRG members' agreed engagement frequency
WAFIC, DPIRD, AFMA, RecFishWest, Boating Industry Association of WA	Bi-annual update	Bi-annual	To provide a Wheatstone Project update, and to seek stakeholder feedback	Twice a year (typically every 6 months)
Interested parties Potentially affected parties 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 of the EP ; that may potentially impact marine users.	Prior to new or significant changes to activities or impacts/risks occurring	Notification of location, start and finish dates	As required

2 Description of the Activity

2.1 Overview

2.1.1 Location

Currently, nine production wells are operational within production licences WA-46-L, WA-47-L, and WA-48-L; all are located off the Pilbara coast of WA. Production licence WA-48-L is ~165 km off the north-west coast of WA, 75 km north of Barrow Island and 40 km north-west of the Montebello Islands. The coordinates for the nine wells are listed in Table 2-1.

Up to five additional production wells associated with the next drilling campaign (Campaign 2) will occur within the same production licences (WA 46-L, WA-47-L, or WA-48-L). The well locations proposed for Campaign 2 are not yet known; however, the wells will be drilled within ~2.5 km of a centrally located manifold. Although the final manifold location is not yet known, the locations of all potential future manifolds are listed in Table 2-2.

Currently, one well is identified for abandonment—Wheatstone 2 BCH01 ST1, which is within WA-47-L, at 212.9 m water depth (E 322709; N 7808247).

Table 2-1: Existing Production Well Locations

Well Name	Eastings	Northings	Water Depth (m)
WST-1A	318720	7798043	183.7
WST-1C	318766	7798036	183.3
WST-1D	318784	7798020	183
WST-3A-ST1	321487	7808552	228.6
WST-3C	321495	7808506	228
WST-3D	321485	7808484	227.8
WST-3F	321445	7808458	228
IAG-1B-ST1	324664	7793733	118.5
IAG-1E	324727	7793723	118.2

Table 2-2: Indicative Campaign 2 Well Locations

Manifold Name	Eastings	Northings	Water Depth (m)
WST North	326000	7815000	237
WST Central-North	321455	7808510	228
WST Central-South	320590	7804255	204
WST South	318750	7798000	183
IA North	326716	7796877	116
IA South	324692	7793706	118

2.1.2 Time Frame

Well intervention activities may be undertaken at any time of year during the operation of the facilities (nominally 30 years), and may commence any time after acceptance of the EP.

It is expected that the five additional Campaign 2 production wells will be drilled before the five-year revision of the EP is undertaken (due in 2022).

Activities covered by 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 PSZ around the nine existing and five planned wells described in the EP.

The Campaign 2 well locations are not yet finalised; however, an area within 2.5 km of each Campaign 2 manifold (Table 2-2) was used to define the operational area for the risk and impact evaluation covered under the EP.

Once the well locations are finalised, the operational area will be the 500 m PSZ around each well.

2.2 Drilling

2.2.1 MODU / Drill Ship Positioning

The rig chosen to complete activities under the EP may comprise a MODU, drill ship, or intervention vessel (collectively termed MODU). The MODU selected to complete the activities in the EP will either be anchored above 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, one of the support vessels will place two or three anchors from each corner of the main deck on the seabed; these moorings will be 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 will remain on the seabed after the transponders are retrieved.

2.2.2 Well Design and Drilling

The drilling methodology proposes using sea water combined with high-viscosity gel sweeps, water-based muds (WBM), and non-aqueous drilling fluids (NADFs) as outlined in Table 2-3.

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

Table 2-3: Summary of the 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)	13⅜” (340 mm)	Sea surface	WBM (contingency – NADF)
12¼” (311 mm)	9⅝” (244 mm)	Sea surface	NADF
8½” (215.9 mm)		Sea surface	WBM

A 42” hole is to be drilled riserless to a depth of ~70 m below the seabed, and a 36” conductor casing run and cemented back to the seabed.

Once the 36" casing is set, a 26" section is to be drilled riserless to a depth of ~400 m below the seabed and a 20" casing string run and cemented to the 36" casing shoe.

After completing the 36" hole section and installing the blowout preventer (BOP) and riser, a 17½" hole is to be drilled to ~1800 m below the seabed using primarily a WBM; however, an NADF may be selected based on engineering considerations. A 13⅜" casing string is then cemented in position.

Before drilling the production section of the well, pilot-hole sections may be required to reduce geological uncertainty. The pilot hole is expected to comprise a 12¼" section followed by an 8½" section. Both sections are proposed to be drilled with NADF. The 12¼" pilot-hole section is to be drilled to a depth of ~3000 to 3600 m below the seabed with NADF. A 9⅝" casing string is to be run to the bottom of this hole section and cemented in position before drilling the 8½" pilot hole, which will then be plugged and abandoned.

The 9⅝" casing will then be cut and retrieved from below the 13⅝" casing shoe. A side-track will be performed and a 12¼" hole will be drilled to ~3000 m to 3600 m depth with NADF. The 8½" × 9⅞" production hole will be drilled with a water-based reservoir drill-in fluid (WBRDIF). The WBRDIF will be re-used, then discharged at the end of the drilling program.

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 allowing solids control equipment to remove 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.

Throughout the drilling program several different fluids will 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 must ensure and demonstrate that heavy metal constituents (mercury and cadmium) of weighting fluid (barite) meets contract specifications. Further control measures are described in Section 5.6.1. Once drilling operations are complete and the NADF is removed from the tanks, the MODU's NADF tanks will be cleaned. Volumes of residual NADF are consolidated and recovered by mechanical means (e.g. squeegee, mud vacuum) before tank washing, dilution, and discharge. NADF tank washing residue (verified to comprise <1% residual hydrocarbon) may be discharged into the marine environment.

Information collated for the nine wells associated with the Wheatstone production drilling program was interrogated to provide an indicative (average) volume of drilling fluids and cuttings discharged per well, as listed in Table 2-4.

Table 2-4: Indicative Volume of Drilling Fluids and Cuttings per Production Well

Discharge Type	Average Volumes (m^3)
WBM	2269
Suspension and completion fluids (brine)	1163
Wellbore clean-up fluid discharge (NADF brine interface)	76
NADF tank washing	90
Cuttings (WBM sections)	463
Cuttings (NADF sections)	143

2.2.4 Cementing Operations

Once the upper-hole sections are complete, 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 (~1 m^3) discharged overboard.

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 completions (D&C) program to provide an additional barrier to prevent a loss of well control (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 the rams within the BOP stack.

The BOP control system discharges control fluid into the sea when operating. A full function test to close and open all rams and annular discharges ~2500 L of diluted control fluid, which is a water-soluble product and is diluted to 1–3% with potable water for use. 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 any different.

2.2.6 Well Suspension Following Drilling

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

After installing 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 either injected 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 Completions

A tubing hanger spool is installed over the last casing string. The tubing hanger spool provides the internal profile, landing shoulder, and orientation helix guide for the tubing hanger.

The previously installed retrievable suspension packer is then removed from wellbore, and the fluid within the wellbore is replaced with filtered brine. The displaced fluid is collected on board and filtered via a diatomaceous earth (DE) filtration system. Spent DE filtration medium will be discharged overboard at the well location. It is anticipated that the completion phase for each well is likely to produce ~2 T of used DE product. After completion activities, any remaining filtered brine may be discharged overboard, with volumes of a single wellbore ~2500 bbl.

After the wellbore has been displaced to brine, the wells are then displaced with the WBRDIF and the 8½" × 9⅞" reservoir section is drilled. Gravel packing will be undertaken for the open-hole completion to keep the produced fluid clear of sand.

A string of completion tubing, complete with production packer and a surface control subsurface safety valve, is then installed. Before the production packer is permanently set and tested, the well is displaced to a treated dilute brine system with an oxygen scavenger, biocide, and hydrate inhibitor (monoethylene glycol [MEG]).

Once the well is successfully completed, it is suspended by releasing the landing string and displacing the riser.

2.2.8 Vertical Subsea Tree Installation

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

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

Following the ROV survey, the wellhead cap is removed in preparation for running the subsea christmas tree. At this stage, the previously injected or placed biocide and corrosion inhibitor is exposed from within the wellhead 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 wellhead is then cleaned by either 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 wellhead, 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 wellhead 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 wellhead for installation.

When the subsea tree engages with the wellhead, the tree cap lock is pressurised, locking the tree in position on the wellhead. 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 wellhead and valve functionality. An overpull test is undertaken to verify the tree is secured in position. Valve functionality testing will result in the discharge of 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 with 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.

2.2.10 Logging

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

Wireline evaluation determines rock and fluid properties of the targets. A suite of standard wireline logs will be run, including gamma ray, neutron-density, resistivity, sonic, acquisition of pressures and samples, vertical seismic profiling (VSP), and side-wall coring.

Typically, between three and six air guns are used during a VSP operation, with a volume of between 150 and 250 cubic inches each. Generally, the source is positioned 5–10 m below the water surface. VSP operations may use various methods: zero-offset, walk-above, or walk-away; Any of these may be used during the drilling program.

2.3 Well Intervention Activities

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

- slickline / wireline operations
- well testing and flowback
- well workovers.

No well interventions are planned to be undertaken; they are usually only required if equipment is underperforming or defective. For the purposes of the EP, it is assumed that intervention on a single well may be required once a year; however, this may be more frequent depending on well performance.

2.4 Well Abandonment

The suspended well that is identified to be abandoned (Wheatstone 2 BCH01 ST1), is currently suspended as per CAPL's applicable barrier requirements documented in the NOPSEMA-accepted Wheatstone Project Producing Phase Well Operations Management Plan (WOMP) (Ref. 97).

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 decided.

2.5 Support Operations

Support vessels, which are based out of the Port of Dampier, are used to 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 powders, drilling fluids, and drilling materials (crane and bunkering operations)

- collect waste
- assist in emergency response situations
- monitor the 500 m radius PSZ around the MODU and intercept errant vessels.

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

The MODU is serviced by helicopters based on Barrow Island. Helicopter flight frequency is five times per week (on average) and will primarily be used for passenger transfers/crew changes and minor supplies.

All crew changes for the MODU will be conducted by helicopter.

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

For the EP, CAPL considers the MODU as a facility that meets the definition under Clause 4 of the OPGGS Act.

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:

- Argo-Rowley Terrace
- Barrow and Montebello Islands
- Dampier Archipelago
- Exmouth Gulf
- Gascoyne
- Ningaloo
- Offshore
- Pilbara Coast
- 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. 3; 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 provided in Sections 3.1 to 3.3.

Section 3.4 summarises the particular values and sensitivities within the remaining IAAs (as identified in CAPL's Description of the Environment document (Ref. 4; ABU140700357).

3.1 Regional Overview

The Wheatstone and Iago production licences are located in 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. A Marine Bioregional Plan for the North-west Marine Region (Ref. 5) was released in 2012; it aims to strengthen the operation of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (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. 5). Information in the bioregional plan is 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. 5). The Wheatstone and Iago production licences are located within the Northwest Shelf Province and Northwest Province. 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. 5).
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. 5).

3.1.1 Marine Environment

3.1.1.1 Marine Habitats

The depth of water associated with the operational area precludes the establishment of benthic primary producer habitat (e.g. macroalgae and seagrass).

Field investigations of benthic habitat near the well locations helped identify broad-scale habitats, including benthic faunal assemblages (Ref. 6). The vast majority of surveyed sites were characterised by:

- sparse (1–10 m^2) to abundant (50–100 m^2) bioturbation (evidence of infauna such as burrows and mounds).
- trace to very sparse (<1%) benthic sessile and motile invertebrates including soft corals, sea pens, sponges, sea whips, ascidians, urchins, and hydroids.

CAPL has conducted extensive surveys within the production titles to understand the nature and composition of the seabed sediments to provide accurate bathymetry for geohazard assessment and engineering design. These surveys comprise high resolution geophysical surveys, which are supported by seabed sampling campaigns. Survey data have been analysed to separate benthic substrate into hard substrates (rocky and gravel) and soft substrates (silty-sand, sand and clay),as presented in Figure 3-1.

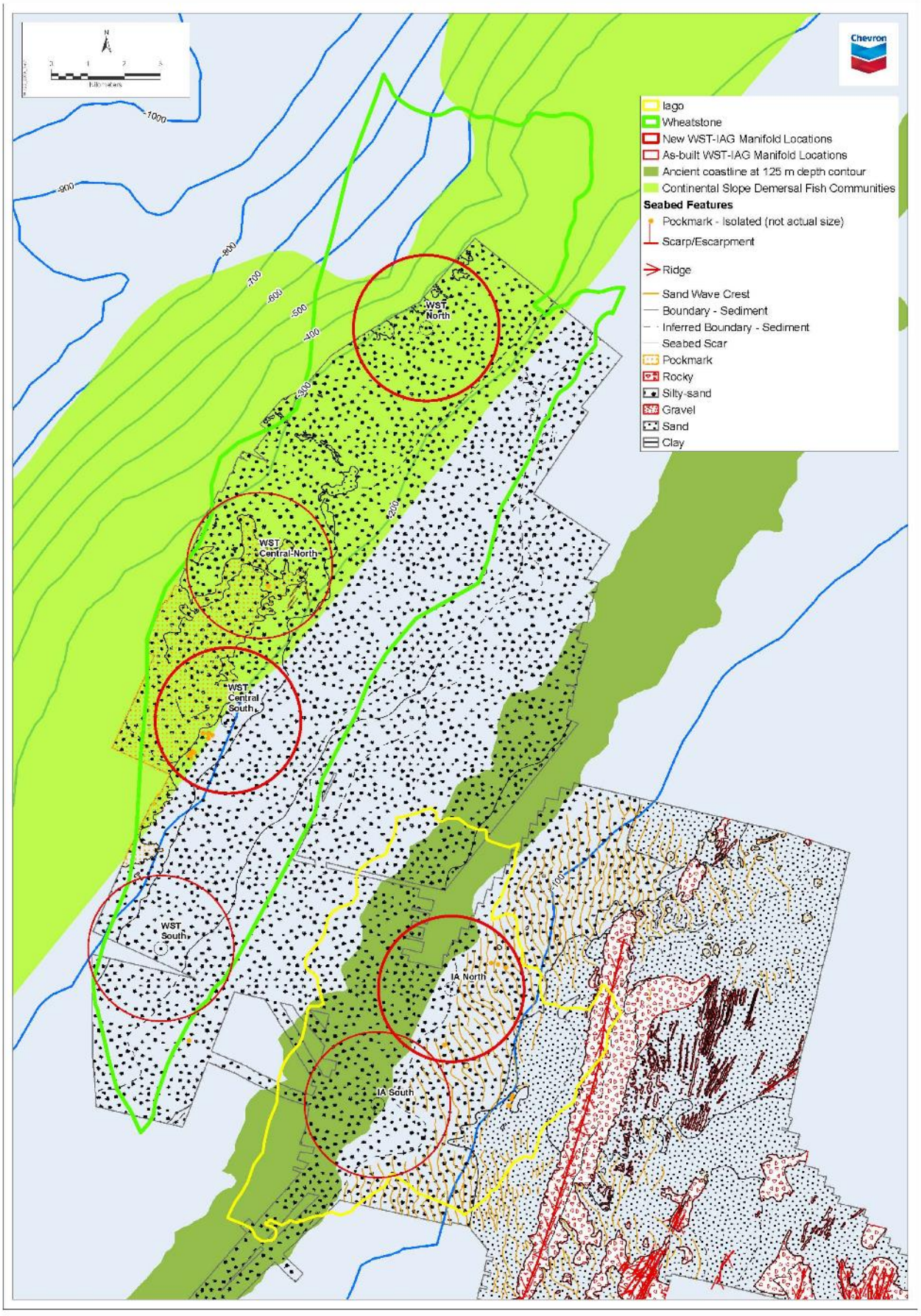

Figure 3-1: Benthic Substrates within the Operational Area

Note: The operational area associated with the EP is located within two Key Ecological Features (KEFs) (Figure 3-1):

- Continental slope demersal fish communities
- Ancient coastline at 125 m depth contour.

A description of the KEFs with the potential to be exposed is provided below.

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. 5).

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. 5).

However, as described above, surveys undertaken near the Campaign 2 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.

Ancient Coastline at 125 m Metre Depth Contour

The ancient coastline is a ledge of hard substrate on the seabed at 125 m water depth and has been recognised as a KEF for its biodiversity values, including unique seabed features with ecological properties of regional significance. It is believed to be a possible navigation aid for whales, Whale Sharks, and other migratory pelagic species as they move through the region (Ref. 5).

Parts of the ancient coastline, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments. The topographic complexity of these escarpments may also facilitate vertical mixing of the water column, providing relatively nutrient-rich local environments (Ref. 5). The North-west Marine Bioregional Plan describes their values to be ‘unique seafloor feature with ecological properties of regional significance’ (Ref. 5).

However, as described above, surveys undertaken near the Campaign 2 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.

3.1.1.2 Marine Fauna

A search of the protected matters database for the Production Licences (Ref. 7) indicated that several Threatened or Migratory species may be present within the operational area. These are described in the various subsections below.

Marine Mammals

Several Threatened or Migratory marine mammals may be present within the 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.

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

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. 8). 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. 9).

Blue Whales migrate north from April to August and south from September to November.

Reptiles

Five Threatened or Migratory marine turtle species 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. 10; Ref. 11; Ref. 12).

Barrow Island and the Montebello Islands (including a 60 km radius buffer) provides critical habitat for the Flatback Turtle. The operational area overlaps this 60 km buffer, described in the Turtle Recovery Plan associated with this identified critical habitat (Ref. 15).

During turtle internesting periods, turtles are known to be more sedentary (Ref. 13). However, studies indicate that during internesting periods, marine turtles (including Flatbacks) tend to travel within 5 km of the nesting coastline (Ref. 14). Because of the distance of the operational area from the nearest coastline (40 km from the Montebello coastline), marine turtles are not expected to practice such internesting behaviour near the operational area. Therefore, the presence of this BIA, and the behaviours it represents are not considered further within the operational area.

A number of sea snake species were identified via the EPBC search as having the potential to be present in the operational area. However, Cogger (Ref. 120; Ref. 121) 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 >115 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 (225–500 m depth) and mid-slope (750–1000 m depth) display a high degree of endemism, supporting more than 508 fish species, of which up to 76 species are endemic (Ref. 16). The high number of species is believed to be associated with areas of enhanced biological productivity as a result 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. 7). However, 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. 122; Ref. 123; Ref. 124; Ref. 125). 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. 126), these species were not identified by the EBPC search for the production titles. 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
- Greater Frigatebird
- 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 EPBC search) overlapped the operational area and thus is 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 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 Platform, which processes gas condensate produced by the wells within the scope of the EP.

The next closest production facility to the operational area is the Pluto Platform, ~7.6 km away.

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. 4).

Consultation with AMSA confirmed that most traffic in and around the operational area comprises offshore support vessels. The traffic patterns are a mixture of transiting commercial vessels and offshore support vessels (Figure 3-2).

There are no channels or navigation hazards that restrict the bearing vessels could take around the operational area.

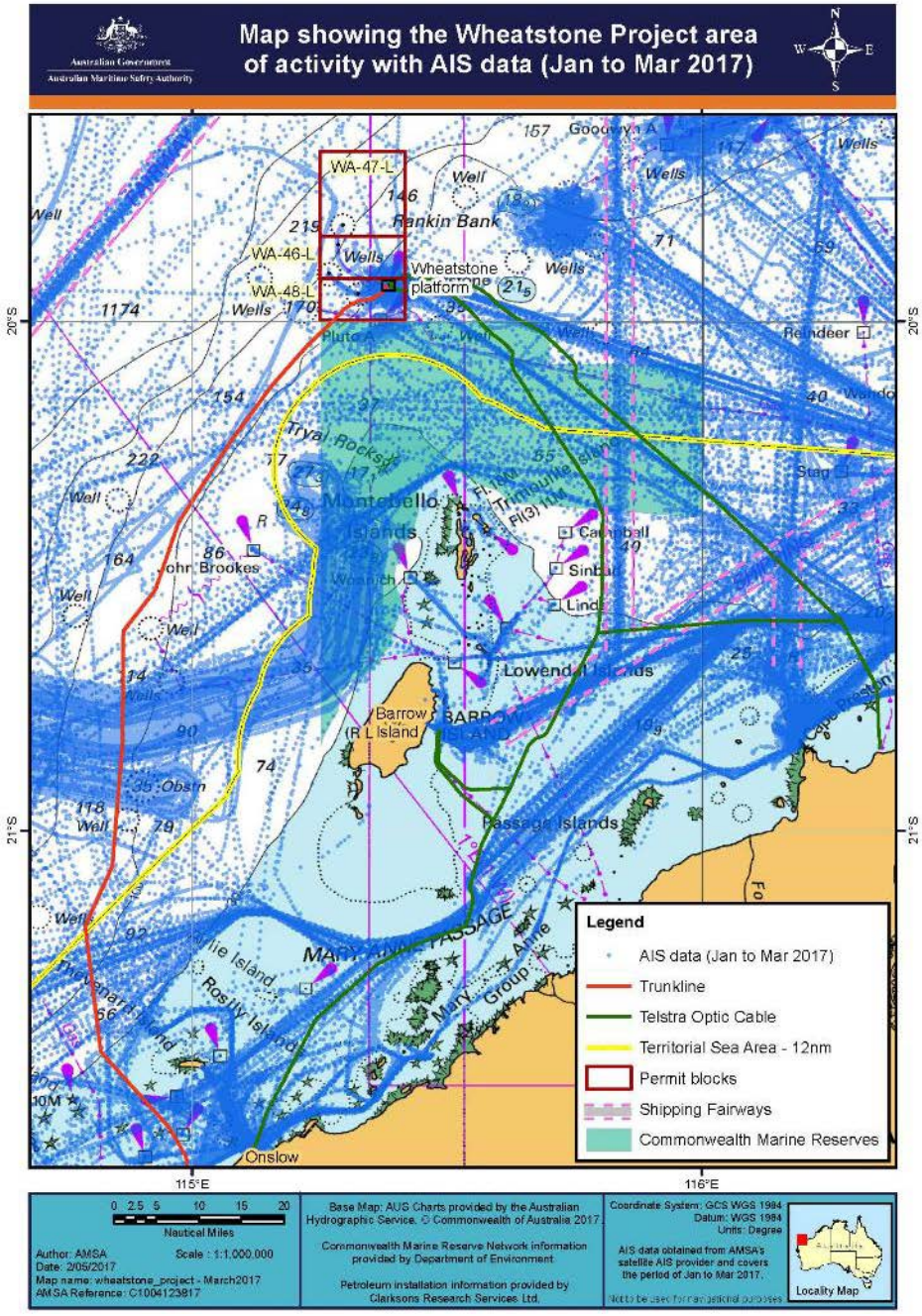

Figure 3-2: Shipping Data for Wheatstone Production Licences

3.2.2 Commercial Fishing and Aquaculture

Several State and Commonwealth fisheries intersect the operational area. However, historically, fishing effort in this area is low, and the operational area only occupies a small proportion of the total area of the fishery permits.

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. 4).

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
Scalefish	
• Pilbara Line Fishery • Pilbara Trap Fishery • Mackerel Managed Fishery • Marine Aquarium Fish Managed Fishery • Pilbara Fish Trawl Interim Managed Fishery	• North West Slope Trawl Fishery • Southern Bluefin Tuna Fishery • Western Tuna and Billfish Fishery • Western Skipjack Tuna Fishery
Benthic Invertebrates	
• Specimen Shell Managed Fishery • Marine Aquarium Fish Managed Fishery • Onslow Prawn Managed Fisheries • Exmouth Gulf Prawn Fishery • Nickol Bay Prawn Fishery • Pilbara Developing Crab Fishery	N/A

3.2.3 Marine-based Tourism and Recreation

No objections or claims were raised during consultation with Recfishwest regarding the activities' proximity to recreational fishing activities. 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. 18).

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. 19).

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)
- ancient coastline at 125 m water depth contour (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
Argo-Rowley Terrace	• The Rowley Shoals comprise intertidal and subtidal oceanic coral reefs. These reef systems are considered regionally and internationally significant because of the Indo-West Pacific species represented there, their undisturbed nature, and their location at the headwaters of the Leeuwin Current. • Considered species-rich with 291 species of hard coral identified. Species show a strong affinity with Indonesia and are different to those found on the adjacent Australian mainland coast.
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. • High diversity of hard corals in relatively undisturbed intertidal and subtidal reefs. • Ancient Coastline at 125 m depth contour.
Dampier Archipelago	• The Dampier Archipelago is recognised as a regionally significant reef system given the high diversity of corals in the area and its high priority for future management as a marine reserve.
Exmouth Gulf	• No values identified.
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). • 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
Argo-Rowley Terrace	• No values identified.
Barrow and Montebello Islands	• No values identified.
Dampier Archipelago	• No values identified.
Exmouth Gulf	• Seagrass beds and macroalgae are extensive along the east coast of the Gulf and southern bays; however, they are relatively low in percentage coverage. These areas are important nursery habitat for juvenile prawns and other species.
Gascoyne	• No values identified.
Ningaloo	• No values identified.
Offshore	• No values identified.

IAA	Seagrass
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
Argo-Rowley Terrace	• N/A. Not known to occur in the Area.
Barrow and Montebello Islands	• No values identified.
Dampier Archipelago	• No values identified.
Exmouth Gulf	• Dugongs are known to frequently occur in shallow waters of this Area. Used for breeding, calving, nursing, and foraging, with use of the Area all year round.
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 variation of habitat use within Shark Bay by Dugongs has been observed, as a consequence of changing water temperatures. • 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
Argo-Rowley Terrace	• Area forms part of the Pygmy Blue Whale (listed as Endangered) migration route for the northern (July) and southern (October to November) migration.
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. • 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. • 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.
Dampier Archipelago	• Area forms part of the Humpback Whale migration route for the northern and southern migration. Usage is seasonally high from July to October. • Adult Humpback Whales and their young frequent the Dampier Archipelago on their southern migration in early spring; Mermaid Sound is a significant resting area for females with their calves.

IAA	Whales and Dolphins
Exmouth Gulf	• Area forms part of the Humpback Whale migration route for the northern and southern migration. Usage is seasonally high during the northern migration from July to August. • The Area is important for resting Humpback Whales during the southern migration (September to November), with the northward-facing embayments providing shelter in prevailing weather and a rest area for whales with calves.
Gascoyne	• Area forms part of the Humpback Whale migration route for the northern and southern migration. Usage is seasonally high from July to October. • 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. • 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. • 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. • Northward-facing embayments have been identified as important for Humpback Whale resting areas during winter. • 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). • 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
Argo-Rowley Terrace	N/A. Not expected to occur in the Area.
Barrow and Montebello Islands	N/A. Not expected to occur in the Area.
Dampier Archipelago	N/A. Not expected to occur in the Area.
Exmouth Gulf	N/A. Not expected to occur in the Area.
Gascoyne	The specific objectives of the recovery plan that are relevant to petroleum activities include: • mitigate the impacts of marine debris on Australian Sea Lion populations • investigate and mitigate other potential threats to Australian Sea Lion populations, including disease, vessel strike, pollution, and tourism.

IAA	Seals
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: • mitigate the impacts of marine debris on Australian Sea Lion populations • 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
Argo-Rowley Terrace	• The Area is an important foraging area for the Loggerhead Turtle.
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. • 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. • 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. • The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 15) indicates that: o Barrow Island and the Montebello Islands (and 20 km radius buffer) provide critical habitat for the Green Turtle o Barrow Island and the Montebello Islands (and 60 km radius buffer) provide critical habitat for the Flatback Turtle 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.
Dampier Archipelago	• These islands and their waters west of the Burrup Peninsula are identified as important for Green Turtles (mating, nesting, internesting, foraging). Major Green Turtle nesting sites occur on Legendre and Huay Islands, with internesting and foraging occurring in the surrounding waters; the intertidal habitat is important to juvenile Green Turtles. • The Area is important for nesting Flatback Turtles. Intercourse, Legendre, Delambre, and Huay Islands represent known Flatback Turtle nesting areas, with varying levels of use. The marine waters of the Dampier Archipelago are important for Flatback Turtle foraging and internesting behaviours. • The marine waters of the Area are important for internesting and nesting behaviour by Hawksbill Turtles, particularly at Rosemary Island, which may represent one of the largest Hawksbill rookeries in the Indian Ocean. • The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 15) indicates that: o the Dampier Archipelago (and 20 km radius buffer) provides critical habitat for the Green Turtle o the Dampier Archipelago, including Delambre Island and Huay Island (and 60 km radius buffer), provides critical habitat for the Flatback Turtle

IAA	Reptiles
	o The Dampier Archipelago (including Rosemary Island and Delambre Island) (and 20 km radius buffer) provides critical habitat for the Hawksbill Turtle.
Exmouth Gulf	• The Area includes important internesting habitat for some marine turtle species.
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. • 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. • 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. • 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. • The northern part of the Area includes important habitat for internesting Flatback Turtles. • The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 15) indicates that: o the North West Cape and Ningaloo Coast (and 20 km radius buffer) provide critical habitat for the Green Turtle 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. • 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. • 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. • 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. • The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 15) indicates that: o Serrurier Island and Thevenard Island (and 20 km radius buffer) provide critical habitat for the Green Turtle o coastal islands from Cape Preston to Locker Island (and 60 km radius buffer) provide critical habitat for the Flatback Turtle 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.

IAA	Reptiles
	• 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. • The Recovery Plan for Marine Turtles in Australia 2017–2027 (Ref. 15) 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
Argo-Rowley Terrace	• The Whale Shark (listed as Vulnerable) is known to forage in this Area. • Mermaid Reef is considered a biodiversity hotspot where the steep change in slope around the reef attracts a range of pelagic migratory species including billfish, sharks, and tuna. • Continental slope demersal fish communities. • Ancient Coastline at 125 m depth contour. • Canyon linking the Argo Abyssal Plain with Scott Plateau. • The Rowley Shoals have a rich diversity of fish fauna with 565 species identified. Many fish species are common to the Indo-West Pacific region and the tropical and subtropical waters of WA. Almost half the species recorded at the Rowley Shoals have not been recorded in mainland WA coral reef environments where waters are more turbid, but these species are more commonly found in other Indo-West Pacific areas such as the Great Barrier Reef. The resident demersal community is an important ecological value of the Rowley Shoals Marine Park.
Barrow and Montebello Islands	• Ancient Coastline at 125 m depth contour. • Continental slope demersal fish communities.
Dampier Archipelago	• Creeks within the Dampier Archipelago may be important juvenile nursery areas for Green Sawfish (listed as Vulnerable).
Exmouth Gulf	• No values identified
Gascoyne	• Demersal slope and associated fish communities of the Central Western Province. • Mesoscale eddies – high productivity for primary producers and associated seabird, fish, and marine mammal diversity. • Perth Canyon and adjacent shelf break, and other west coast canyons. • Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula. • Continental slope demersal fish communities. • Exmouth Plateau – high productivity for primary producers and associated seabird, fish, and marine mammal diversity. • 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. • Commonwealth Waters adjacent to Ningaloo Reef. • Continental slope demersal fish communities. • Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula.

IAA	Fish Sharks and Rays
Offshore	• The Whale Shark (listed as Vulnerable) is known to occur in this Area, where important foraging habitat exists for this species. • Glomar Shoals – high productivity for primary producers and associated seabird, fish, and marine mammal diversity. • Ancient Coastline at 125 m depth contour. • Continental slope demersal fish communities. • Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula. • 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. • 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
Argo-Rowley Terrace	• The Rowley Shoals are considered an important area for seabirds, with a wide range of species recorded. Bedwell and Cunningham islands are recognised as important resting places for northern migrants en route to and from Australia, with large flocks of waders recorded at the Rowley Shoals. • The Area provides important foraging and breeding grounds for the Little Tern and the White-tailed Tropicbird. The Little Tern has a wider distribution along the greater Kimberley coast, while the White-tailed Tropicbird is only recorded in two locations in WA.
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. • Regionally significant for Fairy Tern and Sooty Oystercatcher. • The largest breeding colony of Roseate Terns in WA is located on the Montebello Islands. • Double Island is a regionally significant rookery for Bridled Terns and Wedge-tailed Shearwaters. • The south/south-east of Barrow Island is nationally significant for shorebird foraging habitat.
Dampier Archipelago	• The Area provides regionally important foraging and breeding habitat for a high diversity of seabird and shorebird species. • The small islands and islets such as Goodwyn Island, Keast Island, and Nelson Rocks provide important undisturbed nesting and refuge sites.
Exmouth Gulf	• Exmouth Gulf mangroves and Sunday Island are identified as important bird areas for nesting sites for Roseate Terns and for supporting foraging by Pied Oyster Catchers and Grey-tailed Tattlers.
Gascoyne	• No values identified.
Ningaloo	• The Muiron Islands are important nesting sites for the Wedge-tailed Shearwater and various other seabirds. • This area overlaps foraging areas adjacent to important breeding areas for migratory seabirds (specifically the Wedge-tailed Shearwater).
Offshore	• No values identified.

IAA	Seabirds and Shorebirds
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. 21) 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. 20) and Handbook 203:2012 Managing Environment-Related Risk (Ref. 96).

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 Wheatstone 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 Integrated Risk Prioritization Matrix

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

Likelihood Descriptions & Index (with confirmed safeguards)

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	Likelihood Indices		Decreasing Likelihood						
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
Consequence Descriptions	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
Consequence Descriptions	**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. 24; GN0166), CAPL's D&C Team have adapted the approach developed by Oil and Gas UK (Ref. 23) 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.

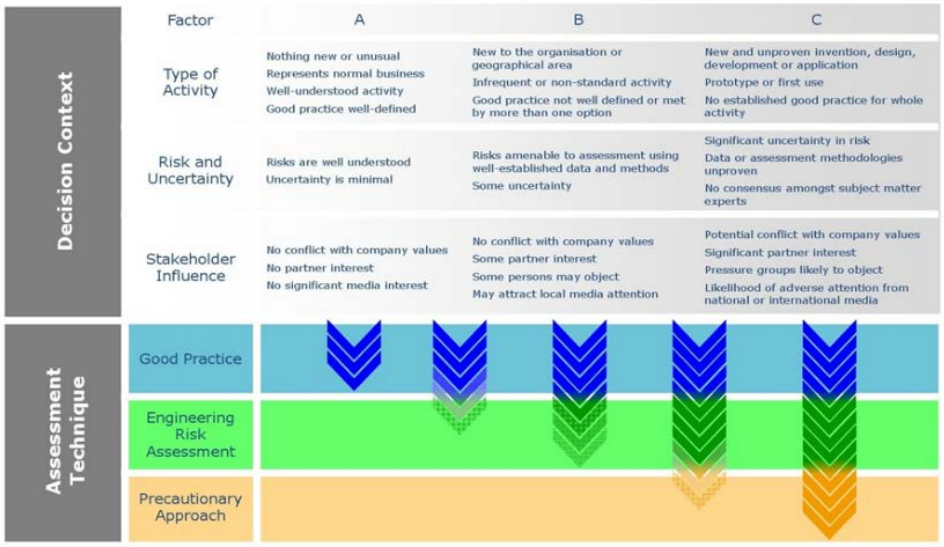

Figure 4-2: ALARP Decision Support Framework

(Source: Ref. 22)

4.2 Risk and Impact Acceptance Criteria

NOPSEMA provides guidance on demonstrating that impacts and risks will be of an acceptable level (Ref. 24). 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])
	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?

Acceptability Test	How Applied
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)? 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)

Cause of Aspect	
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: • MODU positioning • support operations • well abandonment.	
Hazard	
Physical interaction has the potential to result in: • injury or death of marine fauna; or • a disruption to commercial activities.	
Potential Consequence Summary	**Ranking**
Injury or death of marine fauna Surface-dwelling macrofauna are the species most at risk from this hazard and thus are the focus of the 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. Additionally, the Whale Shark has been identified as a surface-dwelling species with a BIA that overlaps the operational area. In total, four BIAs overlap the operational area. These are: • Blue and Pygmy Blue Whale (migration) • Humpback Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting). 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. 25). Cetaceans were the focus of the evaluation as they provide a representative case to enable an evaluation of consequence to be undertaken. Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels and facilities. The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when near a vessel, while others are curious and often approach ships that have stopped or are slow moving, although they usually do not approach, and sometimes avoid, faster-moving ships (Ref. 26). Collisions between larger vessels with reduced manoeuvrability and large, slow-moving cetaceans occur more frequently where high vessel traffic and cetacean habitat occurs (Ref. 27). Laist *et al.* (Ref. 28) 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.	**Incidental (6)**

There have been recorded instances of cetacean deaths in Australian waters (e.g. a Bryde's Whale in Bass Strait in 1992) (Ref. 27), although the data indicate such deaths are more likely to be associated with container ships and fast ferries. Mackay (Ref. 29) 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. The duration of fauna exposure to vessel strike depends on the duration of any maintenance and drilling activities undertaken under the EP. As described in Section 2.1.2, the scope of this activity is expected to be limited to non-continuous activities over the duration of the EP (5 years). If a fauna strike occurred and resulted in death, it is not expected to have a detrimental effect on the overall population; the 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 As identified in Section 3.2.2, several commercial fisheries have licences that overlap the operational area associated with the EP; however, fishing activity in the area is low (Ref. 30; Ref. 31; Ref. 32). Stakeholder engagement, along with annual fishing records, indicates that that the proposed activities are not expected to result in an impact to commercial operations (via loss of catches or damage to fishing equipment). Relatively small numbers of vessels are likely to be encountered near the operational area with only small numbers expected to trawl within the vicinity of the wells. The most credible impact to other marine users would be the minor deviation of commercial vessels around the MODU. The PSZ is only 500 m, so any required deviations would be minor and thus have negligible impact on vessel travel times or fuel usage. Because exclusion zones are already in place around the existing production wells, and only five additional production wells are to be drilled, the potential impacts are limited to the drilling period, which is ~35–65 days per well. 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	• Ministerial Statement EPBC 2008/4469 Condition 26, the Wheatstone Conservation Significant Marine Fauna Interaction Management Plan (CSMFIMP) (Ref. 2) / EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans – The Australian Guidelines for Whale and Dolphin Watching: o Vessel Master o Marine Fauna Observer (MFO) o fauna observation actions o fauna interaction management actions o incident reporting • Commonwealth *Navigation Act 2012* o petroleum safety zones o pre-start notifications	**Consequence**	Incidental (6)
		Likelihood	Remote (5)
		Risk Level	Low (10)

5.2 Light Emissions

Cause of Aspect
These activities were identified as having the potential to result in the generation of light emissions: • wellbore clean-up and flowback (flaring activities) • support operations (navigational and work lighting).

Monitoring undertaken by Woodside (Ref. 33) 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 for light emissions to attract marine species.

Hazard

A change in ambient light levels resulting in a localised light glow may impact receptors by:

- acting as an attractant to light-sensitive species (e.g. seabirds, fish), in turn affecting predator–prey dynamics.

Potential Consequence Summary	Ranking
Acting as an attractant to light-sensitive species No evidence exists 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. 34), so light is not considered to be a significant factor in cetacean behaviour or survival. Light may attract many species of fish, reptiles, and seabirds. At the well locations, the particular values and sensitivities with the potential to be exposed to light emissions include: • Wedge-tailed Shearwater (breeding / foraging) • Flatback Turtle (internesting). Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Ref. 35) and that lighting can attract birds from large catchment areas (Ref. 36). These studies indicate that migratory birds are attracted to lights on offshore platforms when travelling within a radius of 5 km from the light source, but their migratory paths are unaffected outside this zone (Ref. 37). As the operational area is (at its closest) 40 km from coastline habitats, only a small number of Threatened or Migratory listed seabird species would be expected to be present in this area. 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. Pendoley (Ref. 38) 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. 38) and Hick (Ref. 39), it is expected that light emissions from this activity would result in a very small exposure area, which for the evaluation is conservatively determined to be within 500 m of the MODU, and thus the number of marine turtles exposed would be limited. The Recovery Plan for Marine Turtles in Australia (Ref. 15; known as the Turtle Recovery Plan) identifies light emissions as a key threat because it disrupts critical behaviours. However, the Turtle 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 [0.79 km^2]; and a BIA area of 11 309 km^2), light emissions are not expected to affect critical behaviours discussed in the Turtle Recovery Plan. If individual internesting turtles were attracted to the light, it is not expected that this would significantly alter sensitive behaviours that would lead to individual or greater population impacts due to the distance offshore. Based on the distance to critical nesting habitat (~40 km to the Montebello Islands and 75 km to Barrow Island), 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.	**N/A**

5.3 Underwater Sound

Cause of Aspect
These activities were identified as having the potential to result in the generation of underwater sound emissions: • well evaluations (VSP) • support operations (MODU operations) • support operations (vessel operations) • support operations (helicopter operations).
Hazard
The generation of underwater sound has the potential to affect marine fauna through: • localised and temporary fauna disturbance • auditory impairment, Permanent Threshold Shift (PTS). The particular values and sensitivities with the potential to be exposed to sound emissions include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Continental slope demersal fish communities (KEF) • Flatback Turtle (internesting).

Potential Consequence Summary	Ranking
Localised and temporary behavioural disturbance – Pulsed **Whales** 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 rms with disturbance likely at 160 dB re 1 µPa rms (Ref. 42). Although a larger number of cetaceans have the potential 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. 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. **Turtles** McCauley *et al.* (Ref. 127) reported that exposure to air gun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa rms, with turtles identified 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 (identified as a 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. **Fish** Given a lack of observational data for impacts to fish from seismic/VSP sources, Popper *et al.* (Ref. 43) proposed qualitative indicators of relative risk of effects indicating that peak sound pressure level (SPL) (~207 dB re 1 µPa) has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity. As indicated by the modelling, it is unlikely that VSP activities would exceed the levels required to result in recoverable hearing impacts on fish. Therefore, this has not been evaluated further.	**Incidental (6)**

Localised and temporary behavioural disturbance – Continuous **Whales** Using the NMFS guidance for non-pulsed sound, such as vessel noise, a behavioural disturbance limit of 120 dB re 1 µPa rms is adopted (Ref. 42). Richardson *et al.* (Ref. 26) and Southall *et al.*(Ref. 44) indicate that behavioural avoidance of baleen whales may onset from 140 to 160 dB re 1 µPa or possibly higher. McCauley (Ref. 40; Ref 41) indicates that continuous noise sources from MODU and vessel operations are expected to fall below 120 dB re 1 µPA within 4 km of the MODU / vessel. Hearing damage in marine mammals from shipping noise has not been widely reported (Ref. 45). Although a larger number of cetaceans have the potential to be present within 4 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 both individual or local population levels. Therefore, the only potential impacts expected would be short-term effects to individuals. **Turtles** McCauley *et al.* (Ref. 127) reported that exposure to air gun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa rms, with turtles identified 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, it can be expected that continuous noise emissions have the potential to result in behavioural impacts. 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 are known to be well below impact thresholds 4 km from the vessel (120 dB re 1 µPa recorded at 3–4 km; Ref. 40) ~<0.4% of the BIA would be expected to be exposed (assuming a 4 km exposure footprint [50.27 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. **Fish** Due to a lack of observational data on impacts to fish from continuous sources, Popper *et al.* (Ref. 43) proposed qualitative indicators of relative risk of effects indicating that Peak SPL (~207 dB re 1 µPa) has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity. 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. 46). 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, PTS – Pulsed **Whales** The criteria set by Southall *et al.* (Ref. 44) 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 (Peak SPL). **Turtles** Sound levels that could cause auditory impairment or PTS onset are considered possible at an SPL of 180 dB re 1 µPa (Ref. 128). 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 exceeding the levels that would be expected to result in auditory impairment or PTS (Ref. 129; Ref. 130). Consequently, it is not expected that VSP activities would result in auditory impairment to turtles, therefore this is not discussed further.	**N/A**

Fish Popper *et al.* (Ref. 43) propose qualitative indicators of relative risk of effects indicating that Peak SPL (~207 dB re 1 µPa) has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity; thus, peak levels would need to be above this to result in auditory impairment. Due to the nature of the proposed activities and sound monitoring completed from similar offshore vessel operations, CAPL does not expect its activities to exceed the thresholds described above that could result in auditory impairment or permanent injury. Therefore, this potential impact is not considered further.		

Decision Context	Summary of Control Measures	Risk Level Summary	
A	• Ministerial Statement EPBC 2008/4469 Condition 26, the Wheatstone CSMFIMP (Ref. 2) / EPBC Act Policy Statement 2.1 – Interaction between Offshore seismic exploration: Part A: o MFO o pre-start procedures o start-up procedures o shut-down procedures o operations procedures o low visibility / night-time procedures o planned maintenance system.	**Consequence**	Incidental (6)
		Likelihood	Unlikely (4)
		Risk Level	Low (9)

5.4 Physical Presence – Seabed

Cause of Aspect
These activities were identified as having the potential to result in disturbance of the seabed: • MODU positioning – anchoring • drilling – physical footprint of the well.

Hazard
Seabed disturbance has the potential to impact on receptors (including benthic habitats and assemblages, and demersal fish) through: • altering benthic habitat • localised and temporary increase in turbidity near the seabed.

Potential Consequence Summary	Ranking
Alteration of benthic habitat (anchoring) The area of benthic habitat disturbed for each well from anchoring (25 m^2 per anchor × 8), launching transponders and weights (2 m^2 per transponder / clump weight), and drilling (3 m^2 per well) is expected to be very small. Several existing production wells and Campaign 2 wells have the potential to be situated within one of two KEFs present in the area: • Continental slope demersal fish communities • Ancient coastline at 125 m depth contour. Although two KEFs were 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 homogeneous in the region. 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. If all new Campaign 2 wells are located within one of the KEFs, there is the potential for an area of disturbance (indicatively 1000 m^2) from physical presence on the seabed. The type of damage that could be sustained may include destruction of habitat. However, due to limited use in the area, similarity of surrounding habitat, and lack of sensitive benthic habitats, it is expected that recovery (in the longer term) is possible. There are	**Minor (5)**

minimal pressures on this value and the damage would only occur within a small area. Consequently, as there is the potential for long-term localised impact, the potential impact is determined as **Minor (5)**.	
Localised and temporary increase in turbidity near the seabed 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 very small and localised around the disturbance points. 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 has been undertaken, and extensive programs that monitor water quality and benthic receptors have tracked changes in water quality and organism response. 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. 47). 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 indicate plumes are highly localised and result in only short-term exposures (Ref. 48; Ref. 49; Ref. 50). Post-installation monitoring indicates no changes above natural variation (Ref. 50). The nature and scale of this activity is to be significantly less than that of the dredging programs, which have seen more sensitive habitats recover after installation. 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 been discussed further.	**N/A**

Decision Context	Summary of Control Measures	Risk Level Summary	
A	• American Petroleum Institute (API) Recommended Practice 2SK: Design and Analysis of Stationkeeping Systems for Floating Structures (Ref. 51) o Mooring analysis • ISO 19901-7:2013: Stationkeeping systems for floating offshore structures and mobile offshore units (Ref. 52) o Monitoring mooring line tensions	**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: • venting of hydrocarbons within wellbore • support operations – MODU operations • support operations – vessel operations.
Hazard
Generation of atmospheric emissions has the potential to result in: • chronic effects to sensitive receptors from localised and temporary decrease in air quality from diesel combustion.

Potential Consequence Summary	Ranking
Venting would be undertaken intermittently over several days. Volumes released are controlled such that only small amounts are released at any given time. Given the slow	**N/A**

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. Modelling was undertaken for nitrogen dioxide (NO_2) emissions from MODU power generation for another offshore project (Ref. 53). NO_2 is the focus of the modelling as it is considered the main (non-greenhouse) atmospheric pollutant of concern, with larger predicted emission volumes compared to other pollutants, and 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. The Australian Ambient Air Quality National Environmental Protection (Air Quality) Measures (NEPM) recommend 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. 53). Any exposure from these operations would be expected to be below NEPM standards; therefore, no further evaluation of this aspect was undertaken.	

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: • drilling, drilling fluids, and cuttings handling	
Hazard	
A planned discharge of drilling cuttings and fluids has the potential to result in effects to marine fauna and habitat through: • increased turbidity of the water column • smothering seabed habitat and altering seabed substrate • potential chemical toxicity in the water column and sediment • accumulative impact from previous drilling program.	
Potential Consequence Summary	**Ranking**
Increased turbidity of the water column The values and sensitivities with the potential to be exposed to increased turbidity in the water column include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting) • Continental slope demersal fish communities (KEF). The environmental receptors with the potential to be exposed, and considered 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. Planned discharge of cuttings and adhered fluids from the surface will occur intermittently during drilling. Neff (Ref. 54) 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 the discharges are of small amounts of materials and are intermittent. 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	**Incidental (6)**

the plume entrains enough sea water to reach neutral buoyancy). Hinwood *et al.* (Ref. 55) indicate that larger particles of cuttings and adhered muds (90–95%) fall to the seabed close to the release point. The American Chemistry Council (Ref. 56) 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. 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. 54; Ref. 57). Hinwood *et al.* (Ref. 55) and Neff (Ref. 54) 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. 54) 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. Neff (Ref. 54) states that a large body of knowledge exists indicating a discharge of cuttings with adhered fluids dilutes rapidly, and uses several case studies from different regions, including Alaska and California, to support these summaries. Dispersion is influenced by two factors: fluid type (particle size) and 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 ~0.2 to 0.4 m/s (Ref. 6), and WBMs are expected to cause the largest turbidity risk for this program, the dispersion extents in Neff (Ref. 54) are considered representative for this program. Using the widely-accepted dilution factor of 10 000 (Ref. 54), 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. 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. 58) 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. 58) 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. Consequently, any impact to fish larvae would be limited due to the small exposure footprint, high natural mortality of larvae (Ref. 59), 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. 15) identifies chemical and terrestrial discharges as a key threat, acute impacts were associated with indirect events via destruction of seagrass habitat. The operational area intersects the outer extent of a BIA identified as critical habitat for the Flatback Turtle; however, the BIA is associated with internesting behaviours 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 defined foraging area for Flatback Turtles, impacts to marine turtles are not expected. 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 The values and sensitivities with the potential to be exposed to smothering and alteration of the seabed include: • Continental slope demersal fish communities (KEF) • Ancient coastline at 125 m depth contour (KEF).	**Minor (5)**

Although two KEFs were 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 homogeneous in the region.

Hinwood *et al.* (Ref. 55) 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. 57) 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.

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 between 2010 and 2012, in water depths between 200 m and 1000 m. Specifically, surveys were undertaken of the GOR-3C well, which is ~77 km away from the operational area defined in the EP. GOR-3C is located in Title WA-37-L, with a water depth of 198 m, and was drilled with both water-based fluids and NADF (similar to the wells described in the EP). This benthic survey was conducted 34 days after drilling commenced.

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 are similar and current speeds are also comparable. The outcomes from these surveys were:

- For all well locations (including GOR-3C), the benthic environment was consistently identified as flat, featureless, with fine sediment.
- The extent of cuttings piles were consistently identified to be associated with a 50 to 100 m radius from the wellhead.
- Multivariate data analysis of pre- and post-spud surveys reveals no significant difference between the benthic activities of organisms under differing spoil conditions, indicating little (if any) impact to soft sediment benthic organisms.

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 within 50 to 100 m, and light cover >100 m from the well (Ref. 131). 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. 131). 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 (Ref. 60; Ref. 61; Ref. 62; Ref. 63; Ref. 64). An impact area of 500 m was conservatively set.

Neff (Ref. 57) 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 3–10 years (Ref. 65). 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. 131).

Although these studies were associated with cold, deepwater environments, recovery processes in the operational area are expected to be similar. Effectiveness and recovery time may differ; however, those species present in soft sediment (especially burrowing species) are well adapted to changes in substrate (Ref. 132), 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.

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) within the identified KEFs. Based on the smallest spatial area covered by a single KEF (ancient coastline at 125 m depth contour, which covers an area of ~16 189 km^2) and on the assumption all five wells will be drilled within a single KEF, there is the potential to disturb ~0.024% of the KEF. However, any disturbance is expected to be limited to soft sediment infauna communities. Because these communities are known to recover over a longer time

period (Ref. 65), the potential impacts associated with this program are considered to be limited to localised long-term degradation of habitat and therefore **Minor (5)**.	
Potential sediment chemical toxicity The values and sensitivities with the potential to be exposed to chemical toxicity from cuttings with adhered drilling fluids include: • Continental slope demersal fish communities (KEF) • Ancient coastline at 125 m depth contour (KEF). Although two KEFs were 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. Some components of NADF are potentially bioaccumulative. Although there is potential for bioaccumulation, Melton *et al.* (Ref. 66) reason that the ability of organisms to oxidise and expel aromatics means that while hydrocarbons may be bioavailable, they are not expected to bioconcentrate. As per the 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. 133), which indicates NADF cuttings discharges in water depths <300–400 m are usually deposited on sediments within 100–200 m from the discharge point. An impact area of 500 m was conservatively set. When studying the impacts of drilling in Bass Strait, Terrens *et al.* (Ref. 64) observed biological effects within 100 m of the drilling site shortly after drilling; recovery of seabed communities across the area was reported within four months. Terrens *et al.* (Ref. 64) reported that after 11 months NADF was not detectable in sediments, indicating that recovery of the seabed is through dispersion and biodegradation. Neff (Ref. 57) 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. 65). Although these studies were associated with cold, deepwater environments, the recovery processes are expected to be similar. Effectiveness and recovery time may differ; however, the species present in soft sediment (especially burrowing species) are well adapted to changes in substrate (Ref. 132), therefore recovery is expected to be quicker. 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 recovery duration of 10 years has been used to enable a conservative evaluation of the potential impacts and risks associated with this activity. Based on the understanding that there is the potential for biological impacts within 500 m of the well location, it is expected that these discharges would result in toxicity impacts to benthic infauna. Because the exposure area is ~0.79 km^2 per well (based on a disturbance footprint with a 500 m radius) within the identified KEFs, and based on the smallest spatial area covered by a single KEF (ancient coastline at 125 m depth contour), there is the potential to disturb ~0.02% of the KEF (for the entire Campaign 2 drilling program). 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 limited to localised short-term degradation of habitat and therefore **Incidental (6)**.	**Incidental (6)**
Potential chemical toxicity to fauna in the water column The values and sensitivities with the potential to be exposed to chemical toxicity in the water column include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting).	**Incidental (6)**

The toxicity of widely used synthetic-based fluids (NADF) to zooplankton is considered to be low, with acute toxicity indicated to be greater than 10 000 ppm for NADF (Ref. 134). As WBMs are inherently less toxic, the impact threshold for NADF was used for the evaluation. Neff (Ref. 54) 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. 66), 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 operational area are ~0.2 to 0.4 m/s; therefore, this assessment is considered to be suitable (Ref. 8; Ref. 71). Knowing that drilling fluids dilute 100-fold within 10 m of the discharge (Ref. 54), 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) 10 m from the MODU. Using a conservative ocean current speed of 0.1 m/s (currents in the region can be well above this ([Ref. 71]), these discharges are expected to disperse to 10 000 ppm within two minutes. 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. 67; Ref. 68; Ref. 69; Ref. 70; Ref. 66). 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. 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 more sensitive species, 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 to be 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.	
Cumulative impact from previous Wheatstone drilling program 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 nine Wheatstone production wells drilled in 2014, three were drilled within the continental slope demersal fish communities (KEF), and three within the ancient coastline at 125 m depth contour (KEF). 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. Assuming that an extra five infill wells may be drilled within a single KEF, there is the potential to increase the disturbance footprint (from three wells in a single KEF to eight wells) resulting in a total disturbance to a single KEF of 5.6 km^2. Based on the smallest spatial area covered by a single KEF (ancient coastline at 125 m depth contour), there is the potential for an cumulative disturbance footprint of ~0.034% of the total KEF. Impacts to other identified values and sensitivities are not expected. Although the Turtle Recovery Plan (Ref. 15) identifies chemical and terrestrial discharges as a key threat, acute impacts are associated with indirect events via destruction of seagrass habitat. The operational area intersects the outer extent of a BIA identified as critical habitat for the Flatback Turtle, but this BIA is associated with internesting, not foraging, behaviours. Based on the understanding that benthic environments within the	**Minor (5)**

operational area comprise soft sediment communities, and the operational area is not a defined 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 time period (Ref. 65), and given the cumulative disturbance footprint accounts for <0.03% of the spatially defined 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	
B	• Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development (Ref. 72) – Drilling Fluids and Drilled Cuttings Guidance / CAPL's Offshore Drilling Fluid Guidelines (Ref. 73) / CAPL's Australian Business Unit (ABU) Hazardous Materials Environmental Assessment Tool (Ref. 143) o chemical selection process o chemicals used in top-hole section to be water-based fluids o chemicals used in top-hole section to exclude NADF o no overboard discharge of whole NADF o reduce toxicity in NADF by limiting heavy metal concentrations in barite o chemical selection process o solids control equipment / operator o monitor % synthetic on cuttings (SOC) o actions to reduce SOC will be implemented if sampling indicates a well averages trend towards 10% exceedance for the individual well o submerged caisson • USEPA Guidelines and Standards for Synthetic-Based Drilling Fluids and other Non-Aqueous Drilling Fluids (Ref. 135) 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
This activity has the potential to result in planned discharges of cement: • cementing operations

Hazard
Planned discharge of cement has the potential to result in effects to fauna through: • increased turbidity of the water column • smothering benthic habitat resulting in the alteration of benthic substrate • potential chemical toxicity in the water column.

Potential Consequence Summary	Ranking
Increased turbidity of the water column Modelling of cement discharges for another offshore project (Ref. 53) was used as it provides an appropriate (but conservative) comparison of the potential extent of exposure from this activity. The modelling considered significantly larger slurry	**Incidental (6)**

discharge than would occur for this program. i.e. 2 T per event at a rate of 1.3 m^3/hour (equivalent to ~78 m^3/hour). 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. 53). Five hours after ceasing the discharge, modelling indicates that the plume will have dispersed to concentrations <5 ppm (Ref. 53). The values and sensitivities with the potential to be exposed to increased turbidity in the water column include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting) • Continental slope demersal fish communities (KEF). 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. Jenkins and McKinnon (Ref. 58) 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. 58) 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. The discharges associated with this activity are expected to be intermittent surface discharge of cement after flushing lines and equipment (with volumes from ~1 m^3 [planned] to ~47 m^3 [unplanned]). Particular values and sensitivities are not expected to be exposed for extended periods of time given their transient nature and the lack of sedentary fauna behaviours in the operational area. Given the expected rapid dispersion, there is limited potential for receptors to be exposed to levels above impact thresholds for the duration required to result in an impact. Based on the estimated discharge volumes identified for this program, and the potential impact thresholds as identified by McKinnon (Ref. 58), this discharge is expected to result in a localised and short-term exposure or **Incidental (6)** consequence.	
Smothering and alteration of the seabed 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, the intermittent nature of these discharges, and the high potential for dispersion via ocean currents. Other studies have indicated that cement from top hole sections displaced to the seabed may affect the seabed around the well to a radius of ~10 m–50 m from the well, resulting in the potential for disturbance of 0.007 km^2 per well. The values and sensitivities with the potential to be exposed to smothering and alteration of the seabed include: • Continental slope demersal fish communities (KEF) • Ancient coastline at 125 m depth contour (KEF). Although two KEFs were 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. 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.	**Incidental (6)**

It is expected that cement discharges may result in a localised alteration of seabed substrate within a habitat that is considered homogeneous and not overly sensitive. Given the relatively small footprint associated with the subsea release of cement (0.007 km^2 per well), this impact is considered to result in localised impact to habitat with an **Incidental (6)** consequence.	
Potential chemical toxicity The potential for toxicity is associated with the chemical additives that are added to cement mixtures, and as such, toxicity associated with the discharge of cement is limited to the subsurface release of cement (not discharge of dry cement). Terrens *et al.* (Ref. 64) suggest that once the cement has hardened, the chemical constituents are locked into the hardened cement. Therefore, 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. 53) following the surface discharge of cement slurry from washing the cement unit. The values and sensitivities with the potential to be exposed to chemical toxicity include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting) • Continental slope demersal fish communities (KEF). 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. 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 such that 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	• CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 143) o chemical selection process • Drilling and cementing procedures • No overboard discharge of unmixed cement	**Consequence**	Incidental (6)
		Likelihood	Unlikely (4)
		Risk Level	Low (9)

5.6.3 Planned Discharge – Cooling and Brine Water

Cause of Aspect
These activities have the potential to result in planned discharges of cooling and brine waters: • MODU operations • support vessel operations
Hazard
Planned discharge of cooling and brine waters has the potential to result in effects to fauna through: • increased water temperature • increased water salinity • potential chemical toxicity in the water column.

Potential Consequence Summary	Ranking
Increased temperature	**N/A**

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. 33). 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 exposure to spatially defined BIAs associated with these values and sensitivities comprised: • Humpback Whale (migration) – <0.00001% of the BIA • Blue and Pygmy Blue Whale (migration) – <0.00009% of the BIA • Whale Shark (foraging) – <0.00001% of the BIA • Flatback Turtle (internesting) – <0.0002% of the BIA. Marine mammals and fish passing through the area will be able to actively avoid entrainment in any heated plume (Ref. 74), and reptiles and sharks would be 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-temperature discharges can negatively impact the feeding behaviour of marine turtles (Ref. 136); however, the BIA associated with Flatback Turtles is not associated with foraging behaviours. Increases in water temperature have been shown to induce marine turtle movement (Ref. 136), indicating that potential impacts (other than avoiding the area) are not expected to occur. Given the open nature of the receiving environment, the intermittent nature of the discharge, and the limited exposure to sensitive features, it was 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.	
Increased salinity 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 concentrations are highest. This is confirmed by studies that indicate effects from increased salinity on planktonic communities in areas of high mixing and dispersion are generally limited to the point of discharge only (Ref. 75). The environmental receptors with the potential to be exposed to increased salinity are transient marine fauna including whales, sharks, fish, and reptiles found in surface waters around the MODU at the well locations. Changes in salinity can affect the ecophysiology of marine organisms. However, most marine species are able to tolerate short-term fluctuations (~20–30%) in salinity (Ref. 76). 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. A literature review on the effects of desalination plant brine concluded: • no information to suggest brine discharge has a negative effect on cetacean health (Ref. 137) • no studies have been undertaken into the impact of increased salinity on marine turtles (Ref. 138). However, because shallower waters are less saline (Ref. 5), 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. 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**

Potential chemical toxicity Scale inhibitors and biocide used in the heat exchange and desalination process to avoid fouling of pipework are inherently safe at the low dosages used; they are usually consumed in the inhibition process, so there is little or no residual chemical concentration remaining upon discharge. 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. 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
These activities have the potential to result in planned discharges of ballast waters: • MODU operations • support vessel operations. 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 Invasive Marine Pests (IMPs) are likely to have little or no natural competition or predators, thus potentially outcompeting native species for food or space, preying on native species, or changing the nature of the environment. It is estimated that Australia has more than 250 established marine pests, and it is estimated that approximately one in six introduced marine species becomes pests (Ref. 77). The marine habitat values and sensitivities with the potential to be impacted by the introduction of an IMP include: • Continental slope demersal fish communities (KEF) • Ancient coastline at 125 m depth contour (KEF). Although two KEFs were 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. Once established, some pests can be difficult to eradicate (Ref. 78) and therefore there is the potential for a long-term or persistent change in habitat structure. 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. 79). The nature of the marine habitats near the operational area indicate that establishment of IMPs would be difficult due to the water depths, lack of hard substrates, and the presence of soft sediment communities. If an IMP was introduced, and if it did colonise an area, it is expected that any colony would be fragmented and isolated. Therefore, there is the potential for a localised, but irreversible, impact to habitat resulting in a **Moderate (4)** consequence.	**Moderate (4)**

Decision Context	Summary of Control Measures	Risk Level Summary	
B	• Commonwealth *Biosecurity Act 2015*: o Maritime Arrivals Reporting System (MARS) • Australian Ballast Water Management Requirements (Ref. 80): o exchange of MODU ballast water outside Australian waters o report ballast water discharges o maintain a ballast water record system • Commonwealth *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* enacts the Marine Order Part 98 (Marine pollution – anti-fouling systems): o Anti-fouling certificate • Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) MPEC.207(62) 2011 (Ref. 113) o biofouling management plan o biofouling record book	**Consequence**	Moderate (4)
		Likelihood	Remote (5)
		Risk Level	Low (8)

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: • MODU operations • support vessel operations.

Hazard
Discharge of sewage, greywater, and food wastes results in potential impacts to marine fauna by: • changinges to the water quality through nutrient enrichment and increased biological oxygen demand (BOD) • impact to predator / prey dynamics.

Potential Consequence Summary	Ranking
Changes to the water quality through nutrient enrichment and increased BOD Monitoring of sewage discharges for another offshore project (Ref. 33), 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. The values and sensitivities with the potential to be exposed to changes in surface water quality include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting) • Continental slope demersal fish communities (KEF). 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	**N/A**

than that experienced in enclosed areas (Ref. 81) 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. 82) state that BOD of treated effluent is not expected to lead to oxygen depletion in the receiving waters. Due to the rapid rate of mixing and dispersion identified during modelling of sewage releases (Ref. 33), 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 The overboard discharge of sewage and macerated food waste creates a localised and temporary food source for scavenging marine fauna or seabirds, whose numbers may temporarily increase as a result, thus increasing the food source for predatory species. However, the rapid consumption of this food waste by scavenging fauna, and physical and microbial breakdown, ensures that the impacts of food waste discharges are insignificant and temporary and all receptors that may potentially be in the water column are not impacted. The values and sensitivities with the potential to be affected by changes in predator–prey dynamics include: • Whale Shark (foraging) • Wedge-tailed Shearwater (breeding / foraging) • Continental slope demersal fish communities (KEF). Given the distance from shore, these incidental discharges are not expected to influence foraging behaviours of seabirds (specifically the Wedge-tailed Shearwater), and thus are not considered further. As described above, plankton communities are not affected by sewage discharges. Consequently impacts to Whale Shark foraging behaviours are not expected, and thus are not considered further. Although fish are likely to be attracted to these discharges, any attraction and consequent change to predator–prey dynamics is expected to be limited to close to the release and thus expected to result in 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 to be **Incidental (6)**	**Incidental (6)**

Decision Context	Summary of Control Measures	Risk Level Summary	
A	• AMSA Marine Order Part 96 (Sewage) o MARPOL-approved sewage treatment plant • AMSA Marine Order 95 (Marine pollution prevention – garbage) o Food waste macerated • Planned maintenance system (PMS) • MARS	**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: • pressure-control equipment function testing
Hazard
The planned release of control and hydraulic fluids have the potential to result in: • acute and chronic toxicity to marine fauna.

Potential Consequence Summary	Ranking
Acute and chronic toxicity to marine fauna Hydraulics are used to operate pressure-control equipment (including BOP). The control fluid used comprises ~3% active ingredient concentrations. Modelling undertaken by BP 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. 53). 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 (noting currents in the region can be up to 0.25 m/s [Ref. 71]), fluids would be expected to travel 100 m (and thus reach concentrations of 10 ppm) in 16 minutes. The values and sensitivities with the potential to be exposed to changes in water quality near the seabed include continental slope demersal fish communities (KEF). 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. 143) o Chemical selection process	**Consequence**	Incidental (6)
		Likelihood	Rare (6)
		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 brines: • well completion • wellbore clean-up.

Hazard
The planned release of completion (and other) brines has the potential to result in: • acute and chronic toxicity to marine fauna.

Potential Consequence Summary	Ranking
Acute and chronic toxicity to marine fauna The volume of one wellbore and subsequent discharge volume would be ~2500 bbl per well (based on the designs of the existing production wells). The extent of exposure within the water column is considered to be localised; drilling discharges have previously been identified to dissipate no more than 100 m from the drilling site (Ref. 68; Ref. 70). The values and sensitivities with the potential to be exposed to decreased water quality from completion brines include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting) • Continental slope demersal fish communities (KEF). 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. 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	**Incidental (6)**

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. 143) o Chemical selection process • CAPL's Offshore Drilling Fluid Guidelines (Ref. 73) 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: • MODU operations • support vessel operations. 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: • 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. 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 may result in marine fauna deaths. 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 not have a detrimental effect on the overall population, and only result in a localised, short-term impact to individuals, and thus have a consequence level of **Incidental (6).**			**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) o Garbage / waste management plan o Garbage record book • API Recommended Practice 14G (Ref. 114) o Accidental release / waste management training / induction	**Consequence**	Incidental (6)
		Likelihood	Remote (5)
		Risk Level	Low (10)

5.7.2 Single-point Failure

Cause of Aspect
Hydrocarbon spills resulting from single-point failure typically occur because of: • failure or mechanical breakdown of equipment used to store or transfer hydrocarbons • incorrect storage and/or absence of bunding around hydrocarbons • human error. 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: • seabed ROV survey (hose failure) • inadequate hazardous waste management (loss of containment) • general servicing and routine operations. 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. Given the low potential volumes, a loss of containment would likely include a small spatial extent on the water surface and some entrainment in the water column. The values and sensitivities with the potential to be exposed to decreased water quality from hydrocarbon spills include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting) • Continental slope demersal fish communities (KEF). The most sensitive receptors to this type of event are expected to be surface-dwelling species, whales, and Whale Sharks. However, given the small volumes, and transient nature of identified values and sensitivities, only individual fauna passing directly 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)**.	**Incidental (6)**

Decision Context	Summary of Control Measures	Risk Level Summary	
A	• AMSA's Marine Order Part 91, Marine pollution prevention – oil o Shipboard Oil Pollution Emergency Plan (SOPEP) • API Recommended Practice 14G (Ref. 114) o Accidental release / waste management training / induction • 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 noxious liquids:

- MODU operations – crane transfers and bunkering operations
- support vessel operations – crane transfers and bunkering operations.

Causes of spills overboard during transfer activities include:

- hose or connection failure (due to equipment condition or failure of the vessel to keep stationary)
- failure to align valves correctly during transfer to tanks
- overfilling tanks on MODU
- overfilling aviation fuel tank on fuel unit or bulk storage tank of the MODU
- dropped objects from crane transfers.

Hazard
An accidental bulk release of drilling muds, chemicals, and fuel (hydrocarbons) has the potential to affect marine fauna through: • 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. The environmental impacts associated with a larger loss of diesel fuel are considered in Section 5.7.5. 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. The potential environmental impacts associated with an accidental release of drilling fluid are considered in Section 5.7.4. It is anticipated that the total volume of NADF discharged through adhered cuttings per well is ~143 m^3. Neff (Ref. 57) 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 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. The values and sensitivities with the potential to be exposed to decreased water quality from an accidental release of chemicals (~50 m^3) include: • Humpback Whale (migration) • Blue and Pygmy Blue Whale (migration) • Whale Shark (foraging) • Flatback Turtle (internesting) • Continental slope demersal fish communities (KEF). 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. Therefore, any potential impact from such an event is expected to result in widespread but short-term impacts to individuals, thus the consequence level is determined as **Minor (5)**.	**Minor (5)**

Decision Context	Summary of Control Measures	Risk Level Summary	
A	• Guidelines for Offshore Marine Operations (GOMO) 0611-1401 (Ref. 84) o Bulk transfer process o Hoses and connections o PMS • CAPL Offshore Drilling Fluid Guidelines (Ref. 73) o NADF checklist	**Consequence**	Minor (5)
		Likelihood	Unlikely (4)
		Risk Level	Low (9)

5.7.4 Failure of Slip Joint Packer / Marine Riser

Cause of Aspect
A failure of the slip joint packer or marine riser typically occurs by: • MODU stabilisation resulting in accidental BOP disconnect from riser • human error. If the riser is disconnected accidentally or in an emergency, the entire volume of the riser and drill string (up to 100 m^3 of NADF) could potentially be lost to the environment. 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: • smothering seabed habitat and altering seabed substrate • potential chemical toxicity in the water column and sediment.

Potential Consequence Summary	Ranking
Smothering and altering the seabed The impacts and risks associated with drilling fluids smothering and altering the seabed were evaluated to be no larger than described in Section 5.6.1. The risk evaluation is considered suitable because the estimated total volume of NADF discharged through adhered cuttings per well is ~143 m^3. Neff (Ref. 57) 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 is considered suitable for this risk and is not evaluated further.	**Minor (5)**
Potential chemical toxicity to fauna in the sediment The impacts and risks associated with chemical toxicity to fauna in the sediment were evaluated to be no larger than described in Section 5.6.1. The risk evaluation is considered suitable because the estimated total volume of NADF discharged through adhered cuttings per well is ~143 m^3. Neff (Ref. 57) 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 is considered suitable for this risk and is not evaluated further.	**Incidental (6)**
Potential chemical toxicity to fauna in the water column The impacts and risks associated with chemical toxicity to fauna in the water column were evaluated to be no larger than described in Section 5.6.1. The risk evaluation is considered suitable because the estimated total volume of NADF discharged through adhered cuttings per well is ~143 m^3. Neff (Ref. 57) 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 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. 72) – Drilling Fluids and Drilled Cuttings Guidance / CAPL's ABU Hazardous Materials Environmental Assessment Tool (Ref. 143) o Chemical Selection Process • PMS	**Consequence**	Minor (5)
		Likelihood	Remote (5)
		Risk Level	Low (9)

5.7.5 Loss of Well Control

Cause of Aspect	
A LOWC event typically occurs by: • well intervention • dropped objects • intersection with shallow gas • human error. 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 impacts associated with surface hydrocarbon exposures from a LOWC event are: • marine pollution resulting in acute and chronic impacts to marine fauna and seabirds • marine pollution resulting in impacts to marine-based tourism from reduced visual aesthetic.	
Potential Consequence Summary	**Ranking**
Marine pollution resulting in acute and chronic impacts to marine fauna and seabirds **Whales** Whales passing through surface hydrocarbon slicks can be physically impacted through contact, ingestion, and inhalation (Ref. 83; Ref. 102). Baleen whales skim the surface to feed and may ingest hydrocarbons, potentially fouling baleen fibres (Ref. 103). Direct contact may result in skin and eye irritation, burns to mucous membranes of eyes and mouth, and increased susceptibility to infection (Ref. 99). Whales are vulnerable to inhaling evaporated volatiles if they surface in the slick. For the short period that vapours from the spill persist, they 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 also accumulate in tissues (Ref. 99). Whales migrate through the Offshore and Barrow and Montebello Islands IAAs , and if the spill coincided with the migration, a proportion of the migrating population may be exposed to hydrocarbon concentrations >10 g/m^2. Typically, 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).***	**Incidental (6)**

Turtles Turtles can be exposed to hydrocarbons as they surface, resulting in direct contact with the skin, eyes, and other membranes, as well as inhaling vapours or ingesting hydrocarbons (Ref. 104). 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. 103). Oil effects on turtles can include impacts to the skin, blood, digestive, and immune systems, and increased deaths due to oiling. Turtles may be present in internesting and foraging areas of the Barrow and Montebello Islands IAA and exposed to hydrocarbon concentrations >10 g/m^2 in these areas. Surfacing turtles at all life stages may be exposed; however, the surface slick is likely to be in patches, rather than a continuous slick and subjected to weathering once the lighter, more toxic hydrocarbon fractions have volatilised. Therefore, the potential for environmental impacts would be limited to a relatively short period following 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 Birds that rest at the water's surface or surface-plunging birds are particularly vulnerable to surface hydrocarbons (Ref. 98; Ref. 103). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 101). Acute and chronic toxic effects may result if hydrocarbons are ingested when the bird attempts to preen its feathers (Ref. 101). Bird nesting and foraging occurs in the Barrow and Montebello Islands IAA where surface exposures may be >10 g/m^2 (Barrow Island) and 25 g/m^2 (Montebello Islands). Although the Offshore IAA can also have high exposure zones, only individual transient birds would be expected to be exposed, rather than larger aggregations of birds. Given the high sensitivity of birds to surface hydrocarbon phases, a hydrocarbon release has the potential to cause widespread, short-term impacts, and is ranked as ***Minor (5).***	**Minor (5)**
Marine pollution resulting in impacts to marine-based tourism from reduced visual aesthetic Modelling indicates that hydrocarbon exposures >1 g/m^2 are expected to occur within most of the IAAs identified in Section 3. The Ningaloo, Shark Bay, and Pilbara IAAs have clearly identified tourism and recreation values that can be affected by surface hydrocarbon exposure. A visible sheen may be observed in these IAAs and waxy 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: • marine pollution resulting in acute and chronic impacts to marine habitats and marine fauna • reduction in commercially targeted marine species resulting in impacts to commercial fishing and aquaculture.	
Marine pollution resulting in acute and chronic impacts to marine habitats and marine fauna **Coral** 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. 105). Dissolved hydrocarbons are known to cause high coral mortality via direct physical contact (Ref. 105). Given the predicted times for shoreline exposure (minimum 14 days), it is expected that weathering of the volatiles will have occurred before exposure; however,	**Minor (5)**

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. 106). Entrained exposures have the potential for localised and long-term impacts to coral reefs in the IAAs, and are ranked as ***Minor (5)***.	
Seagrass and Macroalgae	**Minor (5)**
Seagrass and macroalgae meadows make up the most important benthic habitats of the Pilbara and Exmouth IAAs, and may be exposed to water-column hydrocarbons in the event of a hydrocarbon release. Dissolved and entrained hydrocarbons have the potential to effect macroalgae and seagrass through toxicity impacts. However, a layer of mucilage is present on most species, which prevents toxic aromatic fractions from penetrating (Ref. 112). 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. 112). Acute, and therefore potentially lethal, exposure may occur as the result of exposure at moderate and high thresholds from a hydrocarbon release. Given that the exposure is predicted to be in patches rather than a continuous plume, impacts to seagrass and macroalgae in these 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)***.	
Whales	**Incidental (6)**
Migrating whales, which may be present in the Offshore IAA, may also be exposed to entrained hydrocarbons above Predicted No Effect Concentrations (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 of whales to these concentrations is not expected to cause significant impacts. Exposure to entrained hydrocarbons can result in physical coating as well as ingestion (Ref. 99). 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 following 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. 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).***	
Turtles	**Incidental (6)**
Turtles, which may be present in the Offshore IAA, 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 of turtles to these concentrations is not expected to cause significant impacts. Turtles can be impacted by fresh condensate, with direct oiling of eyes and other membranes occurring when swimming (Ref. 104); the risk of impacts decrease as the volatiles weather. 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)***.	
Whales Sharks and White Sharks	**Incidental (6)**
Ningaloo Reef is important for Whale Shark aggregation and exposure to entrained hydrocarbons above PNEC (11 760 ppb/hr) may occur in the Ningaloo IAA. Note: Impact thresholds of 11 760 ppb/hr are more relevant for small, immobile organisms. Exposure of Whale Sharks to these concentrations is not expected to cause significant impacts.	

Whale Sharks are also known to forage in the Offshore and Barrow and Montebello Islands IAAs. As identified in the recovery plan for the White Shark (Ref. 17), the 'indicative distribution' and 'known distribution' of White Sharks, may intersect entrained thresholds above 11 760 ppb/hr. Whale Sharks, sharks, and fish have the potential for exposure to hydrocarbons via the entrained and dissolved fractions. Potential effects include damage to the liver and lining of the stomach and intestine, as well as toxic effects on embryos (Ref. 107). Although these concentrations will be 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 White Sharks are localised and long term, and are ranked as **Incidental (6)**.	
Dugongs The spatial extent of water-column hydrocarbons includes the Pilbara and Shark Bay IAAs, which have seagrass and macroalgae meadows that provide a feeding habitat for Dugongs, which are known to aggregate in the shallow waters of these IAAs. Damage to patches of seagrass meadows from the toxic effects of hydrocarbons can affect Dugong feeding (temporary displacement from affected seagrass), although impacts are not expected to have population-level consequences. Entrained exposure may have direct physical effects on Dugongs (Ref. 103), particularly immediately after a hydrocarbon release that can reach Pilbara waters relatively quickly before weathering. Several Dugong individuals could be impacted through ingestion and skin contact if they come into direct contact with areas of moderate or high exposure. The consequences are ranked as localised, short-term impacts, and are ranked as **Incidental (6)**.	**Incidental (6)**
Fish Communities Fish community values include the ancient coastline, Continental slope demersal fish communities, Glomar Shoals, and Exmouth Plateau. 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. 108). Several fish communities in these areas are demersal and therefore more prevalent near the seabed where concentrations of entrained hydrocarbons will be lower; any impacts are expected to be highly localised. 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; the consequences are ranked as **Incidental (6)**.	**Incidental (6)**
World Heritage Environmental values and sensitivities such as species diversity and abundance, coral reef systems, and Whale Shark aggregation areas are assessed individually in the various evaluations within this table. Therefore, they are not assessed further. Potential impacts to heritage values are ranked as ***Minor (6)*** – see ***Coral***.	**Minor (5)**
Reduction in commercially targeted marine species resulting in impacts to commercial fishing and aquaculture Several commercial fisheries operate in the IAAs (Ref. 4), and overlap the spatial extent of the water-column hydrocarbon predictions. 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 have been identified that have the potential to be impacted (Ref. 4). 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 manifest at a fish population viability level. The consequence to	**Incidental (6)**

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: • marine pollution resulting in acute and chronic impacts to marine fauna and seabirds • reduction in amenity resulting in impacts to tourism and recreation.	
Marine pollution resulting in acute and chronic impacts to marine fauna and seabirds	
Coral 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. 109). The Ningaloo coast has extensive fringing coral reefs. 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. 105; Ref. 110). 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 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 and Mudflats Regionally significant mangrove communities in the Exmouth, Pilbara, and Barrow and Montebello Islands IAAs, and intertidal mudflats of the Exmouth IAA, can be contacted by shoreline hydrocarbons. Shoreline hydrocarbons can have smothering and toxic effects on mangroves and intertidal mudflats. Acute and chronic impacts to the health of mangrove communities can occur via pneumatophore smothering and exposure to the toxic volatile fraction of the hydrocarbons (Ref. 111). Intertidal mudflats, which are typically sheltered and have a large surface area for oil absorption, can trap oil, potentially causing toxicity impacts to infauna. Intertidal mudflats are very sensitive to oil pollution, because the oil enters lower layers of the mudflats where a lack of oxygen prevents the oil from decomposing (Ref. 111). There is potential for acute and chronic toxic impacts to mangrove communities and infauna of the mudflats, as well as smothering impacts of mangroves from weathered residues. Given the value and sensitivity of mangrove and mudflat communities in these IAAs, and the potential for shoreline contact before sufficient weathering occurs, and the potential volumes and extent of exposure from a LOWC event, there is the potential for long-term and widespread consequences, which are ranked as ***Moderate (4)***.	**Moderate (4)**
Turtles The Ningaloo, Exmouth, Pilbara, Barrow and Montebello Islands, Gascoyne, and Shark Bay IAAs include important nesting habitats for turtles (Ref. 4). 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. 104). 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	**Minor (5)**

vulnerable to toxicity and smothering as they emerge from the nests and make their way over the intertidal area to the water (Ref. 104). 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 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 Given the extent of the shoreline exposure potentially intersecting turtle habitats, acute effects may occur particularly to hatchlings; however, the risk of 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 The Ningaloo, Exmouth, and 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. 103). Toxic effects may also result when hydrocarbons are ingested as the bird attempts to preen its feathers (Ref. 100). 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 individuals. Although numerous birds may be exposed, 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 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 Modelling predicts the spatial extent of shoreline exposure to include the Ningaloo, Shark Bay, and Pilbara IAAs, which include tourism and recreation values. The Ningaloo IAA includes the Ningaloo Marine Park, which is a key tourist destination of local, state, national, and international significance, and a major component of the local economy; the Pilbara and Shark Bay IAAs also include key coastal tourism areas. Shoreline loading can impact the visual amenity of coastal areas and limit beach access for users, impacting tourism and recreation activities. 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. 87) o well proposal and formation evaluation o well construction CPDEP process. • CAPL's Wellsafe SOP (GS-021 Wellsafe; Ref. 88) o MODU certification o well design and plan certification • Part 5 of the Offshore Petroleum and Greenhouse Gas Storage (Resource	**Consequence**	Moderate (4)
		Likelihood	Unlikely (4)
		Risk Level	Low (7)

	Management and Administration) Regulations 2011 o WOMP • OPGGS(E)R o Wheatstone Project: Start-up and Operations OPEP (Ref. 85) o CAPL ABU OSMP (Ref. 86) o stakeholder consultation • Well Program • PMS		

5.7.6 Vessel Collision

Cause of Aspect
A vessel collision typically occurs as a result of: • loss of DP • navigational error, or • foundering due to weather. Grounding is not considered credible due to the water depths associated with the operational area, and the lack of submerged features in this area.

Hazard
The potential environmental impacts associated with surface hydrocarbon exposures from a vessel collision are: • marine pollution resulting in acute and chronic impacts to marine fauna and seabirds.

Potential Consequence Summary	Ranking
Marine pollution resulting in acute and chronic impacts to marine fauna and seabirds Due to similar volatile hydrocarbon properties, weathering, fate, and characteristics between marine diesel oil (MDO) and condensate fluids, and considering the modelling results, the potential impacts are similar to those described and assessed in Section 5.7.5. The predicted worst-case consequences are slightly lower for the MDO loss of containment due to smaller volumes and shorter release duration. 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. 89) o vessel crew o navigational equipment • AMSA's Marine Order Part 91, Marine Pollution Prevention – oil o SOPEP • OPGGS(E)R o Wheatstone Project: Start-up and Operations OPEP (Ref. 85) o CAPL ABU OSMP (Ref. 86) • Commonwealth *Navigation Act 2012* o Pre-start notifications	**Consequence**	Minor (5)
		Likelihood	Remote (5)
		Risk Level	Low (9)

5.8 Spill Response

The Wheatstone Start-up and Operations OPEP (Ref. 85) outlines specific emergency response options and tactics to respond effectively to an oil spill, if a spill occurs during petroleum activities carried out under the EP, in accordance with the OPGGS(E)R 2009. This OPEP was 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 natural dispersion of oil into the water column
- Containment and Recovery – Using mechanical or manual techniques to confine, collect, recover, and store oil
- Shoreline Protection – Using protective or deflective booming tactics to protect 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.

For the purposes of selecting appropriate response options for the EP, hydrocarbons were grouped into oil types as defined by the International Tanker Owners Pollution Federation (ITOPF) classification system:

- Iago and Wheatstone condensate (Group I)
- MDO (Group II).

The preliminary screened response options that may be implemented for these emergency events are summarised in Table 5-1.

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

ITOPF Class-ification	Response Options						
	Source Control	MES	Chemical Dispersants*	Contain-ment & Recovery	Shoreline Protection	Shoreline Clean-up	OWR
Group I (LOWC)							
Group II (MDO)							

Response Options: *Primary* *Secondary* *Possible*

** Chemical dispersants may be used on residual, persistent components of hydrocarbon fluids upon completion of a NEBA before use and where the response option meets technical requirements (CAPL-preferred dispersants, >20 m water depth, etc.).*

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 to reduce the relief well drilling time frame in the unlikely event of a LOWC. **Service Providers** CAPL has access to external experts, specialised services, and providers for capping stack deployment and relief well drilling. Specifically: • Trendsetter – 2 capping stack engineers • Oceaneering – 2 tool hands. Other companies: • 8 ROV operators • 12 rigging operators • 2 survey personnel. **Contracts with Wild Well Control (WWC)** 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. **Oil Spill Response Limited (OSRL) Membership** CAPL maintains OSRL membership, and has are three agreements for emergency response and subsea capability and equipment: • The **OSRL** '**Service Level Agreement** gives CAPL access to 50% of available personnel and equipment. • The **OSRL** '**Supplementary Agreement in respect to Capping Devices & Toolkits (CW1046766)'** is based on an annual well nomination that gives CAPL access to the to the Subsea Well Intervention System equipment, including capping stack and ancillary equipment in Singapore. • The **'Supplementary Agreement in respect of the Global Strategic Dispersant Stockpile between Oil Spill Response (Dispersants) Limited and Chevron Response Company Limited**' gives CAPL access to 100% of the global dispersant stockpile, which comprises >5000 m^3 of dispersant. It is estimated that the capping stack package can be activated and mobilised to the Pilbara within 22 days. CAPL is signatory to the **APPEA Memorandum of Understanding (MOU) for Mutual Aid** for sharing of 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.

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 Agreements for the duration of this activity: • Capping Devices & Toolkits • Global Strategic Dispersant Stockpile	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 will maintain contracts with specific contractors to provide source control support, including: • WWC • Trendsetter • Oceaneering	Records confirm CAPL has contracts in place with WWC, Trendsetter, and Oceaneering

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 (Subsea First Response Toolkit [SFRT] and Dispersant) CAPL maintains **membership with the Australian Marine Oil Spill Centre (AMOSC)**, which, via the **AMOSC Executed Agreement**, gives access to the Perth-based 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, WA. In addition, CAPL maintains the **Supplementary Agreement with OSRL in respect of the Global Strategic Dispersant Stockpile**, which gives CAPL access to 100% of the global dispersant stockpile, which comprises >5000 m^3 of dispersant. **Service Providers (Personnel)** 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 resources and personnel through WA DoT and AMSA, which includes trained aerial observers from fire and rescue agencies around Australia. **Logistics Contractors (Vessel)** 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. 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 (e.g. pipeline inspection, well intervention, infill drilling), the vessels involved in these work scopes may be able to assist. Tugs are also located at the LNG Plant, at both Barrow Island and Wheatstone/Onslow and may be able to be deployed within six hours to assist in response operations; actual deployment time depends on marine vessel movements occurring at the time. Additionally, offshore vessels could be mobilised via existing contracts from locations with large numbers of vessels on standby in 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
	CAPL will maintain its contract with The Response Group for the duration of this activity	Records confirm CAPL 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

Environmental Performance Outcome	Environmental Performance Standards	Measurement Criteria
	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

5.8.3 Offshore Response

Using aerial dispersant spraying (ADS) and vessel dispersant spraying (VDS) 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 VDS capability; Table 5-7 lists the performance standards in place to ensure preparedness is maintained.

Table 5-6: ADS / VDS Capability

ADS Response Capability	**CAPL** 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. **Specialist Contractors** 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 resources and personnel through WA DoT and AMSA, including trained aerial observers from fire and rescue agencies around Australia. The **AMOSC Services Agreement** provides access to equipment stocks located in Exmouth (chemical dispersant), Perth (large dispersant stocks), and Geelong (chemical dispersant) The **AMSA & AMOSC & Aerotech First Response Joint Standard Operating Procedure (JSOP)** provides access to the National Plan Fixed Wing Aerial Dispersant Contract capability to support dispersant spraying for offshore and nearshore operations. This arrangement can be mobilised to Exmouth within ~24 hours (aircraft can arrive sooner but trained support personnel are required to implement this capability). 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. 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 the global dispersant stockpile, which comprises >5000 m^3 of dispersant.
VDS Response Capability	**CAPL** The Wheatstone LNG Plant and Barrow Island maintain an initial first-strike response capability for offshore VDS. The Wheatstone on-site response team (ORT) has a first-strike capability for events originating from the Wheatstone Asset and its support activities, or potentially affecting the Wheatstone Asset. The Barrow Island ORT has a first-strike capability for events originating from Barrow Island and support activities, or potentially affecting Barrow Island. As such CAPL has a minimum capability for this response technique of: • 8 oil response specialists • 1 vessel available (either harbour tugs or contracted provider) within 24 hours of EMT activation.

	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. **Specialist Contractors** 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 resources and personnel through WA DoT and AMSA including trained aerial observers from fire and rescue agencies around Australia. The **AMOSC Services Agreement** provides access to equipment stocks located in Exmouth (chemical dispersant spraying), Perth (chemical dispersant spraying and large dispersant stocks), and Geelong (chemical dispersant spraying). The **OSRL Service Level Agreement** provides access to OSRL and GRN resources located in Singapore, Bahrain, and Southampton, including stocks of dispersant used for surface dispersant spraying. 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 the global dispersant stockpile, which comprises >5000 m^3 of dispersant. **Logistics Contractors (Vessel)** 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. 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 (e.g. pipeline inspection, well intervention, infill drilling), the vessels involved in these work scopes may be able to assist. Tugs are also located at the LNG Plant, at both Barrow Island and Wheatstone/Onslow and may be able to be deployed within six hours to assist in response operations; actual deployment time depends on marine vessel movements occurring at the time. Additionally, offshore vessels could be mobilised via existing contracts from locations with large numbers of vessels on standby in Singapore; based on a conservative speed of 11 knots, it is anticipated that vessels could travel from Singapore to Dampier within 8 days. **Logistics Services Agreements** The logistics services agreements 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 / VDS 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

Environmental Performance Outcome	Environmental Performance Standards	Measurement Criteria
	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
	CAPL will maintain its contract with The Response Group for the duration of this activity.	Records confirm CAPL has a contract with The Response Group
Maintain VDS 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 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
	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 contract with The Response Group for the duration of this activity	Records confirm CAPL has a contract with The Response Group
	CAPL will maintain its contracts 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 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 maintained access to its Asia–Pacific RRT and WWRT

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** Both Barrow Island and the Wheatstone LNG Plant maintain an initial first-strike response capability for nearshore SPD operations. Based on these capabilities, CAPL can deploy (within 12 to 24 hours of an emergency event) resources and ORT personnel, comprising, as a minimum: • 12 shoreline response specialists (SRSs) • 4 shoreline assessment specialists (SASs) • 5 shoreline protection packages. 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. **Specialist Contractors** 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 resources and personnel through WA DoT and AMSA, including trained aerial observers from fire and rescue agencies around Australia. 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 equipment available through AMSA and WA DoT. The **OSRL Services Agreement** provides access to OSRL and GRN resources located in Singapore, Bahrain, and Southampton, including SPD and deflection equipment. **Logistics Contractors (Vessel)** 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. 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 (e.g. pipeline inspection, well intervention, infill drilling), the vessels involved in these work scopes may be able to assist. Tugs are also located at the LNG Plant, at both Barrow Island and Wheatstone/Onslow and may be able to be deployed within six hours to assist in response operations; actual deployment time depends on marine vessel movements occurring at the time. Additionally, offshore vessels could be mobilised via existing contracts from locations with large numbers of vessels on standby in Singapore; based on a conservative speed of 11 knots, it is anticipated that vessels could travel from Singapore to Dampier within 8 days. **Logistics Services Agreement** The logistics services agreements 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. Agreements (with Coates Hire, PWC Logistics, Sadlier, ATCO) also enable access to set up remote camp, 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. 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 comprising: • 12 SRSs • 4 SASs • 5 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

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** Both Barrow Island and the Wheatstone LNG Plant maintain an initial first-strike response capability for SHC operations. Based on these capabilities, CAPL can deploy (within 12 to 24 hours of an emergency event) resources and ORT personnel, comprising, as a minimum: • 12 SRSs • 4 SASs • 6 SHC packages. CAPL maintains an additional four SRS personnel in Perth who can be deployed to support ongoing response operations within 12 to 24 hours 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. **Specialist Contractors**

	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 equipment available through AMSA and WA DoT. The **OSRL Services Agreement** provides access to OSRL and GRN resources located in Singapore, Bahrain, and Southampton, including SHC equipment. 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. **Logistics Services Agreement** The logistics services agreements 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. Agreements (with other contractors such as Coates Hire, PWC Logistics, Sadlier, ATCO) also enable access to set up remote camp, 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. **Labour Hire Contractors** 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. **Logistics Contractors (Vessel)** 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. 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 (e.g. pipeline inspection, well intervention, infill drilling), the vessels involved in these work scopes may be able to assist. Tugs are also located at the LNG Plant, at both Barrow Island and Wheatstone/Onslow and may be able to be deployed within six hours to assist in response operations; actual deployment time depends on marine vessel movements occurring at the time. Additionally, offshore vessels could be mobilised via existing contracts from locations with large numbers of vessels on standby in 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 comprising: • 12 SRSs • 4 SASs • 6 SHC packages	Records confirm CAPL has the 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

Environmental Performance Outcome	Environmental Performance Standards	Measurement Criteria
	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

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. 139]). 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	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: • 1 Oiled Wildlife Advisor to supervise operations with relevant government agencies (i.e. DBCA) and in accordance State- and region-specific OWR plans. • 1 fauna package to capture and transport potentially affected wildlife (e.g. birds, turtles) from Montebello Islands. • 1 fauna package to the west coast of Barrow Island to capture and treat potentially affected wildlife (e.g. birds, turtles) Although these resources can mobilise within 12 hours of EMT activation, the shortest time to shore is 14 days (with modelling indicating shoreline contact is not expected until Week 4 or 5); therefore, there is sufficient time for mobilisation. **Service Providers** The WAOWRP (Ref. 139) 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. **Specialist Contractors**: Third-party service provider capability will be mobilised under the WAOWRP (Ref. 139), 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. 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 assist with mobilising 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 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) ABU HES Risk Management (Ref. 21) • (OE-03.09.01) Marine Safety Reliability and Efficiency – ABU Standardised OE Process (Ref. 89) • (OE-03.06.02) Managing Safe Work (MSW) – ABU Standardised OE Process (Ref. 90) • (OE-03.16.13) Hazardous Communication Process (Ref. 142) • (ABU151100648) Hazardous Materials Environmental Assessment Tool (Ref. 143)
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. 91)
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. 92)
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. 93)
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. 117)
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. 94) • (OE-12.01.18) Compliance Assurance Management of Instances of Potential Noncompliance (Ref. 95)

6.2 Management of Change for Facilities and Operations

The Management of Change for Facilities and Operations Process (Ref. 91) 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 (Ref. 21), 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. 94) 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. 95) 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 Multiyear Exercise Schedule (MYES) describes the schedule of training and exercises 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 proposed 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
- Wheatstone's ability to effectively operate within an emergency response organisation.

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. A minimum of 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 among members of an EMT, but does not involve the mobilisation of personnel or equipment
Drill	Involves conducting 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 must hold a minimum of two exercises per year per shift. • May be held in conjunction with a Level 2 EMT exercise. • Designed to evaluate the ability of ORTs to implement the Wheatstone Emergency Management System (EMS) as it applies to ORTs. ORTs are also encouraged to conduct as many exercises as they want each year that do not include the Emergency Response Team or a Level 2 EMT.
Level 2 – EMT	• Exercises may include the participation of an ORT and may be held in conjunction with a Level 3 EMT exercise. • Usual duration is one to two hours. • Designed to evaluate a Level 2 EMT's ability to notify and activate team members, set up a Level 2 EMT Emergency Command Centre, and implement the Wheatstone EMS as it applies to Level 2 EMTs.
Level 3 – EMT	• Each exercise may include the participation of a Level 2 EMT and/or ORT. • Usual duration is three to six hours. • Designed to evaluate the EMT's ability to notify and activate team members, transfer command to a Level 3 EMT Emergency Command Centre, and implement the Wheatstone EMS as it applies to incident escalation.

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

Response arrangements as detailed in this EP and the OPEP (Ref. 85) must be tested:

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

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.

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 the Management of Change process (Section 6.2), and, if required by Regulation 17 of the OPGGS(E)R, resubmitted to NOPSEMA for assessment, or revised and re-issued for use accordingly.

The Description of Environment document (Ref. 4) 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 the Management of Change process.

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
°C	Degrees Celsius
µg/m^3	Micrograms per cubic metre
ABU	Australian Business Unit
ADS	Aerial Dispersant Spraying
AFMA	Australian Fisheries Management Authority
AHS	Australian Hydrographic Service
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
AUSCOAST	Australian Coastal (weather warning)
bbl	Barrel
BIA	Biologically Important Area
BOD	Biological Oxygen Demand
BOP	Blowout Preventer
CAPL	Chevron Australia Pty Ltd
cm	Centimetre
Commonwealth Waters	Australian waters seaward of the three nm limit of State Waters out to the limit of the Australian Exclusive Economic Zone (up to 200 nm seaward of the territorial sea baseline); jurisdiction over the water column above the seabed is vested in the Australian Commonwealth Government
CPDEP	Chevron Project Development and Execution Process
CRG	Community Reference Group
CSMFIMP	Conservation Significant Marine Fauna Interaction Management Plan
D&C	Drilling and Completions
dB re 1 µPa	Decibels re 1 micropascal
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DE	Diatomaceous Earth
DMIRS	Western Australian Department of Mines, Industry Regulation, and Safety (formerly Department of Mines and Petroleum [DMP] and Department of Commerce; from 1 July 2017)
DoT	Western Australian Department of Transport

Acronym / Abbreviation	Definition
DotEE	Commonwealth Department of the Environment and Energy
DP	Dynamic Positioning
DPIRD	Western Australian Department of Primary Industries and Regional Development (formerly Fisheries)
EMBA	Environment that May Be Affected
EMS	Emergency Management System
EMT	Emergency Management Team
Endangered Species	A species that is not critically endangered, but is facing a very high risk of extinction in the wild in the near future.
EP	Environment Plan
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically Sustainable Development
g	Gram
GOMO	Guidelines for Offshore Marine Operations
GRN	Global Response Network
HES	Health, Environment, and Safety
IA	Iago
IAA	Impact Assessment Area
IAG	Iago
IC	Incident Controller
IMP	Invasive Marine Pest
ISO	International Organization for Standardization
ITOPF	International Tanker Owners Pollution Federation
JRCC	AMSA's Joint Rescue Coordination Centre
JSOP	Joint Standard Operating Procedure
KEF	Key Ecological Feature
Kill-weight brine	A heavy drilling fluid used to counteract reservoir pressure
km	Kilometre
L	Litre
LC50	Lethal Concentration 50 (concentration in water having 50% chance of causing death to aquatic life)
LNG	Liquefied Natural Gas
LOWC	Loss of Well Control
Lux	Light density (unit of measurement)
m	Metre
m/s	Metres per second
m^2	Square metre
m^3	Cubic metre
MARPOL	The International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978.

Acronym / Abbreviation	Definition
	Also known as MARPOL 73/78.
MARS	Maritime Arrivals Reporting System
MDO	Marine Diesel Oil
MEG	Monoethylene glycol
MES	Monitoring, Evaluation, and Surveillance
MFO	Marine Fauna Observer
mg	Milligram
Migratory Species	Species listed as migratory under section 209 of the EPBC Act.
mm	Millimetre
MODU	Mobile Offshore Drilling Unit, Drill Ship, or Intervention Vessel (collectively termed MODU)
MOU	Memorandum of Understanding
MSW	Managing Safe Work
MYES	Multiyear Exercise Schedule
N/A	Not Applicable
NADF	Non-aqueous Drilling Fluids
National Plan	National Plan for Maritime Emergencies
NEBA	Net Environmental Benefit Analysis
NEPM	National Environmental Protection Measures
nm	Nautical mile
NMFS	National Marine Fisheries Service (United States)
NO_2	Nitrogen dioxide
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority (Australia)
OE	Operational Excellence
OEMS	Operational Excellence Management System
OPEP	Oil Pollution Emergency Plan
OPGGS Act	Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPGGS(E)R	Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPIGN	Offshore Petroleum Industry Guidance Note (DoT publication)
ORT	On-site Response Team
OSCA	Oil Spill Control Agents
OSMP	Operational and Scientific Monitoring Program
OSRL	Oil Spill Response Limited
OWR	Oiled Wildlife Response
PMS	Planned Maintenance System
PNEC	Predicted No-effect Concentration
ppb	Parts per billion

Acronym / Abbreviation	Definition
ppb/hr	Parts per billion per hour
ppm	Parts per million
PSZ	Petroleum Safety Zone
PTS	Permanent Threshold Shift
RMS	Root Mean Square
ROV	Remotely Operated Vehicle
RRT	Regional Response Team
SAS	Shoreline Assessment Specialist
SFRT	Subsea First Response Toolkit
SHC	Shoreline Clean-up
SLA	Safe Lift Area
Slip Joint Packer	An expansion/contraction compensating tool. It accommodates any changes in string length caused by temperature and pressure during drilling.
SOC	Synthetic on Cuttings
SOP	Standard Operating Procedure
SOPEP	Shipboard Oil Pollution Emergency Plan
SPD	Shoreline Protection
SPL	Sound Pressure Level
SRS	Shoreline Response Specialist
SSDI	Subsea Dispersant Injection
State Waters	Australian coastal waters out to three nm seaward of the territorial sea baseline; jurisdiction over the water column and the underlying seabed is vested in the adjacent State
T	Tonne
Threatened Species	Species listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent under section 178 of the EPBC Act.
TRG	Tactical Response Guide
UK	United Kingdom
US	United States of America
USEPA	United States Environmental Protection Agency
VDS	Vessel Dispersant Spraying
VSP	Vertical Seismic Profiling
Vulnerable Species	A species is listed as vulnerable under the EPBC Act if it is not critically endangered or endangered and it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAOWRP	Western Australian Oiled Wildlife Response Plan
WBM	Water-based Muds
WBRDIF	Water-Based Reservoir Drill-In Fluid

Acronym / Abbreviation	Definition
WestPlan – MOP	WA State Hazard Management Plan for Marine Oil Pollution
Wheatstone Operations EP	NOPSEMA-accepted Wheatstone Project: Start-up and Operations Environment Plan (WS2-COP-00001; Ref. 1)
WHS	Wheatstone
WOMP	Well Operations Management Plan
WST	Wheatstone
WWC	Wild Well Control
WWRT	World-wide Response Team

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